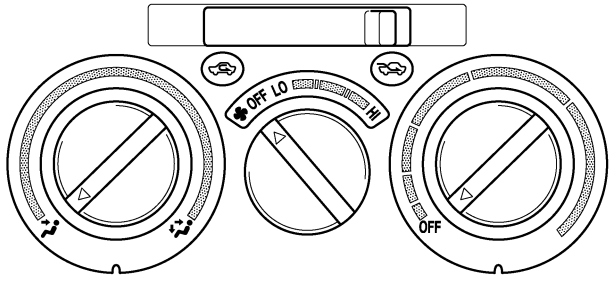
■ CONSTRUCTION AND OPERATION

1. Heater Control Panel for Manual Control Type

General

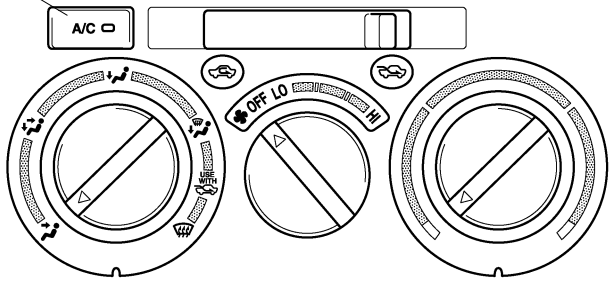
- The rotary switch is used for the heater control panel for the manual cooler and air conditioning.
- Five air outlet modes are provided on the control panel with an air conditioning. To enable finer mode settings, a positive feel is provided between the positions of these modes, thus enhancing the comfort level.
- Conventionally, the air outlet mode and the air inlet temperature control switches were operated with a single cable. Instead, the new model has employed a method that uses two cables on pulleys that are always operated in the pulling direction.



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Models with Cooler

Models with Air Conditioning

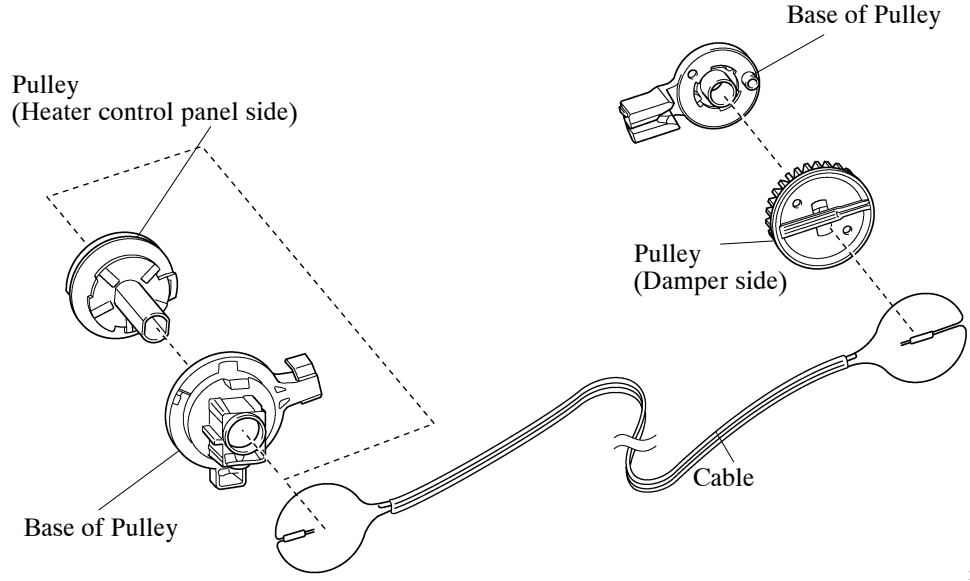


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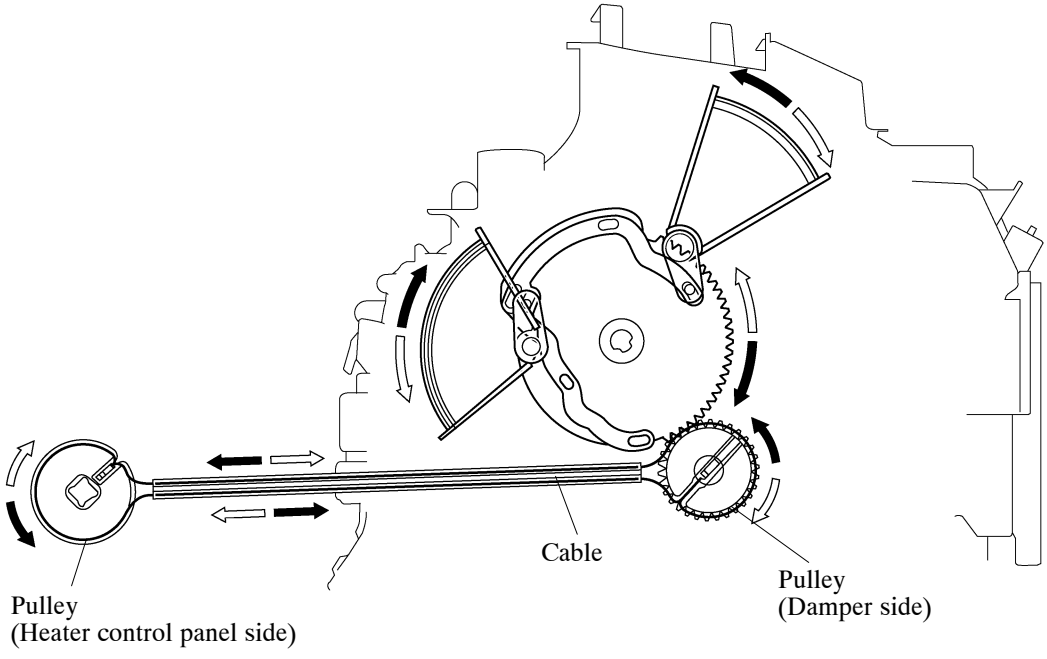
Models with Heater and Air Conditioning

Heater Control Cable

- The heater control cable is circular, and is placed around the cable pulleys that are provided at the heater control panel and the damper.
- The operation of the heater control panel is transmitted to the damper via the control cable, which always moves in the pulling direction. Due to the consistent action point of the pulleys, the fluctuation of the operating effort has been minimized through the use of the pulleys. These measures have improved the ease of use and reduced the operating effort.



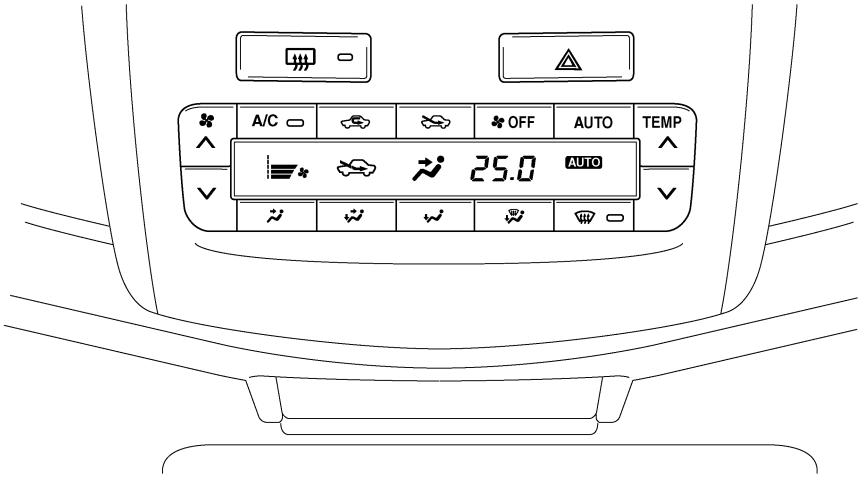
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2. Heater Control Panel for Automatic Control Type

- The heater control panel of the automatic control type uses a push-button control and an LCD (Liquid Crystal Display) to display the set temperature, air outlet mode, and blower speed.
- The rear defogger switch and the hazard switch have been placed on the heater control panel. Furthermore, the air conditioning amplifier has been integrated in the heater control panel.

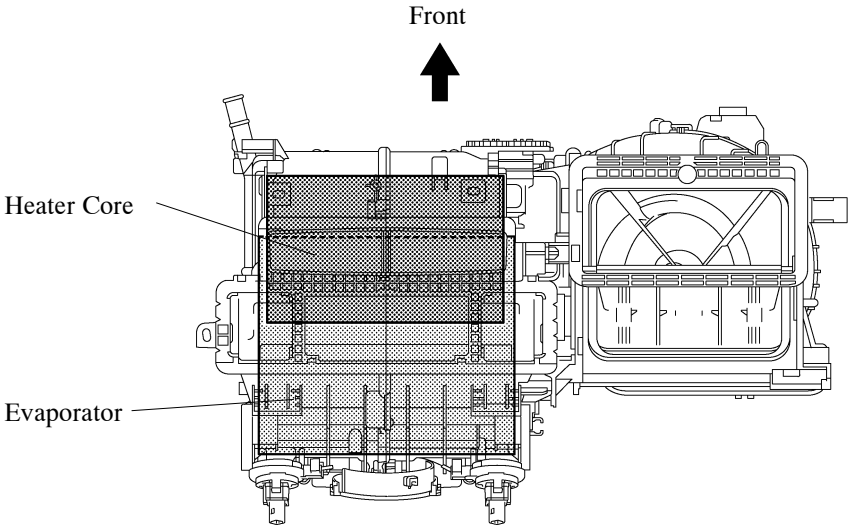


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3. Air Conditioning Unit

General

A semi-center location air conditioning unit is used, in which the evaporator and heater core are placed in the vehicle's longitudinal direction. As a result, the air conditioning unit has been made compact and lightweight.

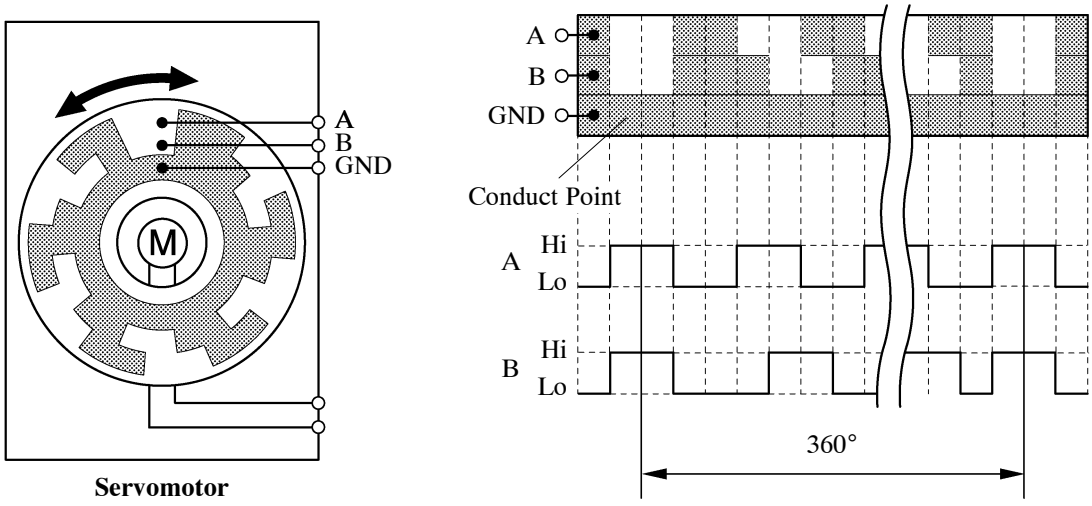


LHD Model

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Servomotor (for Automatic Control Type)

The pulse pattern type servomotor consists of a printed-circuit board and servomotor. The printed-circuit board has three contact points, and transmits the two ON/OFF signals with different pulse phases to the bus connector. The bus connector detects the damper position and movement direction by these signals, and transmits the results to the air conditioning ECU.



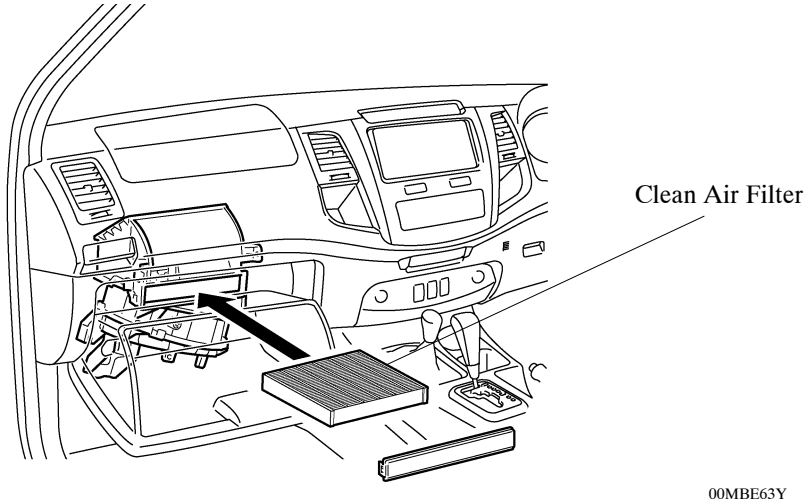
Servomotor

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- After the negative battery terminal cable has been reconnected, the air conditioning amplifier initializes both the mode and air inlet servomotors twice, once when the ignition switch is turned ON and then turned off. The DEF light inside the heater control panel flashes while initializing.

Clean Air Filter

- A semi-standard type clean air filter or a high efficiency type clean air filter is used. The clean air filter is installed in the upper section of the blower fan for easy replacement of the clean air filter without the need for removing the one-touch clip in the glove box.
- The high efficiency type clean air filter is used to remove dust, pollen, and other micron particles from air entering from the outside of the vehicle to provide a comfortable cabin with clean air.



Service Tip

- The replacement intervals are shown in the chart below:

▶ High Efficiency Type ◀

Destination	Replacement interval	
	Normal Condition	Dusty Condition
South Africa	15000 km	15000 km
G.C.C. Countries, Central and South America, ANCOM, and General Countries	20000 km	15000 km

▶ Semi-standard Type ◀

Destination	Replacement interval
Thailand, Indonesia, Philippines, Malaysia, and Vietnam	30000 km

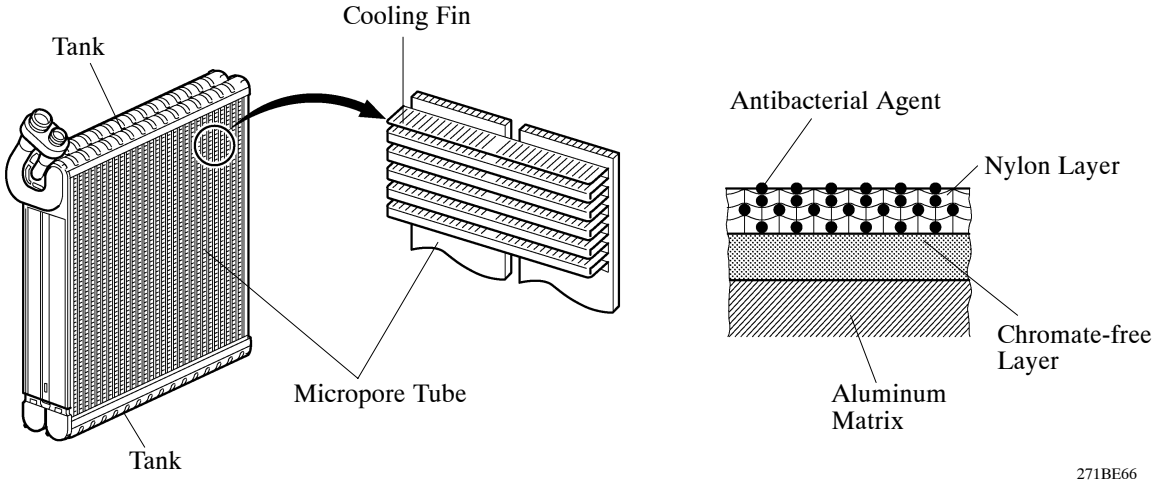
- Replace the clean air filter after the ignition switch is turned off.

Evaporator

- An RS (Revolutionary super-slim Structure) evaporator is used on the models except for ANCOM.
- By placing the tanks at the top and the bottom of the evaporator unit and using a micropore tube construction, the following effects have been realized:

a) The heat exchanging efficiency has been improved.
b) The temperature distribution has been made more uniform.
c) The evaporator has been made thinner.

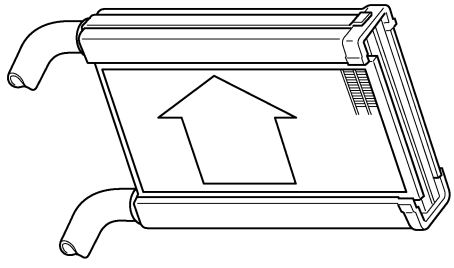
- The evaporator body has been coated with a type of resin that contains an antibacterial agent in order to minimize the source of foul odor and the propagation of bacteria. The substrate below this coating consists of a chromate-free layer to help protect the environment.



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Heater Core

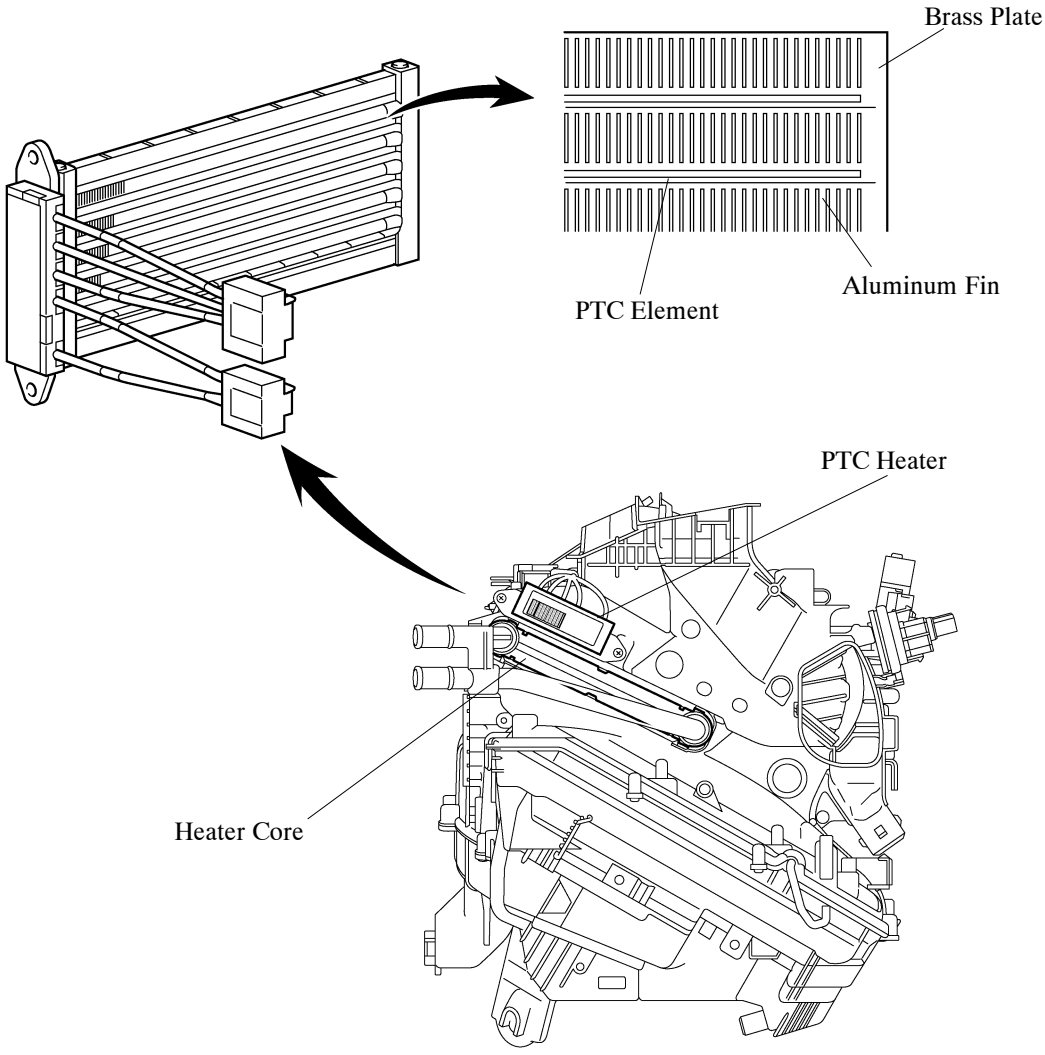
A compact, lightweight, and highly efficient straight flow (full-path flow) aluminum heater core is used.



PTC Heater

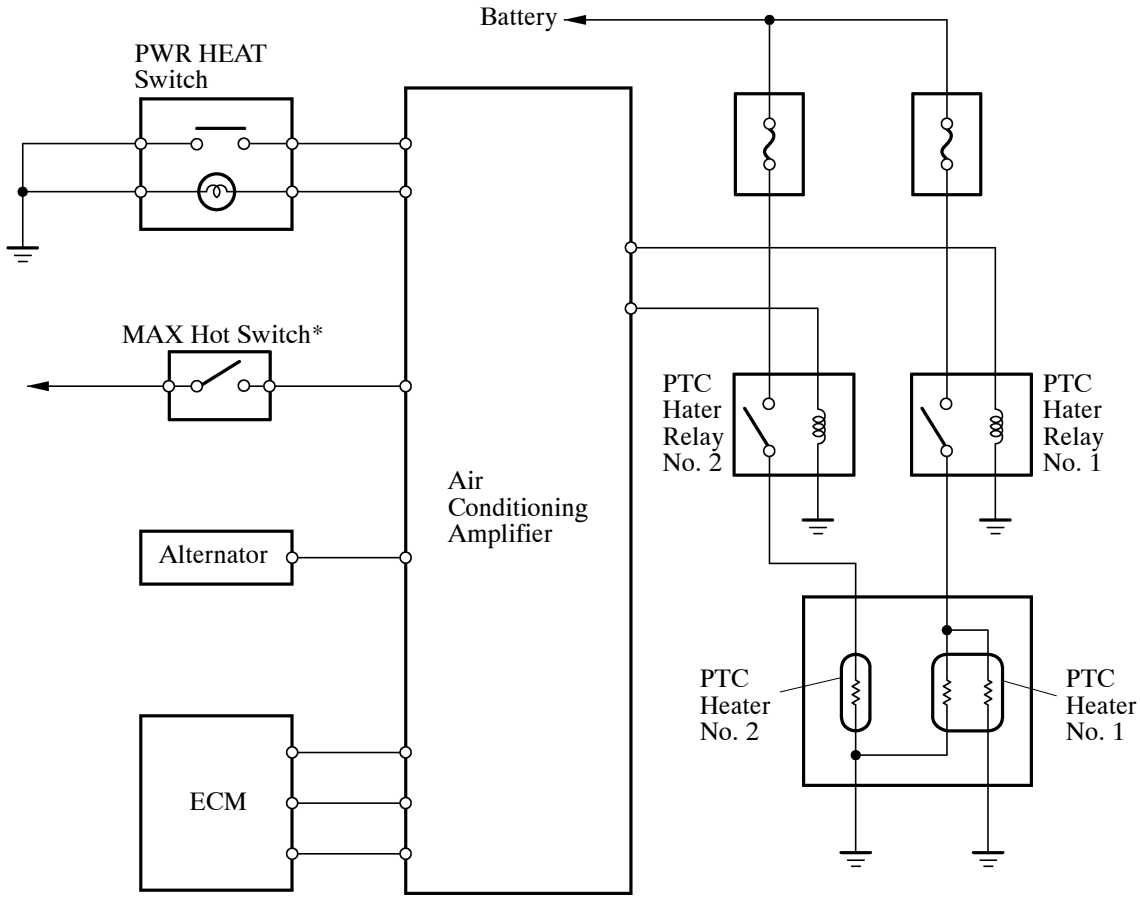
1) General

- The PTC (Positive Temperature Coefficient) heater is provided as optional equipment on the model for Central and South America with the 1KD-FTV engine.
- The PTC heater is located above the heater core in the air conditioning unit.
- The PTC heater consists of a PTC element, aluminum fin, and brass plate. When current is applied to the PTC element, it generates heat to warm the air that passes through the unit.



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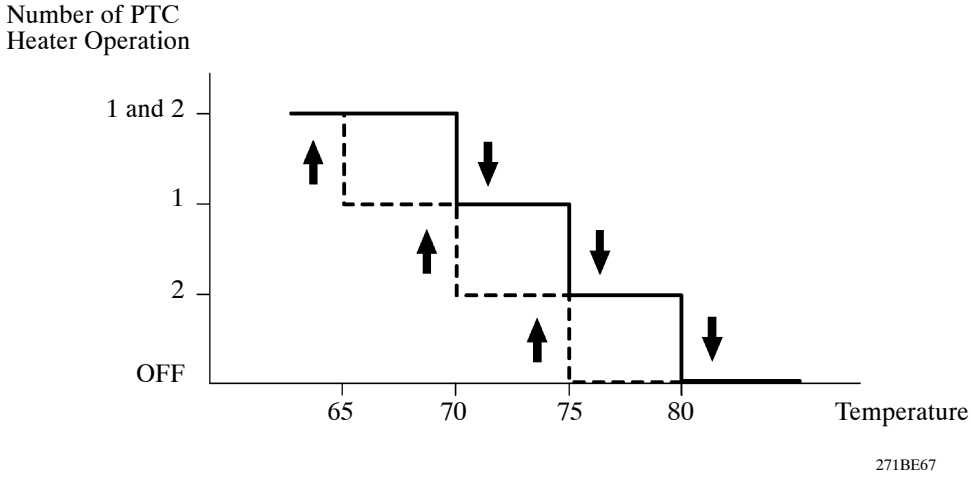
2) Wiring Diagram



*: Models with manual air conditioning

3) PTC Heater Operating Conditions

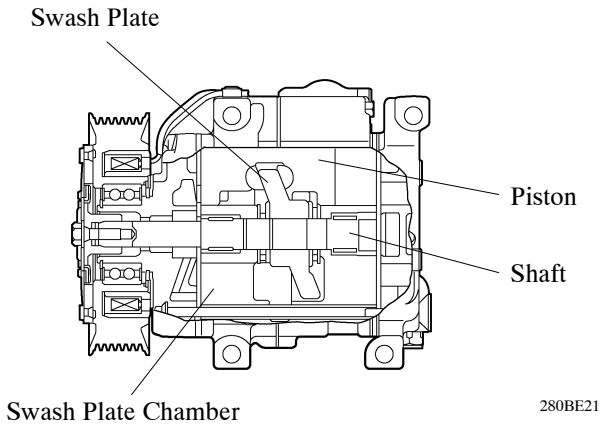
The ON/OFF function of the PTC heater is controlled by the air conditioning amplifier in accordance with the water temperature, engine speed, air mix setting, and electrical load (alternator power ratio).
For example, the number of PTC heater operation varies depending on the water temperature as shown in the graph below.



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4. Compressor

A compact, lightweight, and low-noise 10-cylinder swash plate type compressor is used.



10S15 Type

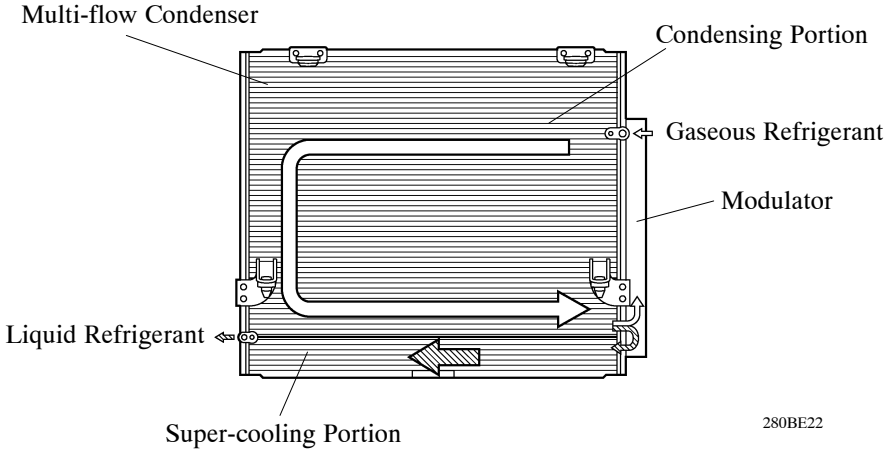
5. Condenser

General

The new Fortuner/Hilux SW4 uses a sub-cool condenser. This is a multi-flow condenser consisting three portions: a condensing portion, a super-cooling portion, and a gas-liquid separator (modulator). This condenser uses a sub-cool cycle for its cooling cycle system to improve heat-exchanging efficiency.

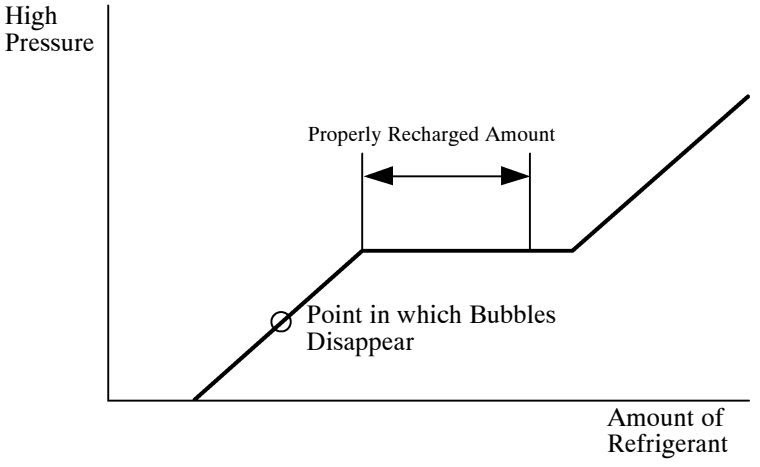
Sub-cool Cycle

In the sub-cool cycle, after the refrigerant passes through the condensing portion of the condenser, both the liquid refrigerant and the gaseous refrigerant that could not be liquefied are cooled again in the super-cooling portion. Thus, the refrigerant is sent to the evaporator in an almost completely liquefied state.



NOTE:

The point at which the air bubbles disappear in the refrigerant of the sub-cool cycle is lower than the proper amount of refrigerant with which the system must be filled. Therefore, if the system is recharged with refrigerant based on the point at which the air bubbles disappear, the amount of refrigerant would be insufficient. As a result, the cooling performance of the system will be affected. If the system is overcharged with refrigerant, this will also lead to a reduced performance.
For the proper method of verifying the amount of the refrigerant and to recharge the system with refrigerant, see the Fortuner/Hilux SW4 Repair Manual.

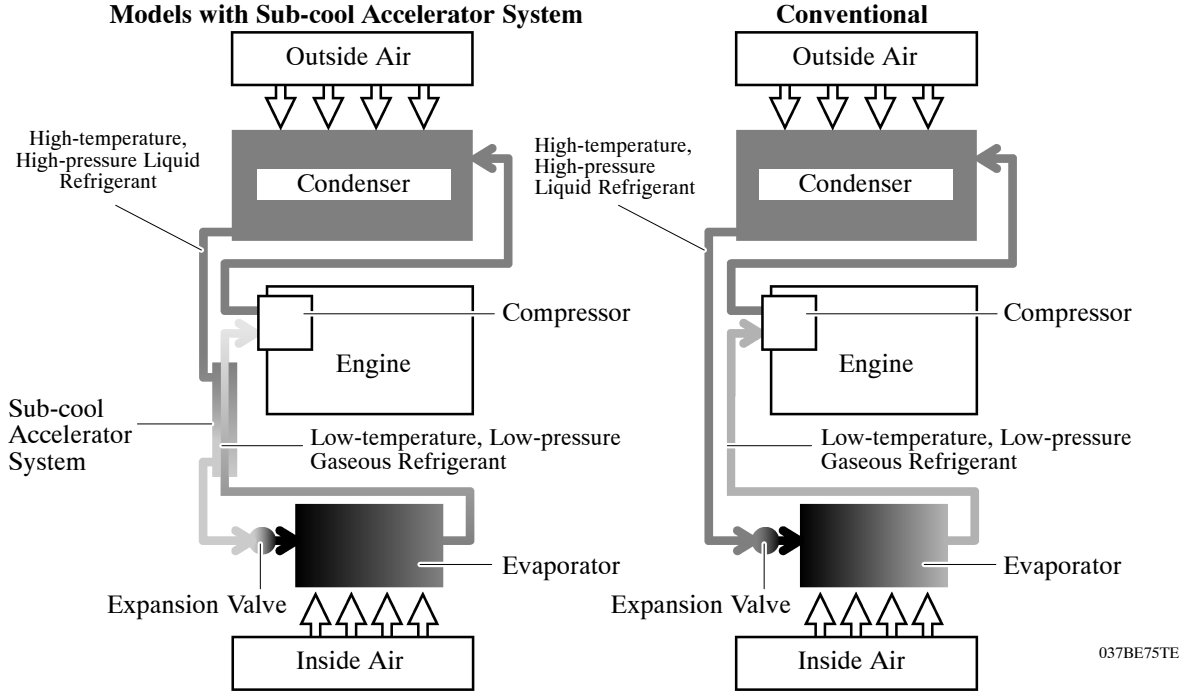


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6. Sub-cool Accelerator (Double-pipe Internal Heat Exchanger) System

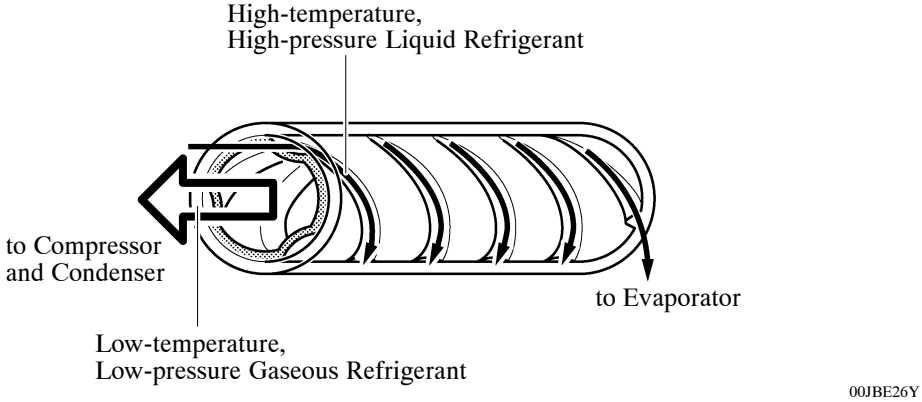
General

- A sub-cool accelerator (double-pipe internal heat exchanger) system has been provided. This system consists of an inner pipe and an outer pipe which are changed from the conventional refrigerant pipes (liquid and gaseous refrigerant pipes).
- The cooling performance can be enhanced by occurring heat exchange by utilizing temperature difference of refrigerant in a refrigeration cycle and further cooling the refrigerant discharged from the condenser.



Refrigerant Pipe

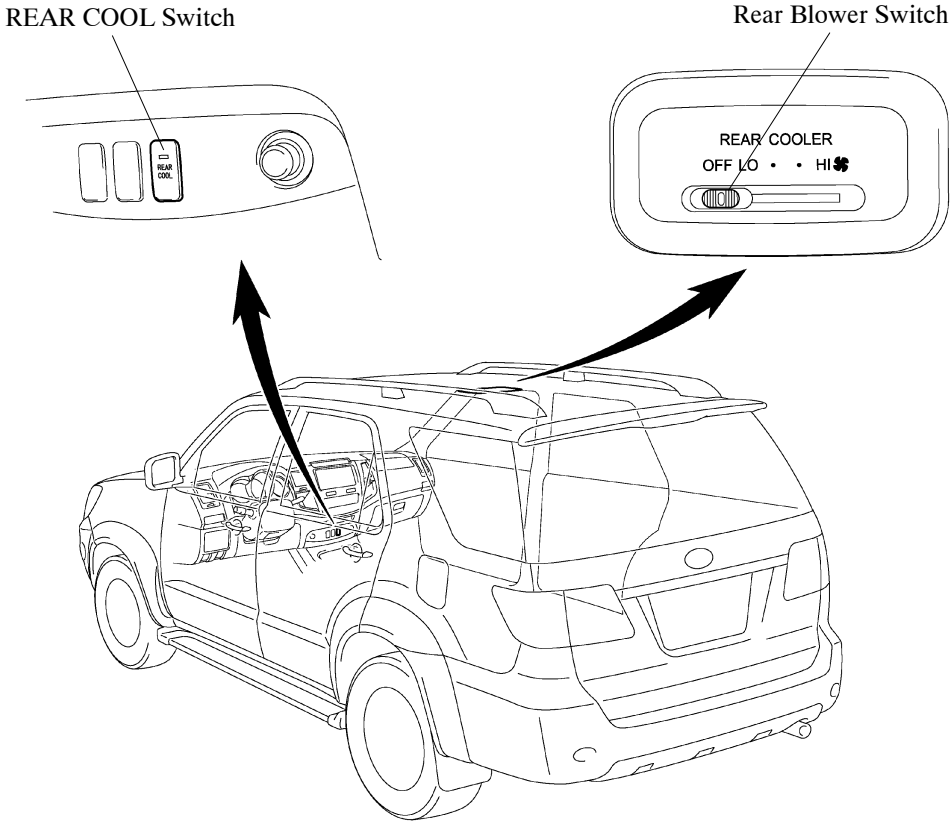
The refrigerant pipe consists of inner and outer pipes, and thus heat exchange can occur by utilizing the temperature difference between low-temperature, low-pressure gaseous refrigerant flowing inside the inner pipe and high-temperature, high-pressure liquid refrigerant flowing between the inner and outer pipes. Furthermore, a spiral groove is formed in the pipe in order to attain further effective heat exchange.



Refrigerant Pipe

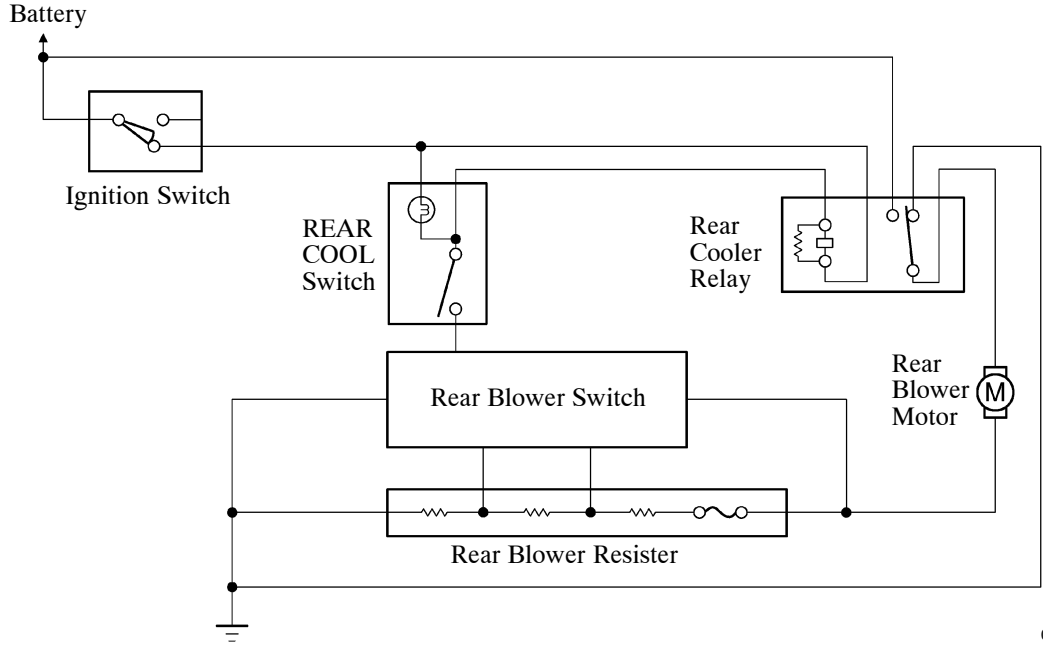
7. Rear Cooler Control Panel

- On the models with a dual cooler or dual air conditioning, the rear cooler control panel is provided on the center of the front roof. The REAR COOL switch has been provided in the center of the instrument panel so that the rear cooler can be turned ON/OFF from the front seat.
- The blower motor of the rear cooler can be operated with the rear blower switch only when the REAR COOL switch is ON.
- When the front air conditioning is not operating, the rear cooler can only blow out air.



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▶ Wiring Diagram ◀

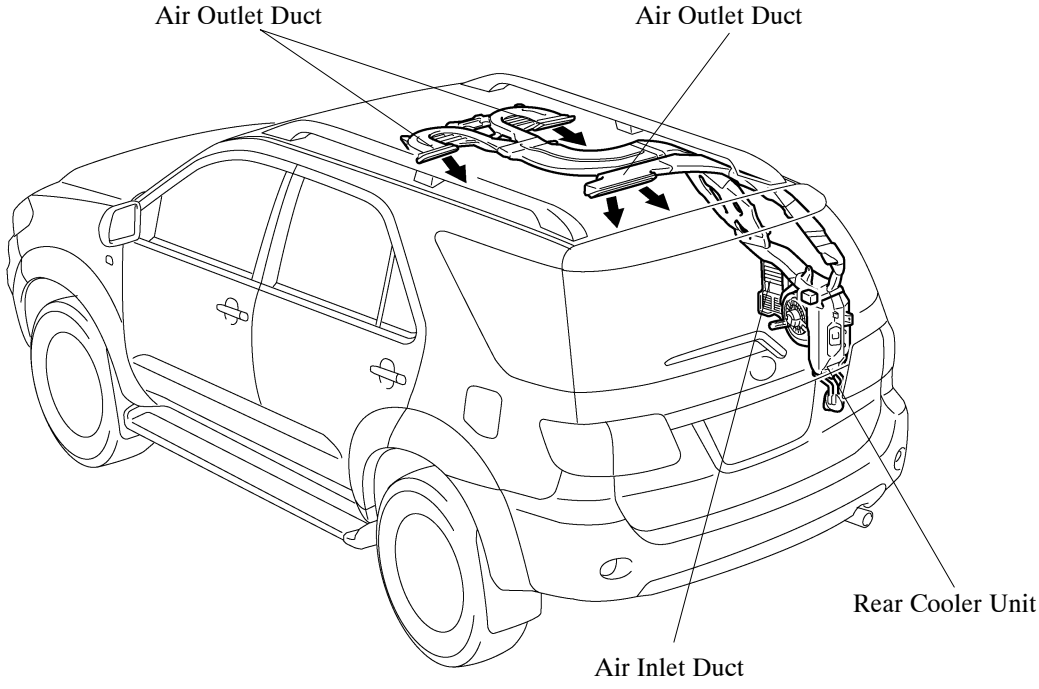


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8. Rear Cooler Unit

General

- The rear cooler unit is mounted inside the right rear quarter trim.
- The air outlet duct is embedded in the pillar and in the ceiling to improve the appearance of the vehicle interior.

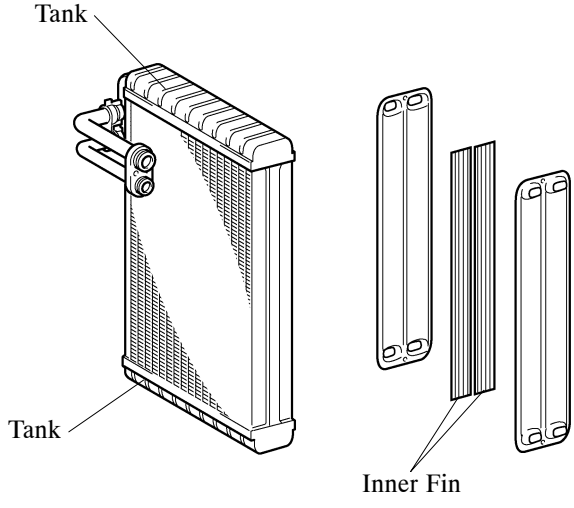


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Evaporator

- An RS (Revolutionary super-slim Structure) evaporator is used.
- By placing the tanks at the top and the bottom of the evaporator unit and by using an inner fin construction, the following effects and design improvements have been realized:

a) Improved heat exchanging efficiency
b) More uniform temperature distribution
c) Thinner evaporator



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9. Air Conditioning Amplifier (Automatic Control Type)

General

The air conditioning amplifier has following control.

Control		Outline
Calculation of Required Outlet Air Temperature		The air conditioning amplifier calculates the required outlet air temperature based on the signals from the sensors and the set temperature that is set through the heater control panel. Then, the air conditioning amplifier regulates the servomotors and the blower motor. This outlet temperature is required in order to maintain the set temperature in a stable manner.
Outlet Air Temp. Control	MAX Fix Control*	This control sets the outlet air temperature to -200°C when the temperature is set to MAX COOL, and to 200°C when the temperature is set to MAX HOT.
	Air Mix Damper Control	This function provisionally calculates the required outlet air temperature through an arithmetic circuit in the air mix damper using the output signals from various sensors, and adjusts the value in accordance with signals from the evaporator temperature sensor and water temperature sensor. It then determines the appropriate air mix damper opening angle in accordance with the temperature control switch setting.
Blower Control	Manual Control	Sets the blower speed according to operation of the blower switch.
	Automatic Control	**Warm-up Control*:** When the air outlet is in the FOOT, BI-LEVEL, or FOOT/DEF mode, the blower will not operate until the water temperature increases above a prescribed value. When the temperature increases above a prescribed value, the blower motor operates at the LO speed. Thereafter, control is effected by comparing the airflow calculated from the water temperature and the airflow calculated from the outlet air temperature. **Time-Lagged Air Flow Control:** 2 types of time-lagged air flow control (in accordance with the detected by the evaporator temperature sensor) help prevent hot air from being emitted from FACE or BI-LEVEL vent. **Sunlight Air Flow Control:** Controls the blower speed in accordance with the intensity of the sunlight when the air outlet mode is at FACE or BI-LEVEL. The blower speed can be adjusted in response to the signal received from the solar sensor.
Air Outlet Control	Manual Control	Changes the air outlet in accordance with the selected position of the mode select switch.
	Automatic Control	**Mode Damper Switching Servomotor Control:** When the AUTO switch of the heater control panel has been turned ON, automatic control causes the mode servomotor to rotate to a desired position in accordance with the target damper opening, which is based on the calculation of the outlet air temperature. (On the models with the automatic cooler, this function switches the damper to FACE and BI-LEVEL.) **Low-temperature FOOT/DEF Control*:** In accordance with the water temperature, ambient temperature, amount of sunlight, required outlet air temperature, and vehicle speed conditions, this control automatically switches the blower outlet between the FOOT/DEF modes to prevent the window from becoming fogged when the ambient temperature is low.
Compressor Control		When the DEF mode switch is turned on, the magnetic clutch relay is activated automatically to engage the compressor. Also, when the blower is turned off, and the front defroster switch is turned on, the blower will turn on in the automatic control condition.
Rear Window Defogger Control		When the driver manually turns ON the rear window defogger switch, the rear window defogger operates for 15 minutes and will stop automatically.
Self-diagnosis		Checks the indicator, sensor, and actuator in accordance with operation of the heater control panel switches, and then LCD portion a DTC (Diagnostic Trouble Code) to indicate if there is a malfunction or not.

*: Except models with automatic cooler

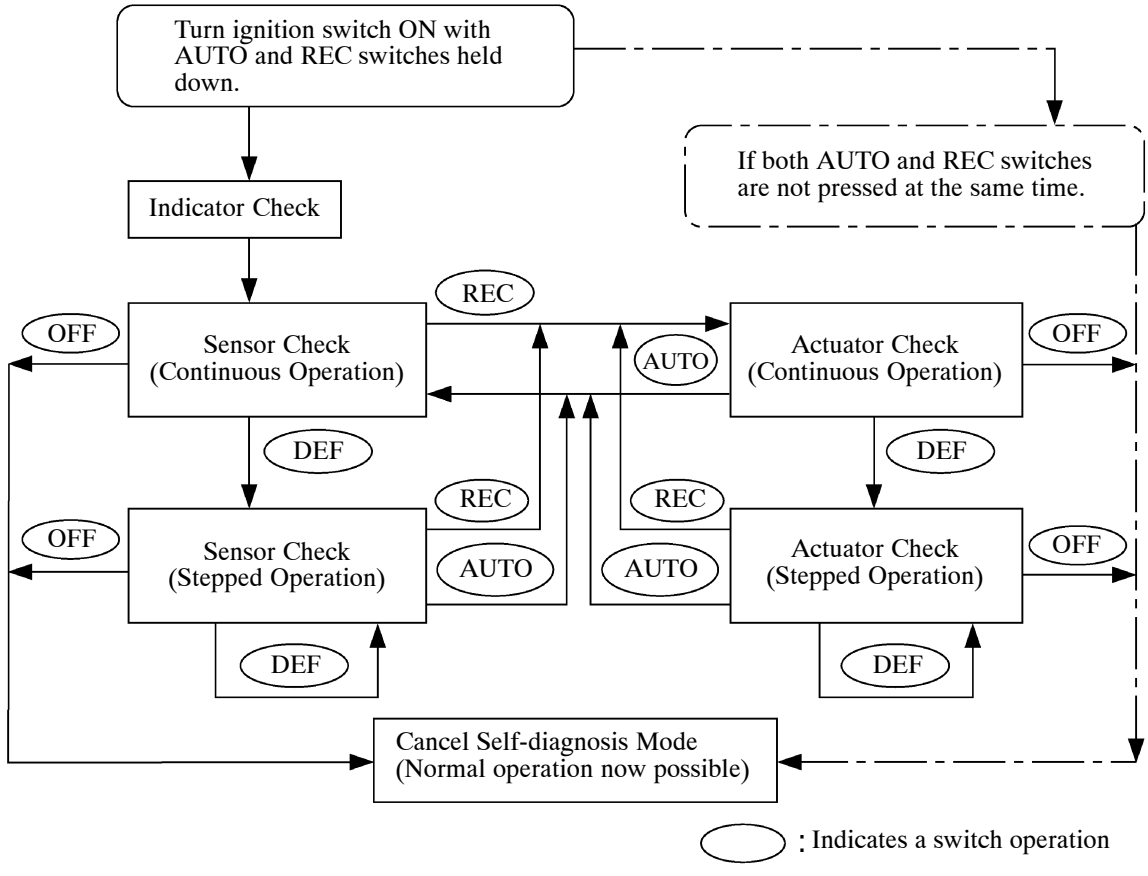
Self-diagnosis

- The air conditioning amplifier has a self-diagnosis function. The self-diagnosis mode has three functions: indicator check, sensor check, and actuator check. These functions are switched by the switches on the heater control panel.

▶ Functions ◀

Function	Outline
Indicator Check	Checks indicator lights and temperature setting display.
Sensor Check	Checks the past and present malfunctions of the sensors, and clearing the past malfunction data.
Actuator Check	Checks against actuator check pattern if blower motor, servomotors and magnetic clutch are operating correctly according to signals from air conditioning amplifier.

- The check function can be started by the following procedure shown below.



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- For details on the indicator check, sensor check, actuator check function, and clearing DTC of this system, refer to the Fortuner/Hilux SW4 Repair Manual.