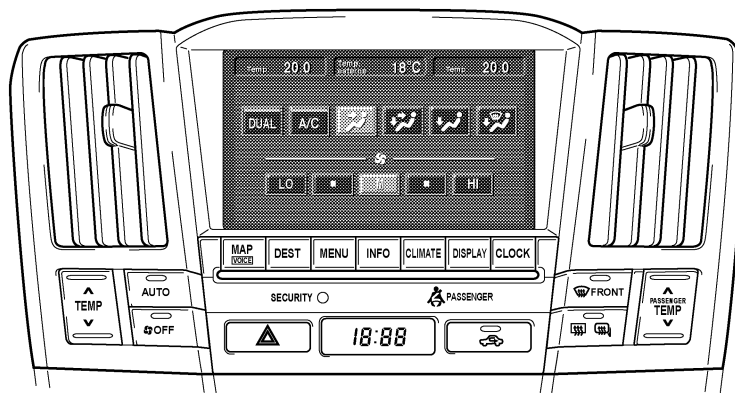


■ CONSTRUCTION AND OPERATION

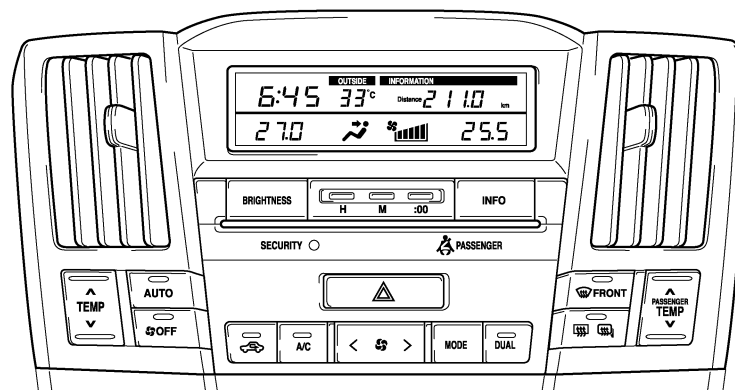
1. Air Conditioner Control Panel

- As in the current RX300, an easy-to-use, push-button type center cluster panel is used. There are two types of control panels, depending on the setting of the multi-display.
- On the models without a multi display, the air conditioner status is displayed on an LCD (Liquid Crystal Display) panel. On the models with multi display, the air conditioner status is displayed on the multi display.
- The independent temperature control switches for the driver and the front passenger have been located closer to the respective seats to enhance their ease of use.



LHD Models with Multi Display

278BE12



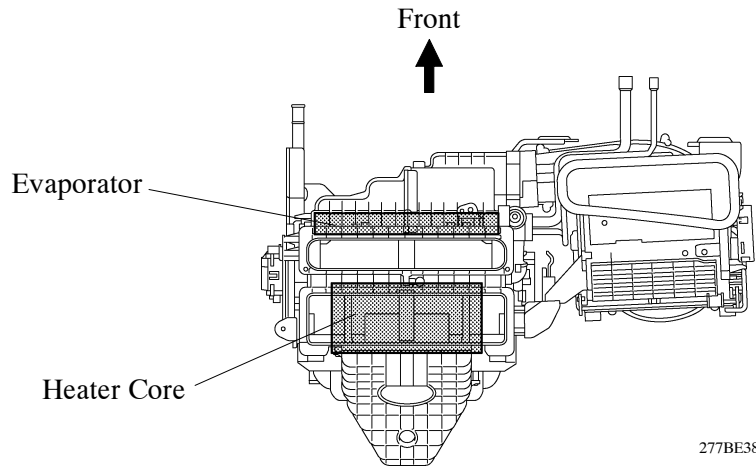
LHD Models without Multi Display

242BE18

2. Air Conditioner Unit

General

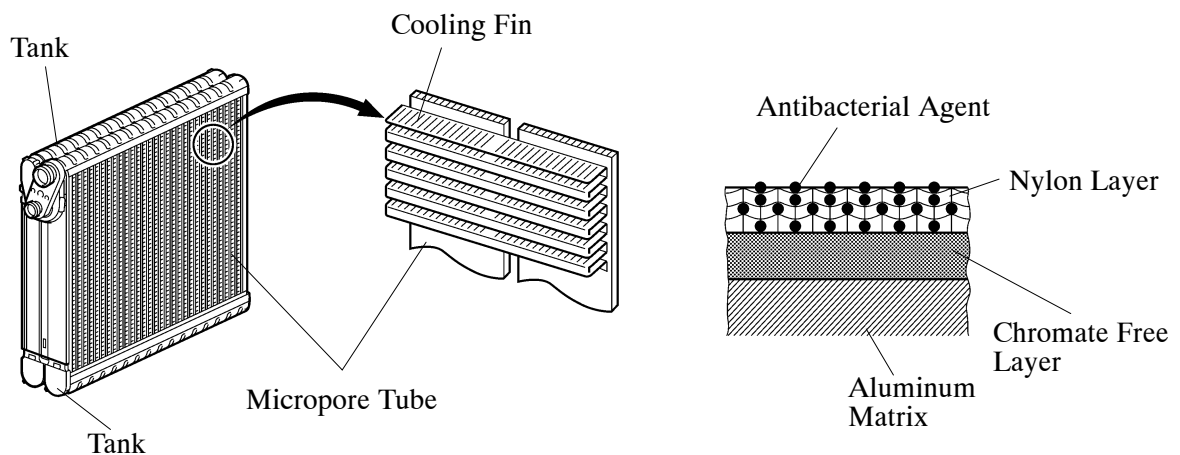
A semi-center location air conditioner unit, in which the evaporator and heater core are placed in the vehicle's longitudinal direction, is used. As a result, the air conditioner unit has been made compact and lightweight.



LHD Models

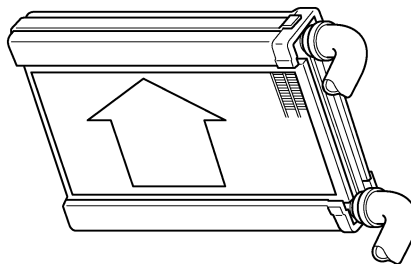
Evaporator

- A revolutionary slim structure evaporator is used.
- 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.



Heater Core

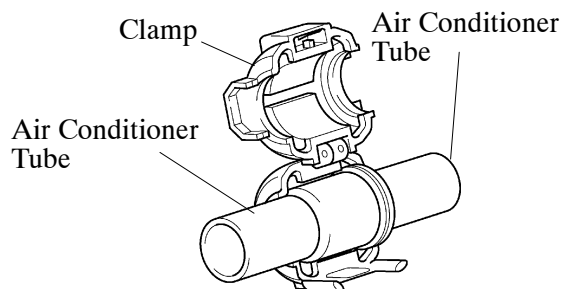
A compact, lightweight, and highly efficient straight flow (full-path flow) aluminum heater core is used.



152BE21

3. Quick Joint

A clamp type quick joint is used to connect the high pressure and low pressure tubes of the air conditioner unit. As a result, the ease of operation and service has been improved.



160CM04

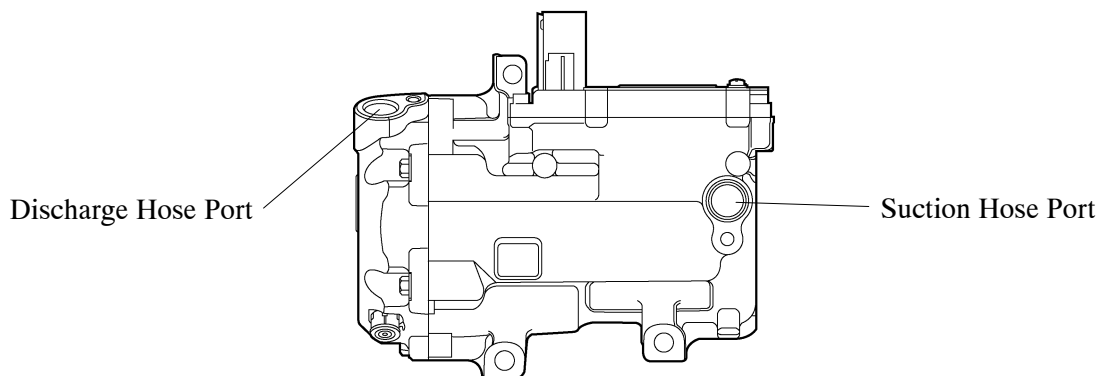
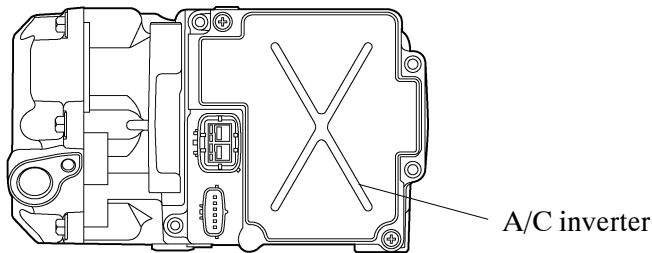
Service Tip

Use the appropriate SST to remove the quick joint (for high pressure tube: 09870-00025, for low pressure tube: 09870-00015). For details, see the LEXUS RX400h Repair Manual (Pub No. RM1139E).

4. Compressor

General

- Along with the installation of the Hybrid Unit on the new RX400h, an S27 electric inverter compressor that is driven by a motor is used. The basic construction and operation of this compressor are the same as the ordinary scroll compressor, except that it is driven by an electric motor.
- The A/C inverter has been integrated with the compressor.
- The electric motor is actuated by the alternating current (288V) supplied by the A/C inverter. As a result, the air conditioner control system on the RX400h is actuated without depending on the operation of the engine, thus realizing a comfortable air conditioner system and low fuel consumption.
- Due to the use of an electric inverter compressor, the compressor speed can be controlled at the required speed calculated by the A/C ECU. Thus, the cooling and dehumidification performance and power consumption have been optimized.
- Low-moisture permeation hoses are used for the suction and discharge hoses at the compressor in order to minimize the entry of moisture into the refrigeration cycle.
- The compressor uses high-voltage alternating current. If a short or open circuit occurs in the compressor wiring harness, the THS ECU will cut off the A/C inverter circuit in order to stop the power supply to the compressor.
- For details on the Electric Inverter Compressor control effected by the A/C ECU, see page BE-81.



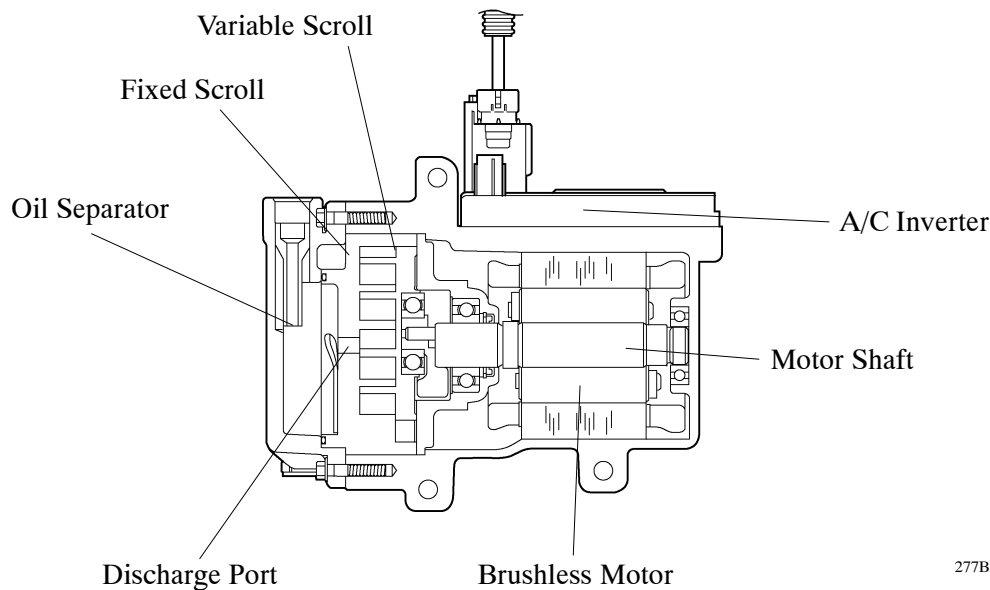
277BE37

Service Tip

In order ensure the proper insulation of the internal high-voltage portion of the compressor and the compressor housing, the RX400h has adopted a compressor oil (ND11) with a high level of insulation performance. Therefore, never use a compressor oil other than the ND11 type compressor oil or its equivalent.

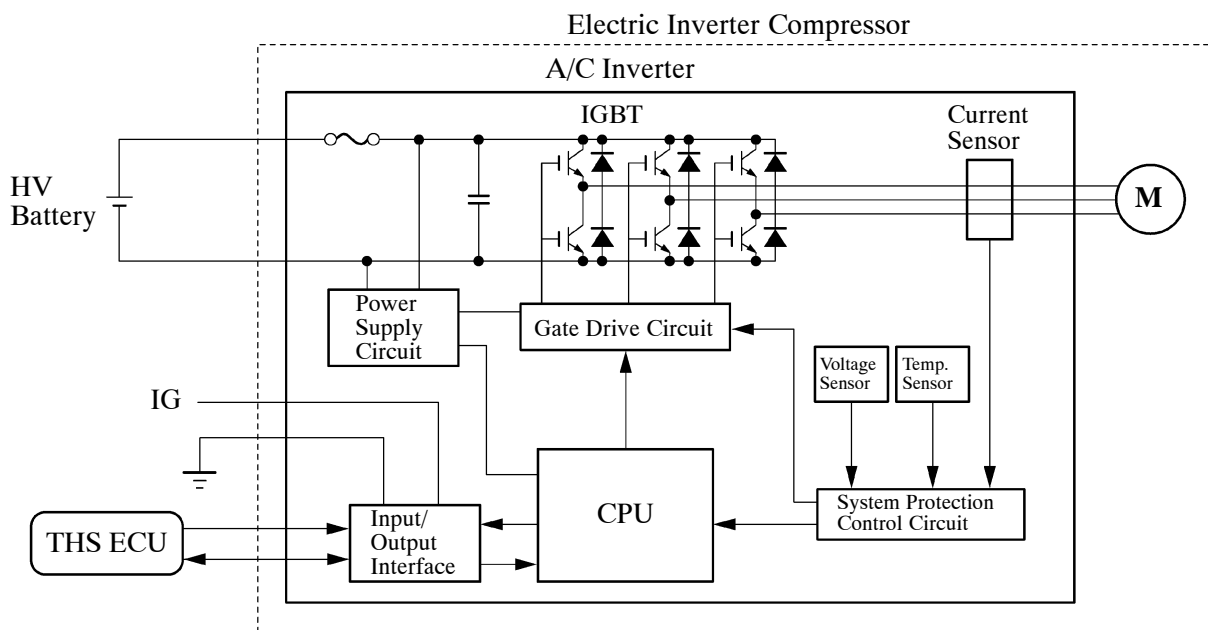
Construction

- The Electric Inverter Compressor consists of a spirally wound fixed scroll and variable scroll that form a pair, a brushless motor, an oil separator, a motor shaft and A/C inverter.
- The fixed scroll is integrated with the housing. Because the rotation of the shaft causes the variable scroll to revolve while maintaining the same posture, the volume of the space that is partitioned by both scrolls varies to perform the suction, compression, and the discharge of the refrigerant gas.
- Locating the suction port directly above the scrolls enables direct suction, thus realizing improved suction efficiency.
- Containing a built-in oil separator, this compressor is able to separate the compressor oil that is intermixed with the refrigerant and circulates in the refrigeration cycle, thus realizing a reduction in the oil circulation rate.
- This inverter converts the HV battery's nominal voltage of DC 288V into AC 288 V and supplies power to operate the compressor.



277BE39

► System Diagram ◀



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Operation

1) Suction

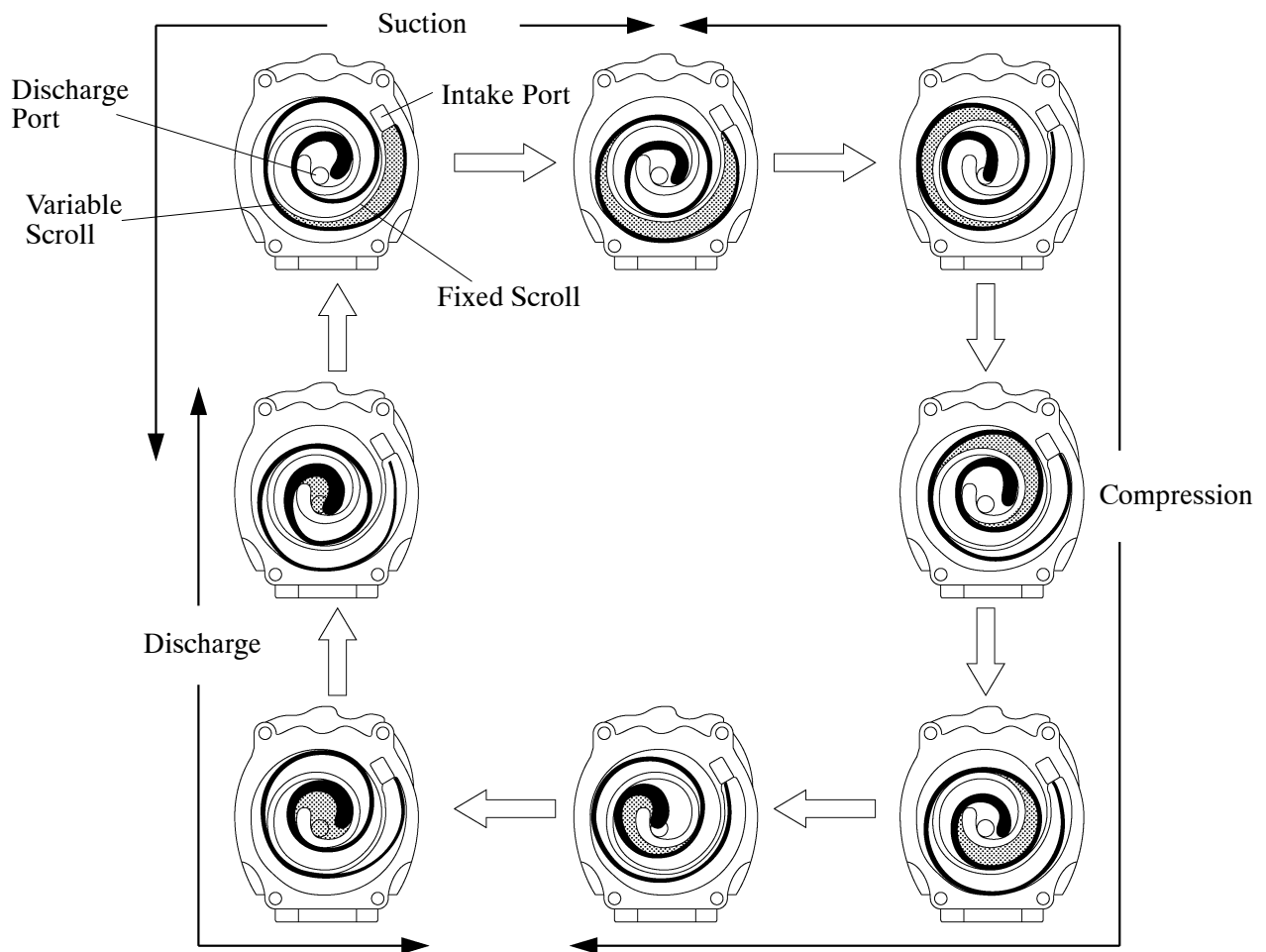
As the capacity of the compression chamber, which is created between the variable scroll and the fixed scroll, increases in accordance with the revolution of the variable scroll, refrigerant gas is drawn in from the intake port.

2) Compression

From the state at which the suction process has been completed, as the revolution of the variable scroll advances further, the capacity of the compression chamber decreases gradually. Consequently, the refrigerant gas that has been drawn in becomes compressed gradually and is sent to the center of the fixed scroll. The compression of the refrigerant gas is completed when the variable scroll completes approximately 2 revolutions.

3) Discharge

When the compression of the refrigerant gas is completed and the refrigerant pressure becomes high, the refrigerant gas discharges through the discharge port located in the center of the fixed scroll by pushing the discharge valve.



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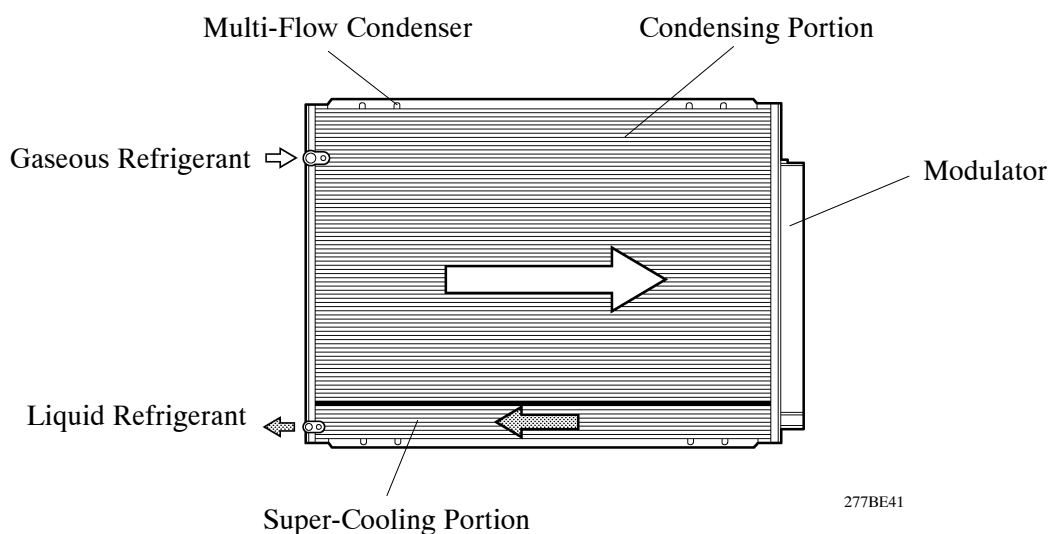
5. Condenser

General

The new RX400h uses 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 uses a sub-cool cycle for its cooling cycle system to improve heat-exchanging efficiency.

Sub-Cool Cycle

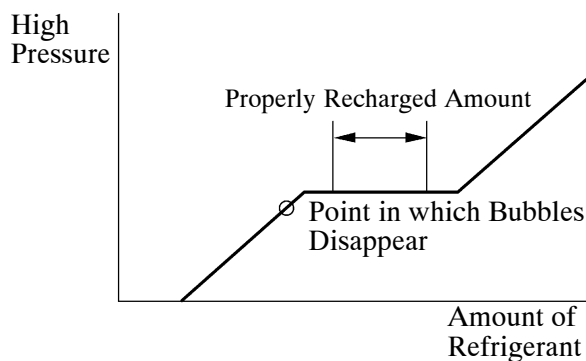
In the sub-cool cycle, after the refrigerant passes through the condensing portion of the condenser, both the liquid refrigerant and the gaseous refrigerant that could not be liquefied, are cooled again in the super-cooling portion. Thus, the refrigerant is sent to the evaporator in an almost completely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



277BE41

Service Tip

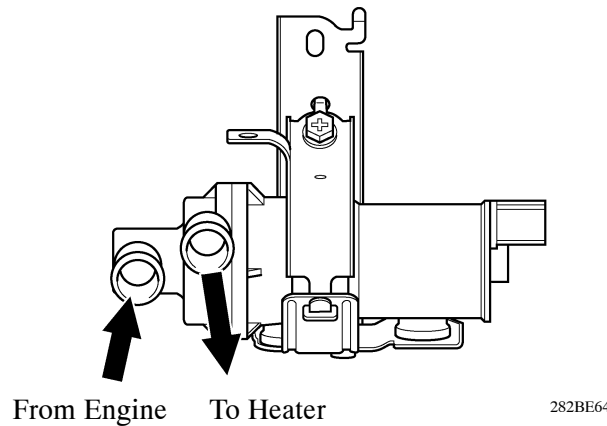
The point at which the air bubbles disappear in the refrigerant of the sub-cool cycle is lower than the proper amount of refrigerant with which the system must be filled. Therefore, if the system is recharged with refrigerant based on the point at which the air bubbles disappear, the amount of refrigerant 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 LEXUS RX400h Repair Manual (Pub. No. RM1139E).



241BE169

6. Water Pump

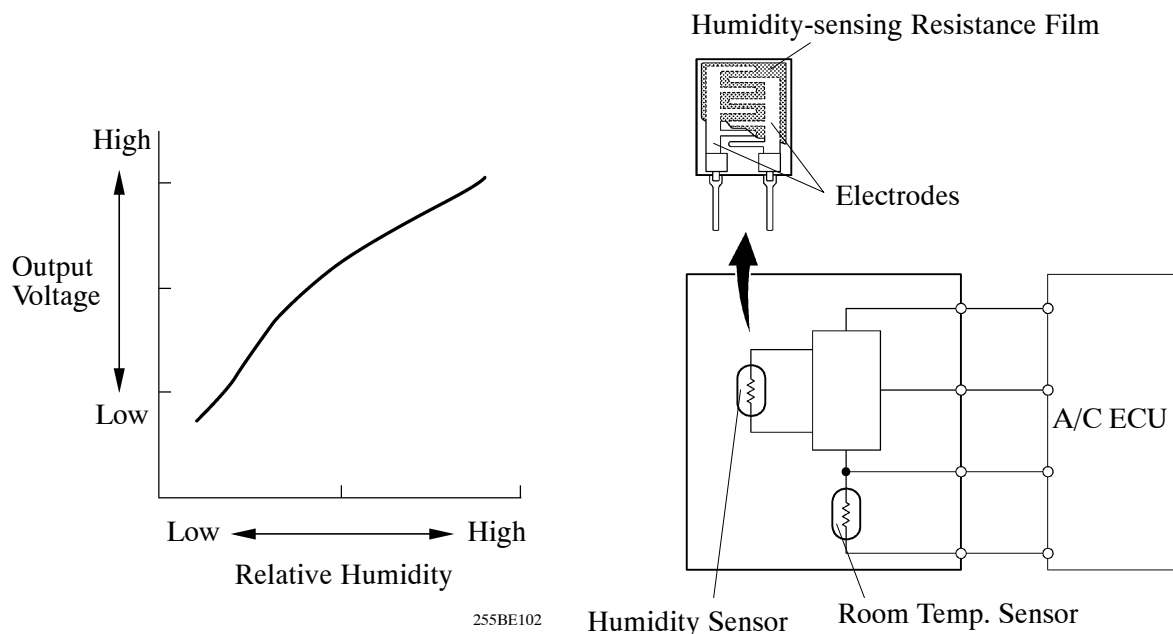
- The new RX400h uses an electric water pump for air conditioning. This provides a stable heater performance even if the engine is stopped because of a function of the THS-II.
- The RX400h uses a new type of electrical water pump in which the water flow resistance has been reduced.



282BE64

7. Room Temp. and Humidity Sensor

- A humidity sensor function has been added to the room temperature sensor. By enabling the detection of humidity in the vehicle interior, this function optimizes the amount of dehumidification effort during the operation of the air conditioner system. As a result, the power consumption of the compressor has been reduced and a comfortable level of humidity has been realized in the vehicle interior.
- The humidity-sensing resistance film that is built into the humidity sensor absorbs and releases the humidity in the vehicle interior. During the absorption and releasing processes, the humidity-sensing resistance film expands (during the absorption of humidity) and contracts (during drying). The clearance between the carbon particles in the humidity-sensing resistance film expands and contracts during absorption and drying, thus changing the resistance between the electrodes. The A/C ECU determines the humidity in the vehicle interior through the changes in the output voltage of the humidity sensor that are caused by the resistance between the electrodes.



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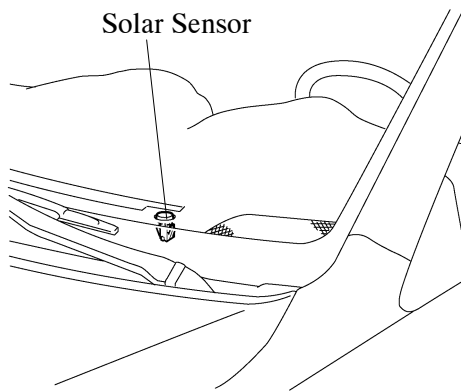
Humidity Sensor

Room Temp. Sensor

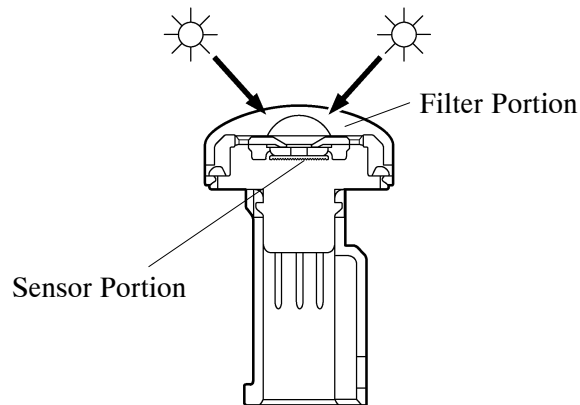
255BE103

8. Solar Sensor

- Detects (in the form of changes in the current that flows through the built-in photo diode) the changes in the amount of sunlight at the driver and front passenger sides (2 directions) and outputs them to the air conditioner ECU.
- This sensor is integrated with the automatic light control sensor that is used in the automatic light control system.
- This sensor is located in the driver side above the instrument panel.



241BE50

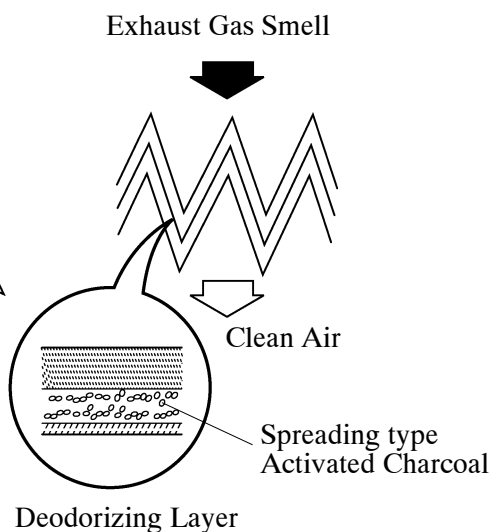
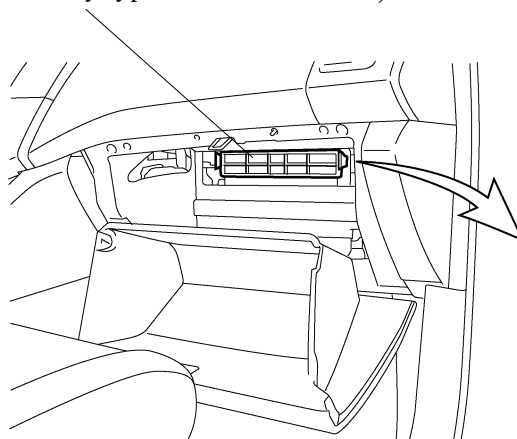


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9. Clean Air Filter

- A clean air filter (high efficiency type combination filter) is used.
- A deodorizing function that eliminates the exhaust gas smell that enters the cabin from the outside has been added to the conventional clean air filter. This clean air filter uses spreading type activated charcoal in the deodorizing layer to eliminate the exhaust gas (include acetaldehyde) smell.

Clean Air Filter
(high efficiency type combination filter)



241BE51

Service Tip

- Do not wash the clean air filter (high efficiency type combination filter) with water or use an air blower to clean it because the clean air filter (high efficiency type combination filter) contains spreading type activated charcoal.
- The clean air filter (high efficiency type combination filter) should be changed at 15,000 km. However, it varies with the use conditions (or environment).

10. Air Conditioner ECU

General

The air conditioner ECU has following control.

Control		Outline
Neural Network Control		This control is capable of effecting complex control by artificially simulating the information processing method of the nervous system of living organisms in order to establish a complex input/output relationship that is similar to a human brain.
Outlet Air Temp. Control		In compliance with the temperature set at the temperature control switch, the neural network control calculates the outlet temperature based on the input signals from various sensors.
		The temperature setting for the driver and front passenger is controlled independently in order to provide a separate vehicle interior temperature for the right and left side. Thus, air conditioner that accommodates the occupants' preferences has been realized.
Blower Control		Controls the blower motor in accordance with the airflow volume that has been calculated by the neural network control based on the input signals from various sensors.
Air Outlet Control		Automatically switches the outlets in accordance with the outlet mode ratio that has been calculated by the neural network control based on the input signals from various sensors.
		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		Automatically controls the air inlet control damper in accordance with the calculation of the required outlet air temperature.
		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.
Electric Inverter Compressor Control	Compressor Speed Control	• The A/C ECU calculates the target speed of the compressor based on the target evaporator temperature (which is calculated by the room temperature sensor, humidity sensor, ambient temperature sensor, and the solar sensor) and the actual evaporator temperature that is detected by the evaporator temperature sensor in order to control the compressor speed. • The A/C ECU calculates the target evaporator temperature, which includes corrections based on the vehicle interior humidity (which is obtained from the humidity sensor) and the windshield glass inner surface humidity (which is calculated from the humidity sensor, solar sensor, room temperature sensor, mode damper position, and wiper operation condition). Accordingly, the A/C ECU controls the compressor speed to an extent that would not inhibit the proper cooling performance or defogging performance.
Electric Water Pump Control		When the blower motor is ON and the engine has been stopped by the hybrid control, the A/C ECU turns ON the electric water pump in accordance with the judgment of the air mix damper opening.
Rear Window Defogger Control		Switches the rear defogger, outside rear view mirror heaters and front wiper deicer* ¹ , on for 15 minutes when the rear defogger switch is switched on. Switches them off if the switch is pressed while they are operating.
Outer Temperature Indication Control		Based on the signals from the ambient temperature sensor, this control calculates the outside temperature, which is then corrected in the air conditioner ECU, and shown in the multi information display* ² /multi display* ³ .
Self-Diagnosis		Checks the sensor in accordance with operation of the air conditioner 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 conditioner switches (actuator check function).

*1: Optional Equipment

*2: Models without Multi Display

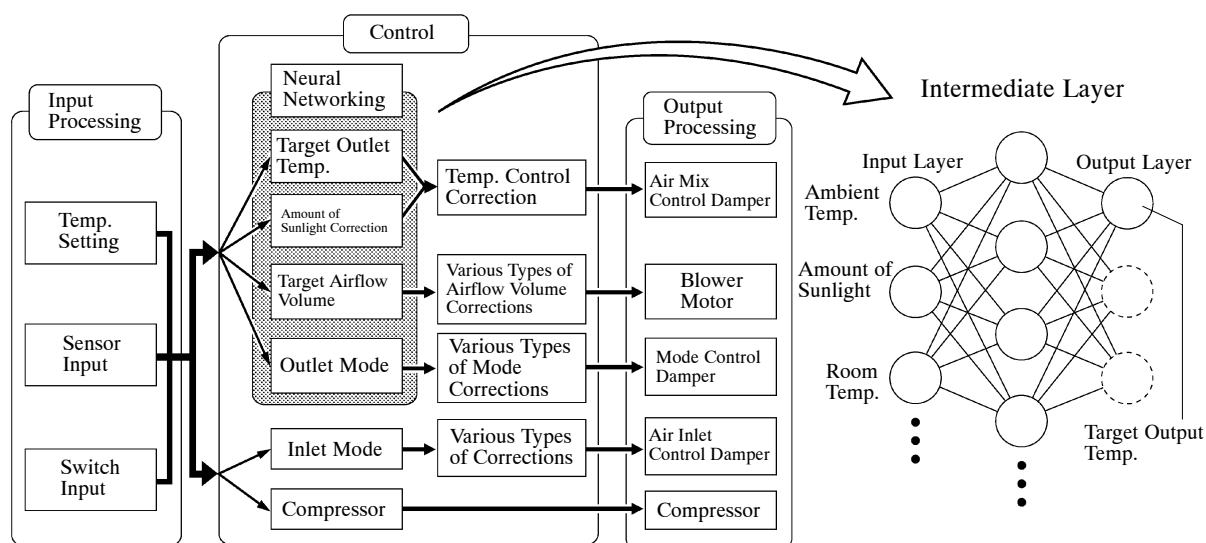
*3: Models with Multi Display

Neural Network Control

- In the previous automatic air conditioner system, the ECU determined the required outlet air temperature and blower air volume in accordance with the calculation formula that has been obtained based on information received from the sensors.

However, because the sensors of a person are rather complex, a given temperature is sensed differently, depending on the environment in which the person is situated. For example, a given amount of solar radiation can feel comfortably warm in a cold climate, or extremely uncomfortable in a hot climate. Therefore, as a technique for effecting a higher level of control, a neural network is used in the automatic air conditioner system. With this technique, the data that has been collected under varying environmental conditions is stored in the ECU, which effects control to provide enhanced air conditioner comfort.

- The neural network control consists of neurons in the input layer, intermediate layer, and output layer. The input layer neurons process the input data of the outside temperature, the amount of sunlight, and the room temperature based on the outputs of the switches and sensors, and output them to the intermediate layer neurons. Based on this data, the intermediate layer neurons adjust the strength of the links among the neurons. The sum of these is then calculated by the output layer neurons in the form of the required outlet temperature, solar correction, target airflow volume, and outlet mode control volume. Accordingly, the air conditioner ECU controls the servo motors and blower motor in accordance with the control volumes that have been calculated by the neural network control.

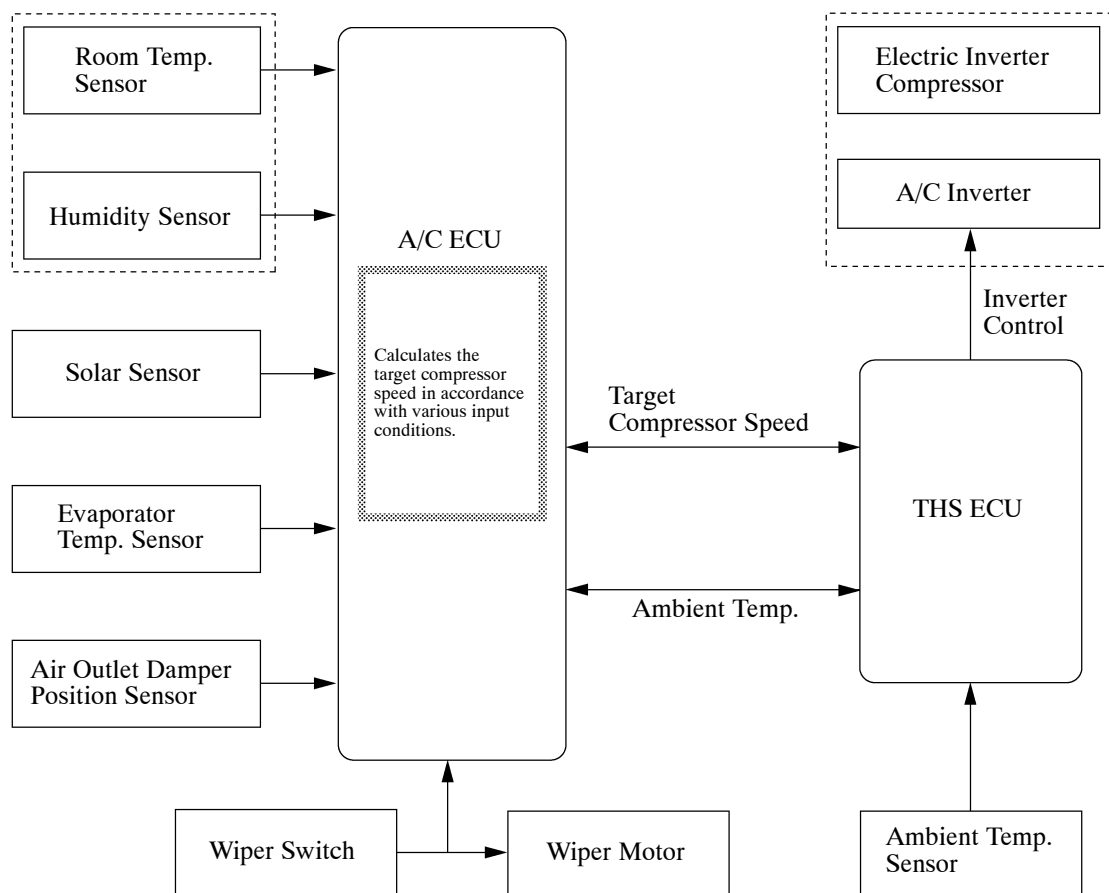


▨ : Neural Network Operation Range

Electric Inverter Compressor Control

1) Compressor Speed Control

- The A/C ECU calculates the target compressor speed based on the target evaporator temperature (calculated from the room temperature sensor, humidity sensor, ambient temperature sensor, and solar sensor) and the actual evaporator temperature detected by the evaporator temperature sensor. Then, the A/C ECU transmits the target speed to the THS ECU. The THS ECU controls the A/C inverter based on the target speed data in order to control the compressor to a speed that suits the operating condition of the air conditioner system.
- The A/C ECU calculates the target evaporator temperature, which includes corrections based on the vehicle interior humidity (which is obtained from the humidity sensor) and the windshield glass inner surface humidity (which is calculated from the humidity sensor, solar sensor, room temperature sensor, mode damper position, and wiper operation condition). Accordingly, the A/C ECU controls the compressor speed to an extent that does not inhibit the proper cooling performance or defogging performance. As a result, comfort and low fuel consumption can be realized.



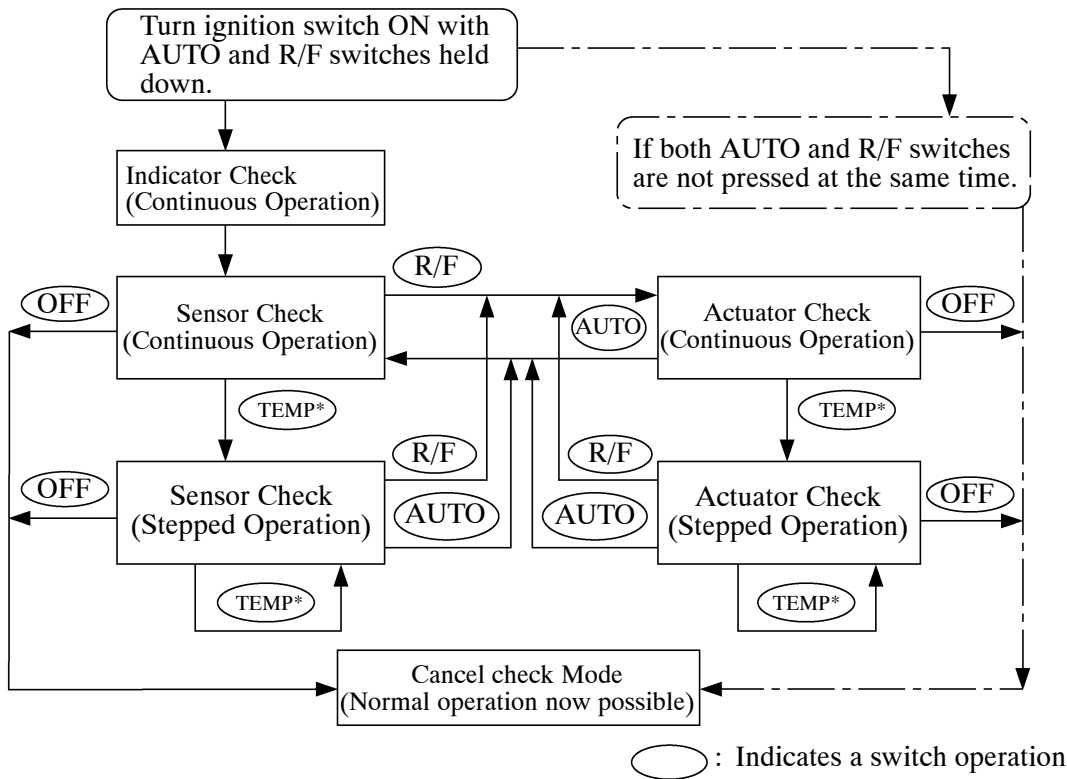
Self-Diagnosis

- 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 the air conditioner control switches, the stored malfunction codes are displayed on the multi display on models with the multi display, and displayed on the air conditioner control panel LCD for models without multi display. Since diagnostic results are stored directly by electric power from the battery, they are not cleared even when the ignition switch is turned off.

► Functions ◀

Function	Outline
Indicator Check	Checks mode 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.



*: Driver side TEMP UP switch

241BE167

- For details on the indicator check, sensor check, actuator check function, and clearing DTC of this system, refer to the LEXUS RX400h Repair Manual (Pub. No. RM1139E).