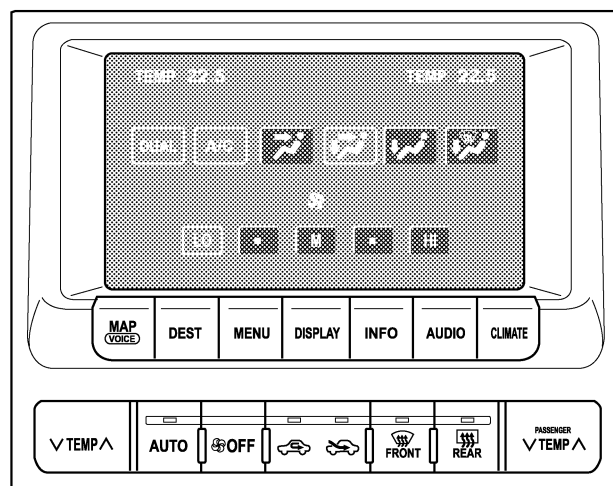


## ■ CONSTRUCTION AND OPERATION

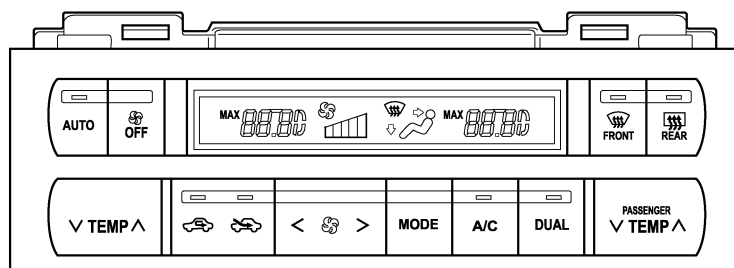
### 1. Front Air Conditioner Control Panel

- Models with the manual control air conditioner uses the same type of rotary switch that is used on the previous model.
- The air conditioner control panel of the automatic control air conditioner model without the multi display uses a push-button control and an LCD (Liquid Crystal Display) to display the set temperature, air outlet mode, and the blower speed.
- The air conditioner control panel of the automatic control air conditioner model with the multi display uses a push-button control. Furthermore, the operation and control of the air conditioner system can be effected through the use of the automatic air conditioner display of the multi display and the touch switch that appears on the display.
- Along with the adoption of the left / right independent temperature control on the models with automatic control air conditioner system, the temperature control switches for the driver and the front passenger have been located closer to the respective seats to enhance their ease of use.
- The air conditioner control panel of the automatic control air conditioner model without the multi display is integrated with the air conditioner ECU.



**Automatic Control Air Conditioner Models with Multi Display**

233BE21



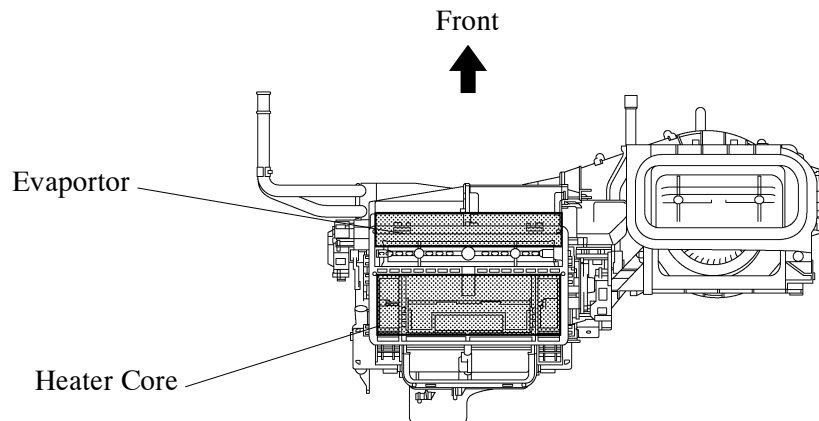
**Automatic Control Air Conditioner Models without Multi Display**

233BE22

## 2. Front Air Conditioner Unit

### General

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

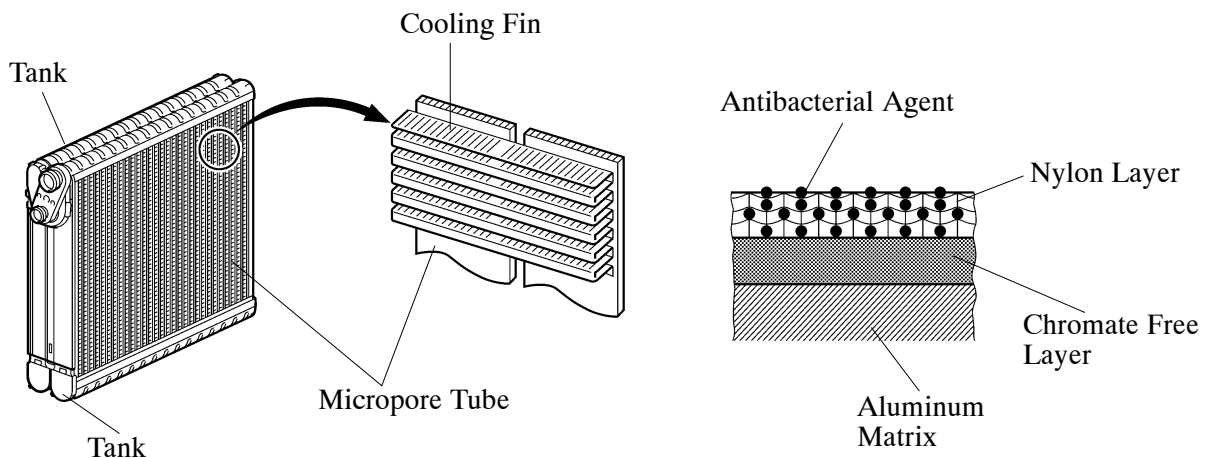


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### Evaporator

- A revolutionary-slim structure evaporator has been adopted.
- By placing the tanks at the top and the bottom of the evaporator unit and adopting 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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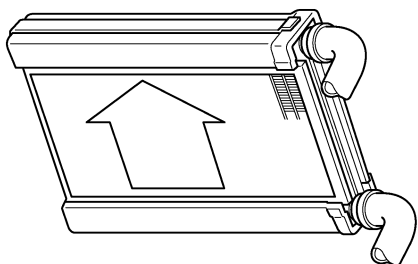


232BE19

## Heater Core

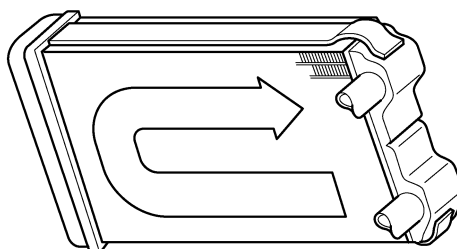
### 1) General

A compact, lightweight, and highly efficient straight flow (full-path flow) aluminum heater core has been adopted.



**New**

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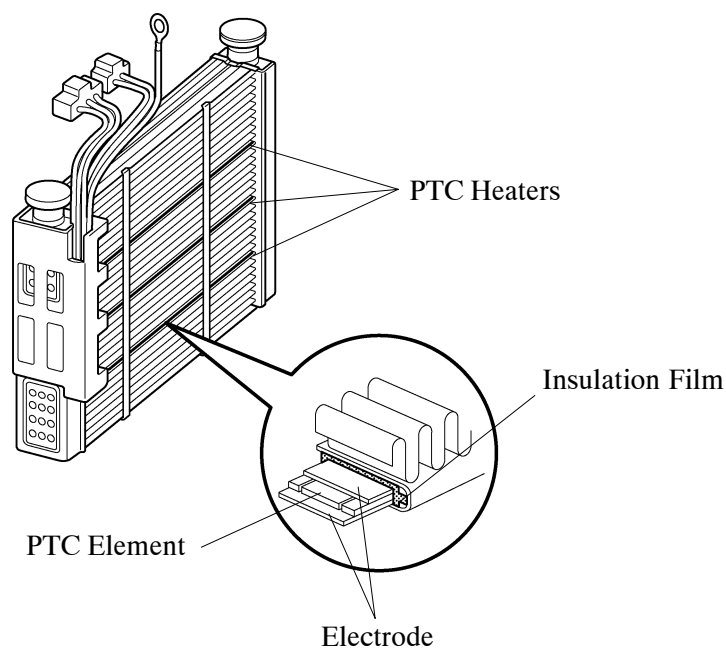
**Previous**

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### 2) PTC Heater

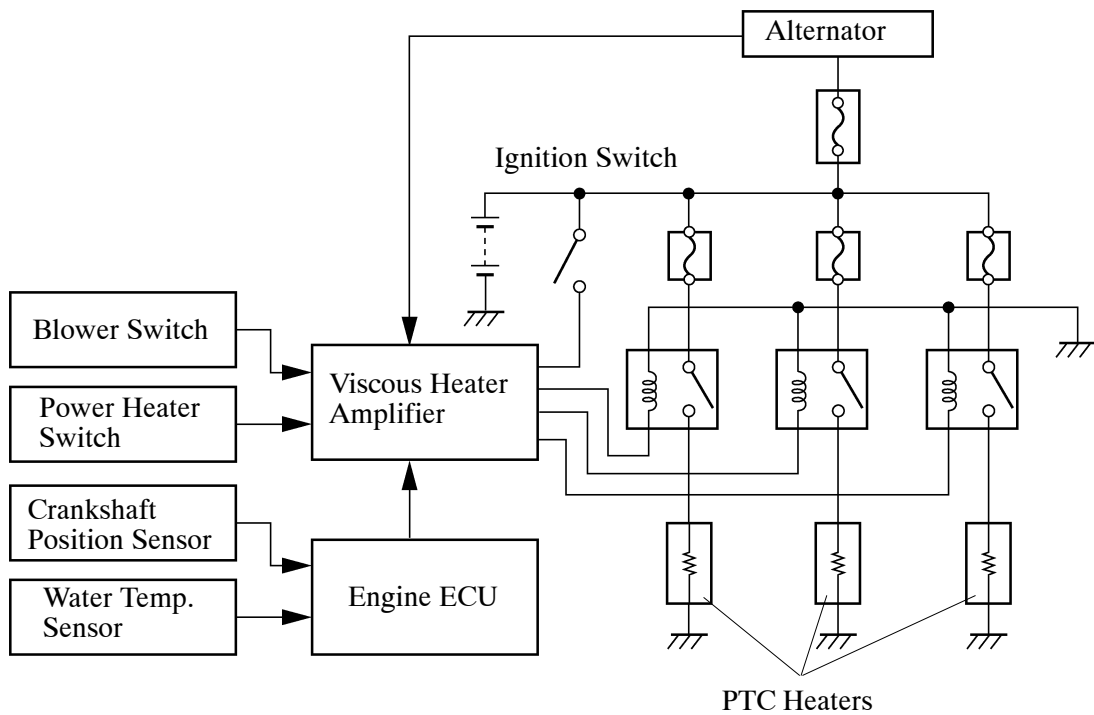
#### a. General

Three PTC (Positive Temperature Coefficient) heaters have been provided on the cold-area specification manual transmission model with the 1KD-FTV engine to provide better heater performance. The heaters have been built into the heater core.



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b. Wiring Diagram

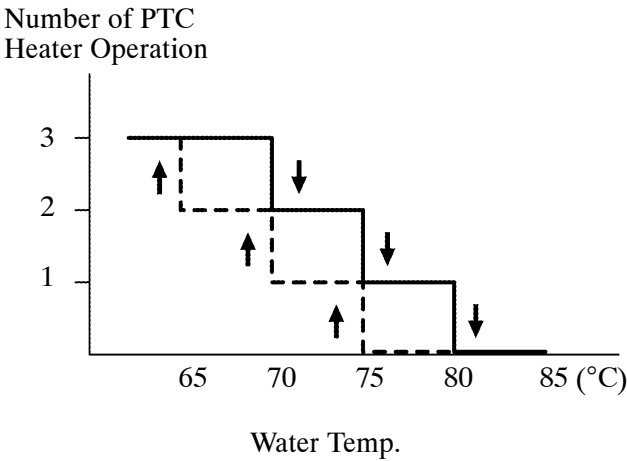


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c. PTC Heater Operating Condition

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

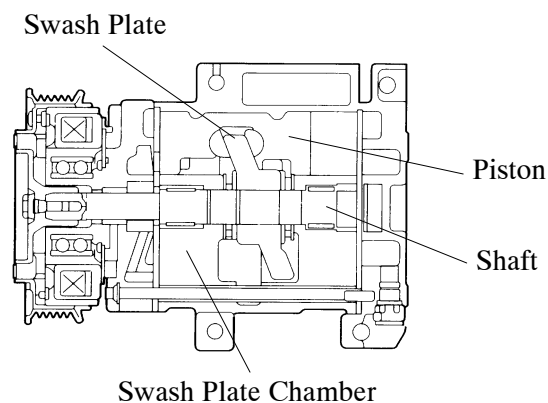
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### 3. Compressor

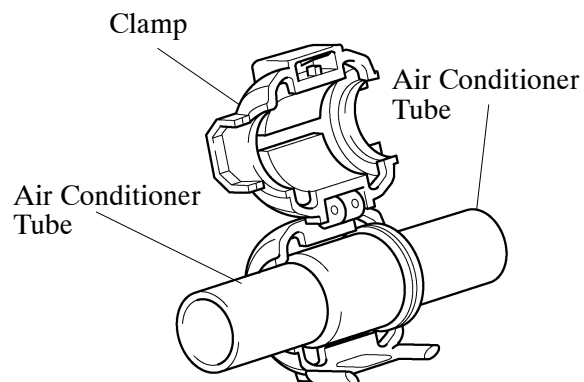
A compact, lightweight, and low-noise 10-cylinder swash plate type compressor (10S17) has been adopted.



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### 4. Quick Joint

The clamp type quick joint has been adopted. As a result, the ease of operation and service has been improved.



160CM04

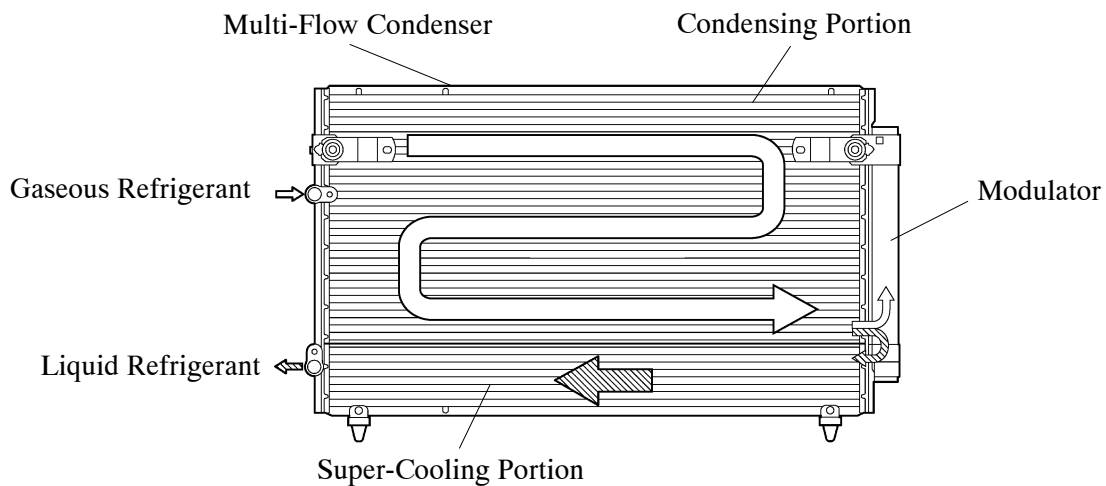
## 5. Condenser

### General

The new Land Cruiser/Land Cruiser Prado has adopted a sub-cool condenser. This is a multi-flow condenser consisting of two cooling portions: a condensing portion and a super-cooling portion, and a gas-liquid separator (modulator) all integrated together. This condenser has adopted a sub-cool cycle for its cooling cycle system to improve heat-exchanging efficiency.

### Sub-Cool Cycle

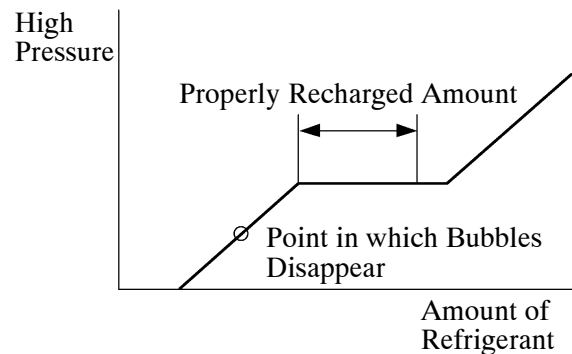
In the sub-cool cycle, after the refrigerant passes through the condensing portion of the condenser, both the liquid refrigerant and the gaseous refrigerant that could not be liquefied are cooled again in the super-cooling portion. Thus, the refrigerant is sent to the evaporator in an almost completely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



198BE32

**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 Land Cruiser /Land Cruiser Prado Repair Manual (Pub. No. RM990E).



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## 6. Power Heater

A viscous type power heater is provided on the 1KD-FTV engine for manual transmission with cold area specification.

The power heater raises the coolant temperature by the shearing heat that is generated by the silicon oil when the silicon oil that is sealed in the heater is stirred by a rotor. Consequently, the temperature of the coolant that flows through the heater core becomes higher than normal, thus improving the output performance of the heater.

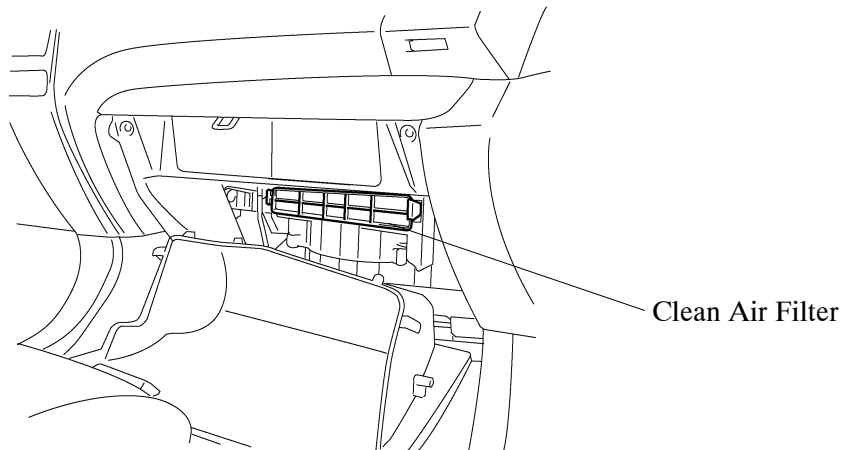
For details, refer to page EG-93 on 1KD-FTV engine section.

## 7. Clean Air Filter

A clean air filter that excels in removing dust has been adopted as standard equipment on Europe model and optional equipment on Australia, G.C.C. Countries and General Countries models (except 5L-E engine model).

This filter, which cleans the air in the cabin, is made of polyester. Thus, it can be disposed of easily as a combustible material, a feature that is friendly the environment.

In case of changing this filter, the operation can be done easily by removing the clips at both positions, opening the filter door and taking out the filter from inside, thus an excellent serviceability has been realized.



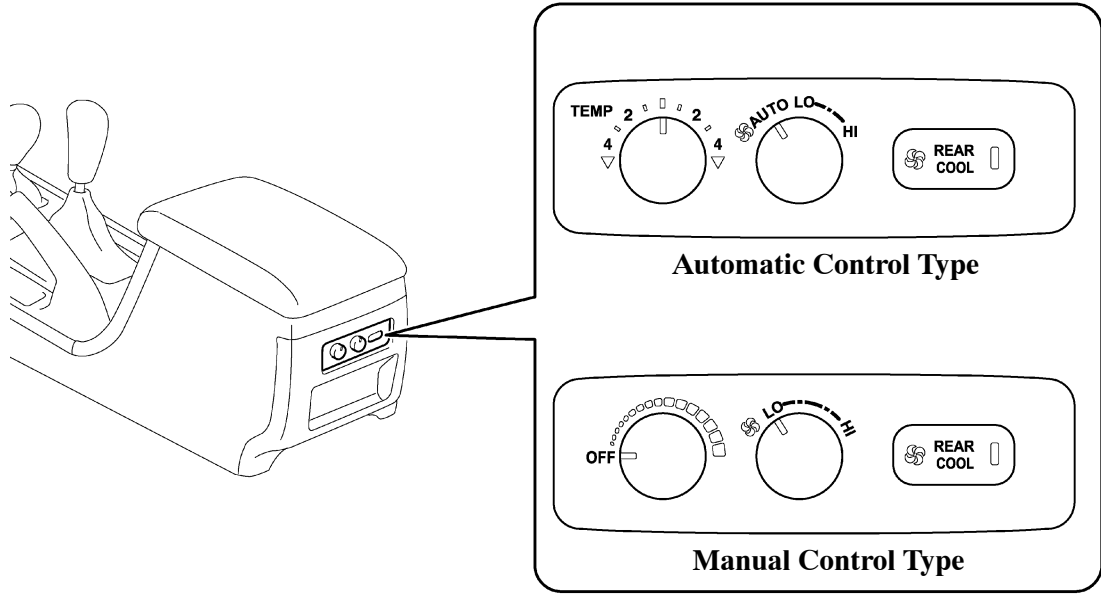
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### Service Tip

Be sure to change the clean air filter every 30,000 km (18,000 miles) in the normal condition, or every 15,000 km (9,000 miles) in the severe condition.

# 8. Rear Cooler Control Panel

- On the models with dual air conditioner, the rotary switch type rear cooler control panel is provided in the rear console panel to improve its ease of use.
- When the front air conditioner is not operating, the rear cooler can only blow out air.



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- On the rear cooler control panel for the automatic control type dual air conditioner, the temperature of the rear cooler can be set as indicated in the table below, in relation to the temperature set on the front air conditioner control panel.

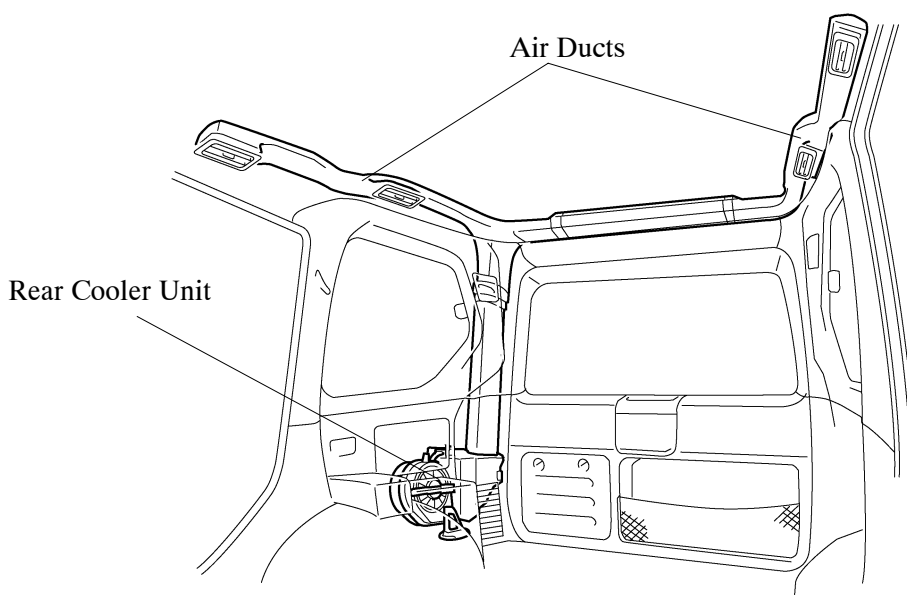
Rotary Switch Position	Difference from front A/C control panel temperature setting
▼ (Red)	+ 5°C (+9°F)
4 (Right Side)	+4°C (+7.2°F)
2 (Right Side)	+2°C (+3.6°F)
Center	0°C (0°F)
2 (Left Side)	-2°C (-3.6°F)
4 (Left Side)	-4°C (-7.2°F)
▼ (Blue)	-5°C (-9°F)



## 9. Rear Cooler Unit

### General

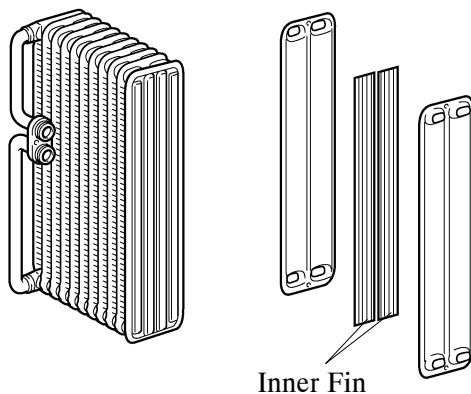
- The rear cooler unit is mounted inside the right rear quarter trim as in the previous model.
- The air duct is embedded in the pillar and in the ceiling to improve the appearance of the vehicle interior.



233BE27

### Evaporator

- By placing the tanks at the top and the bottom of the evaporator unit and by adopting an inner fin 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.



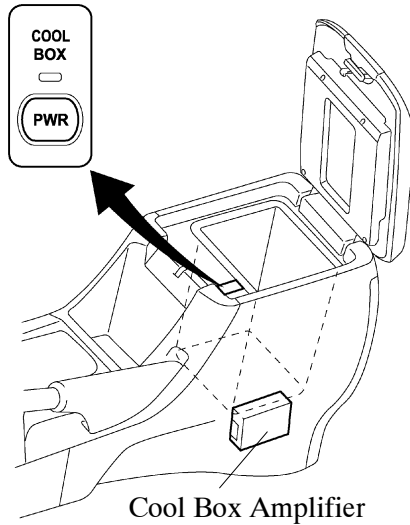
233BE57

## 10. Cool Box

### General

- A cool box is available for the center console as optional equipment.
- The cool box consists primarily of a cool box amplifier, evaporator (for cool box), cool box blower motor, cool box switch, and an expansion valve. The connected refrigerant circuit of the front air conditioner cools the cool box.

Cool Box Switch

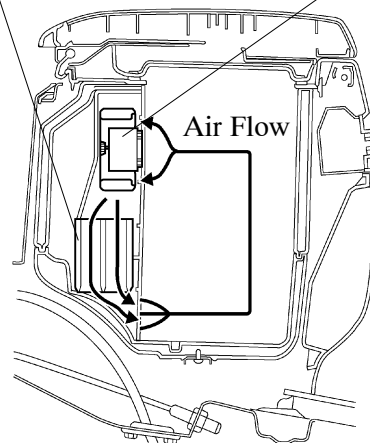


Cool Box Amplifier

233BE28

Evaporator  
(for Cool Box)

Cool Box  
Blower Motor

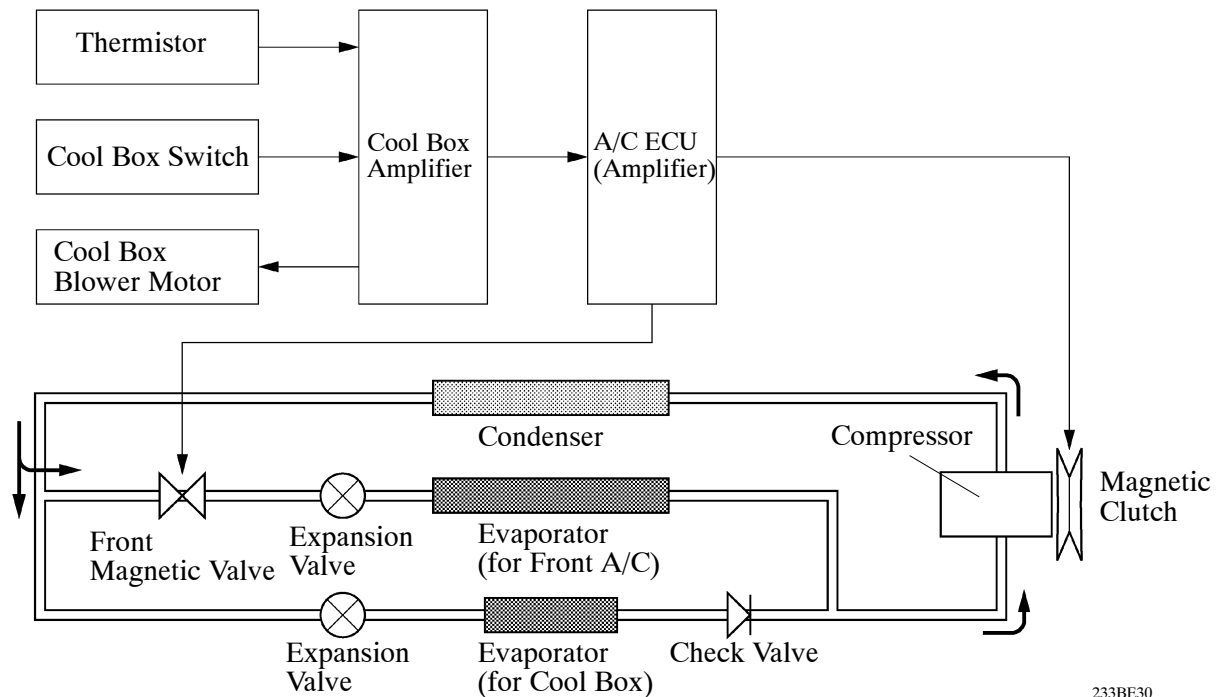


Cross Section

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### System Diagram



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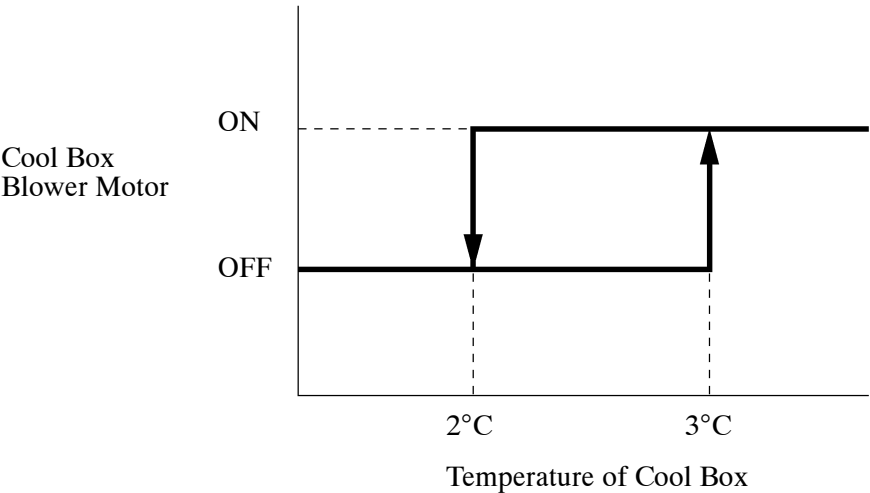
Operation

- In this system, a front magnetic valve that is provided in the refrigerant circuit of the air conditioner is turned ON and OFF to open and close the refrigerant circuit of the front air conditioner. As a result, the refrigerant flows into the evaporator (for cool box) to cool the cool box.
- In accordance with the operating condition of the front air conditioner and the cool box, the air conditioner ECU (Amplifier) controls the opening and closing of the front magnetic valve as indicated in the table below.

► Front Magnetic Valve Operation ◀

		Cool Box	
		ON	OFF
Front A/C	ON	<div>Open → ← Close</div>	Open
	OFF	Close	Close

- Even when the air conditioner system is OFF, the cool box amplifier operates the A/C magnetic clutch via the air conditioner ECU (Amplifier) in order to independently operate the cool box. In this case, the operation of the cool box blower motor changes in accordance with the internal temperature of the cool box.



## 11. Air Conditioner ECU

### General

The automatic controlled type air conditioner system has following control.

Control	Outline	New	Previous
Outlet Air Temp. Control	In response to the temperature control switch setting, the required outlet air temperature, evaporator temperature sensor, and engine coolant temperature sensor compensations are used by the air mix control damper control to calculate a tentative damper opening angle, through an arithmetic circuit in the air mix damper, to arrive at a target damper opening angle.	○	○
	The temperature setting for the driver and front passenger is controlled independently in order to provide a separate air temperature for the right and left outside. Thus, air conditioner that accommodates the occupants' preferences has been realized.	○	—
Blower Control	This function controls the operation of the blower motor in accordance with the signals from the engine coolant temperature sensor, evaporator temperature sensor, and the solar sensor. In addition, it protects the blower motor controller from the sudden drive current that occurs when the blower motor is activated.	○	○
Air Outlet Control	When the AUTO switch has been turned ON, automatic control causes the servomotor (for air mix control) to rotate to a desired position in accordance with the target damper opening, which is based on the calculation of the required outlet air temperature. Furthermore, under automatic control, the potentiometer in the servomotor (for air mix control) is used to detect the actual damper opening, as opposed to the calculated target damper opening, so that control can be effected to match the actual damper opening to the calculated target damper opening.	○	○
	In accordance with the engine coolant temperature, outside air temperature, amount of sunlight, required blower outlet temperature, and vehicle speed conditions, this control automatically switches the blower outlet to the FOOT/DEF mode to prevent the window from becoming fogged when the outside air temperature is low.	○	—
Air Inlet Control	Drives the servomotor (for air inlet) according to the operation of the air inlet control switch and fixes the dampers in the FRESH or RECIRC position.	○	○
	When selecting RECIRC mode with a manual operation, if the outside air temperature is low and the refrigerant pressure has malfunction, the air conditioner ECU automatically switched the air inlet mode to the FRESH mode. However, if the outside air temperature is much lower than the specified temperature, in spite of the malfunction of the refrigerant pressure, the air conditioner ECU automatically switches the air inlet mode to the FRESH mode.	○*1	—
	When selecting RECIRC mode with a manual operation, if the compressor turns OFF, the air conditioner ECU automatically switched the air inlet mode to the FRESH mode.	○*1	—

(Continued)

Control	Outline	New	Previous
Compressor Control	This control turns OFF the magnetic clutch of the compressor when the blower motor is turned OFF at the time the engine coolant temperature is below a predetermined value, an abnormal refrigerant pressure has been input, or the discharge temperature of the evaporator is below a predetermined value.	○	○
	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.	○	—
Automatic ECON (Economy) Control*2	Effects the ON/OFF control of the compressor based on the temperatures (evaporator temperature, ambient temperature, required outlet air temperature, and compressor control temperature) that have been calculated by the sensors and the air conditioning ECU in order to improve fuel economy.	○	—
Self-Diagnosis	Checks the sensor in accordance with operation of the air conditioning switches, then heater control panel display portion a DTC (Diagnosis Trouble Code) to indicate if there is a malfunction or not (sensor check function).	○	○
	Drives the actuators through a predetermined sequence in accordance with the operation of the air conditioning switches (actuator check function).	○	○

\*1: Only for Europe Model

\*2: Except G.C.C. Countries Model

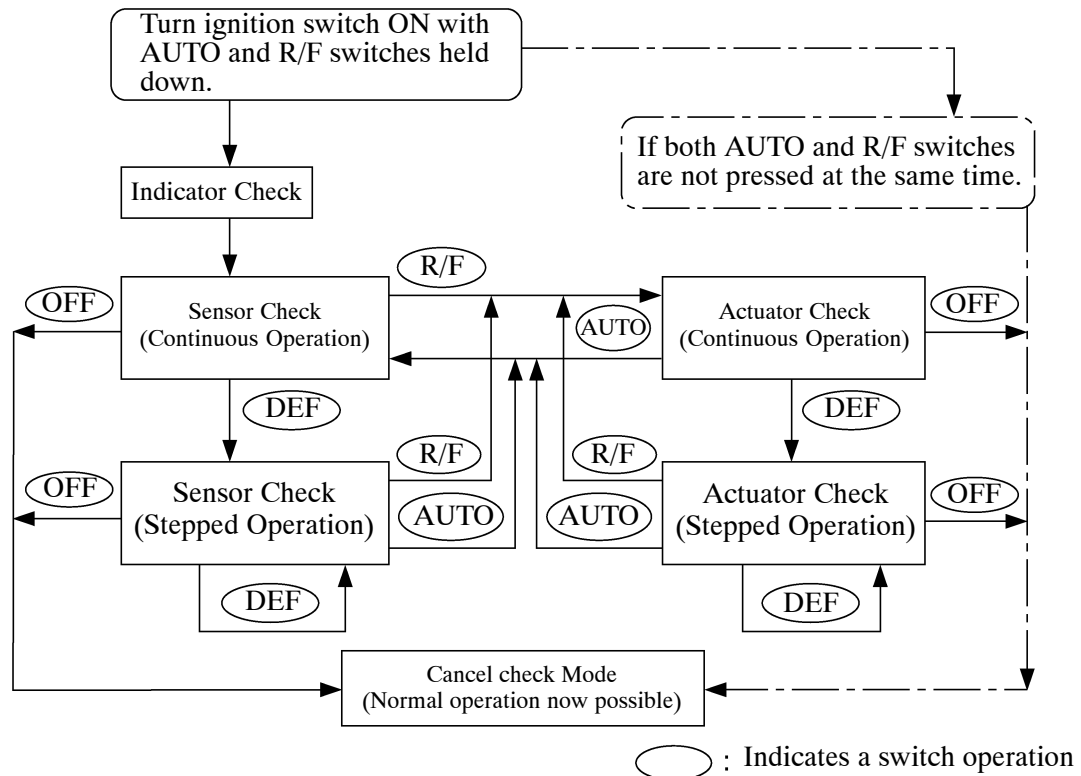
## Self-Diagnosis

- The air conditioner ECU has a self-diagnosis function. It stores any operation failures in the air conditioner system memory in the form of a malfunction code. By operating switches on the air conditioner control panel, the stored malfunction code will be indicated. Since diagnostic codes are stored in memory using battery back-up power, they are not cleared when the ignition switch is turned off.

### ► 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 ECU.

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



187BE33

- For details on the indicator check, sensor check, actuator check function, and clearing DTC of this system, refer to the Land Cruiser/Land Cruiser Prado Repair Manual (Pub. No. RM990E).