

Section 6

Body Electrical

Overview The body electrical system includes special technology to increase fuel efficiency and accommodate the special requirements of a hybrid powertrain. For instance, the 2004 & later Prius uses an electric compressor so that A/C operation is not dependent on the engine. It also uses a humidity sensor to make cabin dehumidification more efficient.

To maintain communication between the vehicle's many electronic control components, hybrid vehicles use three types of multiplex communication: CAN, BEAN and AVC-LAN. A Gateway ECU is used to link the three circuits.

Air Conditioning System The Prius A/C unit provides 2-way flow so it can recirculate warm internal air in the foot well while simultaneously introducing fresh, dry external air to the upper part of the cabin. This allows it to effectively heat the vehicle and demist the windshield at the same time.

- The '01-'03 Prius air conditioning is controlled from the air conditioning control panel.
- The '04 & later Prius air conditioning system can be controlled either from the air conditioning screen on the multi display or from switches on the steering pad.

The system includes several components to meet the special requirements of a hybrid vehicle.

- The '04 & later Prius includes an electric compressor that is powered by the inverter and does not draw any power unless it is needed to run the A/C.
- The hybrid vehicle A/C system also uses two Positive Temperature Coefficient (PTC) heaters embedded in the heater core to supplement the heat provided by the engine.

The A/C control circuits include special logic tailored to support the hybrid powertrain. If the HV battery becomes too warm with recirculation ON, the HV battery ECU will switch to FRESH in order to increase the flow of air across the battery.

A/C Main Components

('04 later Prius)

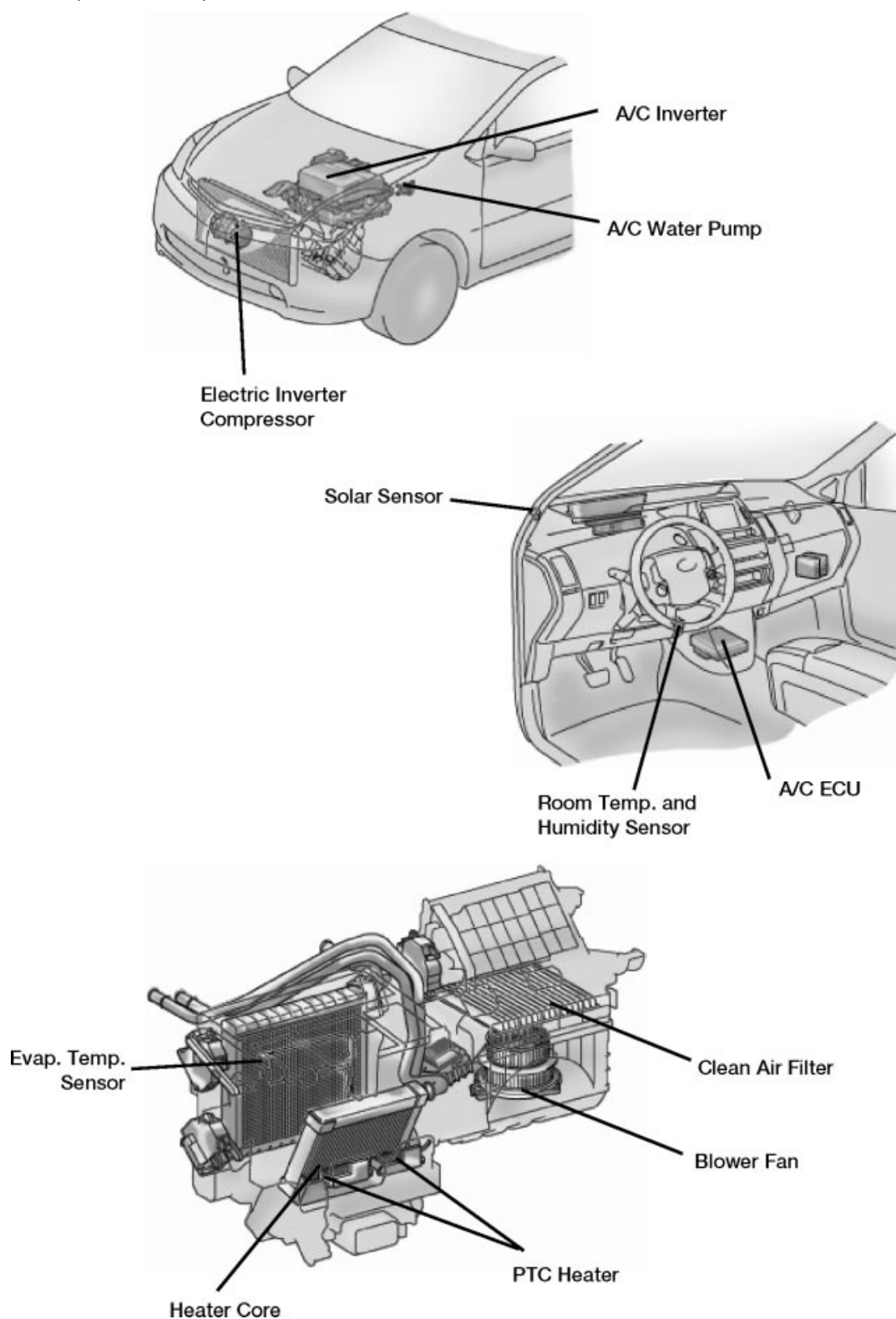


Figure 6.1

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Heater Core and PTC Heater

The hybrid vehicle's gasoline engine is small, thermally efficient, and runs only when needed. Therefore, engine coolant may not always be hot enough to heat the cabin to a comfortable temperature. To address this, two 165-Watt PTC heater elements are embedded in the heater core and used to supplement engine heat when warming the vehicle.

Heater Core

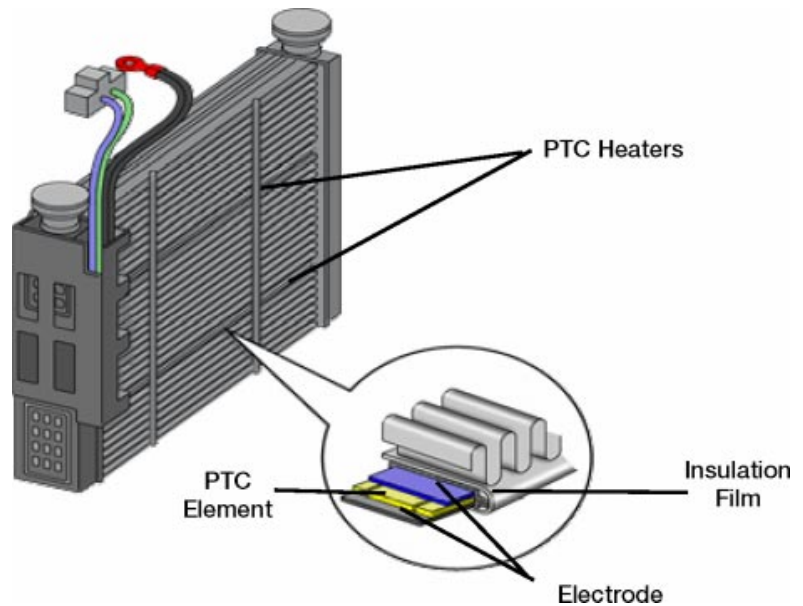


Figure 6.2

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PTC Heater

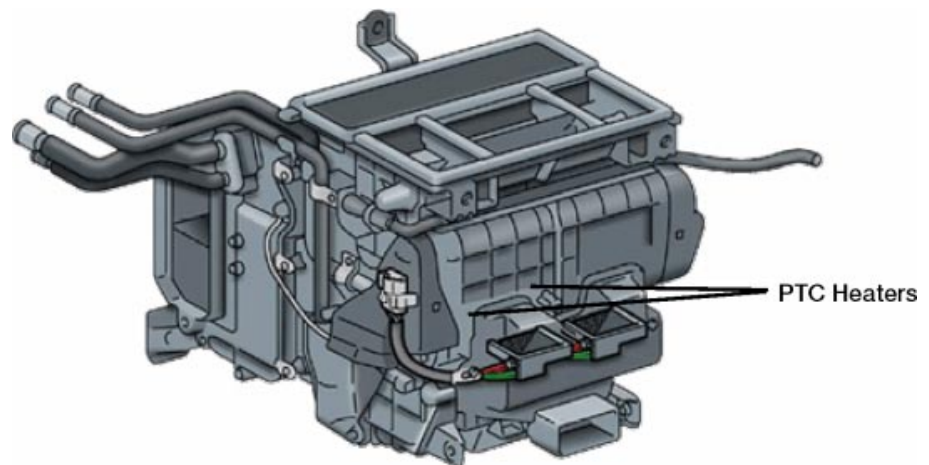


Figure 6.3

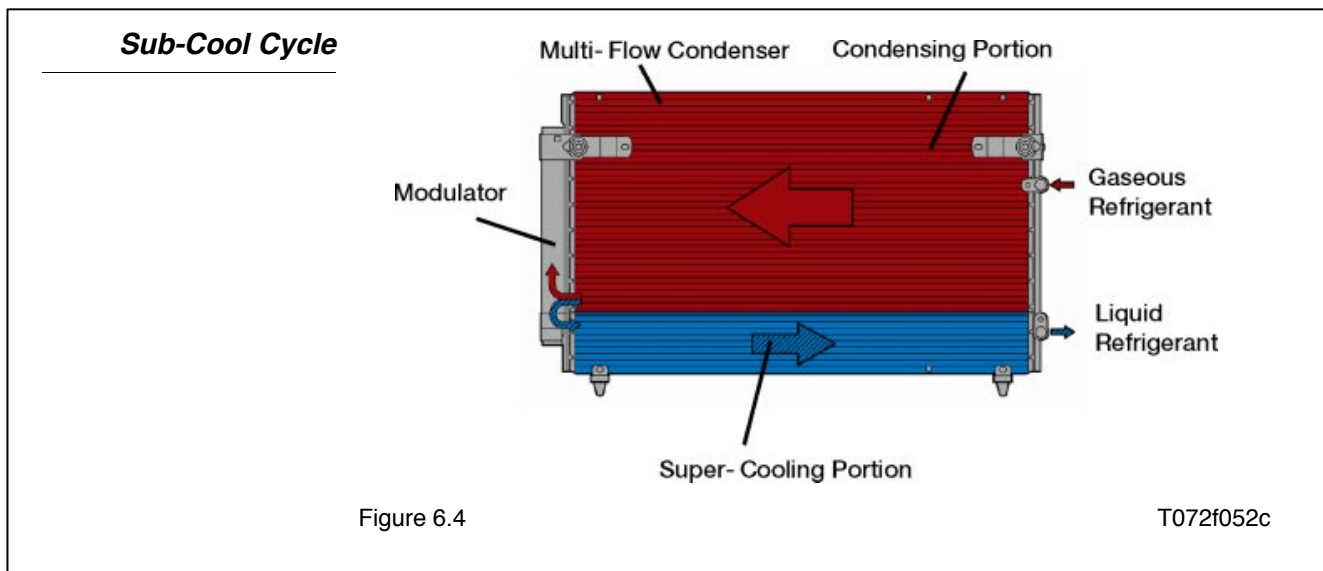
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Condenser and Sub-Cool Cycle

The Prius A/C condenser includes a sub-cooler that improves heat exchange efficiency. After the refrigerant passes through the condensing portion of the condenser, both the liquid refrigerant and any gaseous refrigerant that was not liquefied during condensation are cooled again in the super-cooling portion of the condenser. Because of this two-step approach the refrigerant sent to the evaporator is almost completely liquefied.

NOTE

When recharging most cooling systems, air bubbles disappear from the refrigerant when the system is full. With this system, however, air bubbles will disappear from the refrigerant *before* the system is full. See the Prius Repair Manual for the proper method of recharging this system.

**Compressor ('01-'03 Prius)**

The '01-'03 Prius uses a scroll compressor with an oil separator that reduces the circulation of compressor oil in the system.

NOTE

When diagnosing the A/C, you may need to force the A/C system to remain on. Setting the controls to the MAX A/C position will cause the engine to remain on, maintaining A/C compressor operation.

A/C Compressor

Selecting MAX A/C on the '01-'03 Prius will cause the engine to run continuously



Figure 6.5

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Electric Compressor ('04 & later Prius)

The '04 & later Prius uses an electric compressor driven by an integrated motor. The motor runs on 201.6V AC supplied by the A/C inverter so compressor operation does not depend on the engine.

The electric compressor consists of a spirally wound fixed scroll and variable scroll, a brushless motor, and an oil separator. The oil separator reclaims most of the compressor oil that is intermixed with the refrigerant. To insure proper insulation between the compressor housing and the high-voltage components inside the compressor, the '04 Prius uses a special high insulation value ND11 compressor oil. **NEVER** use any compressor oil other than ND11.

NOTE

The A/C compressor is powered by 201.6V AC. So when servicing the A/C compressor you should use the same high voltage safety procedures you would use for the vehicles other high voltage circuits.

Electric A/C Compressor

('04 & later Prius)



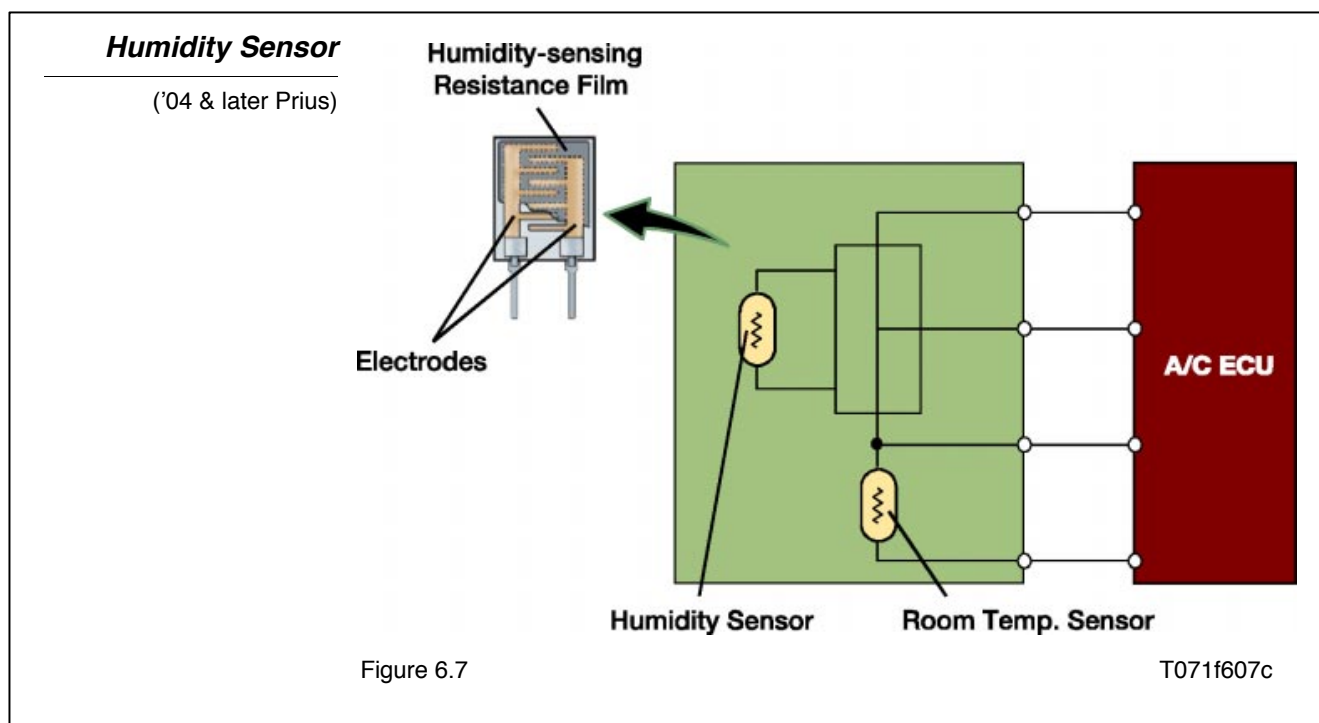
Figure 6.6

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Room Temperature Sensor and Humidity Sensor ('04 & later Prius)

The room temperature sensor includes a humidity sensor to help make the A/C system's dehumidification process more effective. As a result, compressor power consumption has been reduced while still maintaining a comfortable humidity level within the cabin.

The humidity-sensing resistance film contains small carbon particles. As humidity in the cabin changes the hydroscopic film expands and contracts, changing the distance between the carbon particles. This changes the resistance of the film and sensor output voltage.



Water Pump The electric water pump provides stable heater performance even when the engine is stopped. When the engine is running the engine's water pump is forcing coolant through the system so the electric water pump does not operate.

On the '01-'03 Prius, when the engine's water pump is operating a bypass valve opens to minimize flow resistance. The bypass valve has been discontinued on the '04 & later Prius because a new pump design minimizes water flow resistance.

**Water Pump
Coolant Flow**

('01-'03 Prius)

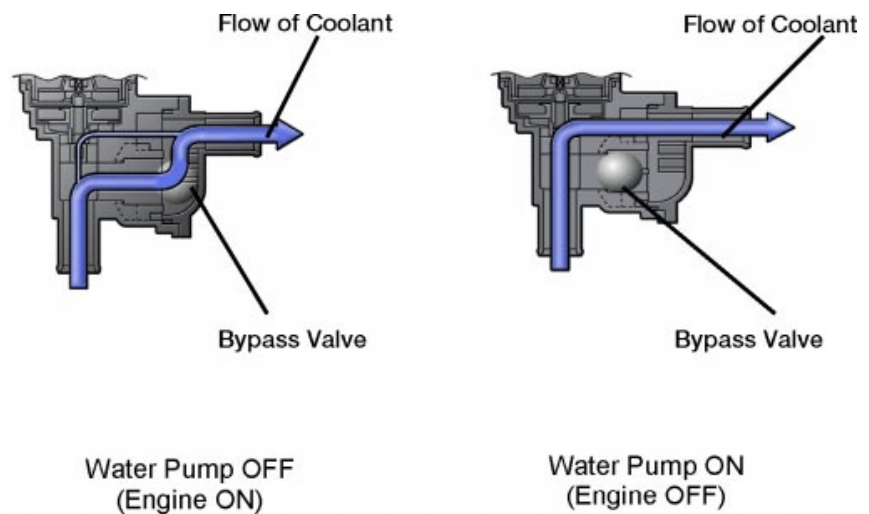


Figure 6.8

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