Main Index

17 Index

ENGINE CONTROL SYSTEM

GENERAL INFORMATION

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

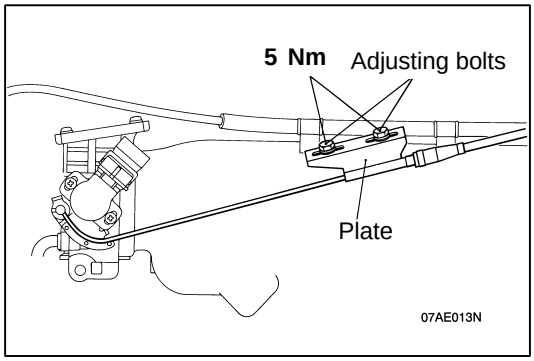
SERVICE SPECIFICATIONS

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

ON-VEHICLE SERVICE

ACCELERATOR CABLE CHECK AND ADJUSTMENT

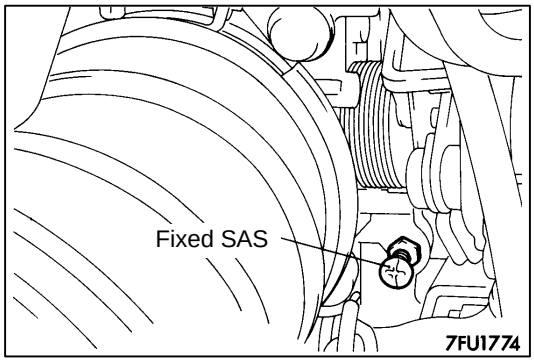
1. Turn A/C and lights OFF.
   Inspect and adjust at no load.
2. Warm engine until stabilised at idle.
3. Confirm idle speed is at prescribed rpm.
4. Stop engine (ignition switch OFF).
5. Confirm there are no sharp bends in accelerator cable.
6. Check inner cable for correct slack.



7. If there is too much slack or no slack, adjust play by the following procedures.
   (1) Loosen the adjusting bolt to release the cable.
   (2) After moving the plate to the position immediately before the throttle lever starts to move, move the plate back towards the throttle body by the standard value amount only to bring the accelerator cable play to the standard value.

   Standard value: 3–5 mm

   (3) Tighten the adjusting bolts to the specified torque.



8. Adjust accelerator cable play and confirm throttle lever stopper touches the fixed SAS.

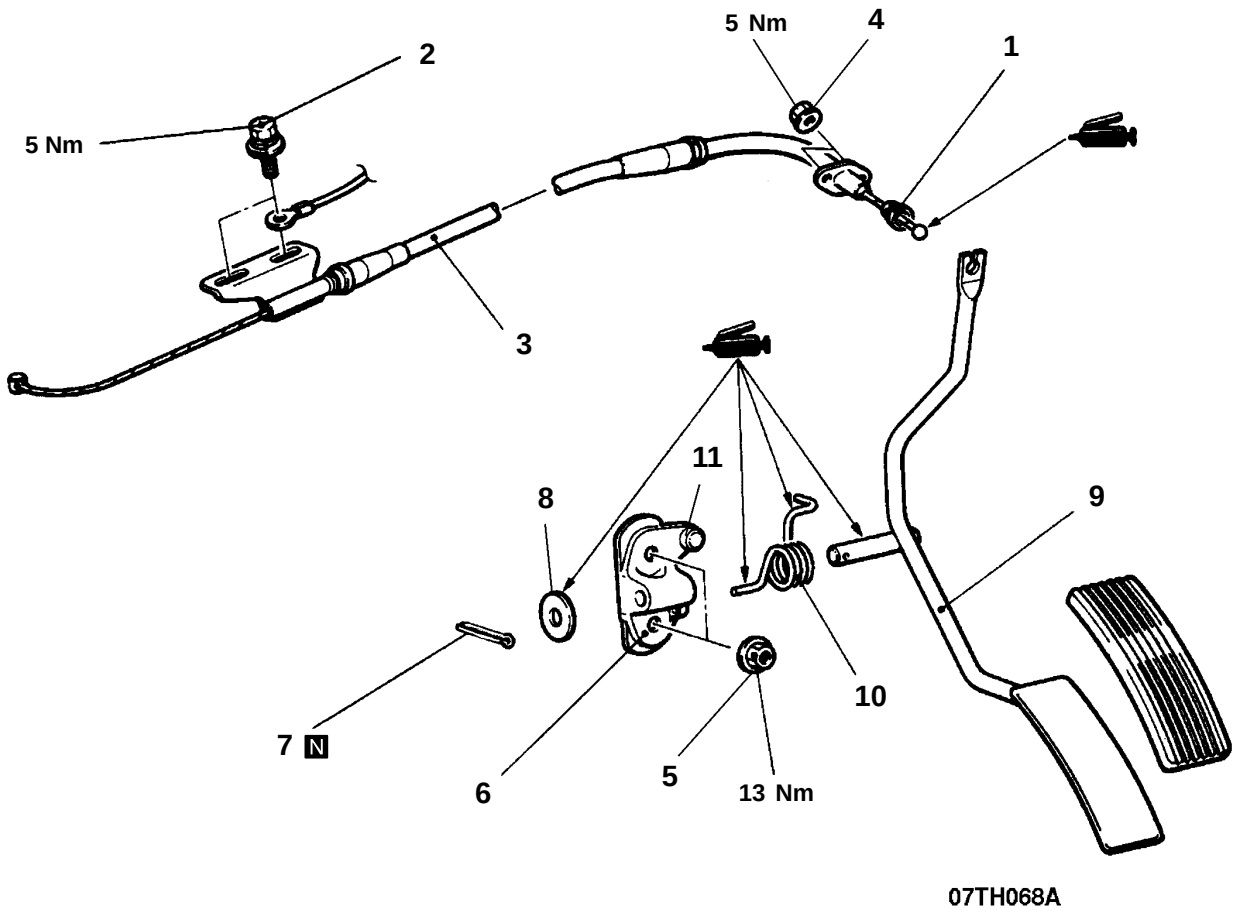
Main Index

17 Index

ACCELERATOR CABLE AND PEDAL

REMOVAL AND INSTALLATION

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



07TH068A

Removal steps of accelerator cable

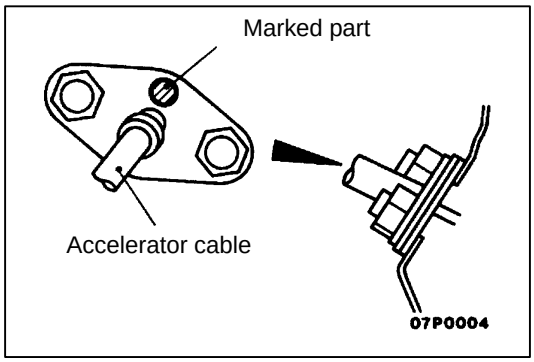
1. Accelerator cable connection
2. Adjusting bolts

▶A◀ 3. Accelerator cable

4. Bolt

Removal steps of accelerator pedal

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



INSTALLATION SERVICE POINT

▶A◀ ACCELERATOR CABLE INSTALLATION

As shown in diagram, install so that the marked part is at the top of the vehicle body.

Main Index

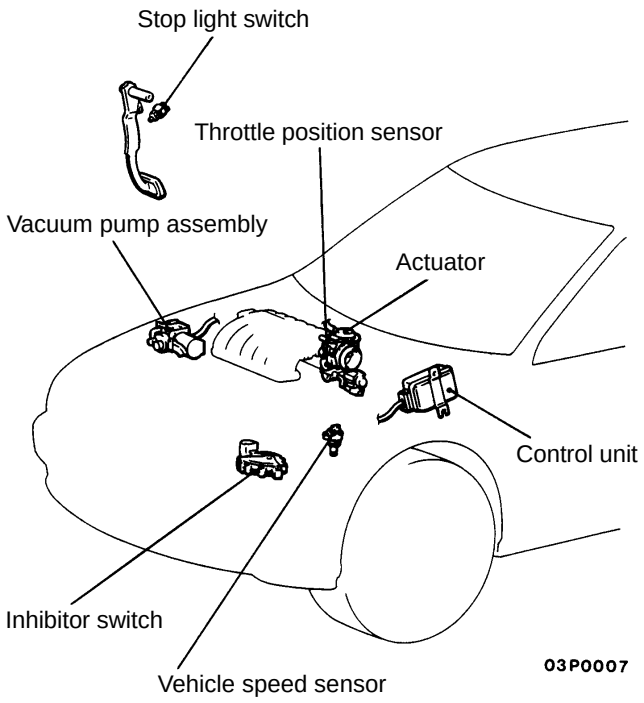
17 Index

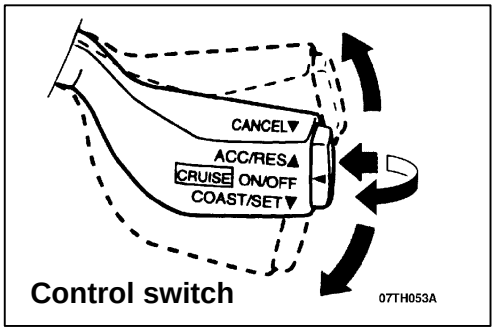
CRUISE CONTROL SYSTEM

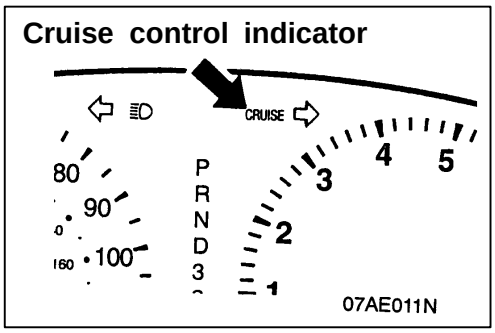
GENERAL INFORMATION

By using the 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.

CONSTRUCTION DIAGRAM





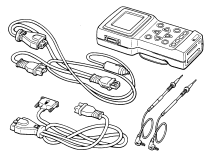
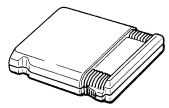
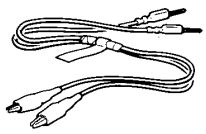


07TH052A

SERVICE SPECIFICATIONS

Items	Standard value
Accelerator cable play mm	3–5

SPECIAL TOOLS

Tool	Tool number and name	Supersession	Application
	MB991502 MUT-II	MB991502	• Reading diagnosis trouble code • Auto-cruise control system inspection
	ROM Pack	–	
	MB991529 Diagnosis trouble code check harness	Tool not necessary if MUT-II is available	Checking the diagnosis trouble code.

Main Index
17 Index

TROUBLESHOOTING

STANDARD FLOW OF DIAGNOSIS TROUBLESHOOTING

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

DIAGNOSIS FUNCTION

DIAGNOSIS CODES CHECK

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

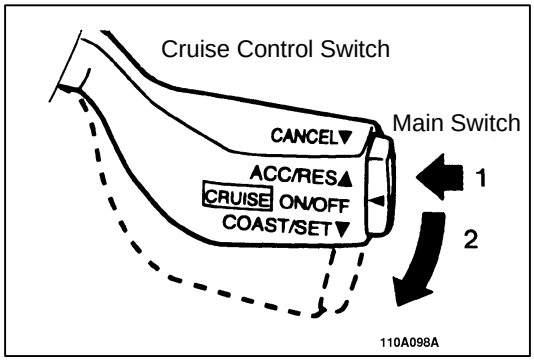
ERASING DIAGNOSIS CODES

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

METHOD OF ERASING DIAGNOSIS CODES

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

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



INPUT SWITCH CODE INSPECTION METHOD

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

Main Index
17 Index

Input Inspection Table

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

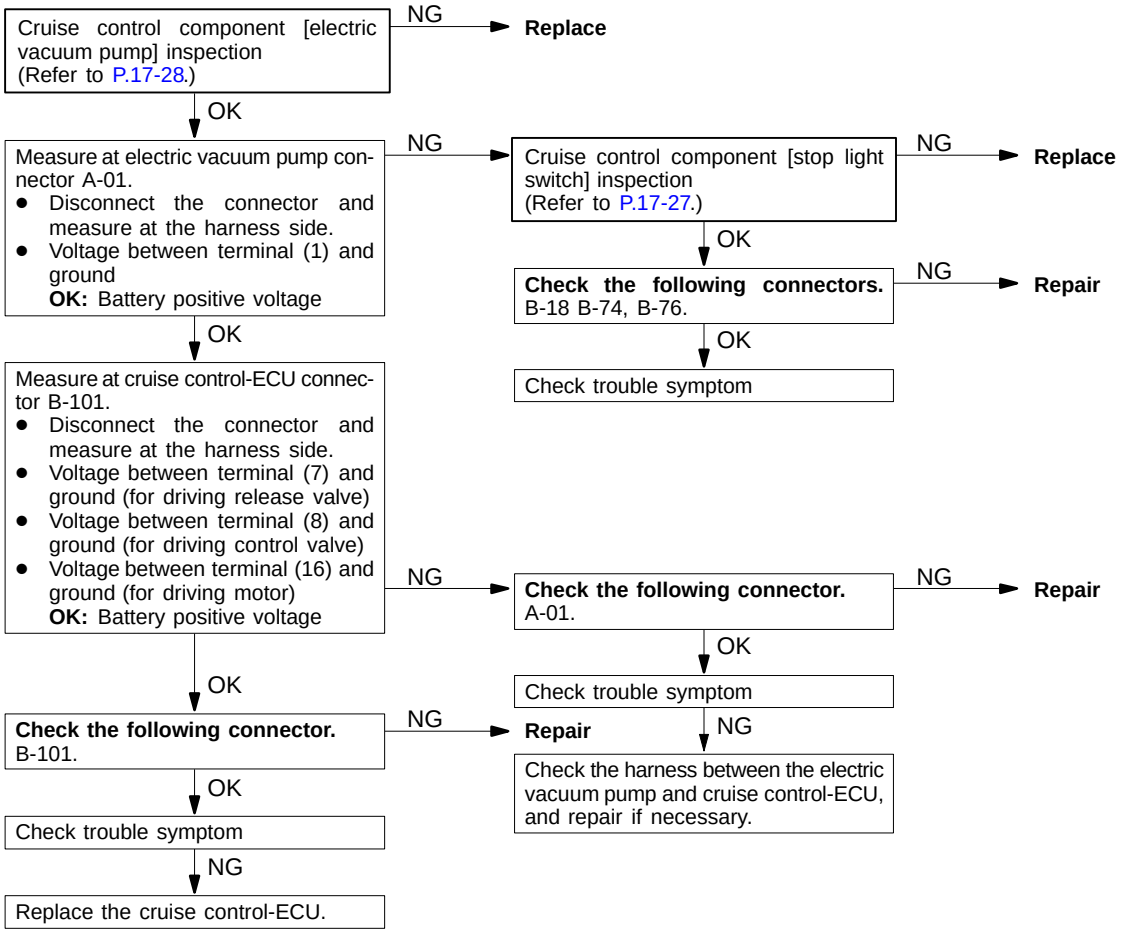
INSPECTION CHART FOR DIAGNOSIS CODES

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

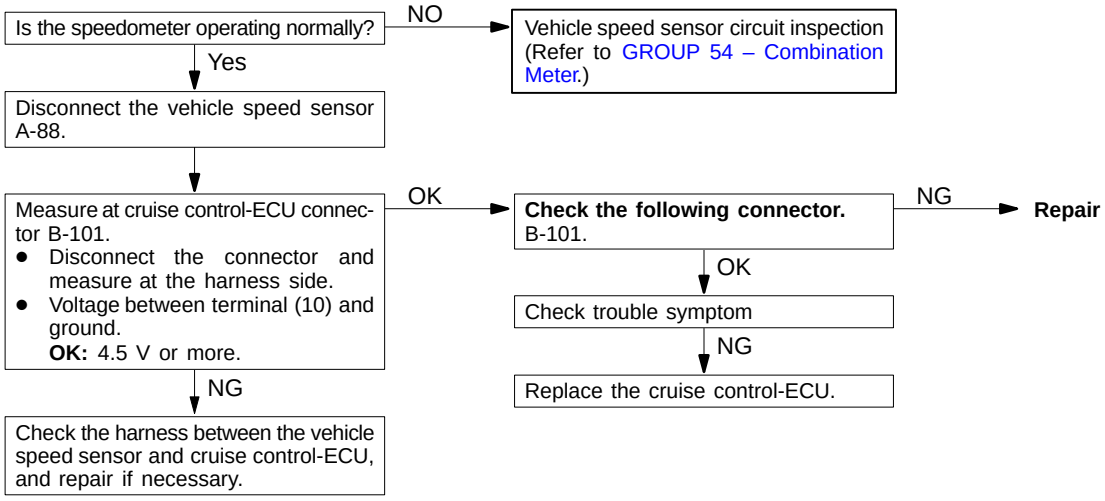
Main Index
17 Index
A-01
B-18
B-74
B-76
B-101

INSPECTION PROCEDURE FOR DIAGNOSIS CODES

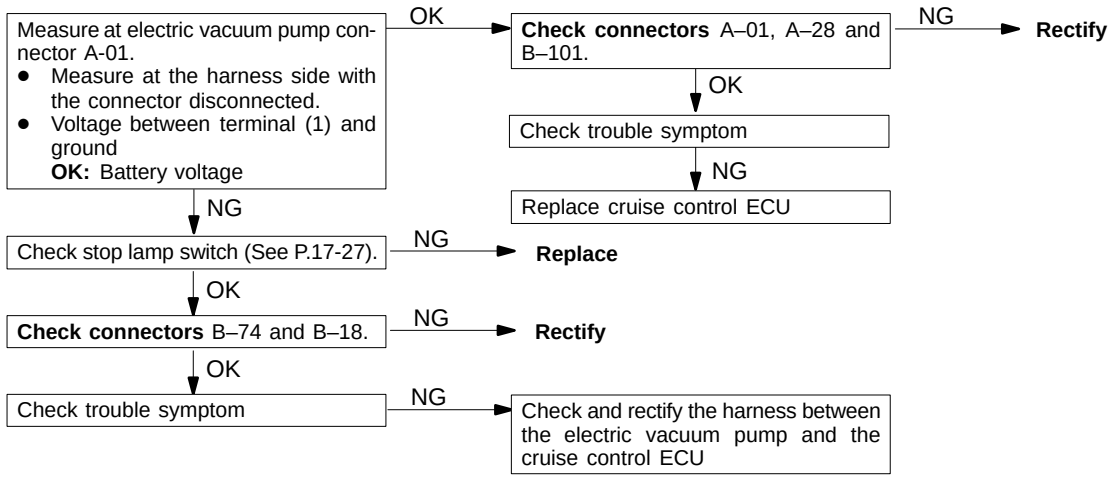
Code No.11 Electric vacuum pump drive system	Probable cause
[Comment] This diagnosis code is output if the release valve, control valve and motor drive signals from the electric vacuum pump are not input to the cruise control-ECU.	• Malfunction of the electric vacuum pump • Malfunction of the stop light switch • Malfunction of the connector • Malfunction of the harness • Malfunction of the cruise control-ECU



Code No.12 Vehicle speed signal system	Probable cause
[Comment] This diagnosis code is output if the vehicle speed signals from the vehicle speed sensor are not input to the cruise control-ECU when the vehicle speed is 40 km/h or more.	• Malfunction of the vehicle speed sensor • Malfunction of the connector • Malfunction of the harness • Malfunction of the cruise control-ECU



Code No.14 Electric vacuum pump power supply system	Probable cause
This diagnosis code is output if the electric vacuum pump release valve, control valve and motor driving signals are not input into the cruise control ECU.	• Stop lamp switch fault • Connector fault • Harness fault • Cruise control ECU fault



Code No.15 Cruise control switch	Probable cause
[Comment] This diagnosis code is output if the cruise control RESUME switch, SET switch or CANCEL switch remains ON.	• Malfunction of the cruise control switch

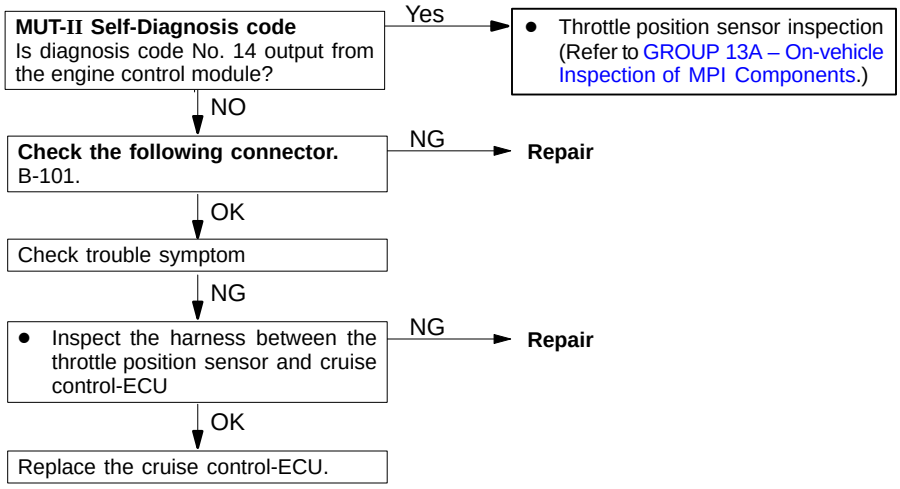
Replace the cruise control switch.

Main Index
17 Index
B-101

Code No.16 Cruise control-ECU	Probable cause
[Comment] This diagnosis code is output if there is an abnormality in the CANCEL hold circuit or the microprocessor monitor circuit in the cruise control-ECU.	• Malfunction of the cruise control-ECU

Replace the cruise control-ECU.

Code No.17 Throttle position sensor system	Probable cause
[Comment] This diagnosis code is output if a voltage of 1.5 V or more when the idle position switch is ON or 0.2 V or less when the idle position switch is OFF is output for a continuous period of 4 seconds or more.	• Malfunction of the throttle position sensor • Malfunction of the connector • Malfunction of the harness • Malfunction of the cruise control-ECU



Main Index
17 Index

INSPECTION CHART FOR TROUBLE SYMPTOMS

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

INSPECTION PROCEDURE FOR TROUBLE SYMPTOMS

INSPECTION PROCEDURE 1

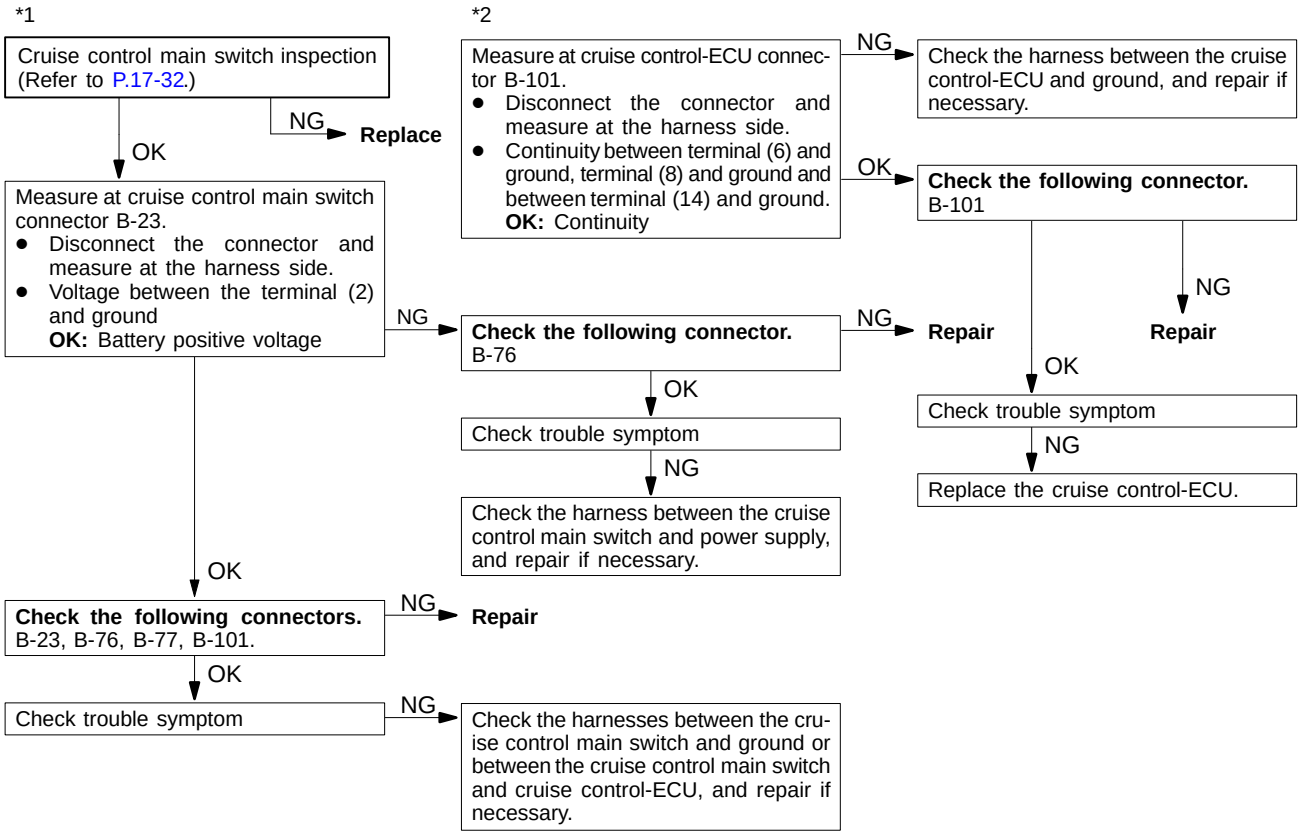
Communication with MUT-II is not possible. (Communication with all systems is not possible.)	**Probable cause**
[Comment] The reason is probably a defect in the power supply system (including ground) for the diagnosis line.	• Malfunction of the connector • Malfunction of the harness

Refer to GROUP 13A – Troubleshooting

Main Index
17 Index
B-23
B-76
B-77
B-101

INSPECTION PROCEDURE 2

Communication with MUT-II is not possible. (Communication with cruise control-ECU only is not possible.)	Probable cause
[Comment] The cause is probably a malfunction of auto-cruise control main switch circuit or a malfunction of cruise control-ECU ground circuit.	• Malfunction of the cruise control main switch • Malfunction of the connector • Malfunction of the harness • Malfunction of the cruise control-ECU

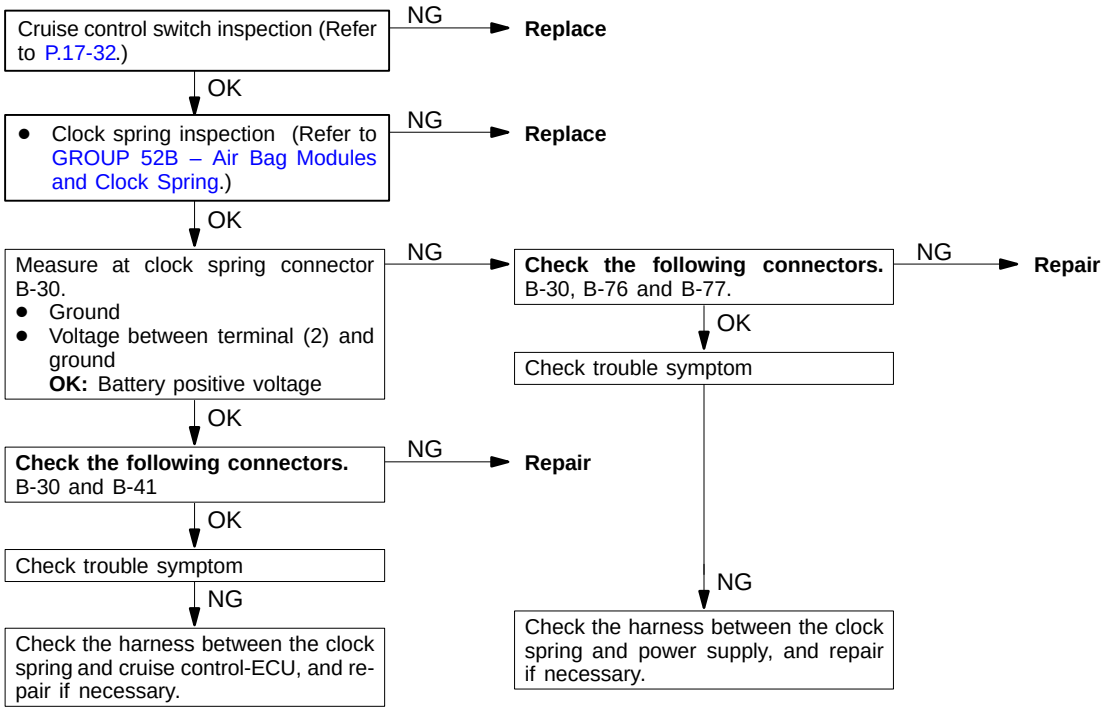


NOTE
*1 indicates malfunction of the cruise control main switch circuit.
*2 indicates malfunction of the cruise control-ECU ground circuit.

Main Index
17 Index
B-30
B-41
B-76
B-77

INSPECTION PROCEDURE 3

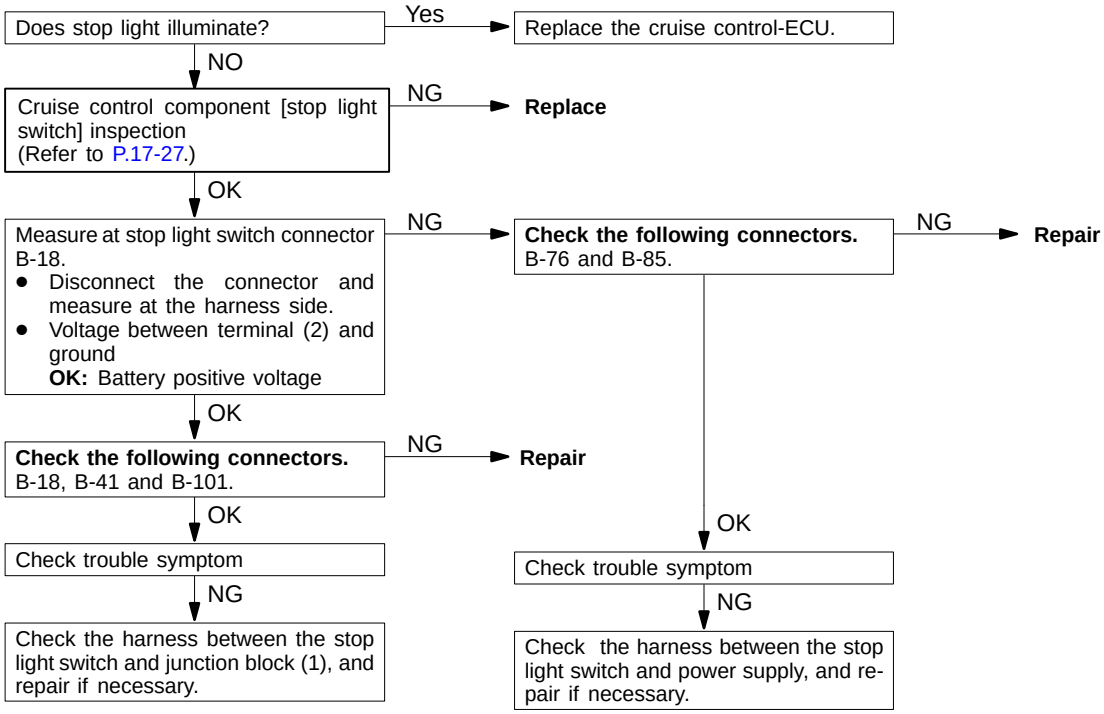
Input switch inspection using the MUT-II is not possible. (However, diagnosis inspection is possible.)	Probable cause
[Comment] The cause is probably a malfunction of cruise control switch circuit system.	• Malfunction of the cruise control switch • Malfunction of the clock spring • Malfunction of the connector • Malfunction of the harness



Main Index
17 Index
B-18
B-41
B-76
B-85
B-101

INSPECTION PROCEDURE 4

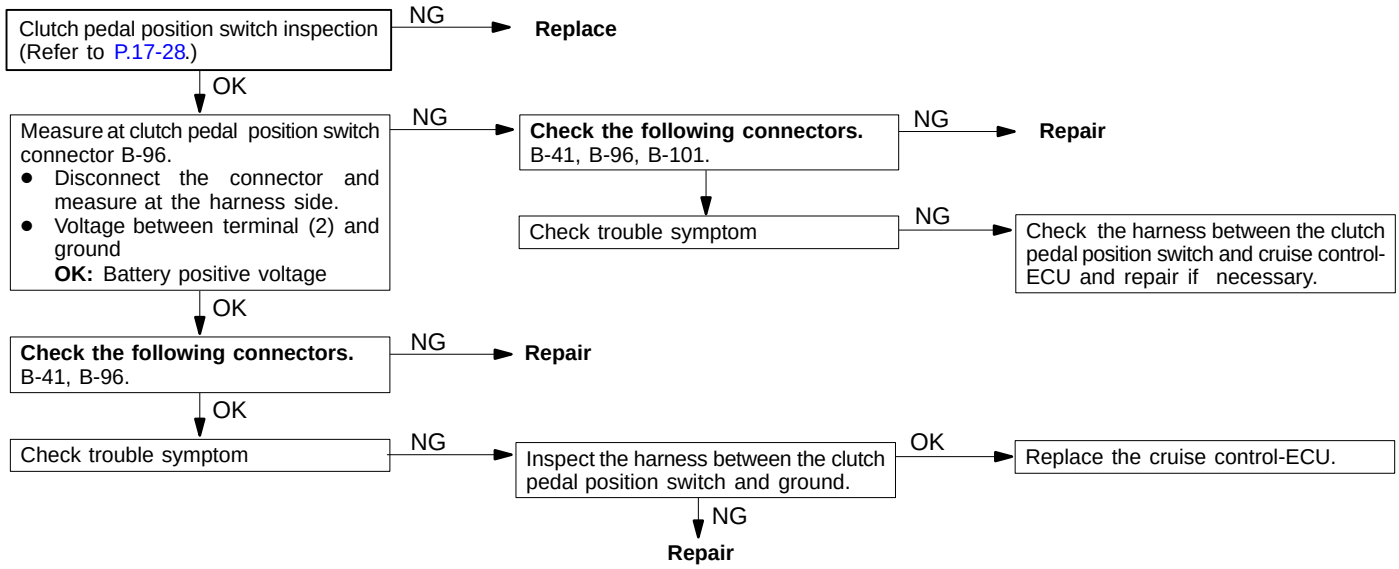
Even if brake pedal is depressed, cruise control is not cancelled.	Probable cause
[Comment] The cause is probably a malfunction of stop light switch or a malfunction of stop light circuit.	• Malfunction of the stop light switch • Malfunction of the connector • Malfunction of the harness • Malfunction of the cruise control-ECU



Main Index
17 Index
B-41
B-96
B-101

INSPECTION PROCEDURE 5

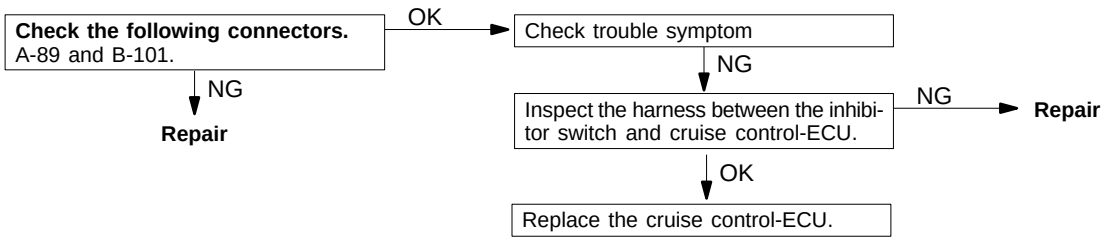
Even if clutch pedal is depressed, cruise control is not cancelled. <M/T>	Probable cause
[Comment] The cause is probably a malfunction of clutch pedal position switch or clutch circuit.	• Malfunction of the clutch pedal position switch • Malfunction of the connector • Malfunction of the harness • Malfunction of the cruise control-ECU



Main Index
17 Index
A-89
B-101

INSPECTION PROCEDURE 6

Even if select lever is set to N range, cruise control is not cancelled. <A/T>	Probable cause
[Comment] The cause is probably an open-circuit in the output signal circuit in N range.	• Malfunction of the connector • Malfunction of the harness • Malfunction of the cruise control-ECU



INSPECTION PROCEDURE 7

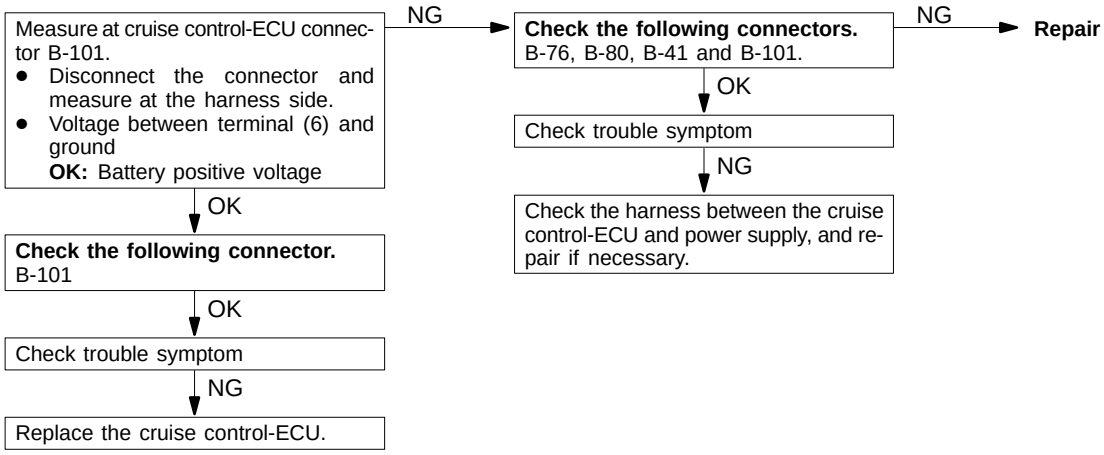
Even if cruise control CANCEL switch is set to ON, cruise control is not cancelled.	Probable cause
[Comment] The cause is probably an open-circuit in the circuit inside the CANCEL switch.	• Malfunction of the cruise control-ECU

Replace the cruise control switch.

Main Index
17 Index
B-41
B-76
B-80
B-101

INSPECTION PROCEDURE 8

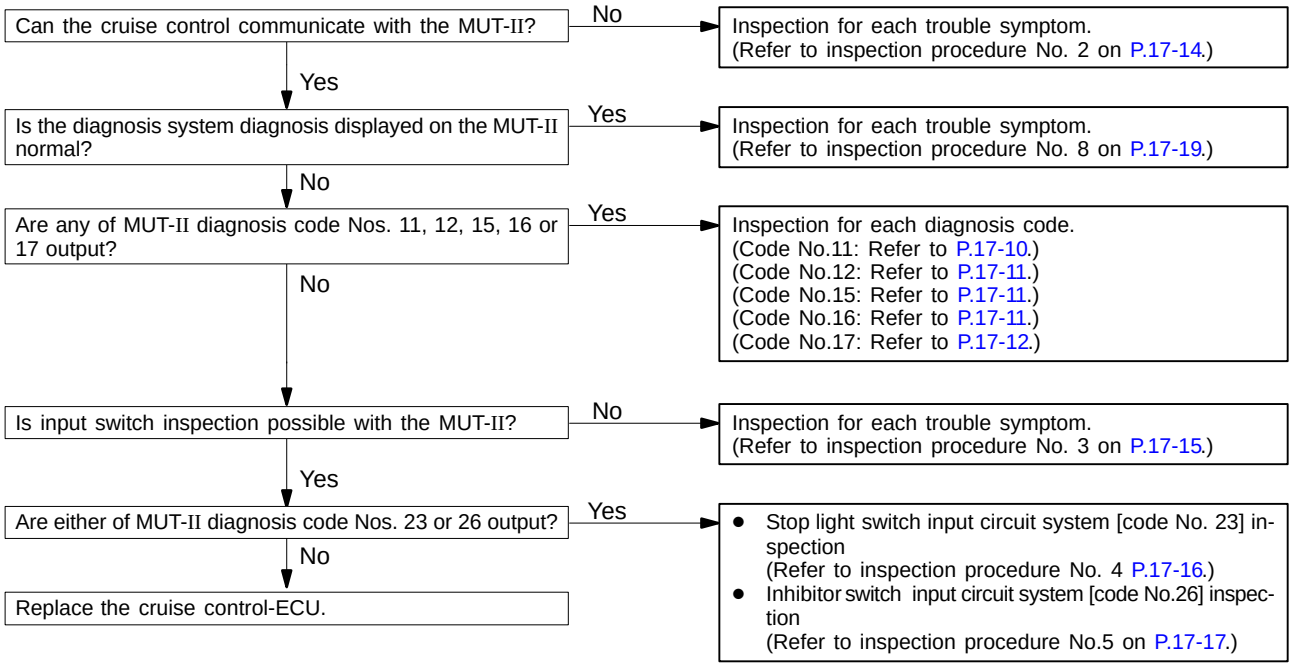
The diagnostic result displayed on the MUT-II is normal even though cruise control cannot be set.	Probable cause
[Comment] Because of an open-circuit in the battery backup circuit system, the fail-safe function prevents diagnosis codes from being memorised and displayed even though cruise control is cancelled.	• Malfunction of the connector • Malfunction of the harness • Malfunction of the cruise control-ECU



Main Index
17 Index

INSPECTION PROCEDURE 9

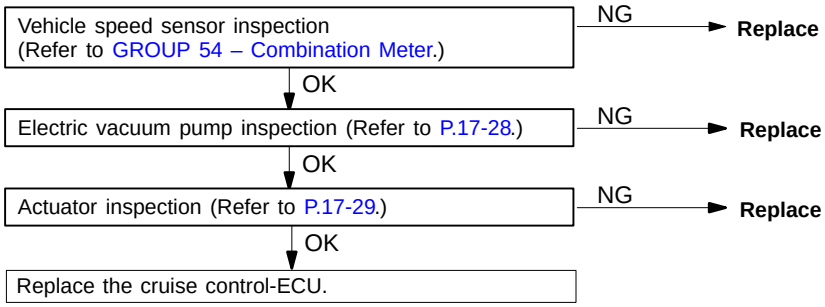
Cruise control cannot be set.	Probable cause
[Comment] The cause is probably that the fail-safe function is cancelling cruise control. In this case, the MUT-II can be used to check the trouble symptoms in each system by inspecting the diagnosis codes. The MUT-II can also be used to check if the circuits of each input switch are normal or not by inspecting the input switch codes.	• Malfunction of the cruise control main switch • Malfunction of the cruise control switch • Malfunction of the clock spring • Malfunction of the harnesses or connectors • Malfunction of the cruise control-ECU



Main Index
17 Index

INSPECTION PROCEDURE 10

Hunting (repeated acceleration and deceleration) occurs at the set vehicle speed.	Probable cause
[Comment] The cause is probably a malfunction of vehicle speed sensor or incorrect vacuum in the electric vacuum pump or actuator.	• Malfunction of the vehicle speed sensor • Malfunction of the electric vacuum pump • Malfunction of the actuator • Malfunction of the cruise control-ECU



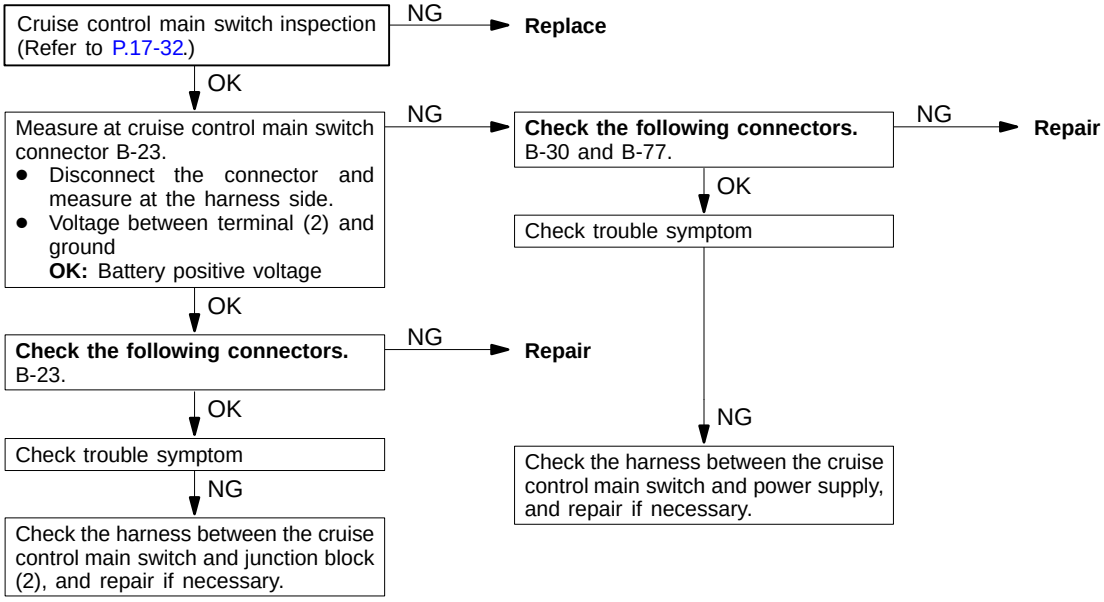
INSPECTION PROCEDURE 11

Even though cruise control main switch is ON, switch indicator does not illuminate. (However, cruise control is normal.)	Probable cause
[Comment] Blown bulb in cruise control main switch	• Malfunction of the cruise control main switch

Replace the cruise control main switch.

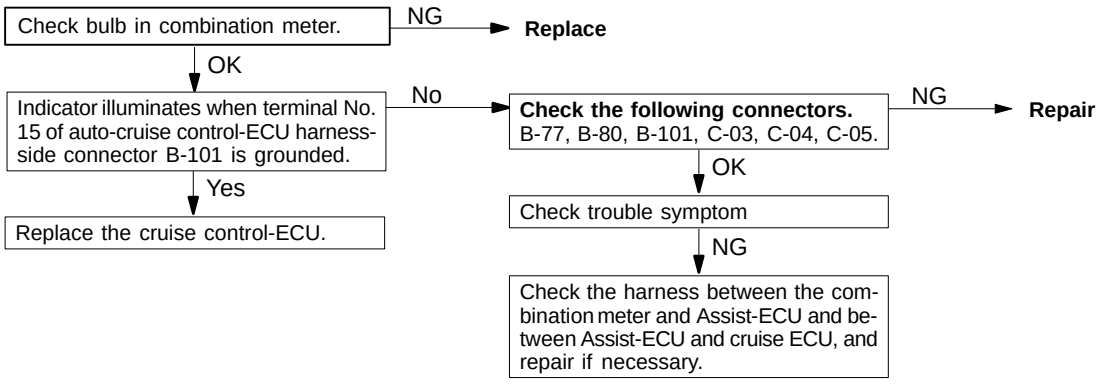
INSPECTION PROCEDURE 12

Cruise control main switch illumination light does not illuminate.	Probable cause
[Comment] The cause is probably a malfunction of cruise control main switch or a malfunction of harness or connector.	• Malfunction of the cruise control main switch • Malfunction of the connector • Malfunction of the harness



INSPECTION PROCEDURE 13

Cruise control indicator inside combination meter does not illuminate. (However, cruise control is normal.)	Probable cause
[Comment] The cause is probably a malfunction of bulb or a malfunction of connector or harness.	• Malfunction of the bulb • Malfunction of the harness • Malfunction of the connector • Malfunction of the cruise control-ECU



Main Index
17 Index
B-18
B-41
B-74
B-76
B-85
B-101

INSPECTION PROCEDURE 14

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

Check the following connectors.
B–18, B-41, B-74 B-76, B-85 and B-101.
NG → **Repair**
OK ↓
Check trouble symptom
NG → Check the harness between junction block (2) and cruise control-ECU, and repair if necessary.

INSPECTION PROCEDURE 15

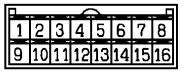
Inhibitor switch input circuit system inspection (Code No. 26)

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

Main Index

17 Index

CHECK AT ECU TERMINALS



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

Main Index
17 Index

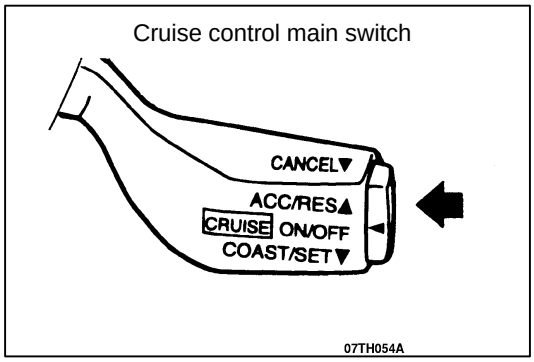
Terminal No.	Check item	Check conditions	Normal condition
13	Inhibitor switch input <A/T>	When the shift lever is other than in the N position (Inhibitor switch OFF)	Battery voltage
		When the shift lever is in the N position (Inhibitor switch ON)	0V
	Clutch pedal switch input <M/T>	When the clutch pedal is released (switch OFF)	Battery voltage
		When the clutch pedal is pressed (switch ON)	0V
14	Ground	–	–
15	Indicator lamp input (In combination meter)	When travelling at constant-speed (Indicator lamp illuminated)	0V
		When constant-speed travel cancelled (Indicator lamp extinguished)	Battery voltage
16	Electric vacuum pump motor input	During constant-speed travel with Set switch (Motor stopped/ running	Battery voltage /0V
		Accelerating with Resume switch during constant-speed travel (Motor stopped/running)	Battery voltage /0V
		Decelerating with Set switch during constant-speed travel (Motor stopped)	Battery voltage
		Constant-speed travel cancelled with Cancel switch (Motor stopped)	Battery voltage

Main Index

17 Index

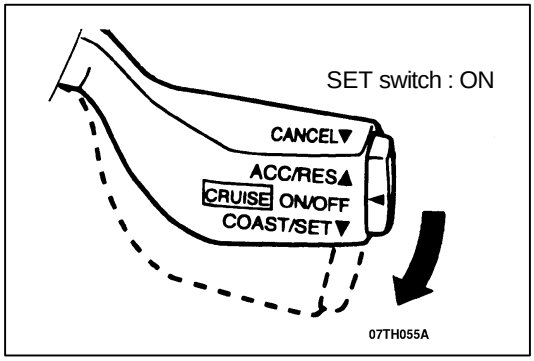
ON-VEHICLE SERVICE

CRUISE CONTROL SYSTEM OPERATION CHECK



CRUISE CONTROL MAIN SWITCH INDICATOR LIGHT

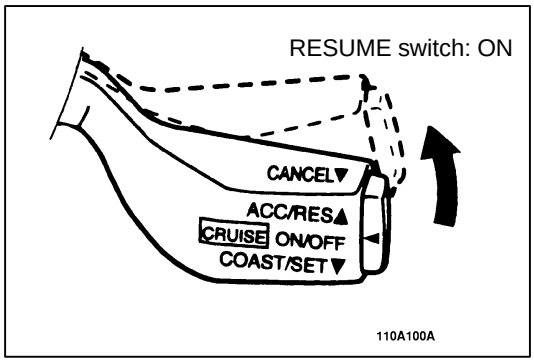
1. Turn the ignition key to ON
2. Check to be sure that the indicator within the switch illuminates when the main switch is switched ON.



CRUISE CONTROL SETTING

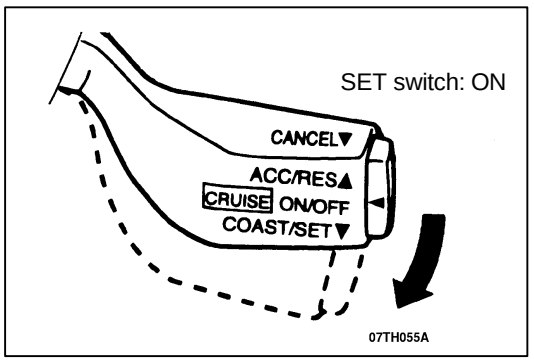
1. Switch ON the main switch.
2. Drive at the desired speed within the range of approximately 40–200 km/h.
3. Switch ON the SET switch.
4. Check to be sure that when the switch is released the speed is the desired constant speed.

   NOTE
   If the vehicles speed decreases to approximately 15 km/h below the set speed because of climbing a hill for example, the cruise control will be cancelled.



SPEED-INCREASE SETTING

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

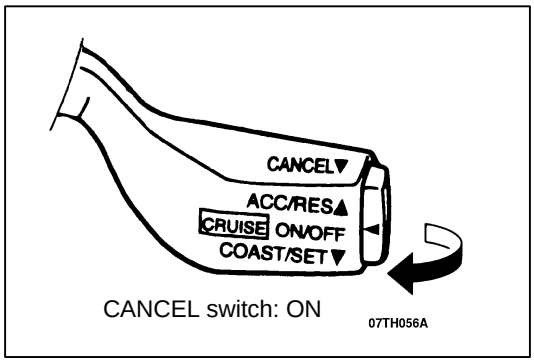


SPEED REDUCTION SETTING

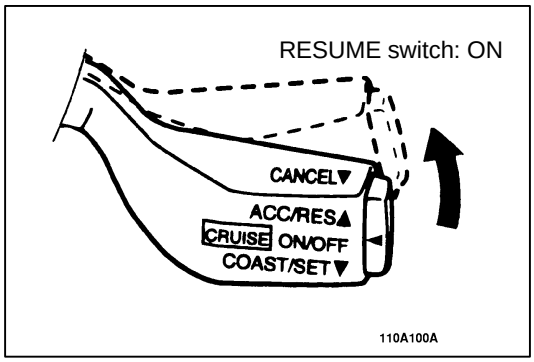
1. Set to the desired speed.
2. Switch ON the SET switch.
3. Check to be sure that deceleration continues while the switch is pressed, and that when it is released the constant speed at the time when it was released becomes the driving speed.

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

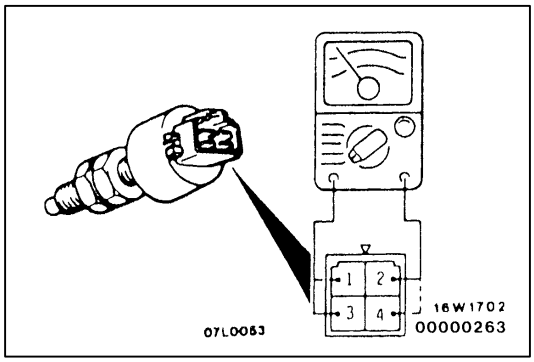
Main Index
17 Index



CANCEL switch: ON



RESUME switch: ON



RETURN TO THE SET SPEED BEFORE CANCELLATION AND CRUISE CONTROL CANCELLATION

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

CRUISE CONTROL COMPONENT CHECK

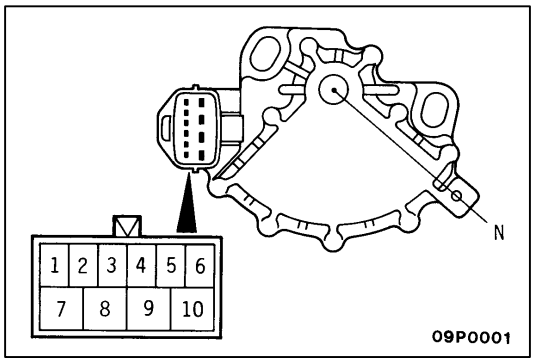
STOP LIGHT SWITCH

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

THROTTLE POSITION SENSOR

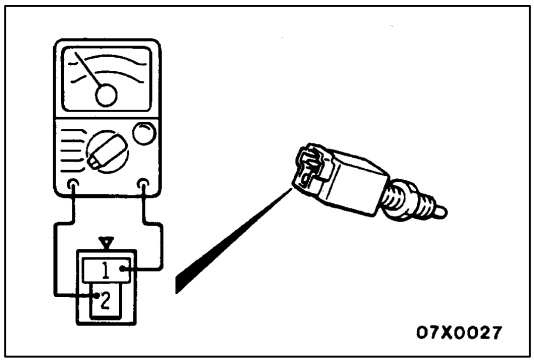
Refer to GROUP 13A – On-vehicle Inspection of MPI Components.

Main Index
17 Index



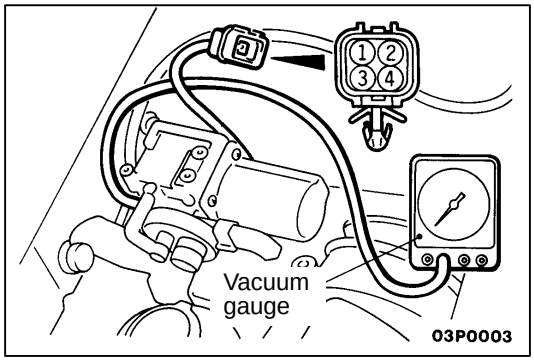
INHIBITOR SWITCH (“N” POSITION)

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



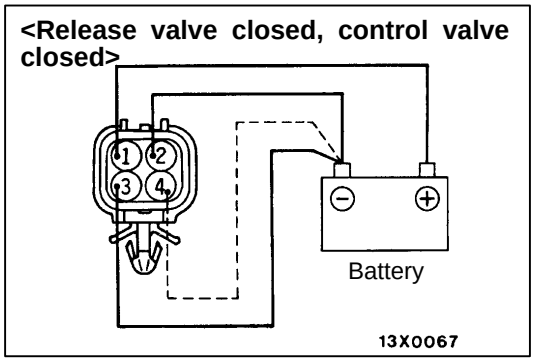
CLUTCH PEDAL SWITCH

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



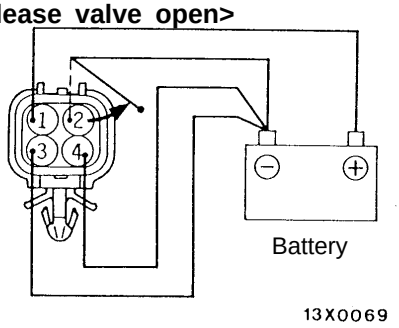
CRUISE VACUUM PUMP

1. Disconnect the vacuum hose from the electric vacuum pump and connect a vacuum gauge to the vacuum pump.
2. Disconnect the electric vacuum pump connector.



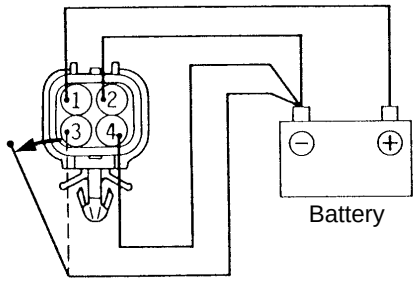
3. Connect terminal (1) to the battery (+) terminal, and connect terminals (2) and (3) to the battery (–) terminal.
4. Check to be sure that the vacuum gauge shows a reading of 53 kPa (398 mm Hg)or more when terminal (4) is connected to the battery (–) terminal.

<Release valve open>



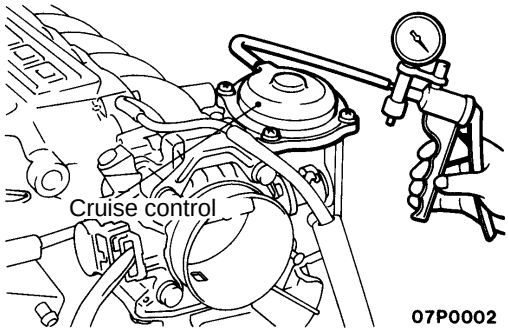
13X0069

<Control valve open>



13X0068
00000264

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



07P0002

ACTUATOR

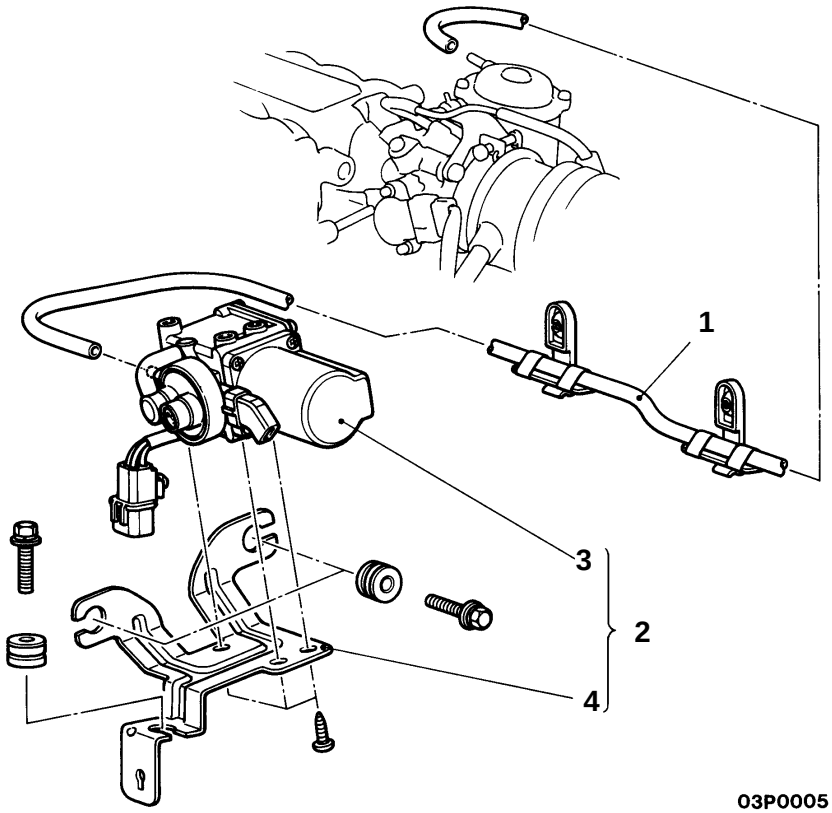
1. Disconnect the vacuum hose from the vacuum actuator and connect a hand vacuum pump to the vacuum actuator.
2. Confirm that the throttle lever operates and the vacuum is also maintained when a vacuum is present.

Main Index

17 Index

CRUISE CONTROL

REMOVAL AND INSTALLATION



07AE015N

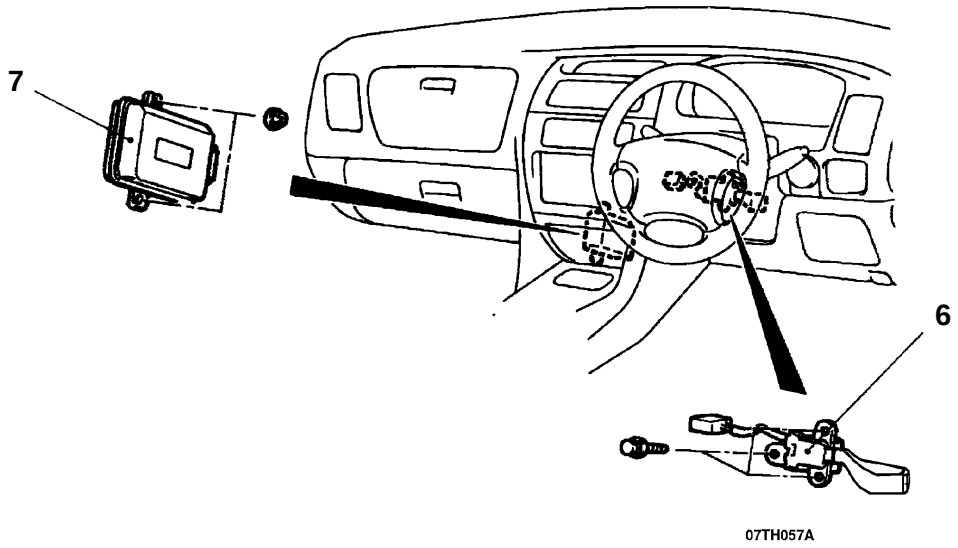
Vacuum pump removal steps

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

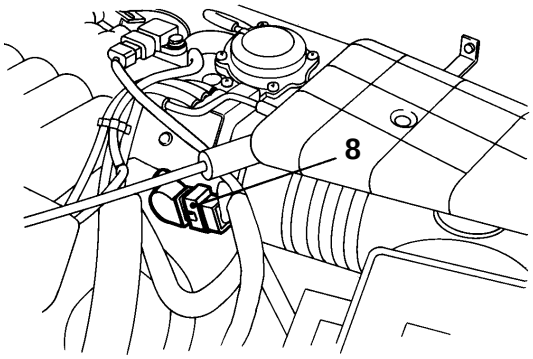
Main Index

17 Index

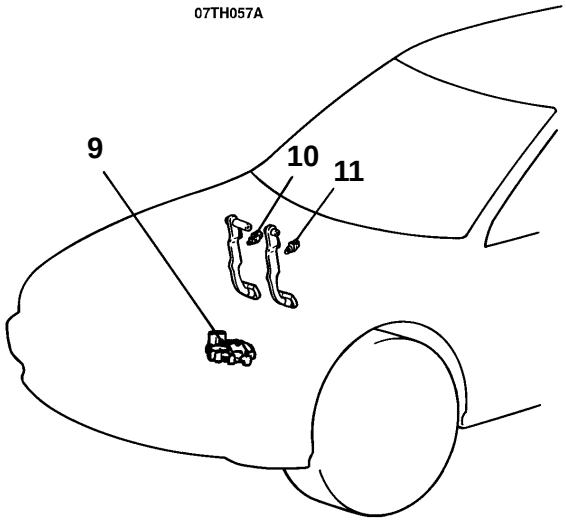
CAUTION: SRS
Before removal of air bag module and clock spring, refer to the followings:
GROUP 52B – SRS Service Precautions.
GROUP 52B – Air Bag Modules and Clock Spring.



07TH057A



03AE024N



03TE023A

07TH069A

Control switch removal steps

- Airbag module (See group 52B)

6. Control switch

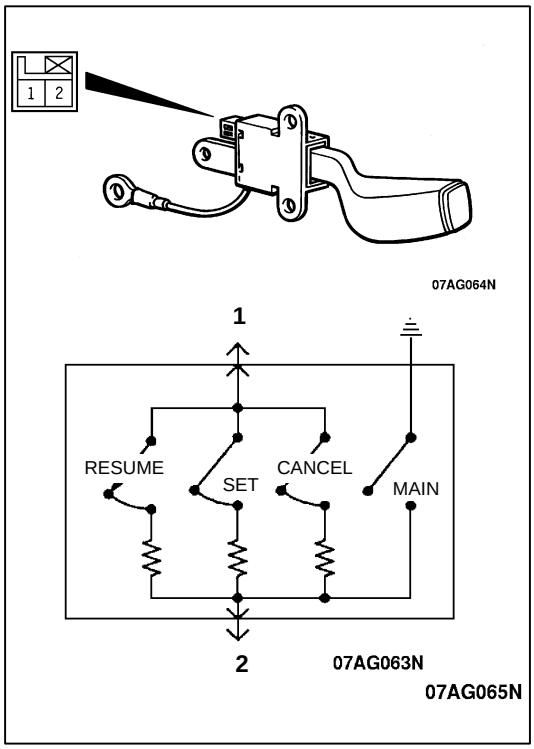
Control unit removal steps

- Floor console box assembly (See group 52A)
- Centre air outlet assembly (See group 52-Instrument Panel)
- Ash tray (See group 52A-Instrument Panel)
- Air conditioner control unit and radio/ tape player

7. Cruise control ECU

Sensor removal steps

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



INSPECTION

CRUISE CONTROL SWITCH CHECK

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

Switch position	Resistance between terminals
Switch OFF	No continuity
CANCEL switch ON	Approx. 1.1 kΩ
RESUME switch ON	Approx. 331 Ω
SET switch ON	Approx. 3.1 kΩ
MAIN switch held in	0 Ω

Main Index
17 Index

EMISSION CONTROL SYSTEM

GENERAL INFORMATION

The emission control system consists of the following subsystems:
- Positive crankcase ventilation system
- Evaporative emission control system
- Exhaust emission control system

Items	Name	Specification
Crankcase emission control system	Positive crankcase ventilation (PCV) valve	Variable flow type (Purpose: HC reduction)
Evaporative emission control system	Canister Purge control valve	Equipped Manifold vacuum purge (Purpose: HC reduction)
Exhaust emission control system	Air-fuel ratio control device–MPI system (vehicles with catalytic converter)	Oxygen sensor feedback type (Purpose: CO, HC, NOx reduction)
	Exhaust gas recirculation system • EGR valve • EGR control solenoid valve	Equipped Single type Duty cycle type solenoid valve (Purpose: NOx reduction)
	Catalytic converter	Monolith type (Purpose: CO, HC, NOx reduction)

EMISSION CONTROL DEVICE REFERENCE TABLE

Related parts	Crankcase emission control system	Evaporative emission control system	Air/fuel ratio control system	Catalytic converter	Exhaust gas recircula-tion system	Reference page
PCV valve	X					17-38
MPI system component		X	X			Group 13A
EGR valve					X	17-46
EGR control solenoid valve					X	17-47
Catalytic converter				X		17-48

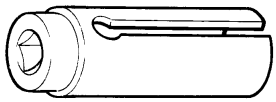
SERVICE SPECIFICATIONS

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

Main Index

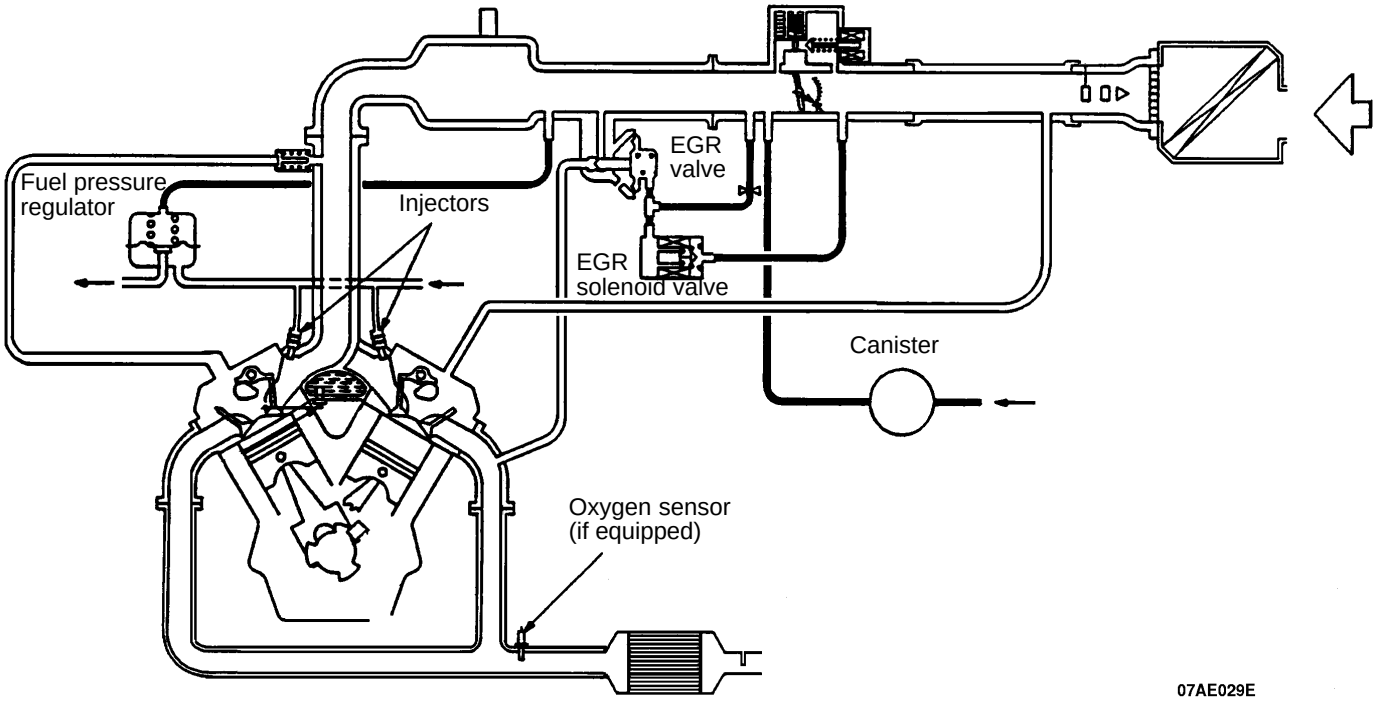
17 Index

SPECIAL TOOL

Tool	Tool number and name	Supersession	Application
	MD998770 Oxygen sensor wrench	–	Removal/Installation of heated oxygen sensor

VACUUM HOSE

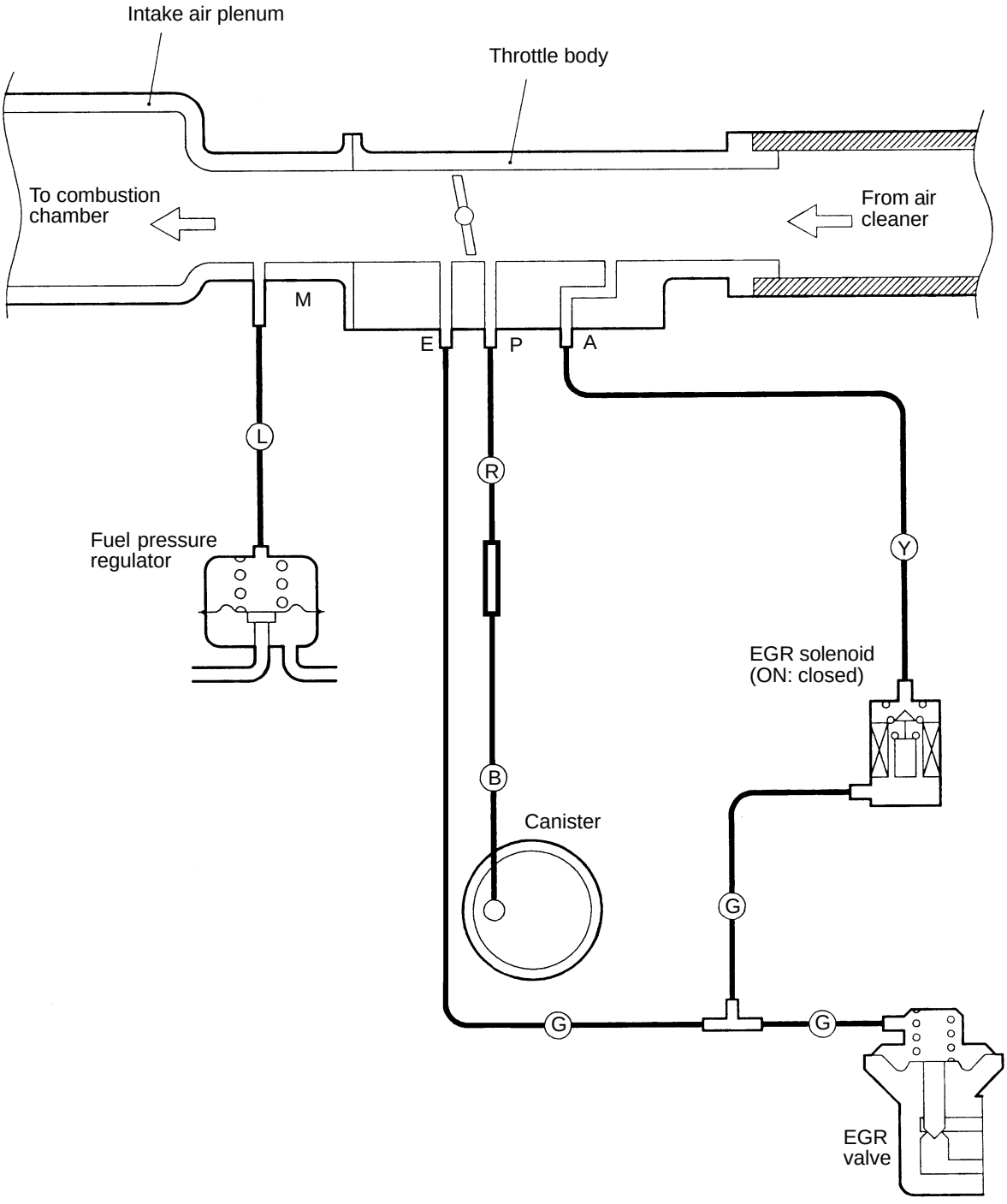
VACUUM HOSE PIPING DIAGRAM



Main Index

17 Index

VACUUM CIRCUIT DIAGRAM



Main Index

17 Index

VACUUM HOSE INSTALLATION

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

VACUUM HOSE INSPECTION

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

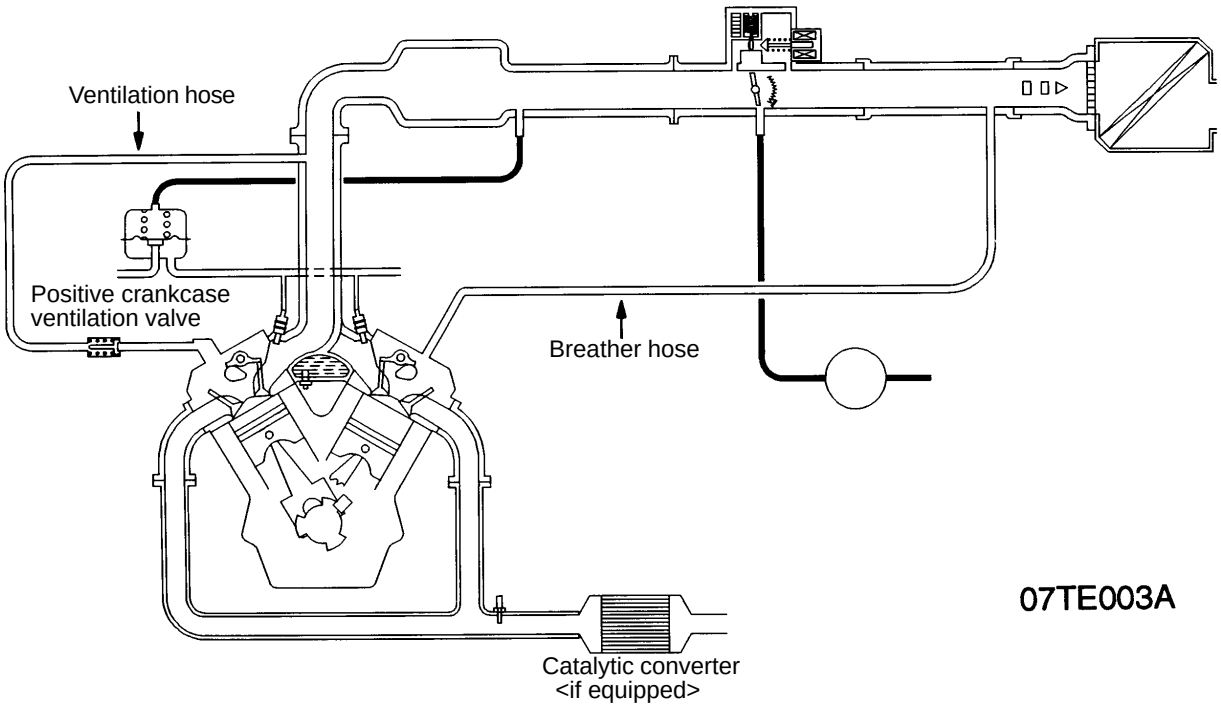
Main Index
17 Index

CRANKCASE EMISSION CONTROL SYSTEM

GENERAL INFORMATION

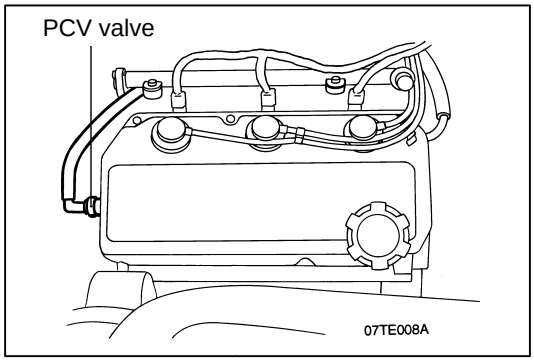
The crankcase emission control system is a system for preventing the escape of blow-by gases from inside the crankcase into the atmosphere.
Fresh air is sent from the air cleaner into the crankcase through the breather hose to be mixed with the blow-by gases inside the crankcase.
The blow-by gas inside the crankcase is drawn into the intake manifold through the positive crankcase ventilation valve.
The positive crankcase ventilation valve is designed to lift the plunger according to the intake manifold vacuum so as to regulate the flow of blow-by gas properly.
In other words, the blow-by gas flow is regulated during low load engine operation to maintain engine stability, while the flow is increased during high load operation to improve the ventilation performance.

SYSTEM DIAGRAM



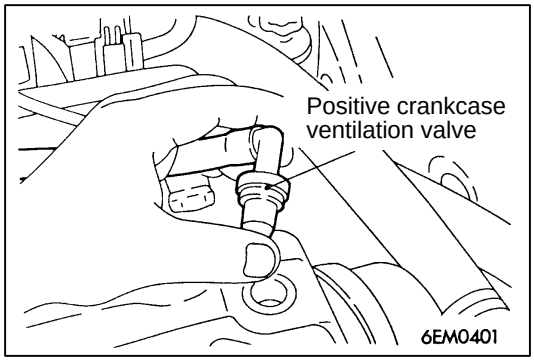
COMPONENT LOCATION

Positive crankcase ventilation valve



POSITIVE CRANKCASE VENTILATION SYSTEM CHECK

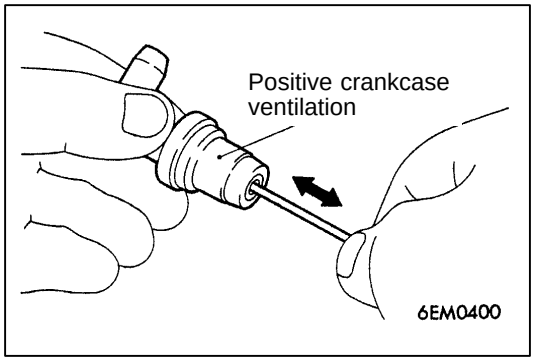
1. Remove the ventilation hose from the positive crankcase ventilation valve.
2. Remove the positive crankcase ventilation valve from the rocker cover.
3. Reinstall the positive crankcase ventilation valve at the ventilation hose.
4. Start the engine and run at idle.



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

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

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



POSITIVE CRANKCASE VENTILATION (PCV) VALVE CHECK

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

Main Index

17 Index

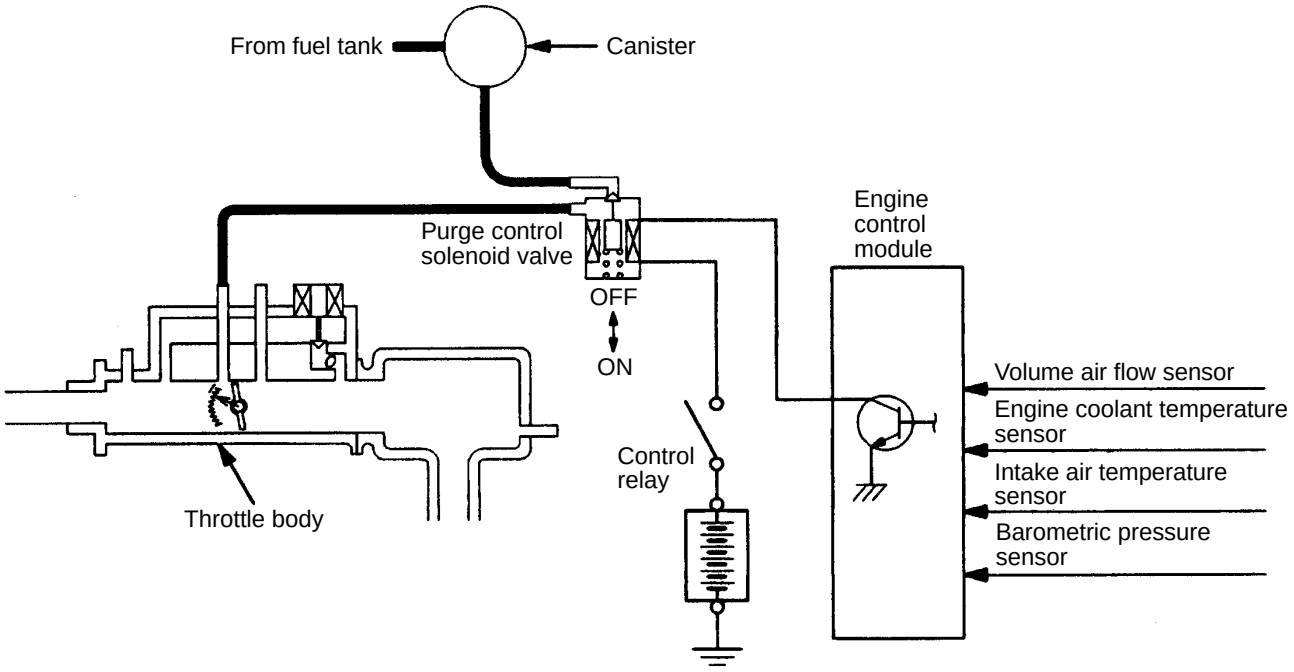
EVAPORATIVE EMISSION CONTROL SYSTEM

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 EVAP canister. When the vehicle is in operation, fuel vapours stored in the EVAP canister flow through the EVAP purge solenoid and purge port and go into the intake manifold plenum 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 module brings the EVAP purge solenoid into the OFF state to shut off the fuel vapour flow to the intake manifold plenum. This does not only insure the driveability when the engine is cold or running under low load but also stabilise the emission level.

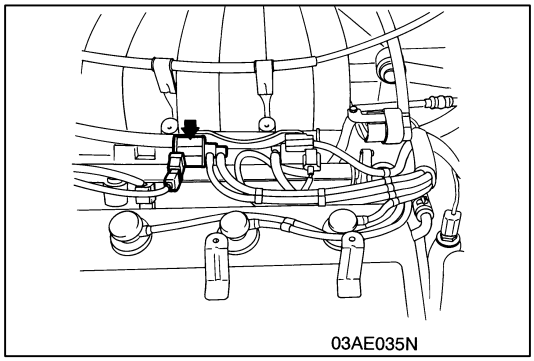
SYSTEM DIAGRAM



9EM0167

COMPONENT LOCATION

Evaporative emission purge solenoid



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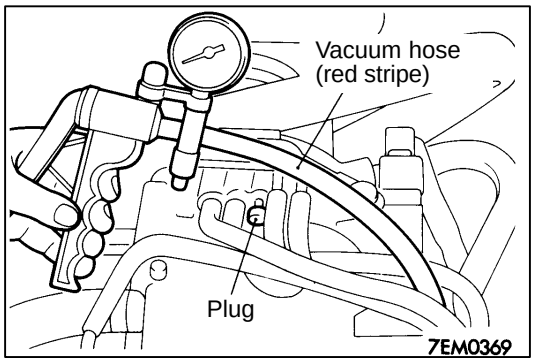


PURGE CONTROL SYSTEM CHECK

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

When engine is cold
[Engine coolant temperature: 40°C or less]

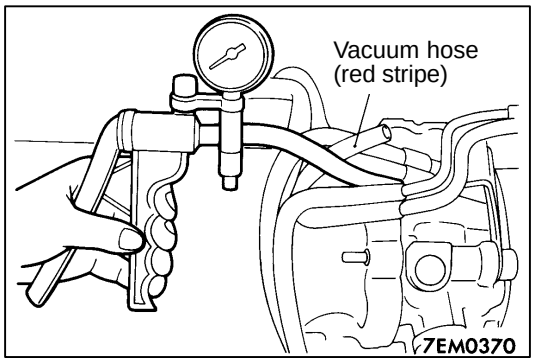
Vacuum	Engine status	Normal condition
400 mmHg	3,000 rpm	Vacuum is maintained

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

Vacuum	Engine status	Normal condition
400 mmHg	Idling	Vacuum is maintained
	3,000 rpm	Vacuum will leak for approximately 3 minutes after the engine is started. After 3 minutes have elapsed, the vacuum will be maintained momentarily, after which it will again leak.*

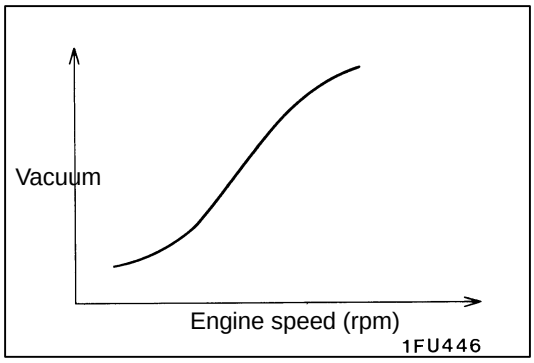
NOTE
* The vacuum will leak continuously if the atmospheric pressure is approximately 580 mmHg or less, or the temperature of the intake air is approximately 50°C or higher.

Main Index
17 Index



PURGE PORT VACUUM CHECK

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



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

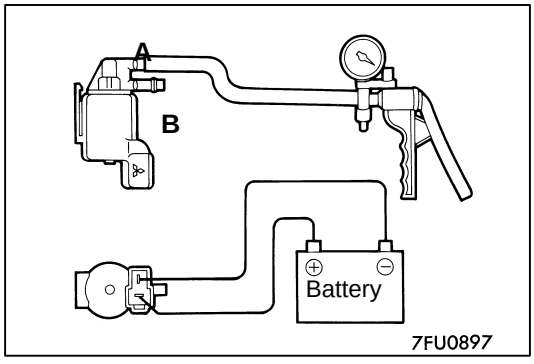
   NOTE
   If there is a problem with the change in vacuum, it is possible that the throttle body purge port may be clogged and require cleaning.

EVAPORATIVE EMISSION PURGE SOLENOID CHECK

1. Remove the engine cover. Refer to GROUP 11B.
2. Disconnect the vacuum hose (black stripe, red stripe) from the solenoid valve.

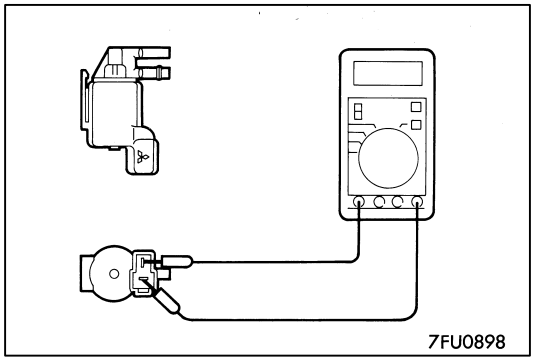
   NOTE
   Before disconnecting the vacuum hose, always make a mark so that it can be reconnected at original position.

3. Disconnect the harness connector.



4. Connect a hand vacuum pump to nipple (A) of the solenoid valve (refer to the illustration at left).
5. Check air tightness 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



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

   Standard value: 36–44 Ω [at 20°C]

VOLUME AIR FLOW SENSOR, ENGINE COOLANT TEMPERATURE SENSOR AND INTAKE AIR TEMPERATURE SENSOR CHECK

To inspect these parts, refer to GROUP 13A – On-vehicle Inspection of MPI Components.

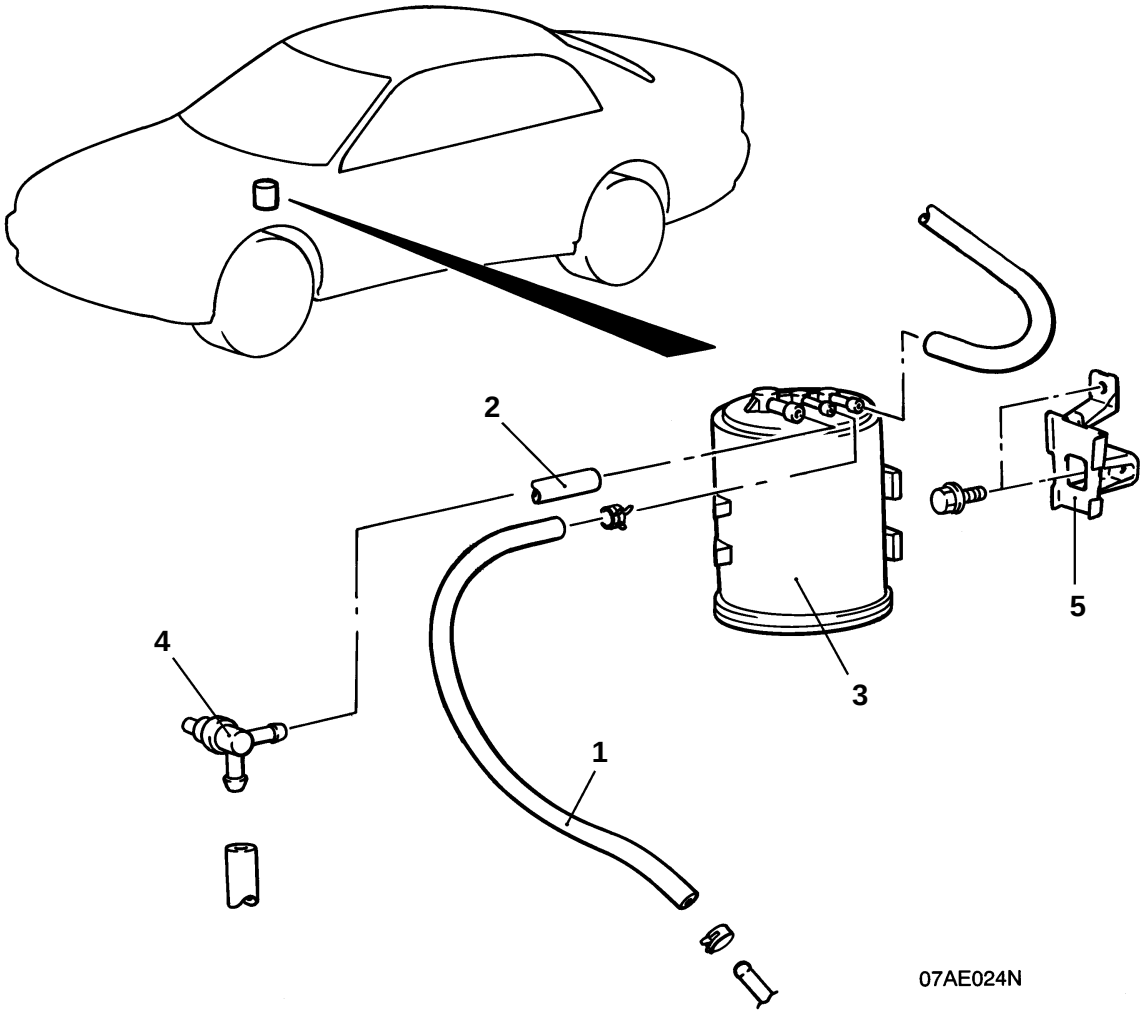
AIR CONDITIONING SWITCH CHECK

To inspect the air conditioning switch, refer to GROUP 55 – Air Conditioning Switch.

Main Index

17 Index

CANISTER AND TWO WAY VALVE REMOVAL AND INSTALLATION



Removal steps

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

INSPECTION

TWO-WAY VALVE

Refer to GROUP 13F – Fuel Supply

EXHAUST GAS RECIRCULATION (EGR) SYSTEM

GENERAL INFORMATION

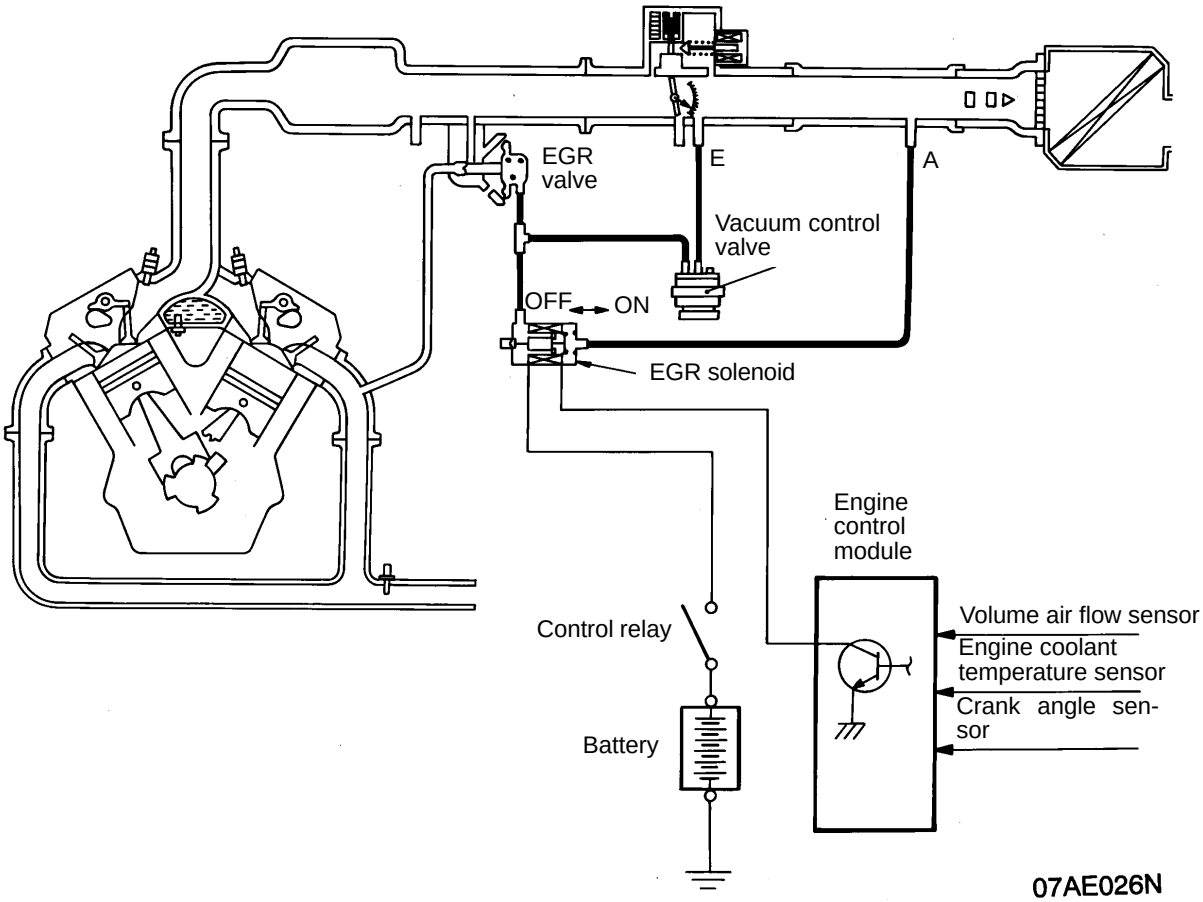
The exhaust gas recirculation (EGR) system lowers the nitrogen oxide (NOx) emission level. When the air/fuel mixture combustion temperature is high, a large quantity of nitrogen oxides (NOx) is generated in the combustion chamber. Therefore, this system recirculates part of emission gas from the exhaust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

When the engine coolant temperature is low, when the engine is at idle or when a wide open throttle operation is performed, the EGR valve is kept closed, achieving no EGR. In normal vehicle operation performed after warming up of the engine, the EGR valve is opened to carry out EGR.

The engine control module monitors EGR system via the manifold differential pressure sensor and turns on the check engine/malfunction indicator light to notify the driver if a failure occurs in the EGR system.

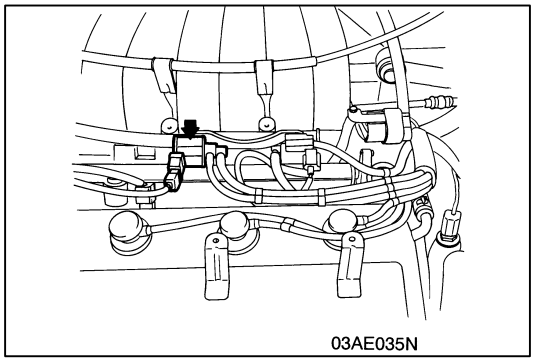
SYSTEM DIAGRAM



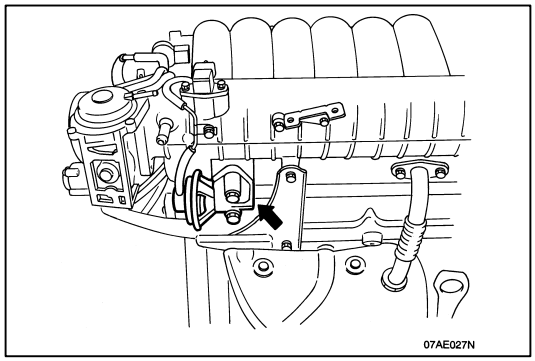
Main Index
17 Index

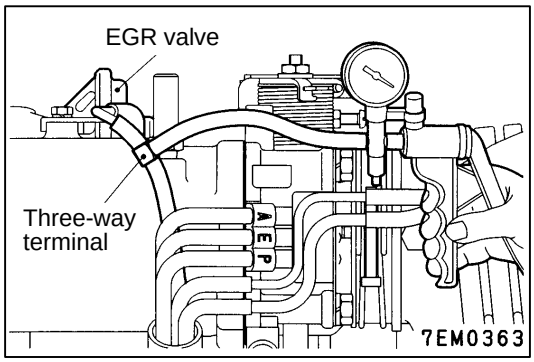
COMPONENT LOCATION

EGR solenoid



EGR valve





EGR SYSTEM CHECK

1. Remove the engine cover. Refer to GROUP 11B.
2. Disconnect the vacuum hose (green stripe) that connects to the EGR valve, and then connect a hand vacuum pump via a three-way terminal.
3. With the engine in cold and hot conditions, check the condition of vacuum when rapid racing has been performed by opening the throttle valve quickly.

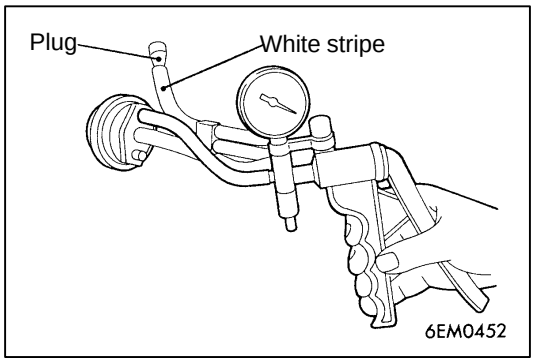
When engine is cold
[Engine coolant temperature: 20°C or less]

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

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

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

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



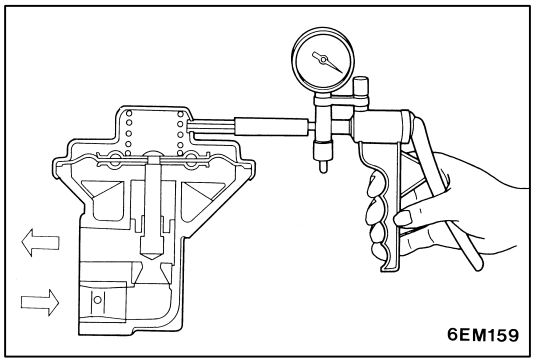
VACUUM CONTROL VALVE CHECK

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 disconnected vacuum hose.
3. Start the engine and run at idle.
4. Check the vacuum condition.

Engine condition	Normal vacuum condition
Idling	Approx. 170 mmHg

EGR VALVE CHECK

1. Remove the EGR valve and inspect for sticking, carbon deposits, etc. If necessary, clean with a suitable solvent so that the valve seats correctly.

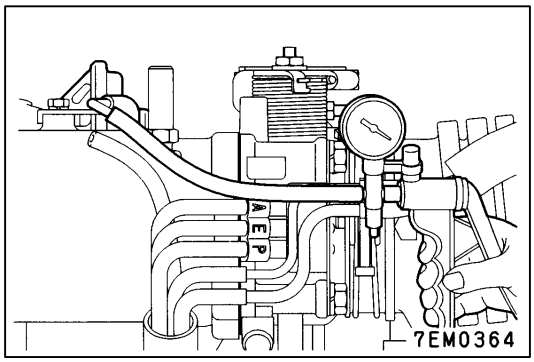


2. Connect a hand vacuum pump to the EGR valve.
3. Apply 500 mmHg of vacuum, and check to be sure that the vacuum is maintained.
4. Apply a vacuum and check the passage of air by blowing through one side of the EGR passage.

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

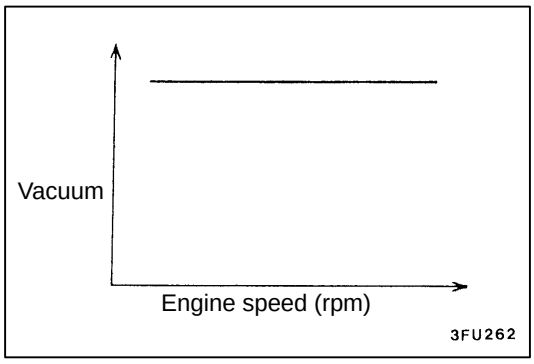
5. Use a new gasket, and tighten to the specified torque.

   Specified torque: 22 Nm



EGR PORT VACUUM CHECK

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

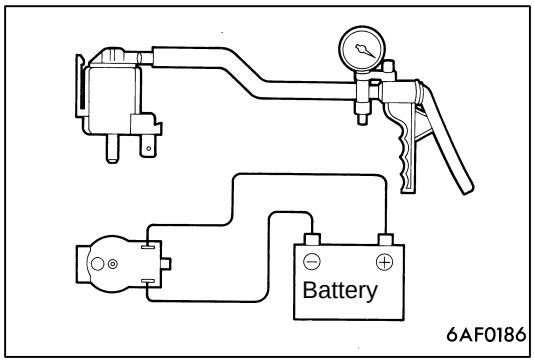


2. Start the engine and check to see that, after raising the engine speed by racing the engine, vacuum remains fairly constant.

EGR SOLENOID CHECK

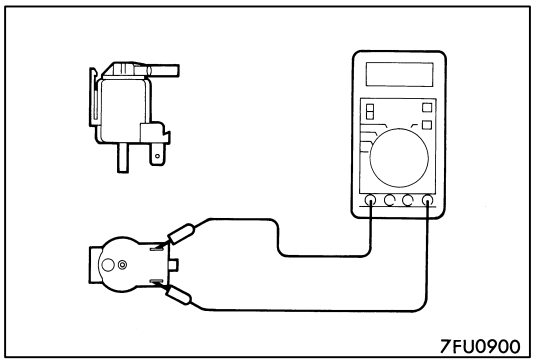
NOTE
When disconnecting the vacuum hose, always make a mark so that it can be reconnected at original position.

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



3. Connect a hand vacuum pump to the nipple to which the green-striped vacuum hose was connected.
4. Check air tightness by applying a vacuum with voltage applied directly from the battery to the EGR control solenoid valve and without applying voltage.

Battery voltage	Normal condition
Not applied	Vacuum leaks
Applied	Vacuum maintained



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

Standard value: 36–44Ω [at 20°C]

Main Index
17 Index

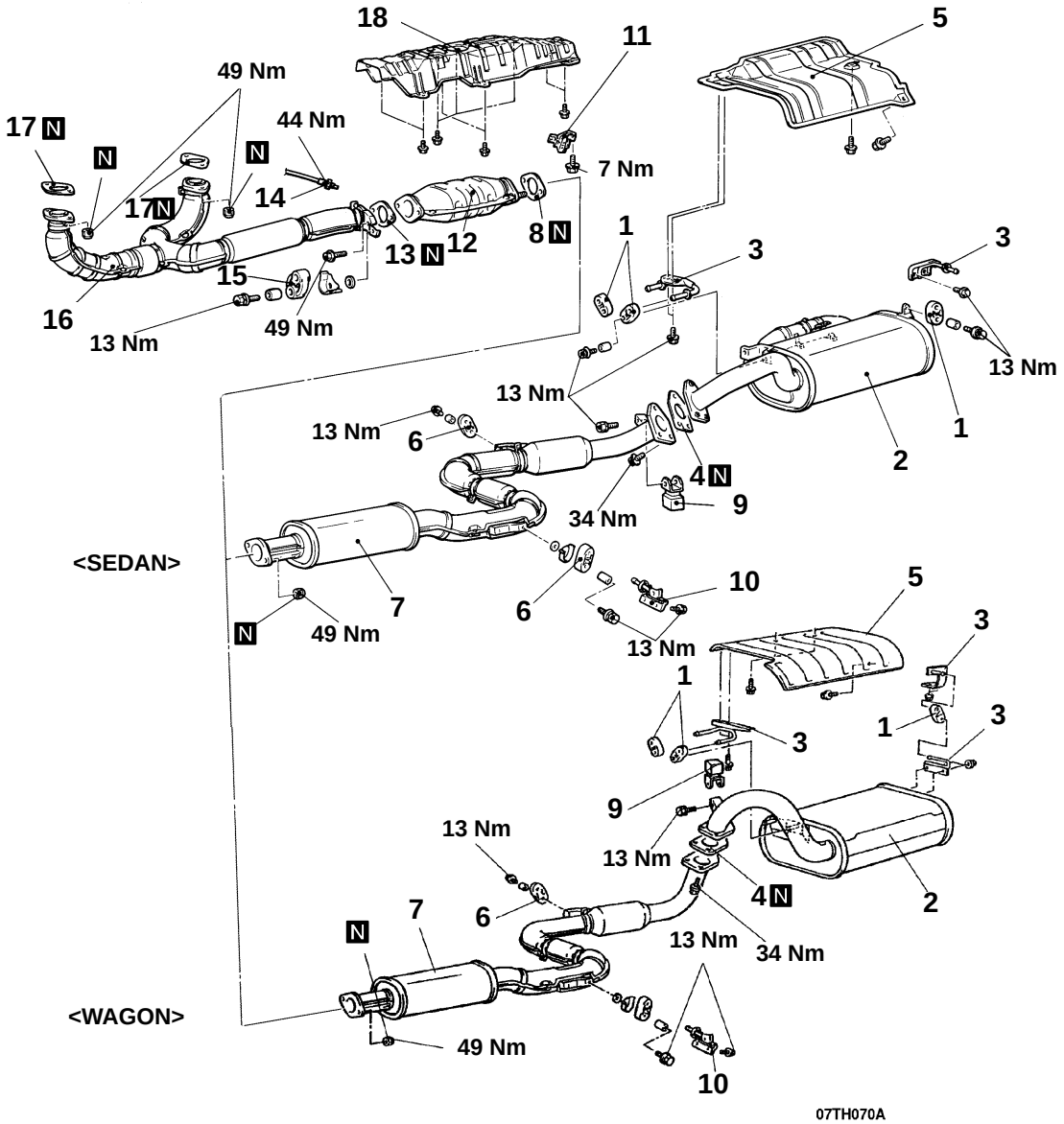
CATALYTIC CONVERTER

GENERAL INFORMATION

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

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

REMOVAL AND INSTALLATION



Removal steps

1. Hanger
2. Main muffler assembly
3. Hanger bracket
4. Gasket
5. Rear floor heat protector panel
6. Hanger
7. Centre exhaust pipe
8. Gasket
9. Damper
10. Hanger bracket
11. Harness protector
12. Catalytic converter
13. Gasket
14. Oxygen sensor
15. Hanger
16. Front exhaust pipe
17. Gasket
18. Front floor heat protector

◀A▶

REMOVAL SERVICE POINT

◀A▶ OXYGEN SENSOR REMOVAL

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

INSPECTION

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

Caution

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