Diagnose Engine Cooling Fan Relay Problem

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Engine overheating or poor air conditioning performance can be caused by an engine or A/C condenser cooling fan that fails to come on. In many cases, the underlying fault is a bad cooling fan relay.

The quickest way to tell whether or not the electric fan(s) are working is to start the engine, let it reach normal operating temperature and then turn the A/C on. The cooling fan in the engine compartment should turn on to pull air through the radiator and A/C condenser. On many vehicles, there may be two fans: a main cooling fan for the radiator, and a second fan for the condenser. Both fans should come on when the A/C is on.

If one or both fans fail to come on, the lack of additional cooling provided by the fan may cause poor A/C cooling performance, and it may cause the A/C compressor to overheat and fail. The engine may also run hot and overheat, too.

Problems in the Cooling Fan Circuit

The typical electric cooling fan circuit includes a temperature sensor, a relay, a control module and the fan motor. The relay is the component that fails most often, so be sure to test the relay as well as its power supply and ground connections.

A good relay coil will typically read 40 to 80 ohms. If resistance is high, the coil may still be working but it is failing, or it may not work when electrical loads are high. If the coil has no resistance, it is open and has failed. Replace the relay.
Another simple relay test is to shake it. If you hear something rattling inside, the relay armature is probably broken.

Types of Electric Cooling Fan Relays

There are three basic types of relays:

- Normally open are the most common type. The armature closes when the coil is energized to route power to the fan motor.
- Normally closed. The armature is normally closed and is pulled open when energized.
- Dual relay. This type conducts current when open and when closed in two different circuits.

Some Vehicles with Cooling Fan Problems

- Chrysler minivans (late 1980s and early 1990s). These use a solid state relay for the cooling fans, and the relays tend to overheat and fail.
- Chrysler Neon. The problem here is the cooling fan circuit uses a radio frequency filter mounted on radiator fan shroud. The filter is mounted in a hot area and tends to fail, preventing the cooling fan from operating.
- On most Chrysler vehicles, the cooling fan relay must be engaged before power can go to the A/C clutch. If the fan relay has failed, it will prevent the compressor clutch from engaging and there will be no cooling.
- Ford cooling fan controllers (late 1980s and early 1990s Mustangs and other models). The controller contains a fan primary relay, A/C fan control relay, and wide open throttle cutout all built into one unit. The controller is supposed to switch on both fans when the compressor clutch is engaged. The problem is the two fan motors pull so much amperage that they rob voltage from the clutch. Consequently, the compressor clutch may only get 9.8 volts instead of full battery voltage causing it to slip, overheat and fail. The cure here is to add a separate relay for the compressor clutch so the clutch can draw full voltage from the battery.
- Ford integrated relay control module (IRCM) (introduced in 1986). This unit controls the both fan relays, compressor clutch relay and the fuel pump relay. The module is mounted on the radiator shroud and is exposed to a lot of heat so failures are common. One symptom here of a failed module is a car that cranks but won't start because the fuel pump isn't getting any power through its relay. A failed module may also prevent one or both fans from operating, or the compressor clutch from engaging. The IRCM module also provides two-speed (high and low) fan operation by using an internal resistor to drop voltage to the fans. This resistor often burns up and fails. If any of the subsystems inside the IRCM module have failed, the whole module must be replaced.

- Chrysler LH cars (since early 1990s). These vehicles use two relays (low fan and high fan), and two fans. Three fuses in the power distribution box protect these circuits. The engine control module provides ground to the fan relays when cooling is needed, and a dropping resistor is located inside each fan motor for two-speed operation (that's why each motor has two power input terminals but only one ground terminal). At 238 degrees F, the fan relay switches power from the low-speed circuit to the high-speed circuit to increase cooling. If this relay fails (which it often does because of the load it carries), the fan may operate at high speed but not low speed. Other inputs that can affect when the fan relays are energized include engine temperature, transmission temperature, intake air temperature and A/C operating pressure. On this vehicle, you should use a scan tool to see which of these inputs is energizing the fans and when.
- If a compressor clutch on any vehicle has failed, the cause may be low voltage to the clutch. Low voltage allows the clutch to slip, which creates excessive friction and heat. Use a voltmeter to measure voltage to the clutch. If it is not within 0.2 volts of battery voltage, other components in the circuit may be stealing power from the clutch. The cure may be to require the clutch circuit by adding a new relay so the clutch can have its own dedicated power circuit.

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