
GROUP 55

HEATER, AIR CONDITIONER AND VENTILATION

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GENERAL INFORMATION

M2551000100577

The heater and cooling units of front and rear A/C in the heater and A/C systems are integrated for greater fan power and reduced noise.

Destination	Front	Rear		
	Automatic A/C	Heater	Cooler	Automatic A/C (Dual Automatic A/C)
Vehicles for Australia and New Zealand	Standard equipment	Without	Without	Standard equipment
Vehicles for Hong Kong and Singapore	Standard equipment	Without	Standard equipment	Option
Vehicles for GCC	Standard equipment	Without	Option	Option
Vehicles for general export and Brazil	Standard equipment	Option	Option	Option

FEATURES

IMPROVEMENTS IN COMFORT

- Increased blower air volume during MAX A/C mode contributed by MAX A/C damper
- Improved heating capacity by the PTC heater <Vehicles with rear heater or dual automatic A/C>
- Increased blower air volume by adopting rotary-type for the outside/inside air selection damper
- Air quality within cabin is improved by adopting the clean air filter <standard for Hong Kong, Singapore and optional for other destinations>
- Securing cabin space by positioning the rear heater unit at the rear quarter panel <Vehicles with rear heater, rear cooler or dual automatic A/C>

IMPROVEMENTS IN OPERATION
PERFORMANCE

Improved operationally by the enlarged tab on the dial knob

RELIABLE VISUAL FIELD

(IMPROVEMENT IN SAFETY)

Improved blower air volume and speed by straightening the defroster passage of heater unit

IMPROVEMENTS IN FUEL ECONOMY

- Equipped with high efficiency compressor with 2-step profile adopted <standard for Hong Kong, Singapore and optional for other destinations>
- Reduced numbers of wirings and lighter vehicle weight from installation of CAN communication system

GLOBAL ENVIRONMENT PROTECTION

Adoption of HFC134a for refrigerant.

IMPROVEMENTS IN SERVICE QUALITY

- Reduction of refrigerant gas leakage and improvement in serviceability by incorporating condenser and receiver

RESPONSIBILITY IMPROVEMENT

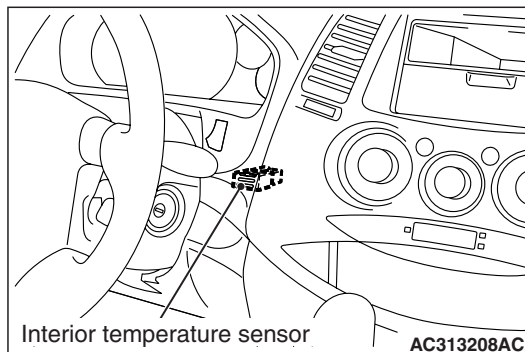
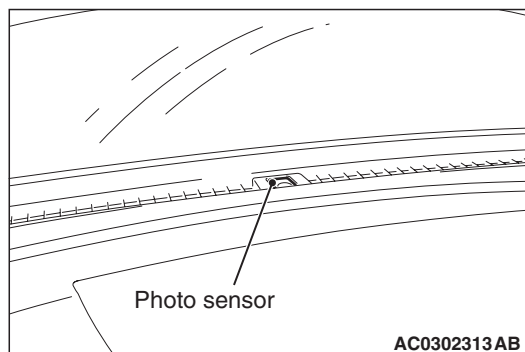
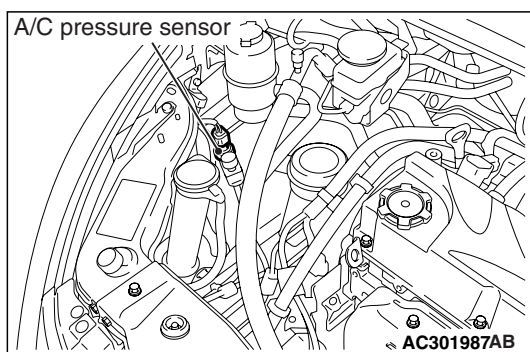
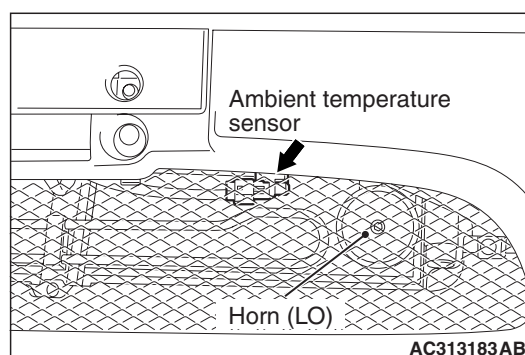
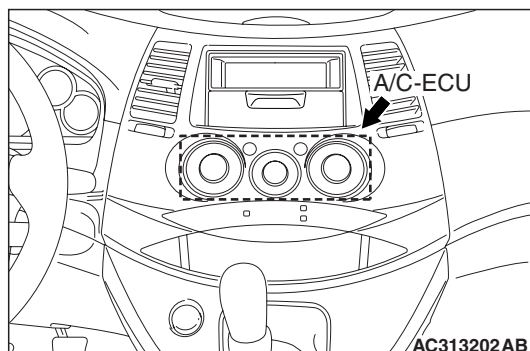
Reliable information transmission is achieved by connecting A/C-ECU and each ECU via CAN communication.

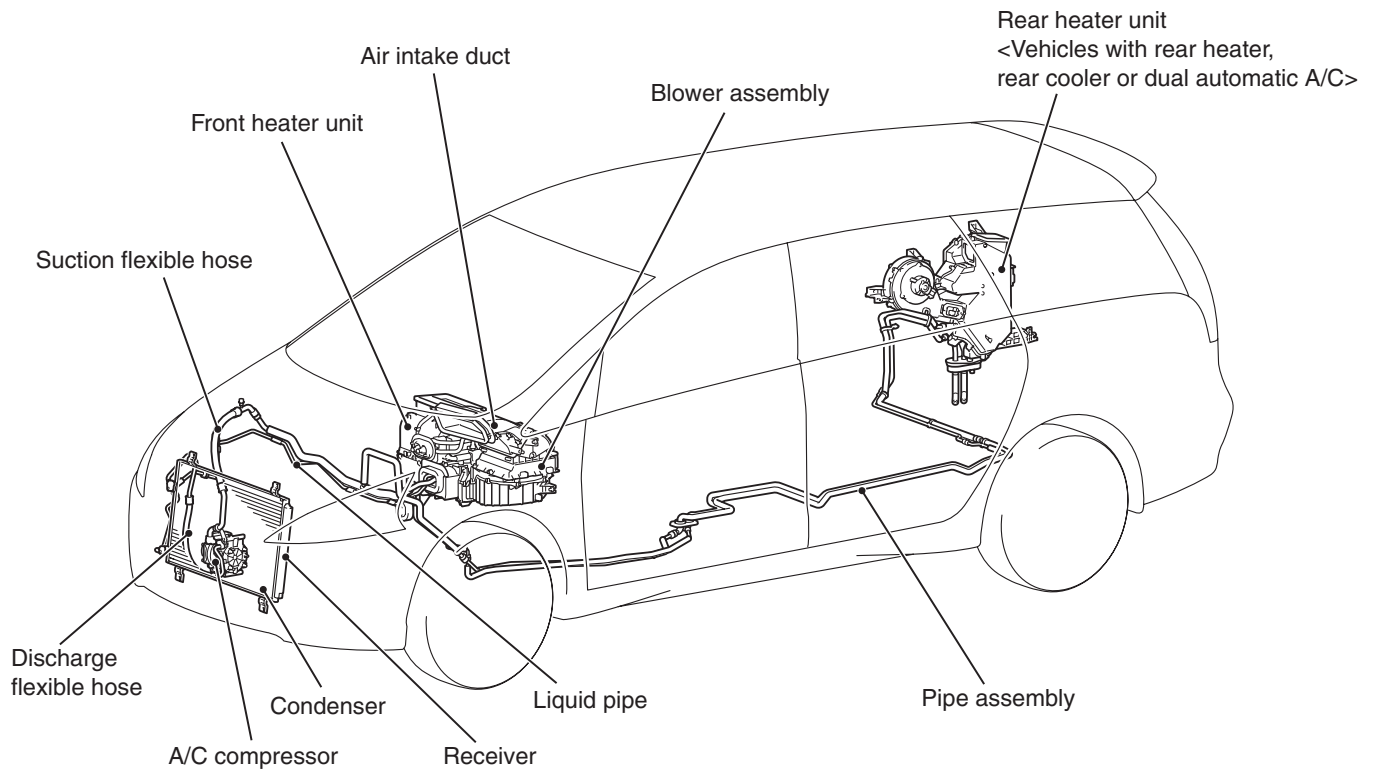
SPECIFICATIONS

Item		Specifications
Heater control type		Rotary type
Front A/C	Heating capacity (W)	5,500
	Cooling capacity (W)	5,400
	Heating capacity of PTC heater (W)	120 × 2

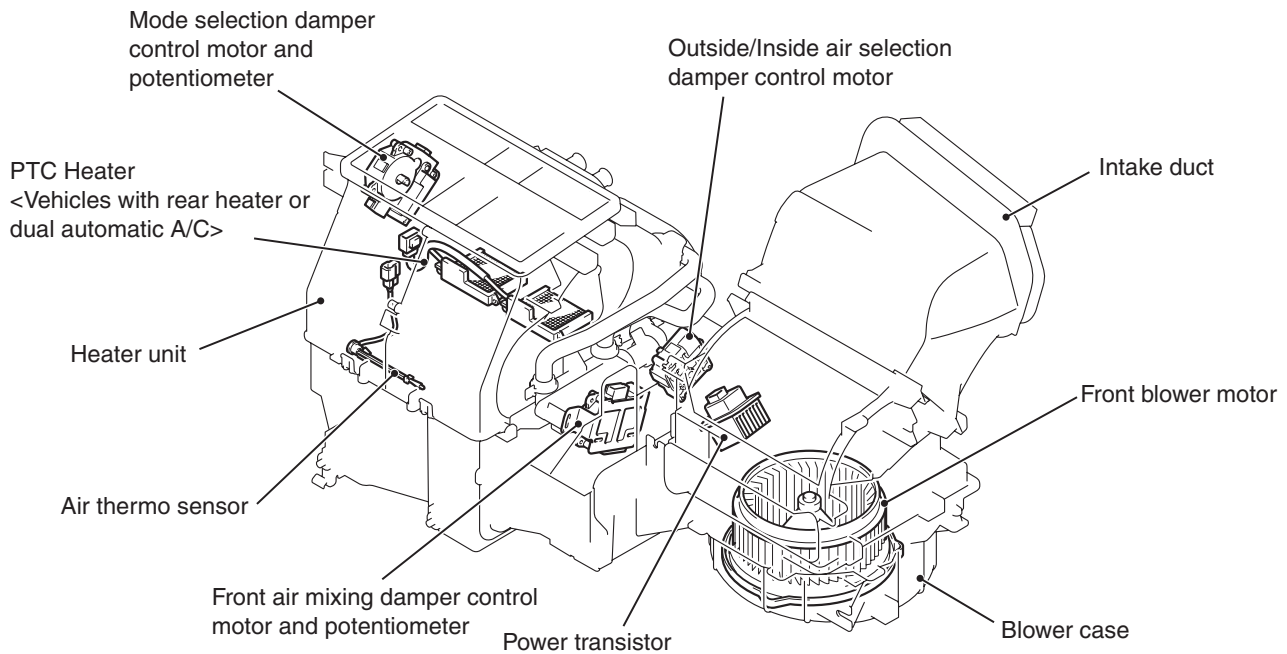
Item			Specifications
Rear A/C	Heating capacity (W)		2700
	Cooling capacity (W)		2100
Compressor type	Vehicles for Hong Kong and Singapore		MSC105CA
	Except vehicles for Hong Kong and Singapore		10S17
Refrigerant	Type		HFC134a
	Charge quantity g	Vehicles without rear cooler or dual automatic A/C	560 ± 25
		Vehicles with rear cooler or dual automatic A/C	700 ± 25
		Vehicles for Hong Kong and Singapore	750 ± 25

CONSTRUCTION DIAGRAM





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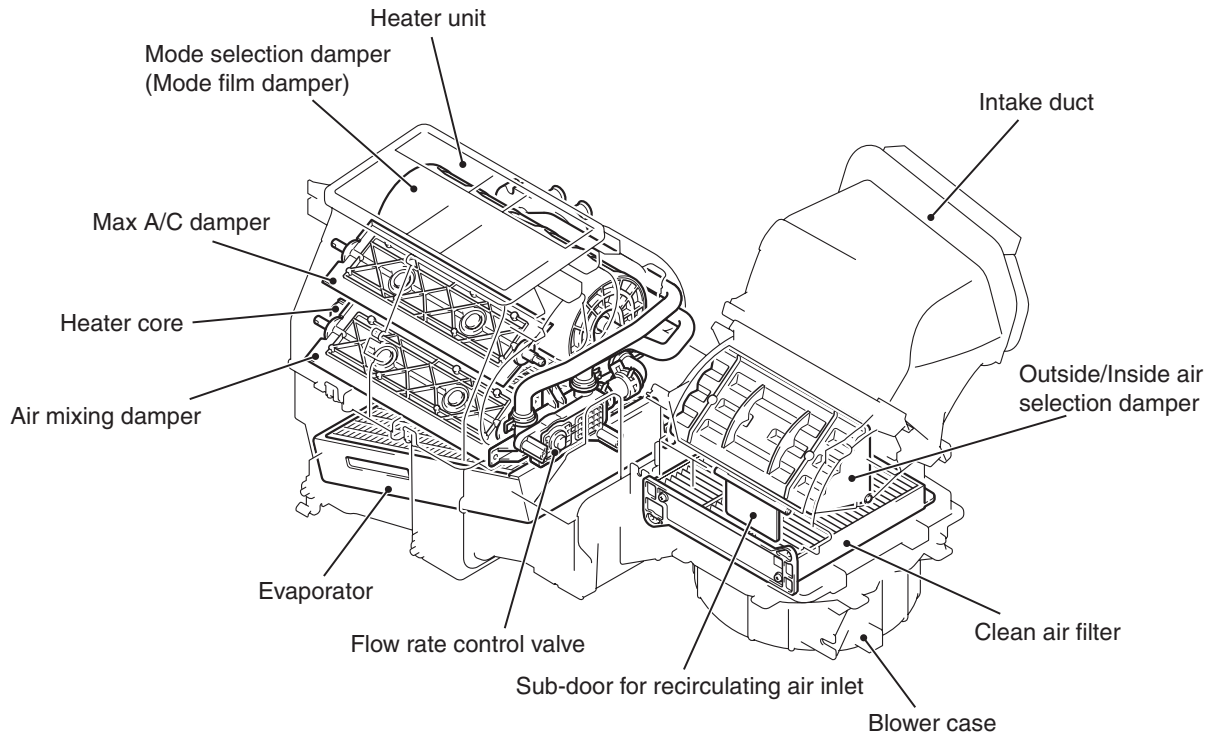


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HEATER UNIT

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FRONT HEATER UNIT

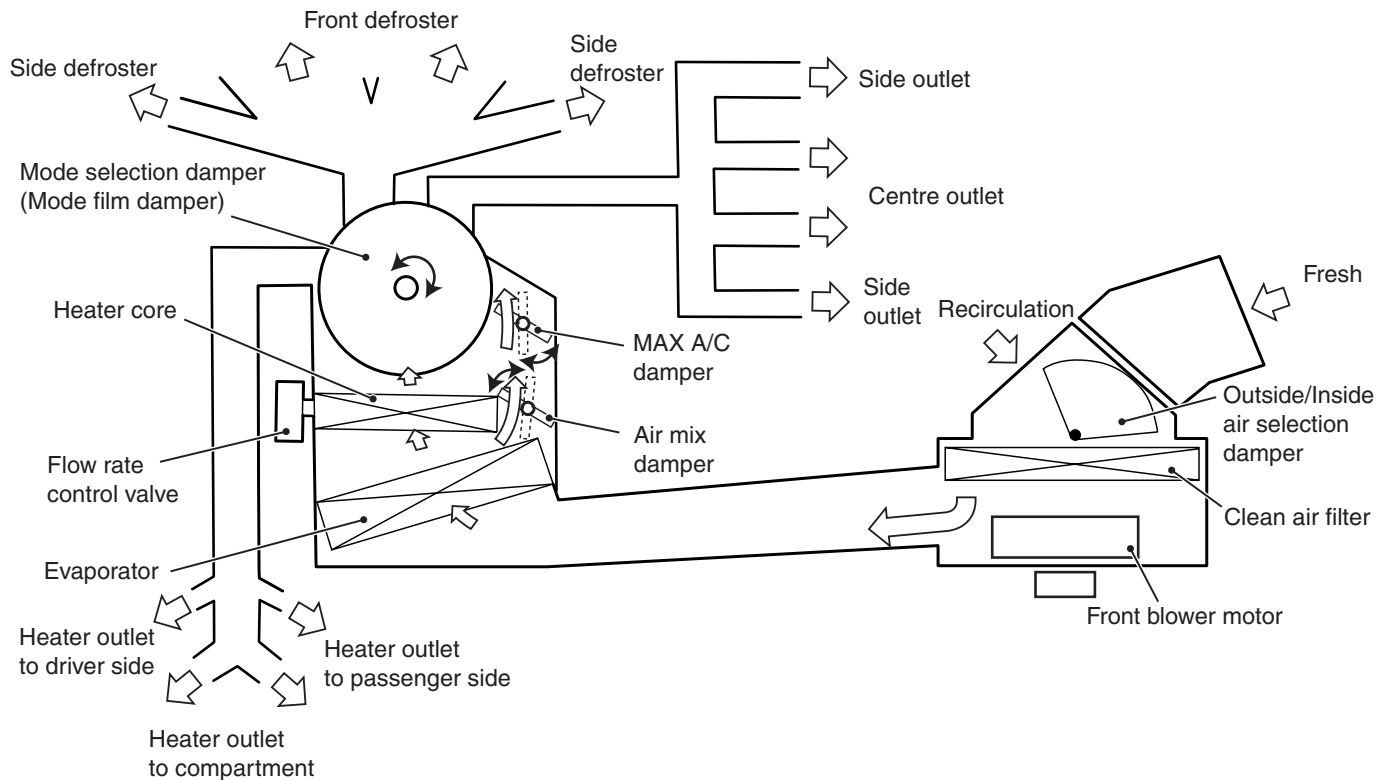


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The following blower assembly and heater unit are installed for greater fan power, reduced noise, and improved cooler and heater performance.

- Integrated heater/cooling unit of the heater unit is adopted for greater fan power and reduced noise.
- Mode selection damper is adopted for air outlet switching damper for greater fan power, reduced noise, and low power consumption.
- MAX A/C damper is installed to enlarge airflow passage for greater fan power during maximum cooling operation.
- PTC heater is adopted for improved heating performance. <vehicles with rear heater or dual automatic A/C>
- Low airflow-resistance rotary damper is installed as outside/inside air selection damper for greater fan power.
- Coolant-flow rate control valve is installed as outlet air temperature adjustment to reduce air-flow resistance for greater fan power.
- Clean air filter has been adopted for improved comfort. <standard for Hong Kong, Singapore and optional for other destinations>
- Sub-door for recirc. air inlet have been adopted for greater heating performance. <vehicles with rear heater or dual automatic A/C>

OPERATION



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DURING COOLING

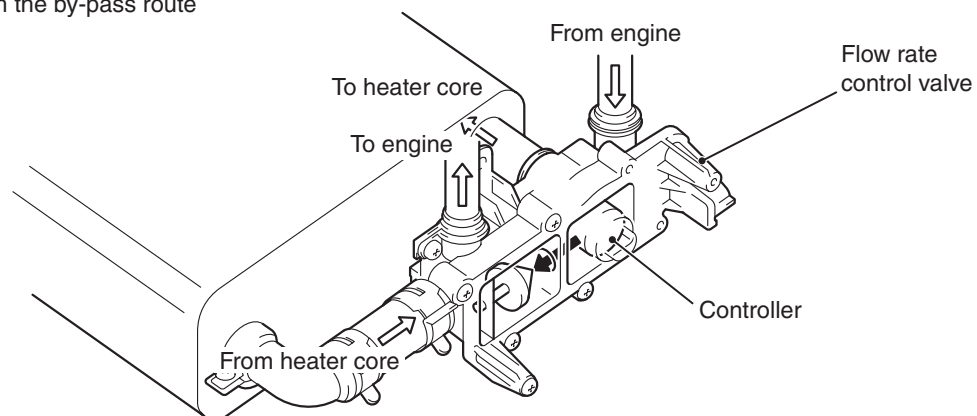
The air sent from the blower assembly (blower motor) passes through the evaporator to be cooled. Cooled air passes through the opened air-mixing damper and is lead to each outlet by the outlet switching damper.

DURING HEATING

The air sent from the blower assembly (blower motor) is cooled and dehumidified in the evaporator, then is sent to the heater core. The air heated-up as passes in the heater core is sent to each outlet by the outlet switching damper.

FLOW RATE CONTROL VALVE

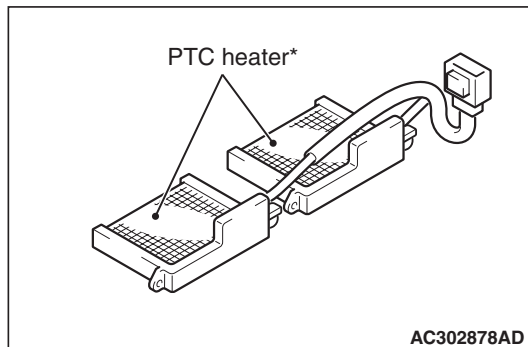
- ↔ : Coolant through the heater core
 ← : Coolant through the by-pass route



AC310021AC

Flow rate control valve adjusts outlet air temperature by controlling amount of coolant. This simplifies the internal structure of the heater unit and reduces air-flow resistance for improved fan power. Coolant does not flow through the heater core, but it only flows through the bypass route during maximum cooling operation. Therefore, temperature-change reaction improves without heating-up cooled air when setting temperature is changed.

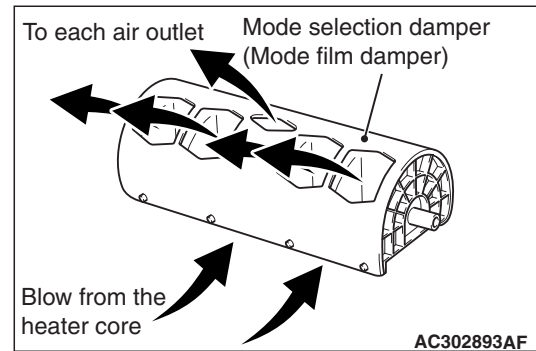
PTC HEATER <VEHICLE WITH REAR HEATER OR DUAL AUTOMATIC A/C>



The PTC heater installed on the front heater unit improves heating performance in cold range just after engine starting by electrically generating heat when ambient and engine coolant temperatures are cold.

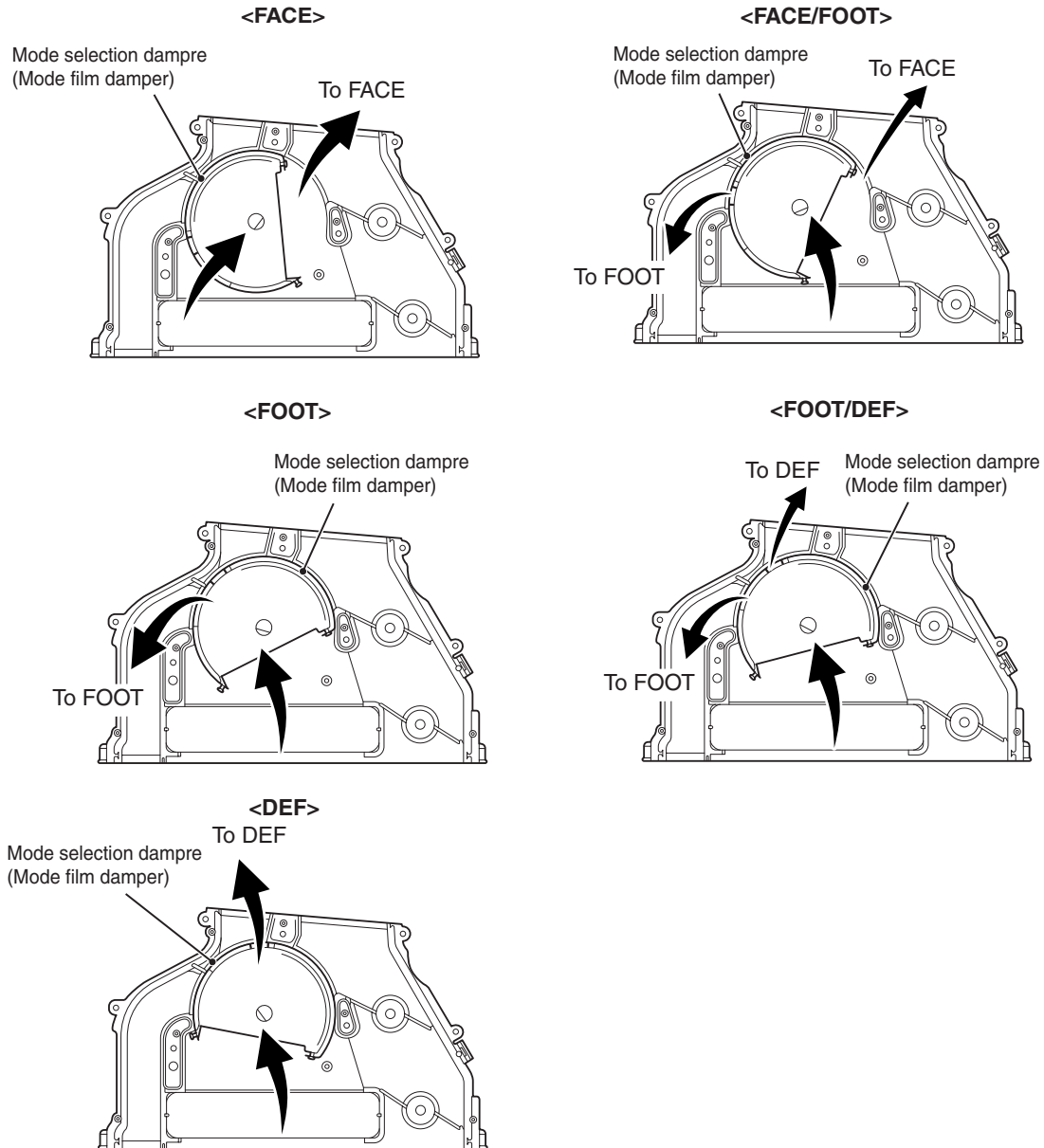
*NOTE: *: Positive temperature coefficient*

MODE SELECTION DAMPER



Mode selection damper is adopted as an air outlet switching damper to reduce airflow resistance for greater fan power, reduced noise, and low power consumption.

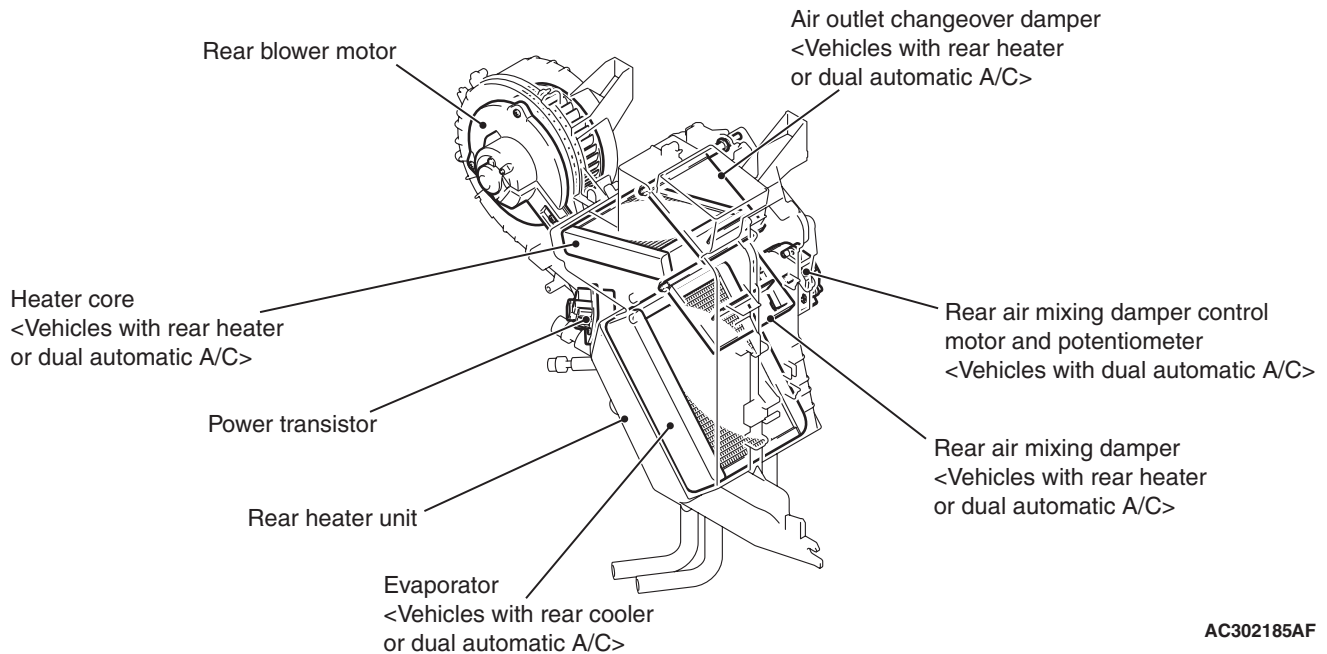
OPERATION



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The motor (mode selection damper) of the air outlet switching damper rotates for air distribution.

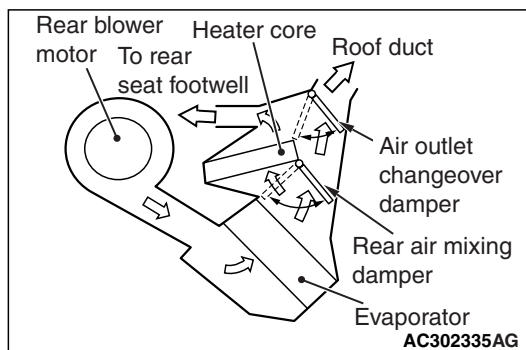
REAR HEATER UNIT <VEHICLES WITH REAR HEATER, REAR COOLER OR DUAL AUTOMATIC A/C>



The following rear heater unit is installed to improve comfortableness of the third seat.

- Cabin speciousness is secured by positioning the rear heater unit in the rear quarter.
- The heater enabling to mix air is installed for heat performance improvement. <vehicles with rear heater or dual automatic A/C>

OPERATION OF REAR AIR CONDITIONER



DURING COOLING <VEHICLE WITH REAR COOLER OR DUAL AUTOMATIC A/C>

The air sent from the rear blower motor is cooled by the evaporator, then is supplied to the roof duct.

DURING HEATING <VEHICLE WITH REAR HEATER>

The air sent from the rear blower motor is sent to the heater core. The air heated-up by the heater core is sent to foot area of the third seats.

DURING HEATING <VEHICLE WITH DUAL AUTOMATIC A/C>

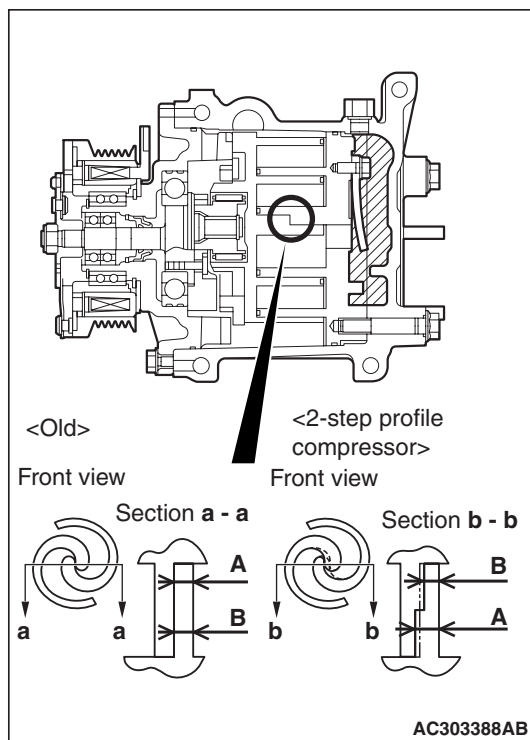
The air sent from the rear blower motor is cooled in the evaporator, then is sent to the heater core dehumidifying air. The air heated-up by the heater core is sent to foot area of the third seats.

COMPRESSOR

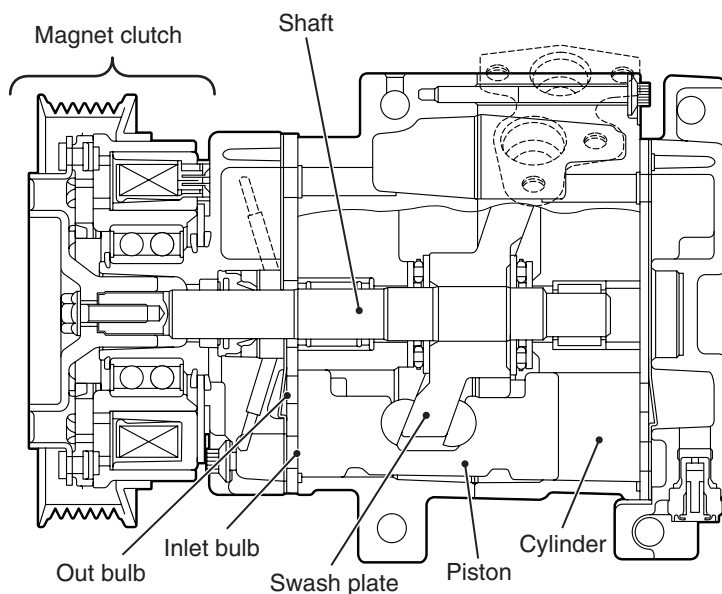
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2-STEP PROFILE COMPRESSOR <VEHICLES FOR HONG KONG AND SINGAPORE>

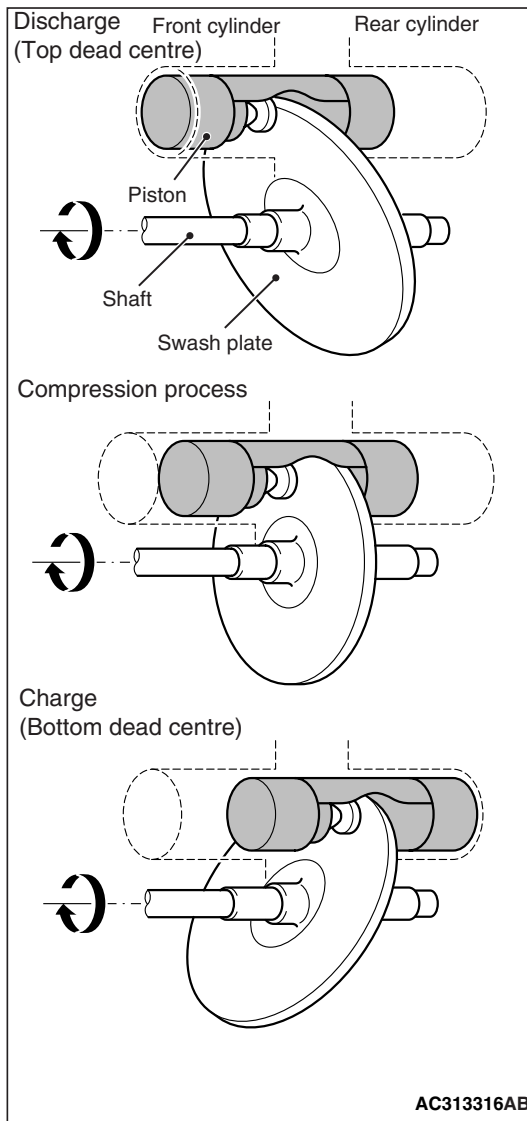
The centre area of the scroll in the compressor provides 2-step profile, and increases thickness of area "B" shown in the figure to improve strength. With this feature, thickness of area "A" shown where lesser load is applied is reduced, thus compressor performance is improved by compressing refrigerant even in central area, comparing to the previous model.



SWASH PLATE TYPE COMPRESSOR <EXCEPT VEHICLES FOR HONG KONG AND SINGAPORE>



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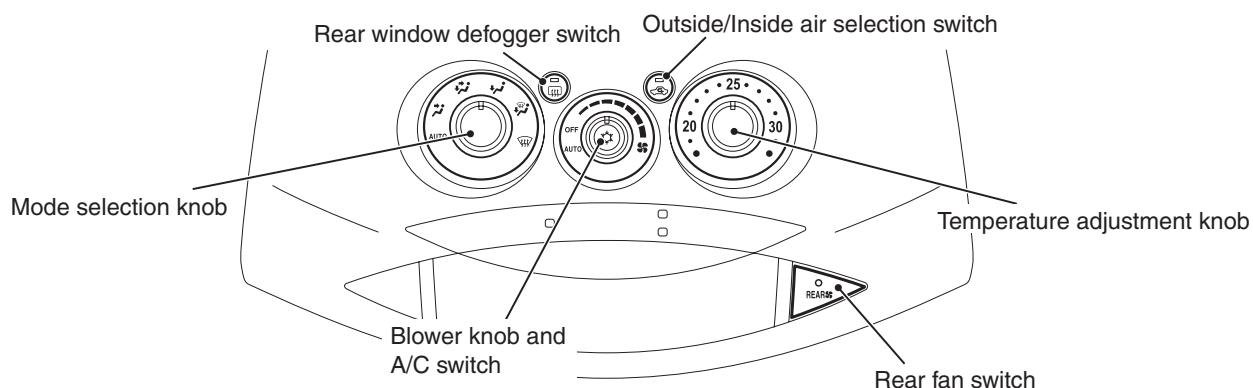


When the compressor clutch is turned on, the compressor shaft rotates together with the swash plate. The swash plate rotation allows the charge/discharge operation of the compressor piston.

HEATER CONTROL

M2551000900227

FRONT HEATER CONTROLLER



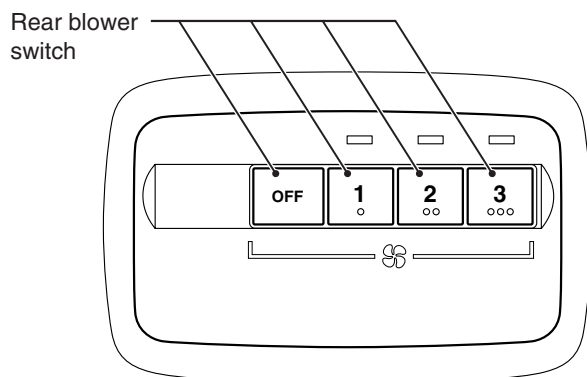
AC503156 AC

The features of the heater controller described below are designed for better operation and easier visual recognition.

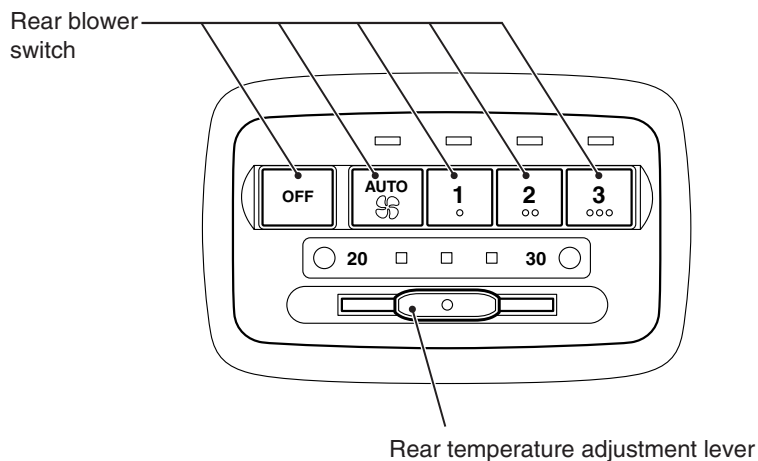
- The dials of outlet switching, fan volume control, and temperature adjustment are enlarged to improve operationally.
- Dial-type temperature control is adopted to improve operationally during driving.

REAR HEATER CONTROLLER

<Vehicle with rear heater or rear cooler>



<Vehicle with dual automatic A/C>



AC311883AB

The rear controller switch is enlarged to improve operationally. By positioning the rear heater controller on the headliner in front area of the second seat, operation of the switch from driver's seat has been made available.

A/C-ECU

M2551001200050

CONTROL

FORCED DEF CONTROL

When air outlet position is switched to DEF, A/C is automatically turned ON, and outside/inside air selection damper is set to the fresh air position to quickly defrost the windshield screen.

MAX COOL, MAX HOT CONTROL <FRONT A/C>

When setting temperature is at MAX COOL or MAX HOT with the air outlet and air volume at the AUTO position, the following control is made.

Subject to control	MAX COOL	MAX HOT
Air mix damper	MAX COOL position	MAX HOT position
Outlet mode (Auto position)	FACE position	FOOT position
Air volume (Auto position)	Maximum	Maximum
Outside/inside air selection damper	Air recirculation position	Fresh air position
A/C switch	ON	OFF

IDLE-UP CONTROL

Communication between A/C-ECU and engine-ECU (M/T) or engine-A/T-ECU (A/T) controls the engine idle-up-speed via CAN communication depending A/C load, thus cooling capacity in summer time is secured and fuel economy in mid-range is improved.

DETECTION CONTROL FOR REFRIGERANT LEAKS

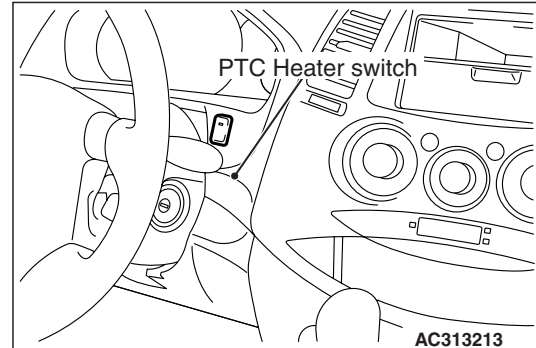
A/C-ECU judges if refrigerant amount is less than specified or refrigerant pressure is abnormal by ambient temperature (ambient temperature sensor to measure refrigerant inflation rate) and refrigerant pressure (measured by A/C pressure sensor). When refrigerant amount or refrigerant pressure is judged abnormal, the compressor is cut-off to protect the A/C system.

NOTE: When abnormality occurs, the A/C indicator flashes.

REAR WINDOW DEFOGGER TIMER CONTROL

In order to prevent battery consumption, the defogger is automatically turned OFF, 20 minutes after it is turned ON.

PTC HEATER CONTROL <VEHICLE WITH REAR HEATER OR DUAL AUTOMATIC A/C>



When the following conditions are met, the PTC heater operates.

- PTC heater switch: ON
- Air outlet: FOOT/DEF, FOOT, FACE/FOOT
- Temperature control dial: 32° C (MAX HOT)
- Coolant temperature: below 82 °C

NOTE: When coolant temperature becomes above 82 °C and PTC heater stops operation, PTC heater will not operate until coolant temperature becomes below 72 °C

WARMING-UP IDLE UP CONTROL <VEHICLE WITH REAR HEATER OR DUAL AUTOMATIC A/C>

When the following conditions are met, idle-up is made to assist heating capacity.

- With vehicle stopped
- PTC heater switch: ON

CAN COMMUNICATION INPUT SIGNALS TABLE

Signal	Transmitter ECU
Engine speed signal	Engine-ECU <M/T> or engine-A/T-ECU <A/T>
A/C information signal	
Vehicle stop signal	
Vehicle speed signal	
Engine coolant temperature signal	
ACC ON signal	ETACS-ECU

DIAGNOSTIC FUNCTION

Code No.	Diagnostic item	Service data display contents when diagnosis code is set
B1001	Interior temperature sensor system (short circuit)	25° C
B1002	Interior temperature sensor system (open circuit)	
B1011	Ambient air temperature sensor system (short circuit)	20° C
B1012	Ambient air temperature sensor system (open circuit)	
B1021	Air thermo sensor system (short circuit)	– 6° C
B1022	Air thermo sensor system (open circuit)	
B1041	Potentiometer system for front air mixing damper (short to power)	Moved to MAX HOT position
B1042	Potentiometer system for front air mixing damper (short to earth or open circuit)	
B1045	Motor drive system for front air mixing damper	–
B1051	Potentiometer system for rear air mixing damper (short to power) <vehicles with dual automatic A/C>	Moved to MAX HOT position
B1052	Potentiometer system for rear air mixing damper (short to earth or open circuit) <Vehicles with dual automatic A/C>	
B1055	Rear air mixing damper motor drive system <Vehicles with dual automatic A/C>	–
B1061	Potentiometer system for mode selection damper (short to power)	Moved to DEF position
B1062	Potentiometer system for mode selection damper (short to earth or open circuit)	
B1065	Motor drive system for mode selection damper	–
U1073	Bus off error	–
U1100	Engine-related CAN timeout	–
U1109	ETACS-related CAN timeout	–
U1120	Engine-related failure data	–

SERVICE DATA OUTPUT

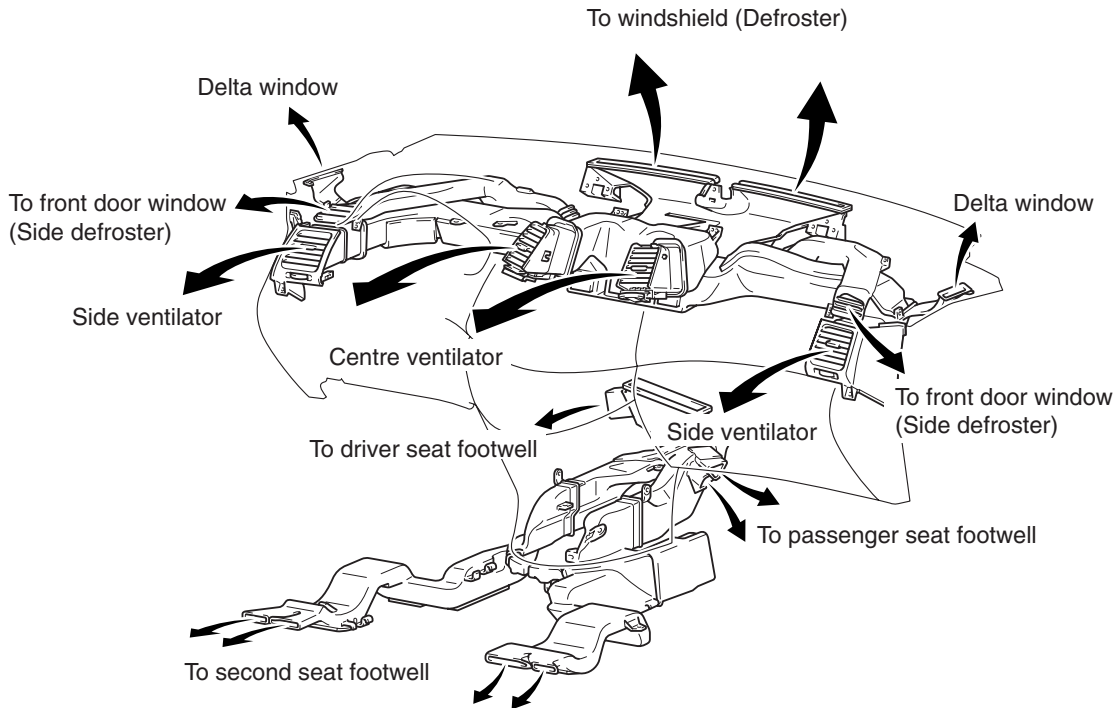
Item No.	Check items
01	Inside temperature sensor
02	Outside temperature sensor
03	Air thermo sensor
04	Pressure sensor
05	heater water temperature sensor
06	Photo sensor
10	F. Air mix potentiometer
11	F. Air mix potentiometer (Target)
12	R. Air mix potentiometer <Vehicles with Dual automatic A/C>
13	R. Air mix potentiometer (Target) <Vehicles with dual automatic A/C>
14	F. Air outlet c/o potentiometer
15	F. Air outlet c/o potentiometer (Target)
16	In/out air damper motor
20	Front blower fan
21	Front blower fan (Target)
22	Rear blower fan
23	Rear blower fan (Target)
30	A/C switch
31	Rear fan SW (Front)
32	Rear control OFF switch
33	Rear control fan switch
34	Rear defogger switch
35	PTC heater switch <Vehicle with rear heater or dual A/C>
36	Rear fan SW lamp (Front)
38	Rear control SW lamp
39	PTC heater lamp <Vehicles with rear heater or dual automatic A/C>
40	Illuminations power supply
41	PTC heater relay <Vehicles with rear heater or dual automatic A/C>
50	Front Temperature setting
51	Rear Temperature setting
55	Refrigerant leak
56	Low pressure
6B	Rear control SW operation flag
6C	Rear control SW lamp
6F	A/C OFF SW operation flag

ACTUATOR TEST

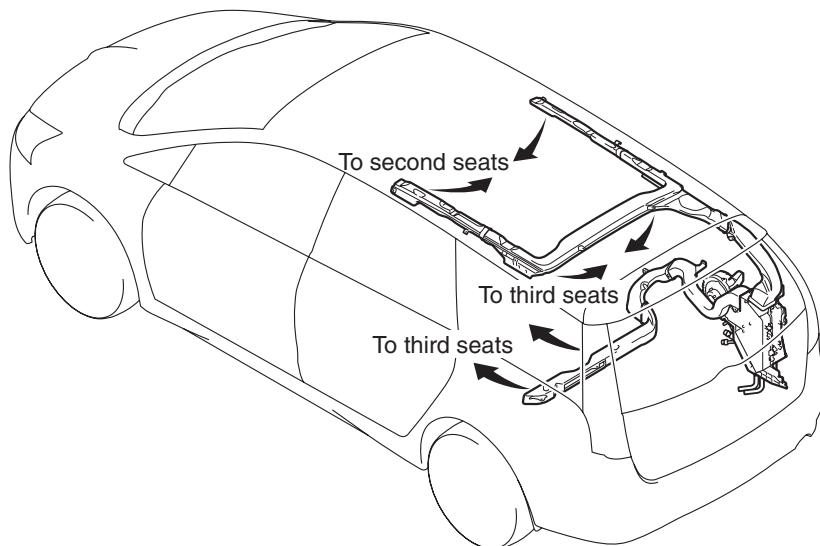
Item No.	Check items	Drive content
01	Front blower fan: OFF	Stop
02	Front blower fan: Middle	Middle speed
03	Front blower fan: High	High speed
04	Rear blower fan: OFF	Stop
05	Rear blower fan: AUTO	AUTO
06	Rear blower fan: Lo	Low speed
07	Rear blower fan: Middle	Middle speed
08	Rear blower fan: High	High speed
09	Condenser fan: OFF	Stop
0A	Condenser fan: 50%	Middle speed
0B	Condenser fan: 100%	High speed
10	F. Air mix dumper motor: 0%	Opening angle: Approximately 0% (MAX COOL)
11	F. Air mix dumper motor: 50%	Opening angle: Approximately 50%
12	F. Air mix dumper motor: 100%	Open angle: Approximately 100% (MAX COOL)
13	R. Air mix dumper motor: 0% <Vehicles with dual automatic A/C>	Opening angle: Approximately 0% (MAX COOL)
14	R. Air mix dumper motor: 50% <Vehicles with dual automatic A/C>	Opening angle: Approximately 50%
15	R. Air mix dumper motor: 100% <Vehicles with dual automatic A/C>	Open angle: Approximately 100% (MAX COOL)
20	Air outlet c/o dumper: FACE	Air outlet at FACE position
21	Air outlet c/o dumper: Bi-Level	Air outlet at FACE/FOOT position
22	Air outlet c/o dumper: FOOT	Air outlet at FOOT position
23	Air outlet c/o dumper: DEF/FOOT	Air outlet at DEF/FOOT position
24	Air outlet c/o dumper: DEF	Air outlet at DEF position
30	In/out changeover dumper: Recirculation	Moved to recirculation-side
31	In/out changeover dumper: Fresh	Moved to outside air-side
40	Rear defogger switch: OFF	Rear window defogger OFF
41	Rear defogger switch: ON	Rear window defogger ON
42	PTC heater relay: OFF <Vehicles with rear heater or dual automatic A/C>	PTC heater OFF
43	PTC heater relay: ON <Vehicles with rear heater or dual automatic A/C>	PTC heater ON (air outlet at FACE or DEF position, not operate with blower OFF)
50	Idle up request: OFF	Idle rpm (not operate with compressor ON)
51	Idle up request: low load	Idle up with low load rpm
52	Idle up request: high lode	Idle up with high load rpm

DUCT

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The following ventilation system has been adopted in order to improve comfortableness, appearance, and defroster performance.

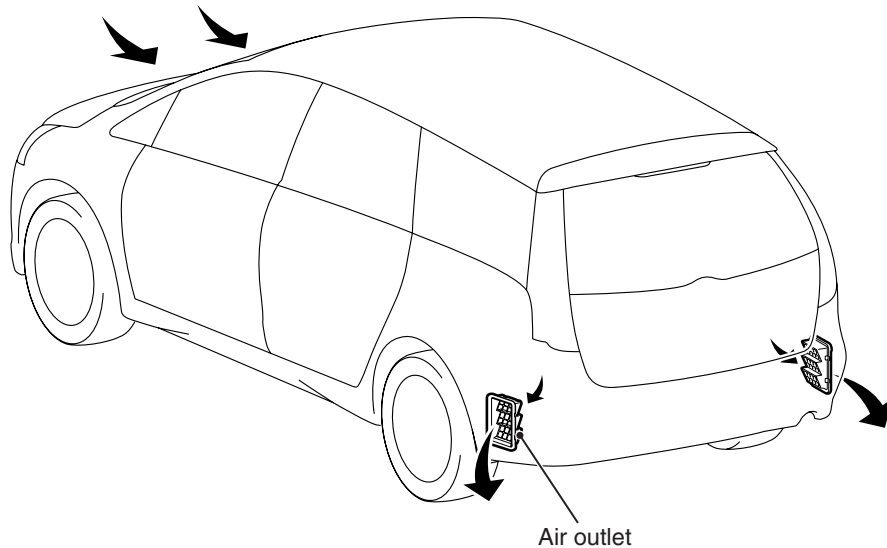
- Air outlet is established to provide comfortable cooling space.
- The defroster outlet is hidden from the front seats to improve cabin appearance.
- The defroster passage of heater unit has been straightened to improve defogger performance.

- The rear automatic A/C automatically switches to blowing of warm air for foot area and cool air from the roof outlet in order to improve comfortable-ness of rear seat. <vehicles with dual automatic A/C>

VENTILATION SYSTEM

M2551002000264

REAR VENTILATION



AC302229AB

Fresh air is drawn from the front deck, and it is extracted from air outlet located back of rear bumper. Areas of fresh air intake hole and air outlet ventilation have been optimised in order to improve air volume (ventilation performance) while securing cabin quietness.