GROUP 55

HEATER, AIR CONDITIONER AND VENTILATION

CONTENTS

GENERAL INFORMATION

M2551000100801

The heater and A/C system incorporating the heater and cooling units has reduced ventilation resistance to increase air volume and reduce noise. The manual A/C is installed for LHD-INVITE model, and the automatic A/C is installed for RHD-INVITE, TURBO and INTENSE models.

FEATURES

IMPROVEMENTS IN COMFORT

- Installation of two-layer blow full air mix heater
- Adoption of low noise, large air volume heater and A/C system

IMPROVEMENTS IN OPERATION PERFORMANCE

- Large rotary control to improve controllability
- Enlarging the figures on the heater control panel improves the visibility.

RELIABLE VISUAL FIELD (IMPROVEMENT IN SAFETY)

- Achievement of ventilation system to defog windows by increasing the fresh air intake duct area on the front deck and adopting a large air vent
- Windshield defogging speed improvement derived from increase in air volume and wind speed by adopting a blower type defroster and high performance heater

IMPROVEMENTS IN FUEL ECONOMY

- Optimisation of engine idle speed according to A/C load
- Cooling fan speed continuously varies on the A/C load, thus reducing the alternator load
- Installation of sub-cooling type condenser to improve heat exchanging efficiency

GLOBAL ENVIRONMENT PROTECTION

- Adoption of HFC refrigerant
- Reduction of refrigerant amount by using sub-cooling type condenser

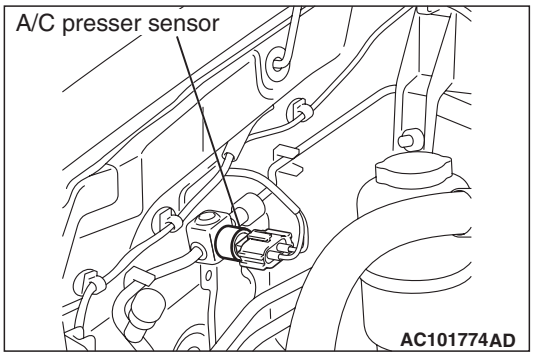
IMPROVEMENTS IN SERVICEABILITY

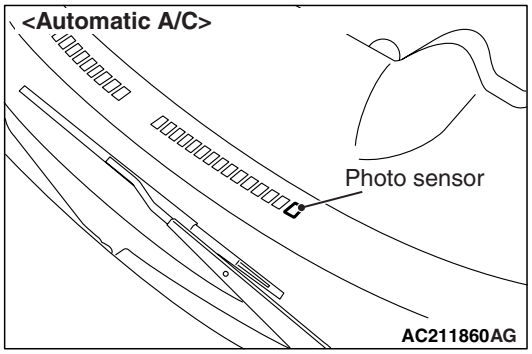
- Integration of condenser with receiver

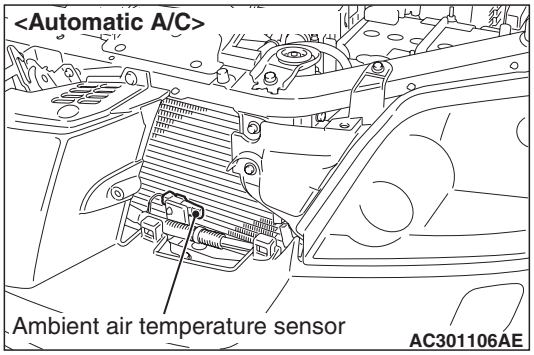
SPECIFICATION

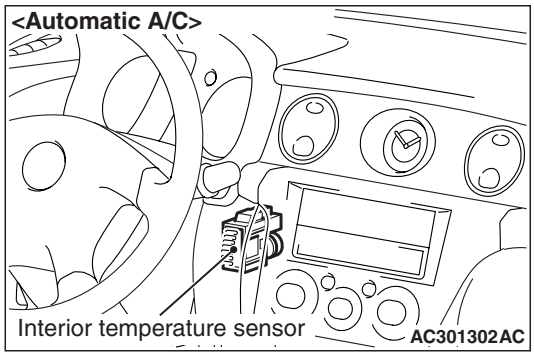
Item		Specification
Heater unit type		Two-layer full blow air mix method
Heater control type		Rotary type
A/C switch type		Push button type
Compressor type	Standard type	MSC90CA
	Large capacity type	MSC105CA
Cooling output		5.5 kW
Heating output		5.0 kW
Refrigerant	Type	R134a (HFC-134a)
	Charge quantity g	530 – 570

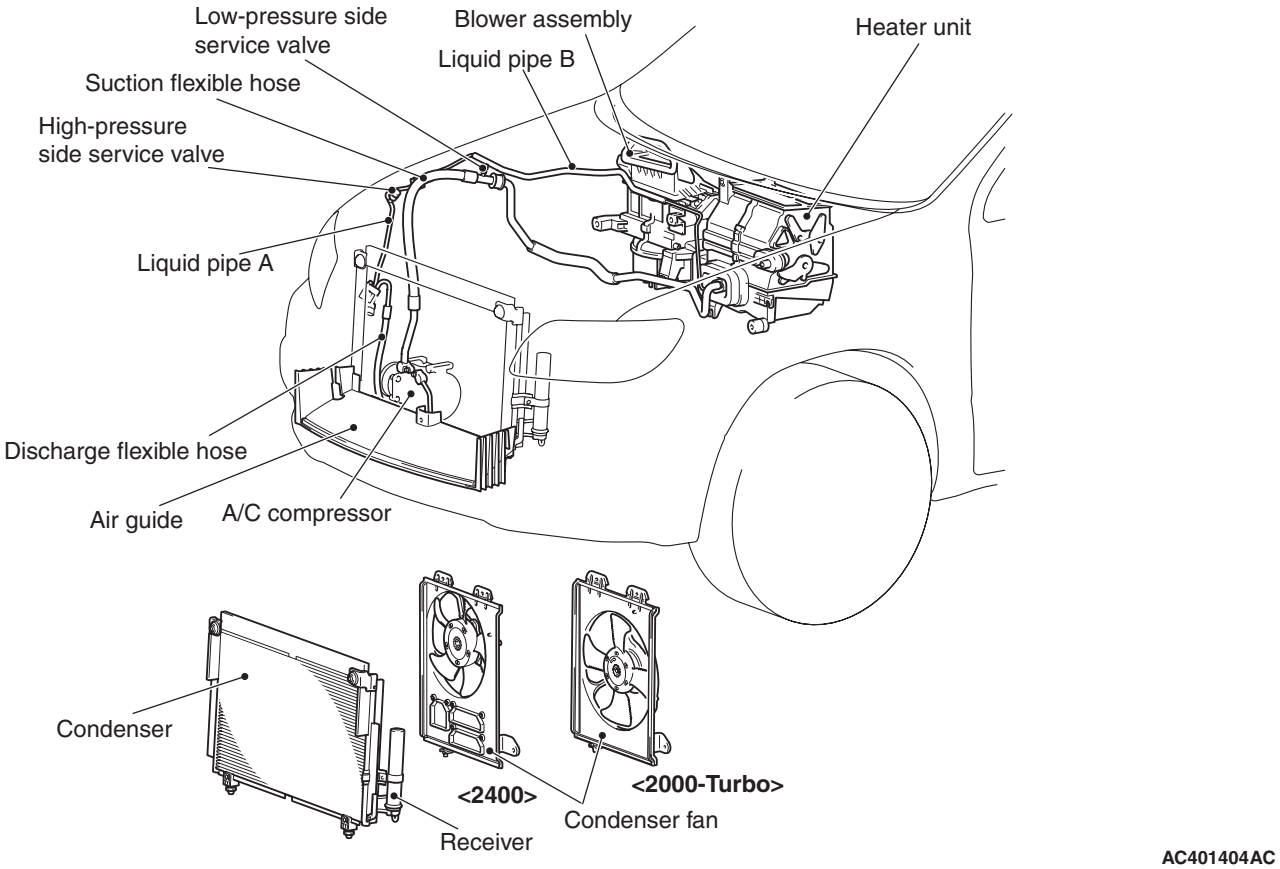
CONSTRUCTION DIAGRAM



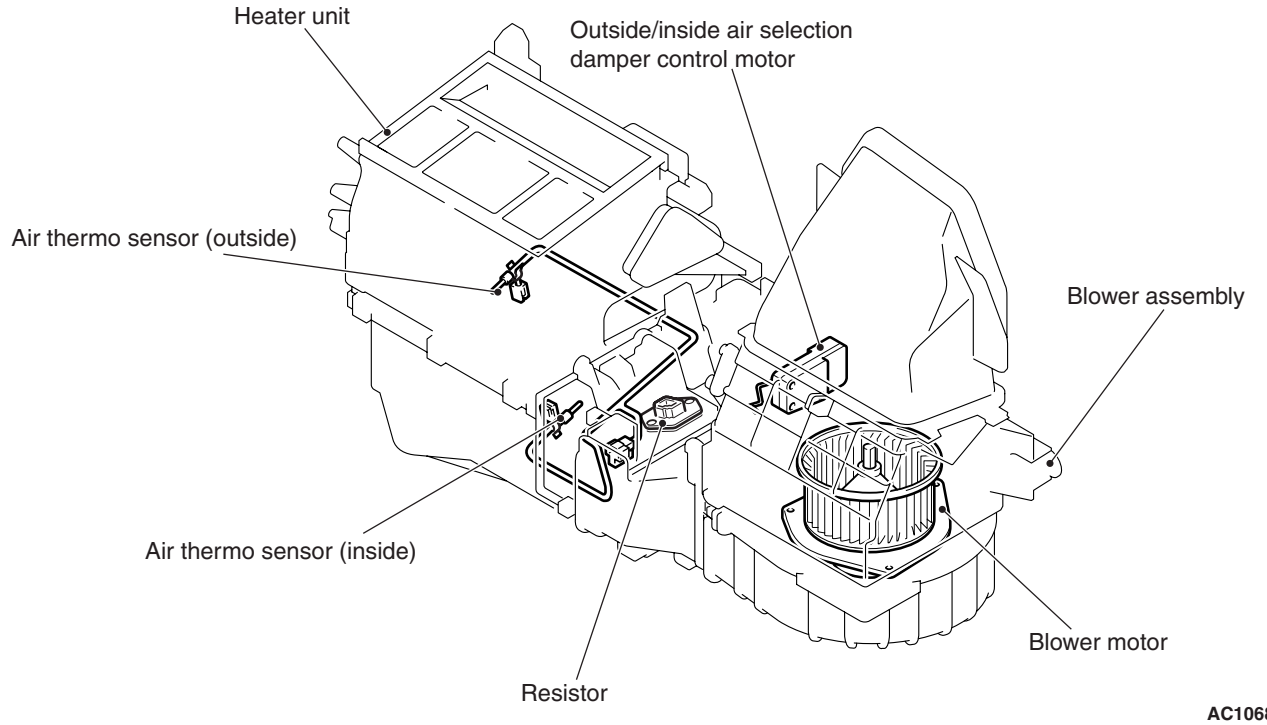








<Manual A/C>



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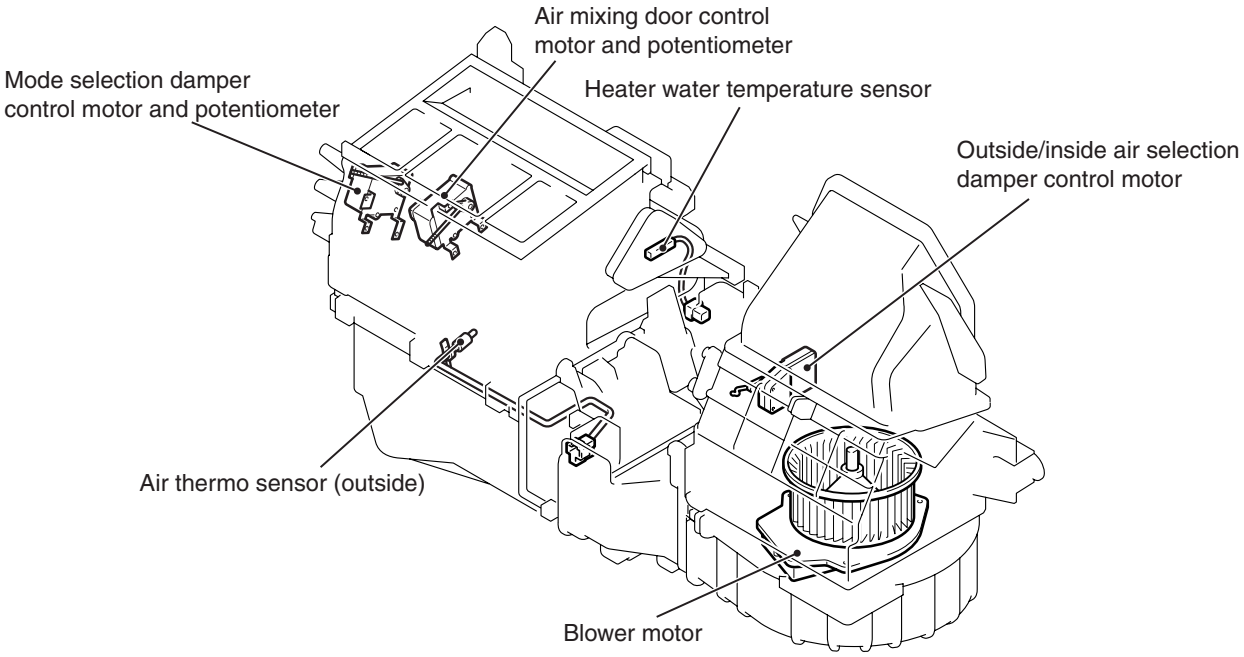

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HEATER AND A/C SYSTEM

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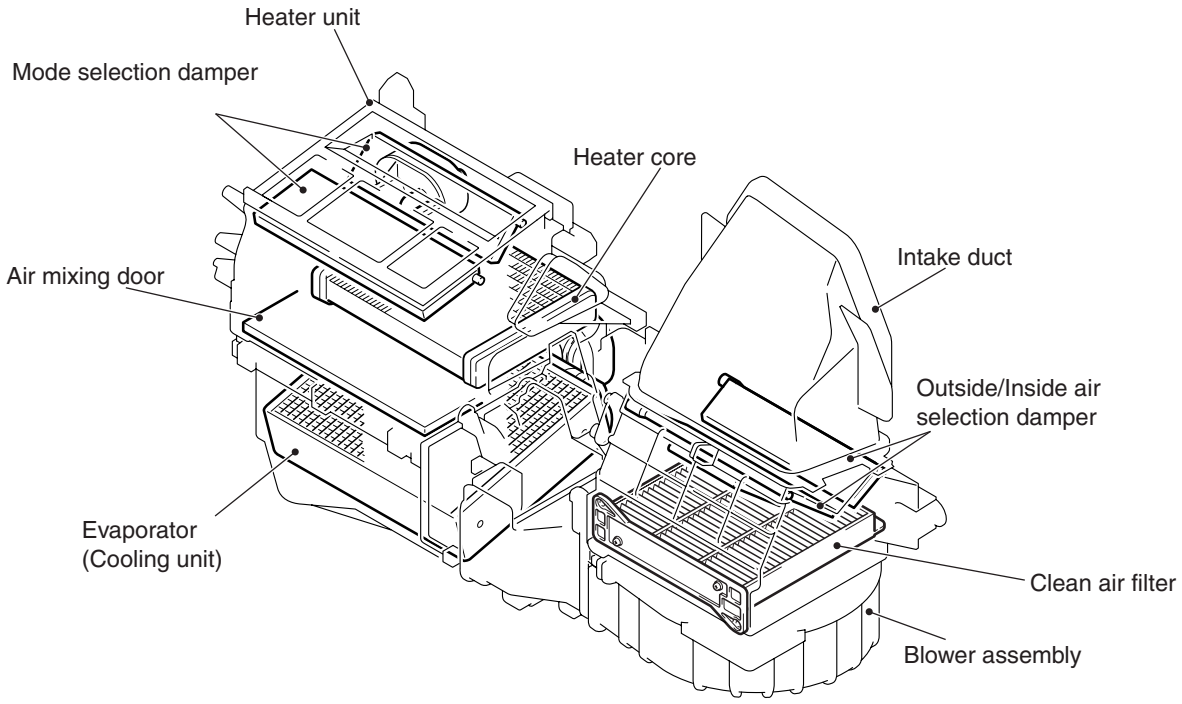
BLOWER ASSEMBLY AND HEATER UNIT



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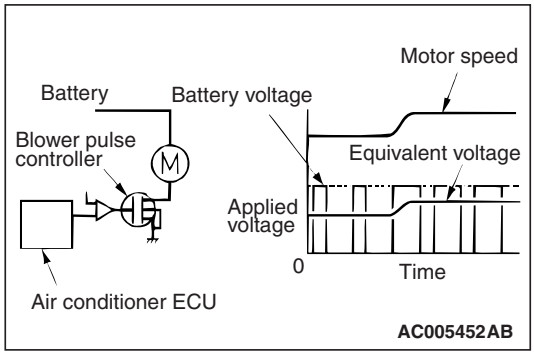
The following blower and heater unit has been adopted to increase air volume, reduce noise, improve A/C performance, as well as improve the passenger compartment environment.

- Installation of two-layer blow full air mix heater
- Incorporation of heater and cooling units
- Increase in the fresh air intake duct area size of the blower assembly and optimisation of its shape
- Large-size heater core to improve the heating performance (Heating output: 5.0kW)
- Adopting the thinner evaporator and enlarging its surface area improves the air-conditioning function (Cooling output: 5.5kW)

BLOWER MOTOR CONTROL <VEHICLES WITH THE AUTOMATIC A/C>



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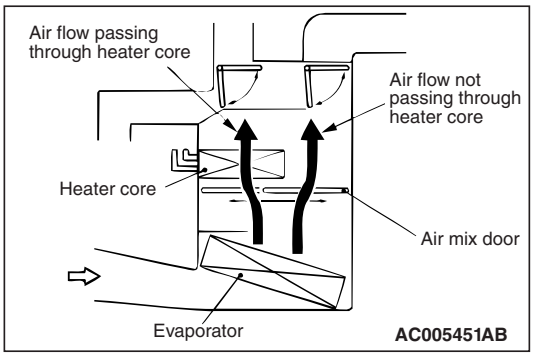
The linear control with PWM (pulse-width modulation) is adopted to the blower motor speed control. Adopting it prevents the excess rotation of the blower motor and decreases the fuel consumption and noise.

The blower pulse controller changes the motor switching time using the pulse signal from A/C-ECU and the motor applied voltage equivalently to control the motor speed linearly.

TWO-LAYER BLOW FULL AIR MIX HEATER

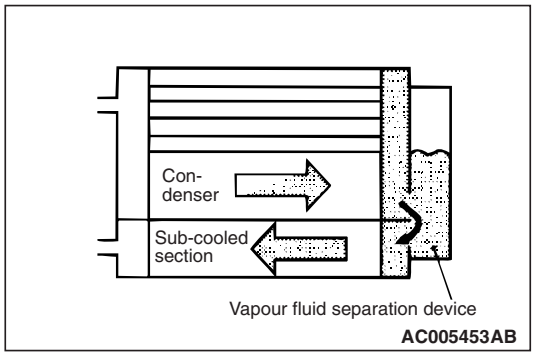


In the heater unit, there are two layers of air; one which passes through the heater core, and another which does not pass through the core. One air mix door is used for temperature control. The two-layer blow full mix heater with low ventilation resistance has increased air volume and has reduced noise.

MAGNETIC CLUTCH WITH THERMAL FUSE

A thermal fuse is installed in the A/C compressor field core. If the compressor fails and locks, the thermal fuse will be blown due to friction heat produced by the drive belt and locked compressor. This deenergises the magnetic clutch and allows the compressor to run freely.
Fuse temperature: 184°C

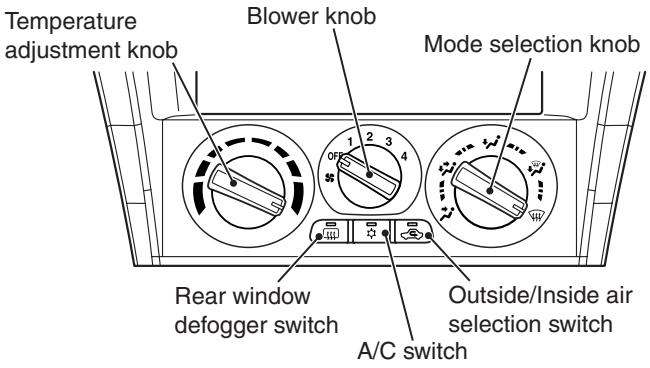
CONDENSER



The heat exchange efficiency has been improved with the adoption of a sub-cooling type condenser added with a sub-cooled section.
The reduction of line connections by incorporating the condenser and receiver reduces the possibility of refrigerant gas leakage and increases serviceability.

HEATER AND A/C CONTROL

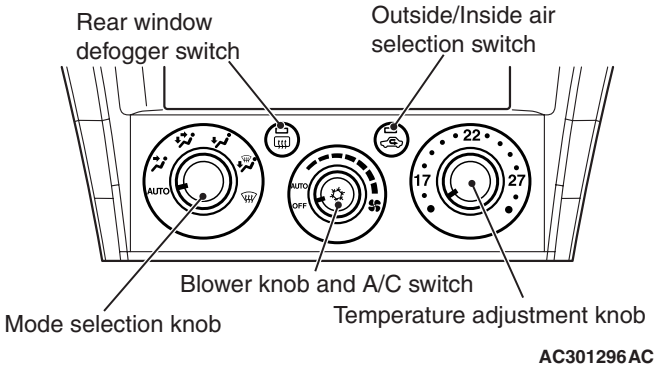
<Manual A/C>



Adoption of the following heater and A/C control has improved operation performance and visibility observation.

- Use of rotary control
- Incorporation of rear window defogger switch with timer
- Use of a large knobs has improved operation performance

<Automatic A/C>



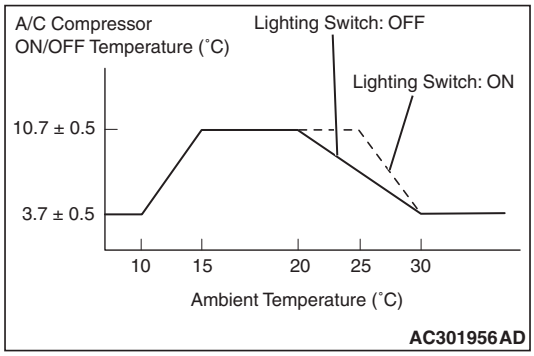
- Improved appearance by incorporating the centre panel
- Adopting the push button for air selection switch improves manoeuvreability.
- Enlarging the figures improves the visibility.
- Green is adopted for the indicator lamp of the A/C.

A/C-ECU integrated in the control panel controls the system as follows.

DEFOGGER TIMER

When the rear window defogger switch is turned to ON with the ignition switch ON, the manual A/C automatically turns off after approximately 11 minutes, and the automatic A/C turns off after 20 minutes to prevent the battery discharge.

COMPRESSOR ENERGY CONSERVATION CONTROL



If the air selection switch is in the outside air mode, information of the lighting switch position and the air thermo sensor sensing temperate is sent to A/C-ECU. Then, sending the signal form the engine-ECU to A/C-ECU executes the energy conservation control of the compressor when evaporator inlet air temperature is from approximately 10°C to approximately 30°C: evaporator outlet temperature is controlled higher than the freezing temperature. If lighting switch is turned ON (tail and headlamp), the temperature is controlled higher than OFF state, presuming of no sun shine.

NOTE: Using the lighting switch position checks the insulation.

COMPRESSOR CUT CONTROL

If A/C-ECU detects that the refrigerant amount is less than the specified level or the refrigerant pressure is lower or higher than thresholds, the air temperature (using the air thermo sensor <for the manual A/C>, or outside air temperature sensor <for the automatic A/C> to measure the refrigerant gas expansion) and the refrigerant pressure (A/C pressure sensor) blink the A/C switch indicator lamp, and forcedly turns off the compressor to prevent the A/C system damage.

COOLING FAN LOAD CONTROL

Depending on the A/C cooling load, the cooling fan speed is controlled continuously with PWM and the exterior noise in the intermediary stage is decreased. Also, the load of the alternator is decreased to improve the fuel economy.

AIR CIRCULATION AUTOMATIC CHANGE CONTROL <VEHICLES WITH THE MANUAL A/C>

If the outside air temperature is high with the A/C switch and the blower switch ON, A/C-ECU changes automatically from the outside air circulation state to the inside air circulation state to cool the room quickly. (With the inside air circulation state, the auto-change control will not be made.) After that, only when the A/C switch or the blower switch is turned OFF, the change control is made. If the outside/inside air selection switch is operated after the auto change, the switch operation takes the priority.

OUTSIDE/INSIDE AIR CIRCULATION AUTO CHANGE CONTROL <VEHICLES WITH THE AUTOMATIC A/C>

If the inside air temperature is cooled quickly with the A/C switch and the blower switch ON, A/C-ECU set the inside air circulation mode automatically. Other than during cooling quickly, A/C-ECU gives priority to set the fresh air mode. If the outside/inside air selection switch is operated after the auto change, the switch operation takes the priority.

DIAGNOSIS CODE <VEHICLES WITH THE AUTOMATIC A/C>

Code No.	Diagnostic item
11	Room temperature sensor system (open circuit)
12	Room temperature sensor system (short circuit)
13	Outside air temperature sensor system (open circuit)
14	Outside air temperature sensor system (short circuit)
15	Heater water temperature sensor system (open circuit)
16	Heater water temperature sensor system (short circuit)
21	Air thermo sensor system (open circuit)
22	Air thermo sensor system (short circuit)
31	Potentiometer system for the air mixing door
32	Potentiometer system for air mode selection damper
41	Motor drive system for air mixing door
42	Motor drive system for air mode selection damper

SERVICE DATA TABLE <VEHICLES WITH THE AUTOMATIC A/C>

Item No.	Check items	Check contents	
11	Room temperature sensor	Ignition switch: ON	Room temperature is the same as M.U.T.-II/III displayed temperature.
13	Outside air temperature sensor	Ignition switch: ON	Outside temperature is the same as M.U.T.-II/III displayed temperature.
15	Heater water temperature sensor	Ignition switch: ON	Heater core wall surface temperature is the same as M.U.T.-II/III displayed temperature.
21	Air thermo sensor	Ignition switch: ON	Evaporator outlet temperate is the same as M.U.T.-II/III displayed temperature
25	Photo sensor	• Ignition switch: ON • Change the volume of insolation.	The volume of insolation takes inverse proportion with the M.U.T.-II/III displayed voltage.
31	Potentiometer for air mixing door	• Ignition switch: ON • Door position: MAX HOT	Opening angle: approximately 100%
		• Ignition switch: ON • Door position: MAX COOL	Opening angle: approximately 0%
32	Potentiometer for air mode selection damper	• Ignition switch: ON • Damper position: FACE	Opening angle: approximately 0%
		• Ignition switch: ON • Damper position: FOOT	Opening angle: approximately 60%
		• Ignition switch: ON • Damper position: FOOT/DEF	Opening angle: approximately 80%
		• Ignition switch: ON • Damper position: DEF	Opening angle: approximately 100%
42	A/C pressure sensor	• Ignition switch: ON	Refrigerant pressure is the same as M.U.T.-II/III displayed pressure.

ACTUATOR TEST TABLE <VEHICLES WITH THE AUTOMATIC A/C>

Item No.	Drive object	Drive content
01	Blower motor	Stop
02		Low speed
03		Middle speed
04		High speed
05	Motor for air mixing door	Open angle: Approximately 0% (MAX COOL)
06		Opening angle: approximately 50%
07		Open angle: Approximately 100% (MAX HOT)
08	Motor for air mode selection damper	FACE
09		FOOT
10		DEF
11	Compressor output	OFF
12		ON
13	Motor for air outside/inside air selection damper	Outside air
14		Inside air
38	Idle-up	OFF
39		ON

VENTILATION SYSTEM

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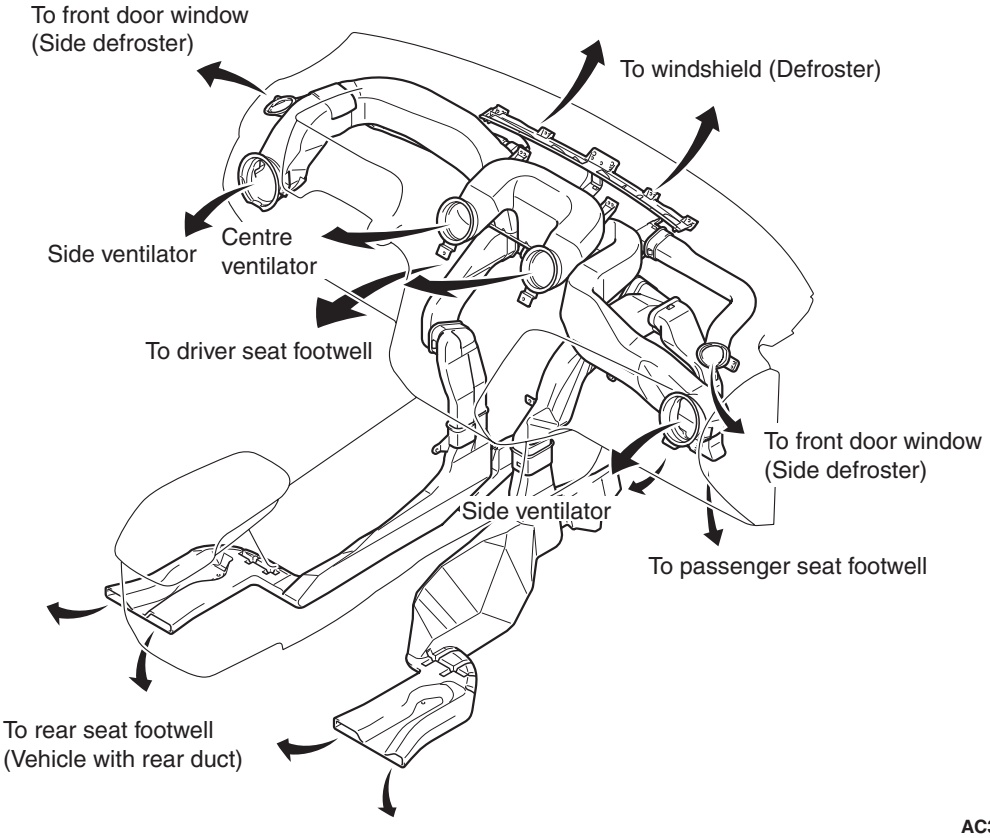
DESCRIPTION OF STRUCTURE AND OPERATION



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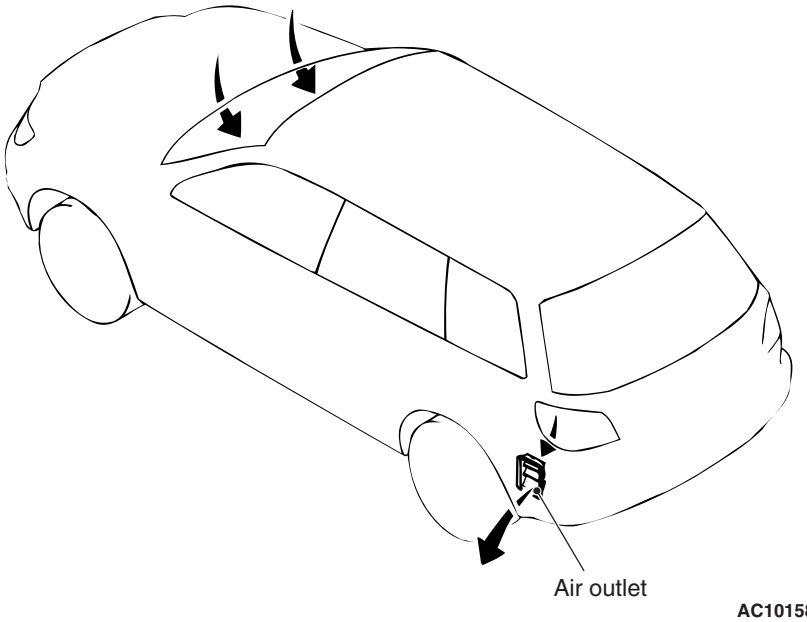

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The adoption of the following mechanism has increased air volume for ventilation and has achieved a ventilation system for defogging windows.

- Adopting the flow-speed type defroster and the unified heater system improves the defroster capacity and speed.
- Optimising areas of the outside air induction hole and the air outlet improves ventilated air amount consisting with the quietness of the room.