
GROUP 17

ENGINE AND EMISSION CONTROL

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ACCELERATOR SYSTEM

GENERAL INFORMATION

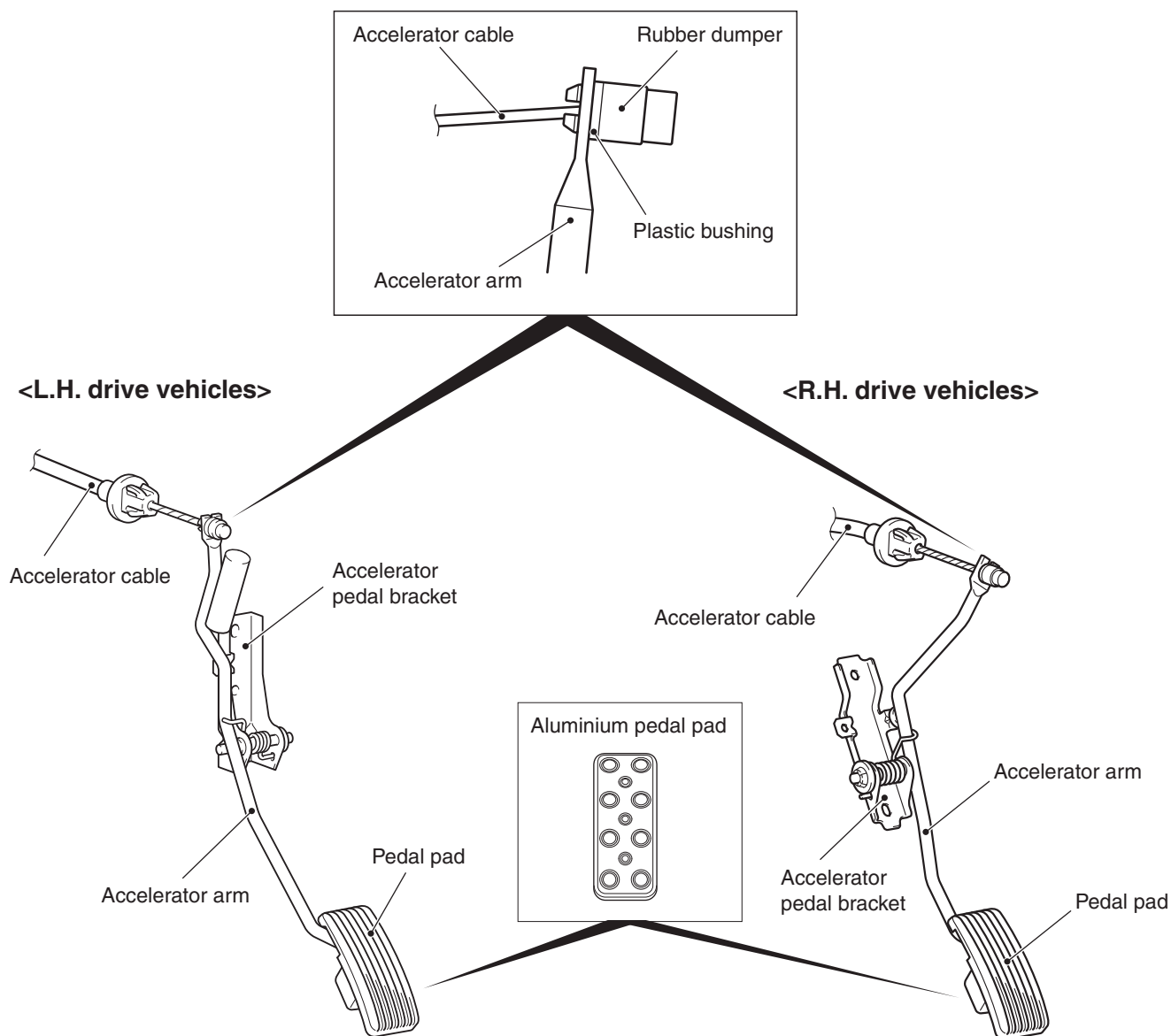
M2170001000400

<4G64, 4G69-L.H. DRIVE VEHICLES>

The accelerator system is a cable and suspended pedal combination. Plastic bushing and rubber dumper have been attached to the end of the accelerator cable, to prevent noise and vibration when the cable and accelerator arm contact.

For the accelerator pedal of some models, the aluminium pedal pad has been adopted as an option in order to improve the drivability and to enhance the sporty image.

CONSTRUCTION DIAGRAM



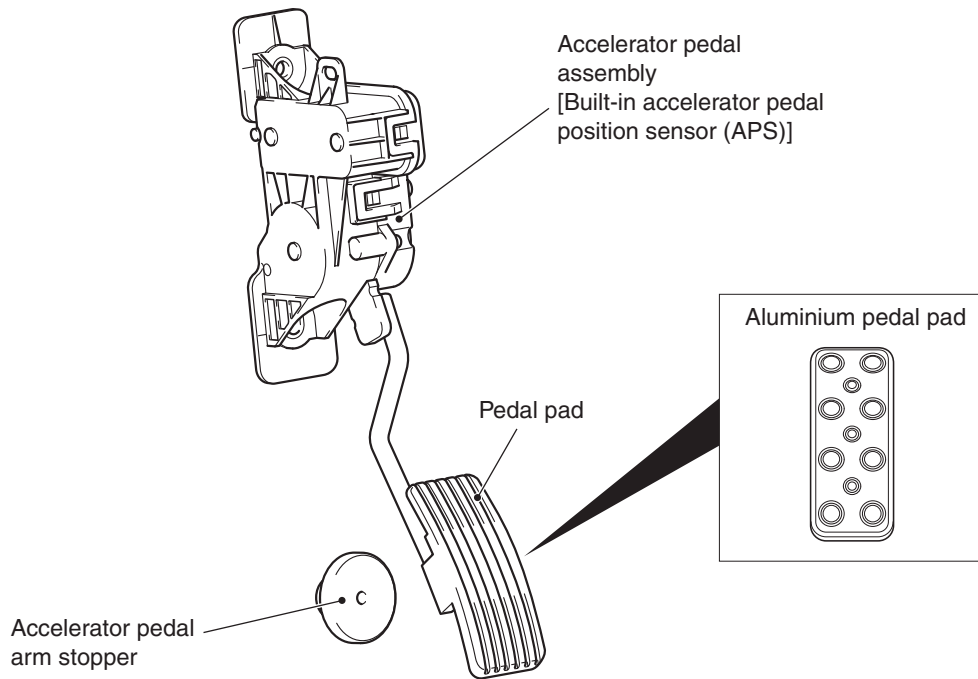
AC504542AB

<4G69-R.H. DRIVE VEHICLES>

For the accelerator system, an electronic throttle valve control system has been adopted, eliminating of an accelerator cable. This system detects the amount of the accelerator pedal movement by using an accelerator pedal-position sensor (APS) in the accelerator pedal assembly for electronic control of the throttle valve angle.

For the accelerator pedal of some models, the aluminium pedal pad has been adopted as standard or as an option in order to improve the drivability and to enhance the sporty image.

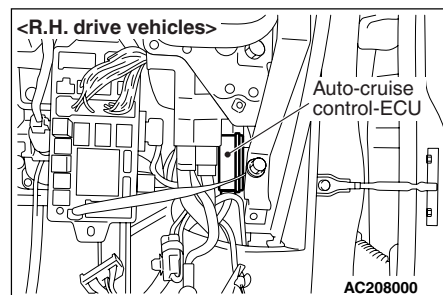
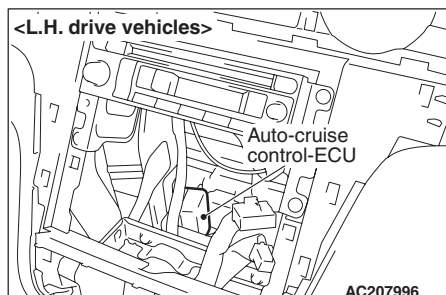
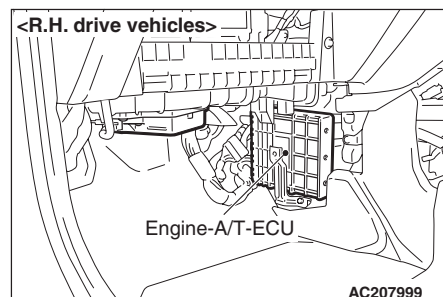
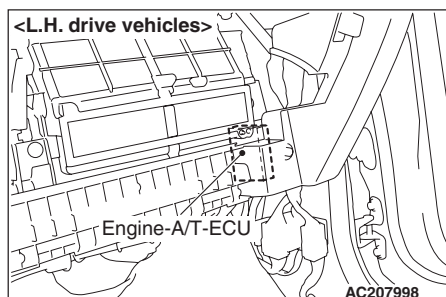
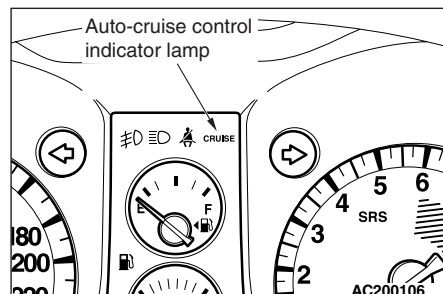
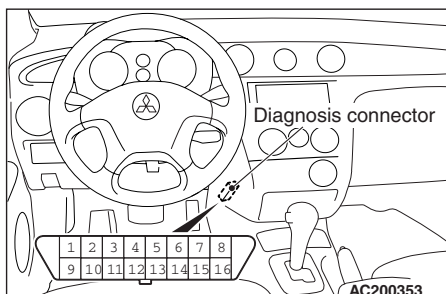
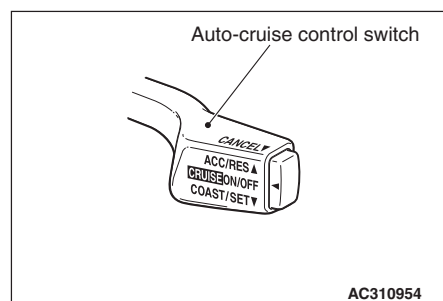
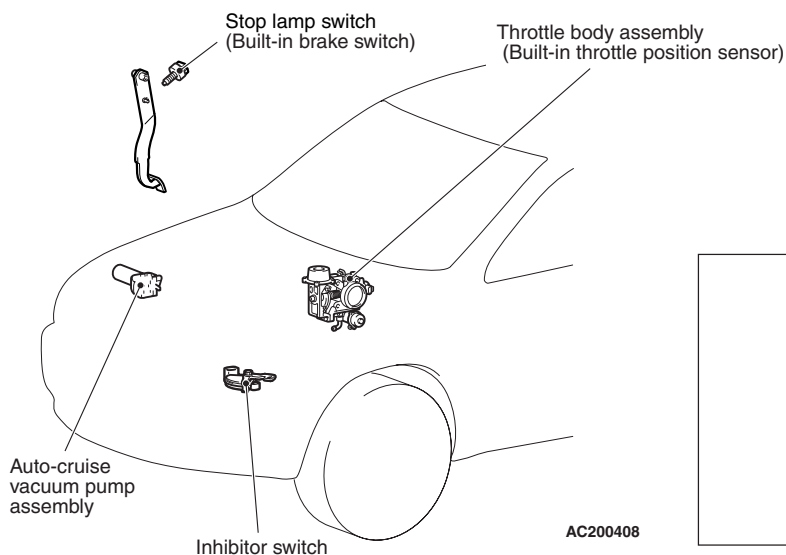
CONSTRUCTION DIAGRAM



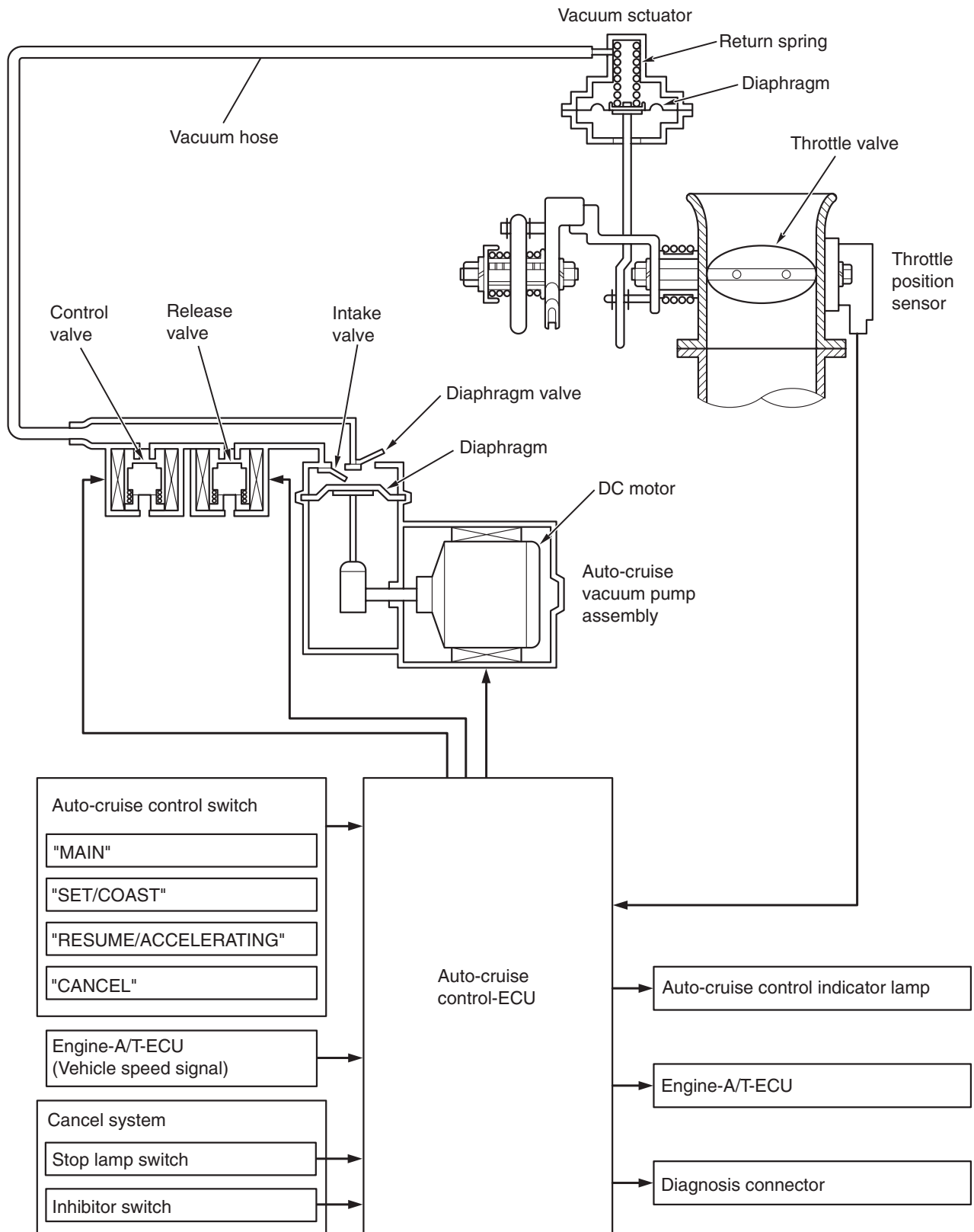
AUTO-CRUISE CONTROL SYSTEM**<4G64-Vehicles with auto-cruise control system>****GENERAL INFORMATION**

M2170001000411

By using the auto-cruise control, the driver can drive at preferred speeds in a range of approximately 40 to 200 km/h without depressing the accelerator pedal.

CONSTRUCTION DIAGRAM

SYSTEM DIAGRAM



COMPONENTS AND FUNCTIONS

Component		Function
Engine-A/T-ECU		Generates a pulse signal proportional to vehicle speed (revolving speed of the transmission output gear).
Auto-cruise control-ECU		Receives signals from the engine-A/T-ECU and each switch, and uses a microprocessor to control all functions of the auto-cruise control.
Actuator system		Drives the auto-cruise vacuum pump according to signals from the Auto-cruise control-ECU and adjusts the throttle valve to the set opening with the actuator.
Auto-cruise control switch	"MAIN" switch	Switch for cruise control power.
	"SET/COAST" switch	Vehicle speed is set with the "SET/COAST" switch and "RESUME/ACCELERATING" switch.
	"RESUME/ACCELERATING" switch	
	"CANCEL" switch	Cancels the cruise speed setting
Cancel system	Stop lamp switch	Outputs a signal to cancel cruise control
	Inhibitor switch	
Throttle position sensor (TPS)		Generates an analogue voltage proportional to throttle opening.
Diagnosis connector		If the M.U.T.-II/III is connected, the diagnosis code and input check code from the Auto-cruise control-ECU can be read.
Auto-cruise control indicator lamp		It is included in the combination meter and illuminates when the auto-cruise control "MAIN" switch is "ON" position.

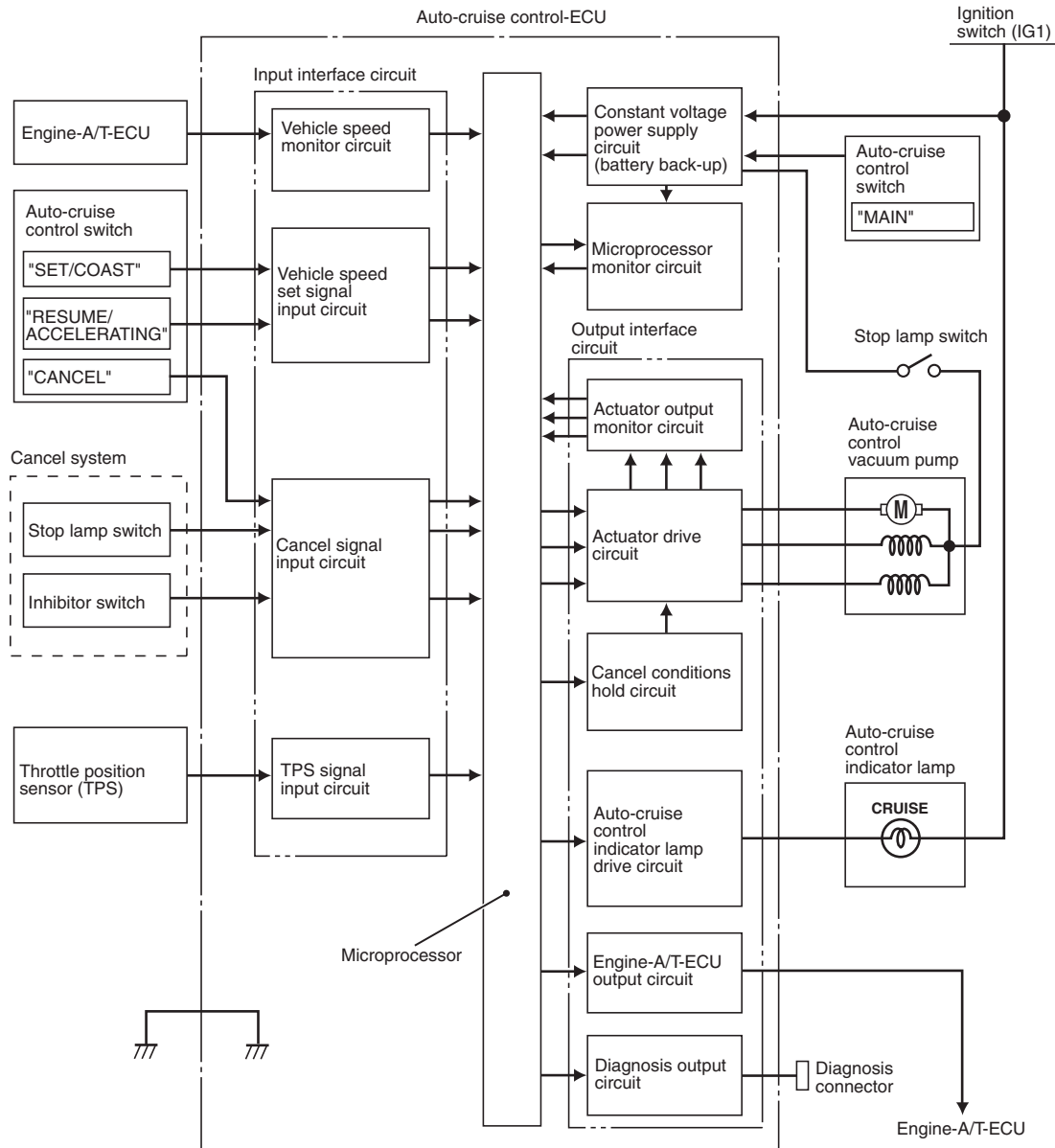
AUTO-CRUISE CONTROL-ECU

M2170006000063

The auto-cruise control-ECU consists of the input interface circuit, microprocessor, constant voltage power supply circuit, microprocessor monitor circuit and output interface circuit. Vehicle signals from the engine-A/T-ECU, TPS and each switch are input into

the auto-cruise control-ECU. It processes them according to the program in the microprocessor memory and outputs control signals to the actuator. It also outputs system self-diagnosis results and conditions of input signals to the diagnosis connector.

BLOCK DIAGRAM



AC212413 AB

SET/COAST SWITCH FUNCTION

SET

The vehicle speed at the moment the "SET" switch was switched from ON to OFF while driving within the limit vehicle speed range is memorized as the "set vehicle speed" and thereafter the actuator is controlled so that fixed-speed driving at that speed is possible. However, the fixed-speed driving can not be set if the vehicle is being driven at a predetermined high speed limit or more.

COAST

While the "COAST" switch is held ON during auto-cruise driving, the vehicle keeps decelerating. If the "COAST" switch is turned OFF before the vehicle speed decreases to 40 km/h, the vehicle runs at the fixed speed at the moment the switch is turned OFF. If the "COAST" switch is turned OFF after the vehicle speed decreases to less than 40 km/h, the auto-cruise control is cancelled. However if the "COAST" switch has been ON for 0.5 second or less, a tap-down operation is performed (decelerating from the current speed by 1.6 km/h). At over 0.5 second, continuous deceleration is performed.

"ACC/RES" SWITCH FUNCTION**RESUME**

When fixed speed driving is cancelled by the conditions given in "CANCEL FUNCTION", switching the "RESUME" switch from OFF to ON while driving at a speed higher than the set speed causes the vehicle to be driven at a fixed speed which is the speed memorized just before cancelling.

ACCELERATING

While the "ACCELERATING" switch is ON during fixed speed driving, the vehicle is accelerates to the target speed. The vehicle speed at the moment the switch is turned OFF is then memorized and the vehicle remains at this for fixed speed. When the "ACCELERATING" switch is ON, the vehicle may accelerate to speeds above the high-speed limit but after the "ACCELERATING" switch is turned OFF, the vehicle will remain at this high-speed limit. However if the "ACCELERATING" switch has been ON for 0.5 second or less, a tap-down operation is performed (accelerating from the current speed by 1.6 km/h). At over 0.5 second, acceleration is performed continuously.

OVERDRIVE-CANCEL FUNCTION

When during fixed speed driving, the actual vehicle speed decreases to (or below) the memorized speed, the overdrive is cancelled temporarily, the memorized speed is restored when driving conditions allow.

Overdrive is cancelled in the following case:

- The vehicle speed is less than 130 km/h, and during fixed speed travel, the actual vehicle speed decreases from the preset speed by 7 km/h.

CANCEL FUNCTION

When any of the following conditions occur, the power supply to the motor-driven negative pressure pump is shut off and the auto-cruise control is cancelled.

- "CANCEL" switch ON
- Stop lamp switch ON (brake is applied)
- Inhibitor switch is "N" position
- Vehicle speed at the low-speed limit (about 40 km/h) or lower
- Vehicle speed going lower than memorized speed by 15 km/h or more
- Vehicle speed once increasing to memorized speed less 10 km/h and then decreasing more than 15 km/h during
- Vehicle speed changing sharply
- Stop lamp switch input malfunction or open circuit

FAIL-SAFE FUNCTION

When any of the following conditions are met, the power supply to the auto-cruise vacuum pump is shut off and the auto-cruise control stops entirely or cancels while driving.

Condition	Auto-cruise stopped	Auto-cruise cancelled
"SET" or "RESUME" switch held ON for 60 seconds or more	Yes	Yes
Fault in cancel state holding circuit	Yes	Yes
Auto-cruise vacuum pump drive signal and valve drive signals not matching	Yes	Yes
Vehicle speed signal failing to be input for 0.1 seconds or longer	Yes	Yes
"MAIN" switch held ON for five seconds or more	Yes	Yes
Auto-cruise control-ECU power voltage continues at a state of 4V or more, 9V or less for four seconds or more during fixed speed travel.	Yes	Yes
Failed TPS	Yes	No

**SELF-DIAGNOSIS AND SERVICE DATA
OUTPUT FUNCTIONS****SELF-DIAGNOSIS**

When the auto-cruise control system operation cancels without driver input determine the cause simply

by reading the diagnosis code.

DIAGNOSIS CODE CHART

Code No.	Major contents of diagnosis
11	Abnormality in auto-cruise vacuum pump drive system
12	Abnormality in vehicle speed signal system
14	Defective stop lamp switch/brake switch
15	Defective auto-cruise control switch
16	Defective auto-cruise control-ECU
17	Defective throttle position sensor and idle position signal system

HOW TO ERASE DISPLAY DIAGNOSIS CODE

Use the M.U.T.-II/III to erase the diagnosis code.

SERVICE DATA OUTPUT

The service data output are shown in the following.

Items No.	Service data item		Unit
01	Auto-cruise control switch	"MAIN"	ON/OFF
02		"SET/COAST"	ON/OFF
03		"RESUME/ACCELERATING"	ON/OFF
04		"CANCEL"	ON/OFF
05	Stop lamp switch		ON/OFF
08	Accelerator switch (Idle switch)		ON/OFF
10	Vehicle speed signal		km/h
13	Throttle position sensor (TPS)		mV
14	Inhibitor switch		ON/OFF
15	Over drive detective		ON/OFF

NOTE: If two or more actions are taken at the same time, codes are set in ascending order of code number.

AUTO-CRUISE CONTROL SYSTEM

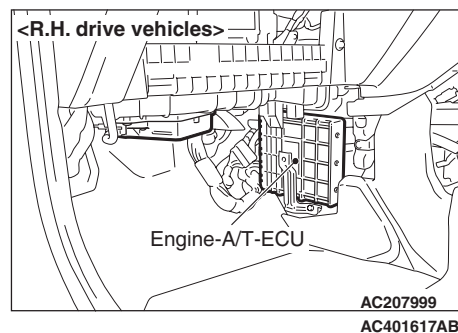
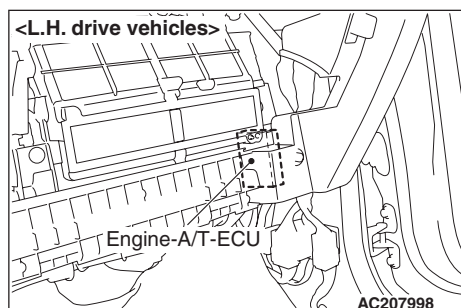
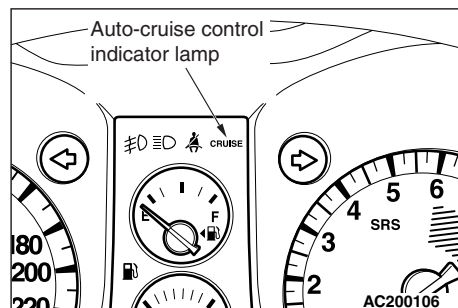
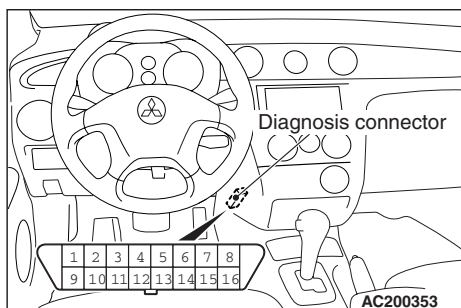
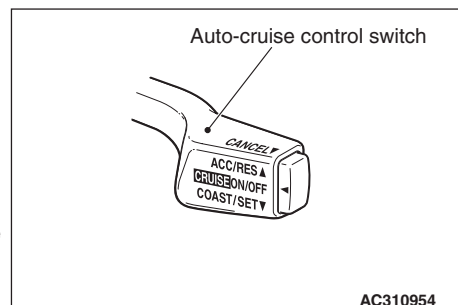
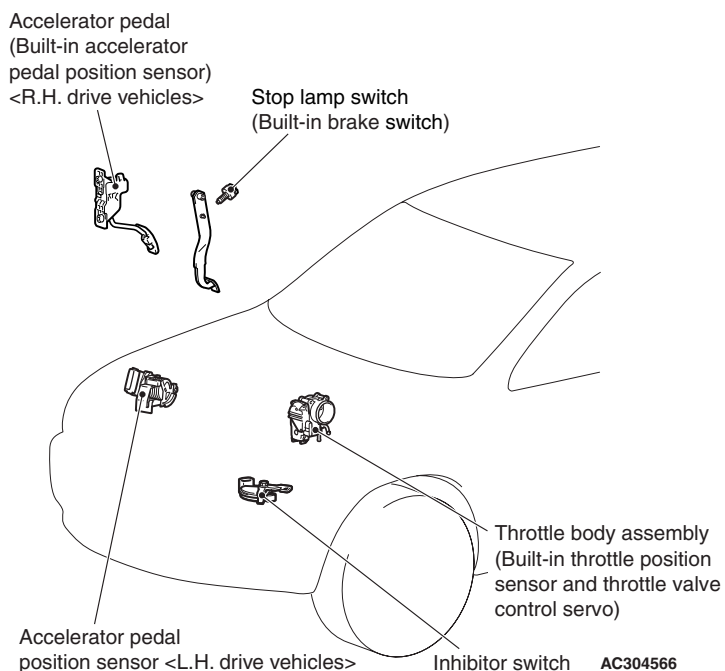
<4G69-Vehicles with auto-cruise control system>

GENERAL INFORMATION

M2170001000295

By using the auto-cruise control, the driver can drive at preferred speeds in a range of approximately 40 to 200 km/h without depressing the accelerator pedal. For this auto-cruise control system, in conjunction with the electronic throttle valve control system, the engine-A/T-ECU electronically controls the throttle valve.

CONSTRUCTION DIAGRAM



COMPONENTS AND FUNCTIONS

Component		Function
Accelerator pedal position sensor		Informs the engine-A/T-ECU of the accelerator pedal depression.
Auto-cruise control indicator lamp		It is included in the combination meter and illuminates when the auto-cruise control "MAIN" switch is "ON" position.
Auto-cruise control switch	"MAIN" switch	Switch for cruise control power.
	"SET/COAST" switch	Vehicle speed is set with the "SET/COAST" switch and "RESUME/ACCELERATING" switch.
	"RESUME/ACCELERATING" switch	
	"CANCEL" switch	Cancels the cruise speed setting.
Cancel system	Stop lamp switch	Outputs a signal to cancel cruise control
	Inhibitor switch	
Diagnosis connector		If the M.U.T.-II/III is connected, the diagnosis code and input check code from the engine-A/T-ECU can be read.
Engine-A/T-ECU		<ul style="list-style-type: none"> Judges how the cruise control is operating by using input signals from the auto-cruise control system and the cancel system, and sends the throttle valve opening angle signal to the throttle actuator control motor by using the accelerator pedal position sensor signal. The diagnosis code and input check code are sent to the diagnosis connector. When the "MAIN" switch "ON" signal is entered, a signal is sent to illuminate the auto-cruise control indicator lamp.
Throttle valve control servo		The throttle valve opens and closes in response to the throttle angle control signal from the engine-A/T-ECU.
Throttle position sensor		Informs the engine-A/T-ECU of the throttle valve opening angle.

CONSTRUCTION AND OPERATION

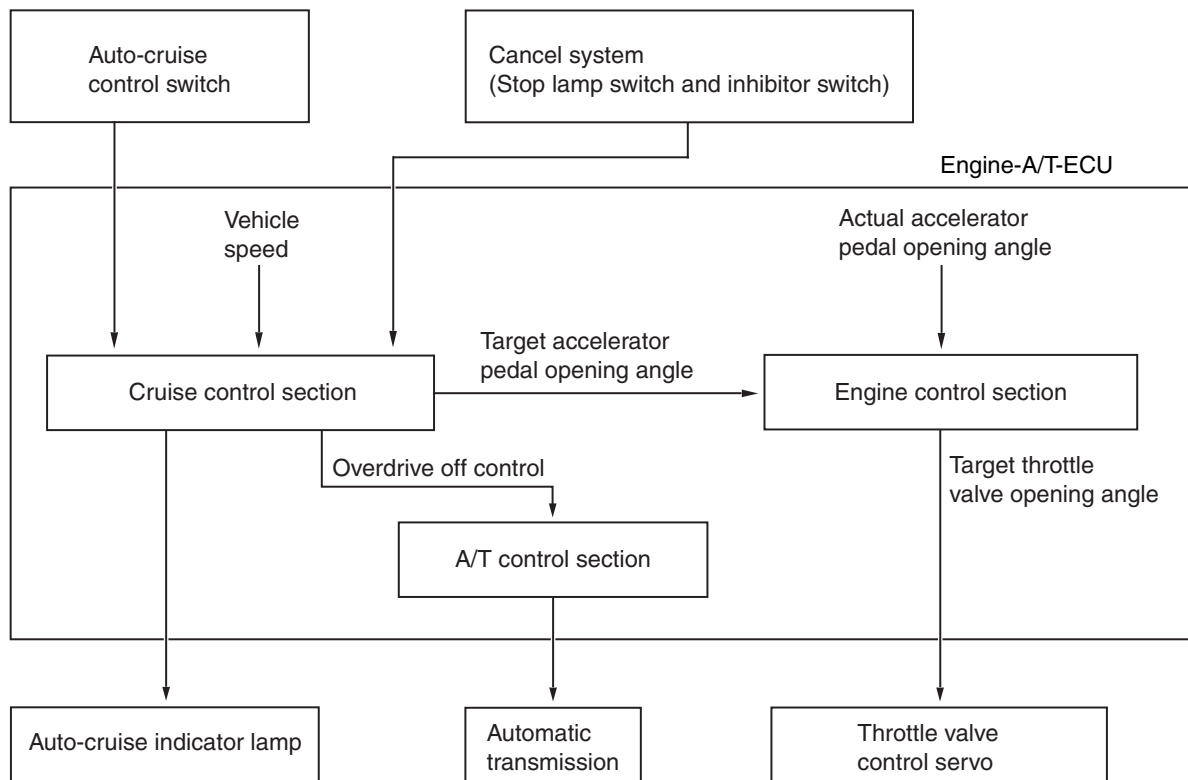
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SYSTEM OUTLINE

The engine-A/T-ECU calculates the cruise control operation status when the control section of the cruise control inside the engine-A/T-ECU receives the input signals of the auto-cruise control switch, vehicle speed, and cancel system (stop lamp switch and inhibitor switch). To the engine control section it sends the target accelerator angle value for cruise

control, to the A/T control section it issues a command to cancel OD, and to the gauge it issues an ON/OFF command for the auto-cruise control indicator lamp. In the engine control section, the target throttle angle value is calculated from the target acceleration value for cruise control and the actual accelerator angle value, and the vehicle speed is controlled by applying the throttle valve control servo.

BLOCK DIAGRAM



AC313000

"SET/COAST" SWITCH FUNCTION**SET**

The vehicle speed at the moment the "SET" switch was switched from ON to OFF while driving within the limit vehicle speed range is memorized as the "set vehicle speed" and thereafter the throttle actuator control motor is controlled so that fixed-speed driving at that speed is possible. However, if the vehicle speed is set at 200 km/h or higher, the speed of 200 km/h is saved as the vehicle speed, but if the vehicle speed is set above 205 km/h, the vehicle will not reach the specified speed.

COAST

While the "COAST" switch is held ON during auto-cruise driving, the vehicle keeps decelerating. If the "COAST" switch is turned OFF before the vehicle speed decreases to 40 km/h, the vehicle runs at the fixed speed at the moment the switch is turned OFF. If the "COAST" switch is turned OFF after the vehicle speed decreases to less than 35 km/h, the auto-cruise control is cancelled. However if the "COAST" switch has been ON for 0.5 second or less, a tap-down operation is performed (decelerating from the current speed by 1.6 km/h). At over 0.5 second, continuous deceleration is performed.

"ACC/RES" SWITCH FUNCTION**RESUME**

When fixed speed driving is cancelled by the conditions given in "CANCEL FUNCTION," switching the "RESUME" switch from OFF to ON while driving at a speed higher than the set speed causes the vehicle to be driven at a fixed speed which is the speed memorized just before cancelling.

ACCELERATING

While the "ACCELERATING" switch is ON during fixed speed driving, the vehicle accelerates to the target speed. The vehicle speed at the moment the switch is turned OFF is then memorized and the vehicle remains at this for fixed speed. When the "ACCELERATING" switch is ON, the vehicle may accelerate to speeds above the high-speed limit but after the "ACCELERATING" switch is turned OFF, the vehicle will remain at this high-speed limit. However, if the "ACCELERATING" switch has been ON for 0.5 second or less, a tap-down operation is performed (accelerating from the current speed by 1.6 km/h). At over 0.5 second, acceleration is performed continuously.

OVERDRIVE-CANCEL FUNCTION

When during fixed speed driving, the actual vehicle speed decreases to (or below) the memorized speed, the overdrive is cancelled temporarily, the memorized speed is restored when driving conditions allow. Overdrive is cancelled in the following case:

- When the set speed can not be maintained with the current gear ratio due to insufficient drive power under constant speed control mode.
- When a proper acceleration can not be obtained with the current gear ratio due to insufficient drive power during the driver's acceleration switch operation (under acceleration mode).
- When a proper acceleration can not be obtained with the current gear ratio due to insufficient drive power after the driver's resume switch operation until being the set speed.

CANCEL FUNCTION

When any of the following conditions occur, the auto-cruise control is cancelled.

- "MAIN" switch OFF
- "CANCEL" switch ON
- Stop lamp switch ON (brake is applied)
- Brake switch ON (brake is applied)
- Inhibitor switch in "N" position
- The vehicle speed is about 35 km/h or lower
- Vehicle speed is lower than memorized speed by 15 km/h or more
- Vehicle speed signal abnormality

FAIL-SAFE FUNCTION

When any of the following conditions are met and do not activate auto-cruise control, and if the requirements are met during auto-cruise control, auto-cruise control is cancelled instantly. At this time, after the regular state is restored, auto-cruise control is possible again.

- "SET" or "RESUME" switch held ON for 60 seconds or more.
- Fault in cancel state holding circuit
- The vehicle speed signal fails to be input for 0.1 second or longer during the vehicle speed is 40 km/h or more.

When any of the following conditions are met, until the ignition is switched OFF once, do not activate auto-cruise control. If the requirements are met during auto-cruise control, auto-cruise control is cancelled instantly.

- Defective engine-A/T-ECU
- Defective throttle position sensor
- Defective accelerator pedal position sensor

SELF-DIAGNOSIS AND SERVICE DATA OUTPUT FUNCTIONS

SELF-DIAGNOSIS

When the auto-cruise control system operation cancels without driver input determine the cause simply by reading the diagnosis code.

DIAGNOSIS CODE CHART

Code No.	Major contents of diagnosis
15	Defective auto-cruise control switch
21	Defective cancel latch
22	Defective stop lamp switch/brake switch
23	Defective in engine-A/T-ECU

**HOW TO ERASE DISPLAY DIAGNOSIS
CODE**

Use the M.U.T.-II/III to erase the diagnosis code.

SERVICE DATA OUTPUT

The service data output is shown in the following.

Items No.	Service data item	Unit
01	Auto-cruise control switch	"MAIN"
02		"SET/COAST"
03		"RESUME/ACCELERATING"
04		"CANCEL"
05	Stop lamp switch	ON/OFF
06	Brake switch	ON/OFF
07	Inhibitor switch	ON/OFF
08	Closed throttle position switch	ON/OFF
09	Auto-cruise control operation	ON/OFF
10	Vehicle speed signal	km/h
11	Throttle position sensor	mV
12	Accelerator pedal position sensor	mV
13	Cancel code	Displays a cancel code number.

NOTE: If two or more actions are taken at the same time, codes are set in ascending order of code number.

EMISSION CONTROL

GENERAL INFORMATION

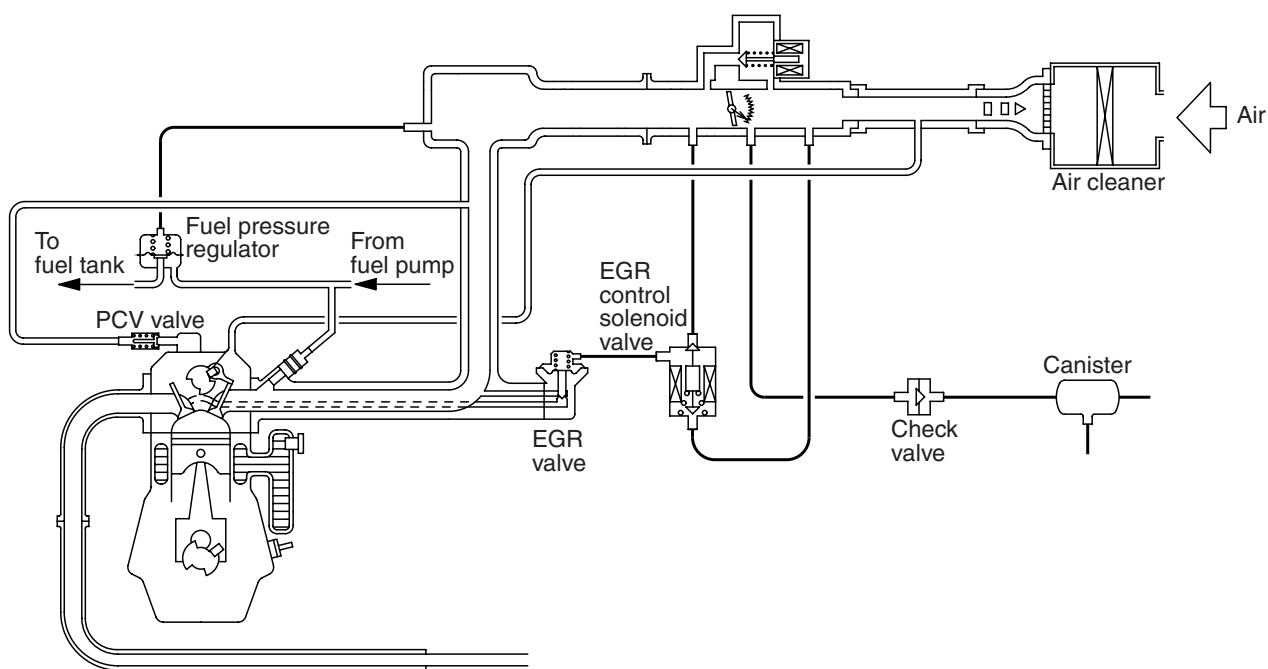
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<4G64>

The emission control system is basically the same as that of the 4G6 engine used in the Space Wagon.

System	Vehicles with catalytic converter	Vehicles without catalytic converter	Remarks
Crankcase ventilation system	×	×	Closed type
Evaporative emission control system	×	—	Electronic control type with duty signal only (ON/OFF control for others)
	—	×	Vacuum control type
Exhaust gas recirculation (EGR) system	×	×	Electronic control type with duty signal
Air/fuel ratio closed loop control	×	—	Oxygen sensor signal used
Catalytic converter	×	—	Three-way catalytic converter

EMISSION CONTROL SYSTEM DIAGRAM



AK201209AB

<4G69>

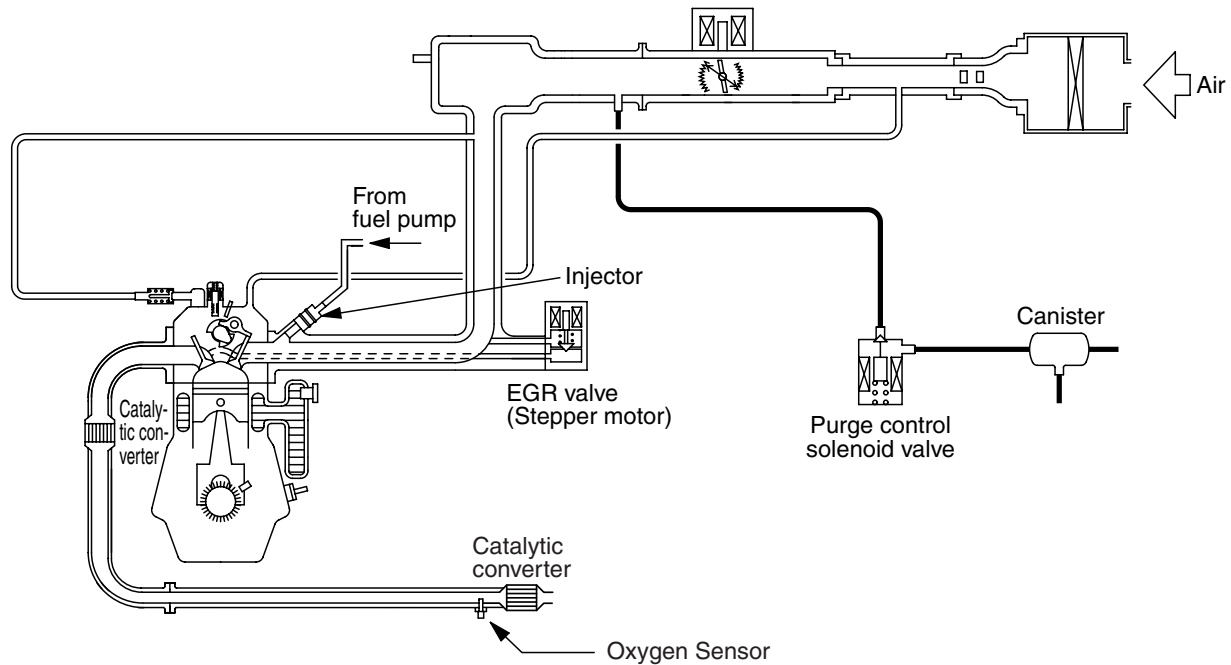
Based on the controls on the previous 4G6-MPI engine, the following improvements have been made to improve exhaust gas reduction performance

- Adoption of an electronically controlled EGR valve (stepper motor type)

- Adoption of dual manifold catalytic converters (MCC).
- Adoption of dual oxygen sensors, along with the adoption of dual manifold catalytic converters (MCC).

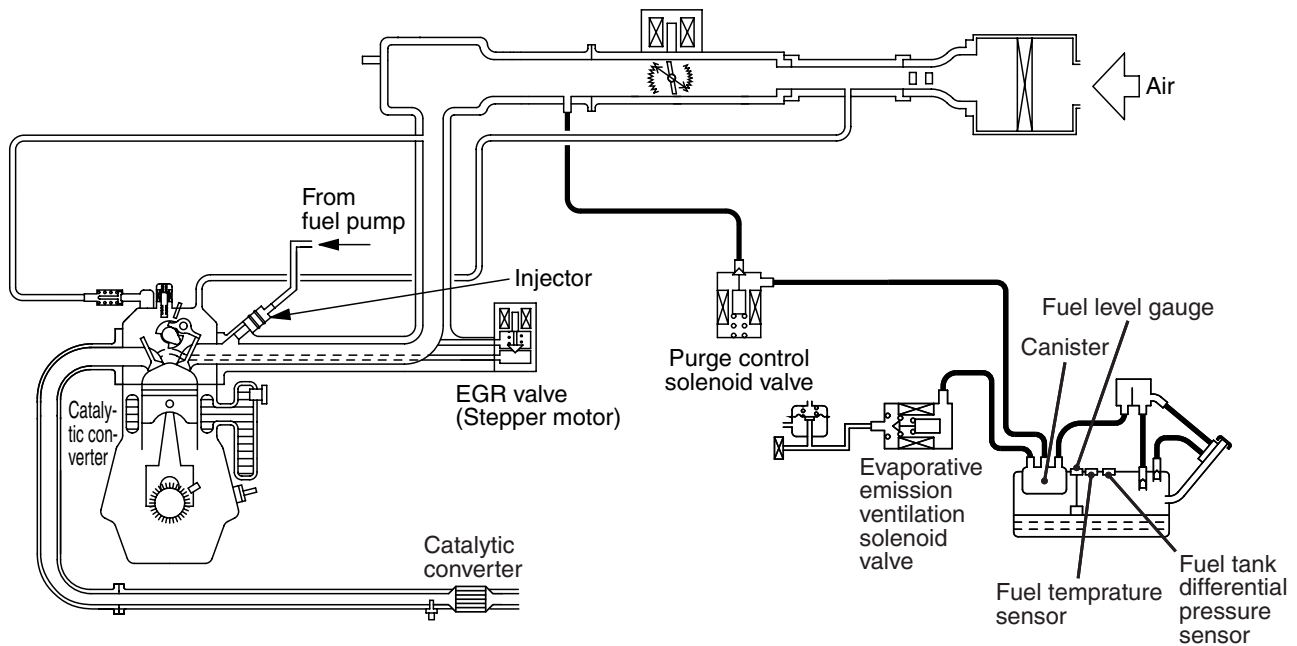
System	Remarks
Crank case ventilaton system	Closed type
Evaporative emission control system	Electric control type with duty signal
Exhaust gas recirculation (EGR) system	Electric control (Stepper motor) type with duty signal
Air/fuel ratio closed loop control	Oxygen sensor signal used
Catalytic converter	Three-way catalytic converter

<4G69-Except for Brazil, Chile, Australia and New Zealand>



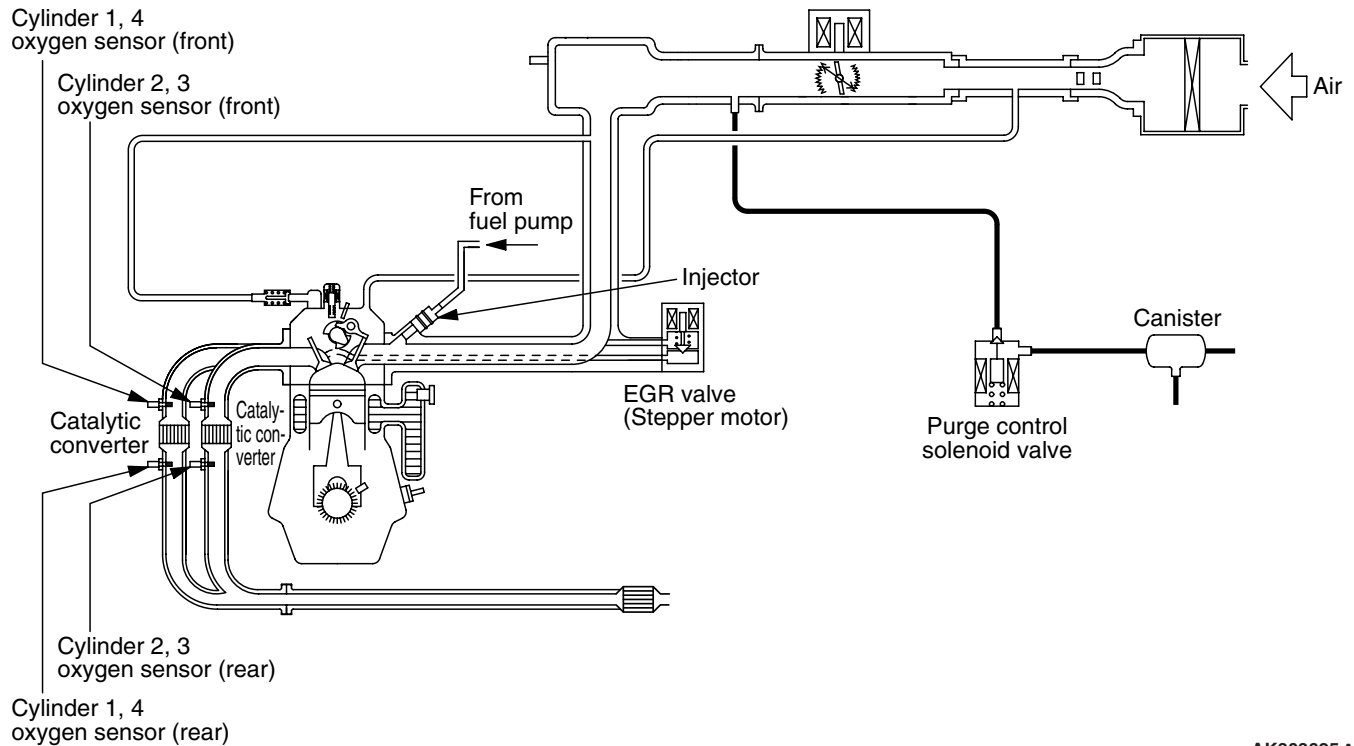
AK400219 AB

<4G69-Vehicles for Brazil and Chile>



AK400220 AB

NOTE: The evaporative emission ventilation solenoid valve [always OPEN (OFF)], fuel tank differential pressure sensor, fuel level gauge, fuel temperature sensor are not used for engine control.

<4G69-Vehicles for Australia and New
Zealand>

AK303625 AB