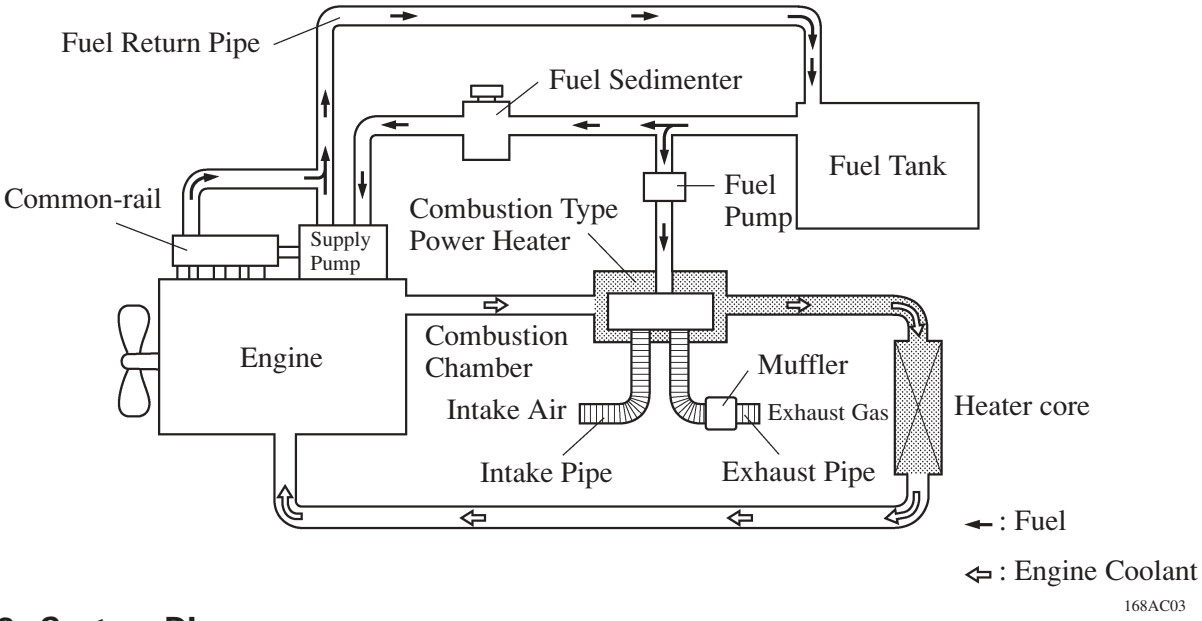
■COMBUSTION TYPE POWER HEATER

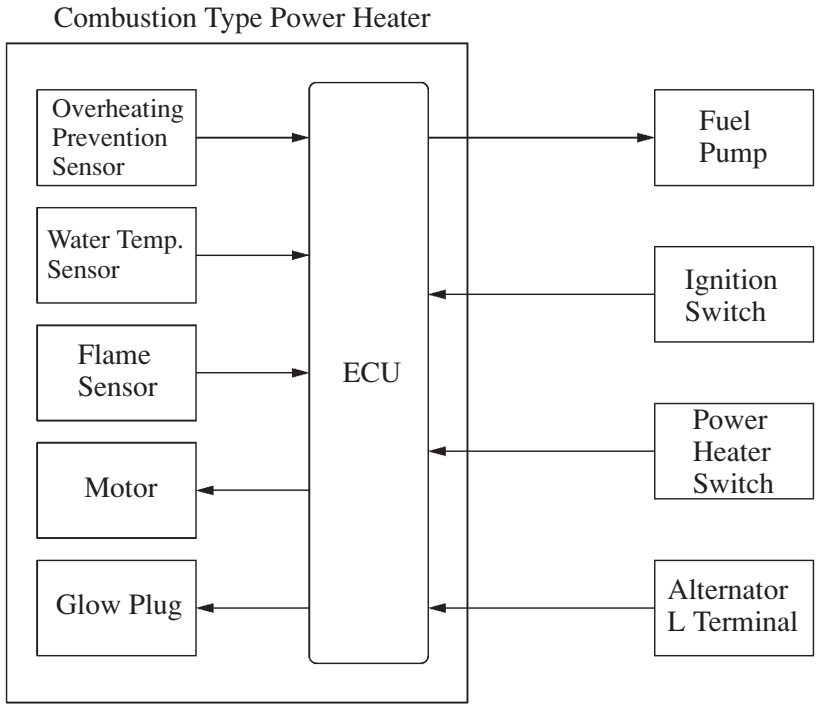
1. General

- While the 2AD-FTV and 2AD-FHV engines offer excellent combustion efficiency, it generates less heat. Therefore, depending on the operating condition, the coolant temperature remains low, making it difficult to ensure the proper heating effect. Thus, in order to provide adequate heating effect, a combustion type power heater is provided as optional equipment on the cold area specification LHD model for Europe.
- This heater system provides a combustion type power heater between the engine and the heater core. Air and fuel are introduced into the heater's combustion chamber, and a glow plug is used to ignite this mixture. By heating the engine coolant that flows around the combustion chamber, this system enhances the heating effect. The system can be activated or deactivated by turning the power heater switch provided on the floor console ON/OFF.



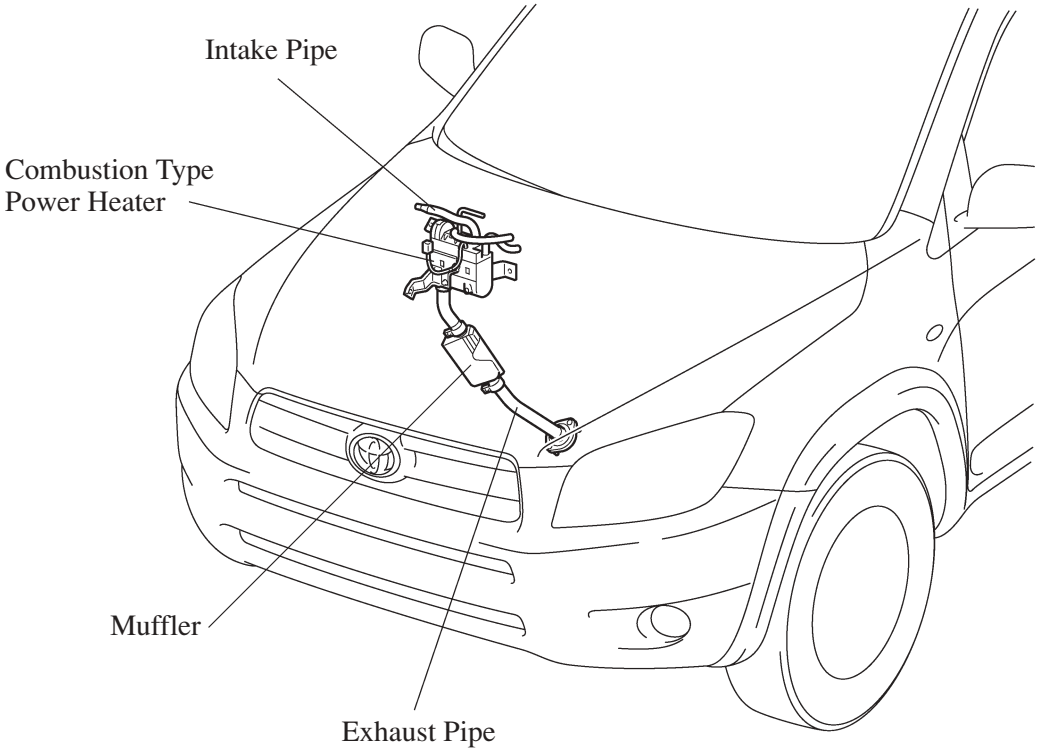
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2. System Diagram

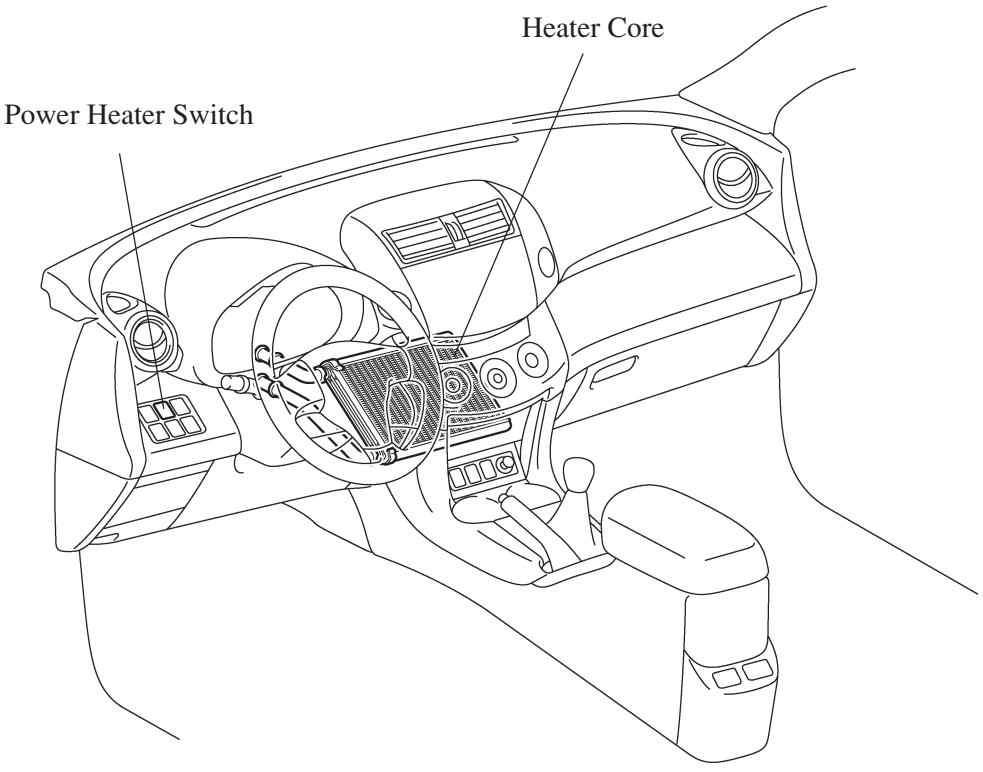


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3. Layout of Main Components



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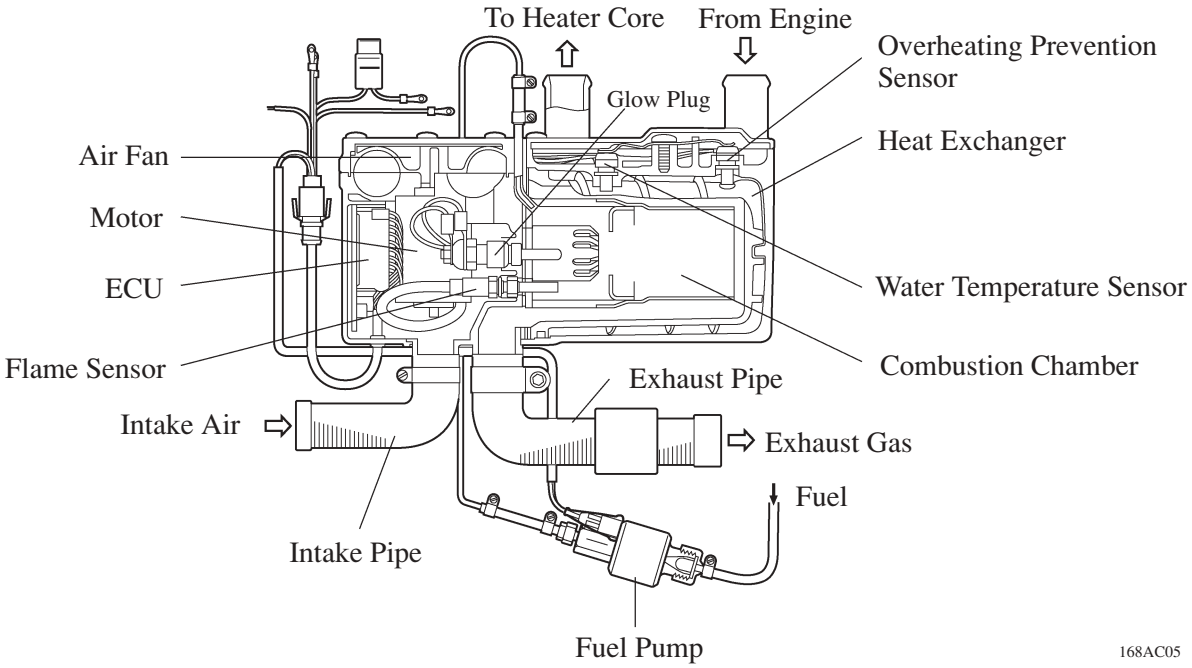


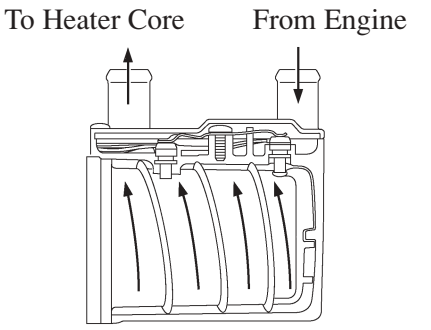
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4. Combustion Type Power Heater Assembly

General

The combustion type power heater assembly consists mainly of a heater exchanger, glow plug, motor, air fan, ECU, water temperature sensor, overheating prevention sensor, flame sensor, intake pipe, exhaust pipe and fuel pump.
This heater is installed between the engine and the heater core. The coolant from the engine flows through the spiral passage around the heat exchanger and flows into the heater core. At this time, the glow plug ignites the air and fuel in the combustion chamber of the heat exchanger, and the resultant heat of combustion heats the engine coolant.





Engine Coolant Flow

Sensors

The table below shows the function of the sensors.

Sensor	Function
Water Temperature Sensor	Detects the temperature of the engine coolant in the heater.
Overheating Prevention Sensor	Detects the temperature of the wall surface of the combustion chamber.
Flame Sensor	Detects the temperature of the exhaust gas.

5. Operation

General

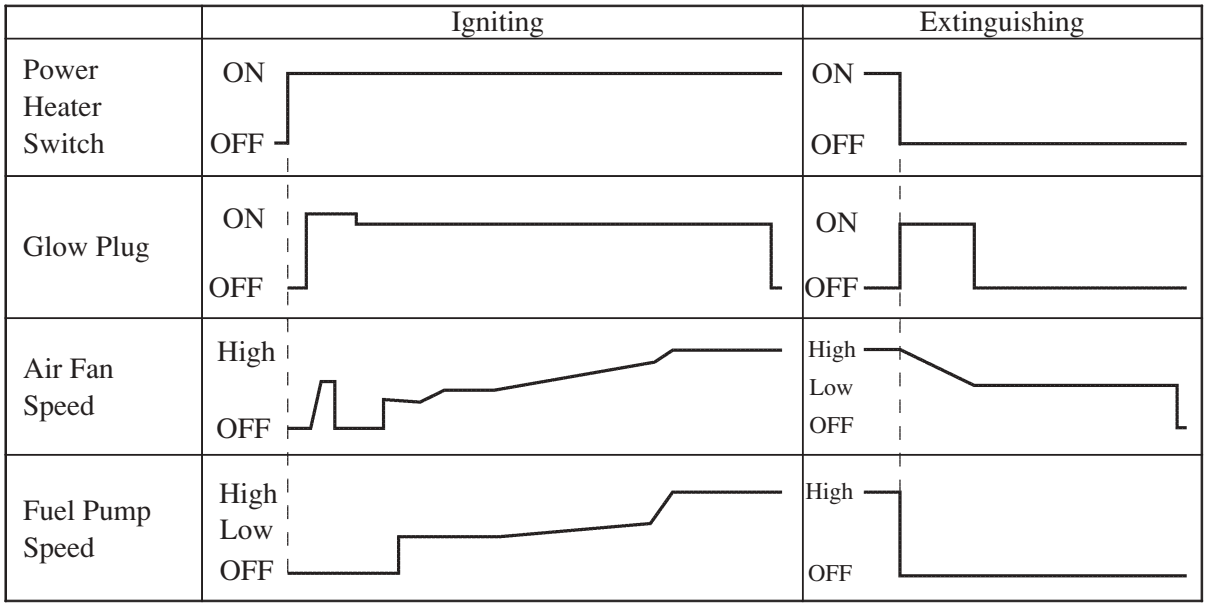
1) Igniting

When the engine is operating, turning the power switch on causes the air fan to operate for several seconds for verification purposes. Then, the glow plug starts to preheat the combustion chamber. After that, the fuel pump and the air fan turn on in order to start low combustion. The fuel pump speed is then increased in steps, and this is accompanied by a gradual increase in the speed of the air fan, thus leading to high combustion.

2) Extinguishing

When the power source mode is selected to OFF or the power heater switch is turned off, the fuel pump stops, causing the combustion to stop. For the purpose of after-purge, current is applied again to the glow plug, and the air fan is activated for several seconds. Then, the entire system comes to stop.

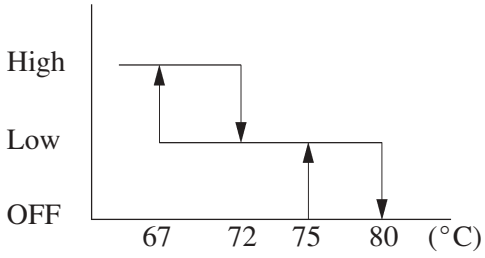
▶ Timing Chart ◀



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3) Operating

While the system is in operation, it controls the fuel pump speed and switches high combustion and low combustion, and always keeps the water temperature between 67°C and 80°C.
If the water temperature exceeds 80°C, the fuel pump stops automatically to stop the combustion.
Thereafter, when the water temperature reaches 67°C or below, ignition occurs again.
The operation of the glow plug, the air fan, and the fuel pump during extinguishing and re-igniting is the same as when these are operated by switch as mentioned previously.



Water Temperature Control

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Protective Control

For self-protection, this system stops if an abnormal condition is detected. A description of the control is indicated below.

Function	Control
Dry Run Prevention	If the temperature detected by the water temperature sensor or the overheating prevention sensor exceeds 125°C, the ECU determines that the heater is operating without engine coolant and automatically stops the system.
Overheating Prevention	If the difference in temperature detected by the water temperature sensor and the overheating prevention sensor exceeds 15°C, the ECU determines that the flow volume of the engine coolant is insufficient and automatically stops the system.
Non-ignition or Misfiring Detection	If the temperature of the exhaust gas detected by the flame sensor is low, the ECU determines that a non-ignition or a misfiring condition exists and automatically stops the system.
Open or Short Circuit Detection	If an open or short circuit exists in the sensors or actuators, the ECU automatically stops the system.
Air Fan Seizure Detection	If the air fan becomes seized, the ECU automatically stops the system.

Diagnosis

If a malfunction occurs in the system, it is possible to access the DTC (Diagnostic Trouble Code) by using a SST (Special Service Tools) that has been designed exclusively for the combustion type power heater. For details on the DTC, etc., refer to the RAV4 Repair Manual (Pub. No. RM01N0E).

NOTES:

- When the power heater is turned on or off, some white smoke and a slight odor may be emitted from the exhaust located under the floor. If the power heater is being used under extremely cold conditions, vapor may be visible from the exhaust. This is normal.
- We recommend not to restart the power heater for 10 minutes after you turn it off.
  Otherwise, a noise may be heard as the heater ignites.
- Do not turn the power heater on and off repeatedly within 5 minutes intervals as this can shorten the life of the heater components. If the engine is to be turned on and off repeatedly within short intervals (such as when being used for delivery purposes), turn the power heater switch off.