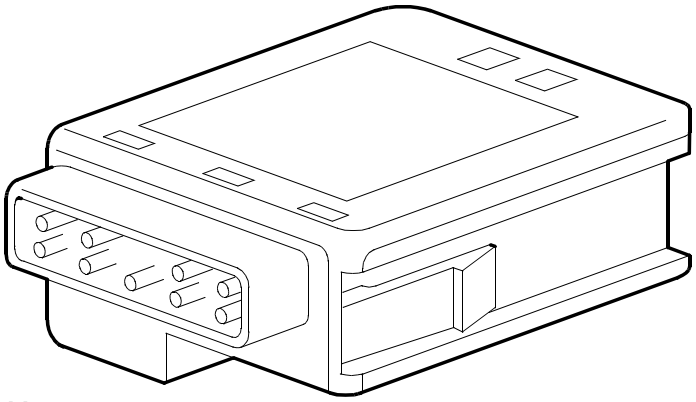
Voltage input to the relay winding and the contacts comes from the vehicle battery. When the main relay is energised, the switching contact closes and power is supplied to various components on the vehicle.

The earth path for the main relay winding is supplied by the ECM. When the earth path is completed, the main relay energises.

In the event of a main relay failure any of the following symptoms may be observed:
- Engine will crank but not start.
- The engine will stop if the relay fails.

Glow Plug Relay And Glow Plugs



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The glow plug relay is located next to the ECM in the E-box. The ECM controls all glow plug operations via the glow plug relay. The glow plug warning lamp is controlled by the ECM from information received from the glow plug relay.

The 4 glow plugs are located in the cylinder head on the inlet side. The glow plugs form a vital part of the engine starting strategy. The glow plugs heat the air inside the cylinder during cold starts to assist combustion. The use of glow plugs helps to reduce the amount of extra fuel required on start up, the main cause of black smoke. It also requires less injection advance, which reduces engine noise, particularly when idling with a cold engine.

The main part of the glow plug is a tubular heating element that protrudes into the combustion chamber of the engine. The heating element contains a spiral filament encased in magnesium oxide powder. At the tip of the tubular heating element is the heater coil. Behind the heater coil, and connected in series, is a control coil. The control coil regulates the heater coil to ensure that it does not overheat.

Pre-heat is the length of time the glow plugs operate prior to engine cranking. The ECM controls the pre-heat time of the glow plugs based on battery voltage and coolant temperature information.

Post-heat is the length of time the glow plugs operate after the engine starts. The ECM controls the post-heat time based on ECT information. If the ECT fails, the ECM will operate pre-heat and post-heat time strategies with default values from its memory. The engine will be difficult to start.

The glow plug relay is supplied with power directly from the vehicle battery, an earth connection directly to the vehicle body from the glow plug relay is used. The glow plug relay also receives a voltage signal from the main relay to indicate ignition switch operation. Input information relating to engine temperature and time base calculations comes from the ECM. The glow plug relay is able to process this information and then supply output control to the glow plugs in the engine.

In the event of a glow plug failure any of the following symptoms may be observed:
- Difficult starting.
- Excessive smoke emissions after engine start.