



NRF TECHNICAL ARTICLE

# ELECTROFANS - THE HELP OF THE ENGINE COOLING



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## WHAT IS AN ELECTROFAN?

An electro fan is, as his name says, a fan that works electric/electronically. Old models was working when a sensor (usually mounted in the radiator) allows to pass electric current (if temperature rises, sensor's intern resistor decreases, so current can pass to the electrofan), closing the circuit and setting on the fan.

Photo 1: NRF 47647



Nowadays, working principle is not that easy, but they have a lot of information of the vehicle's sensors behind, as for example, engine RPM sensor (that informs about engine speed), temperature sensors (of engine, exhaust gases, cooling and exterior temperature), throttle position sensors (that inform about the engine load demanded), etc.

There is two types of fans depending of the mounting position: Blowing ones (if they are mounted in the front of the radiator, in contact with exterior) or suctioning ones (if they are mounted in the back of the radiator, near to the engine)

## HOW A MODERN ELECTROFAN WORKS?

Nowadays, we maintain the sensor-fan scheme, but the engine's Electronic Control Unit (ECU) joins the game. Sensors are not that simple, but they send electric signals to the ECU depending of the temperature of the system. The ECU read those data and compare it with the info in his memory, and if the temperature reach some certain point, fan turns on to force some extra cooling.

In this case, ECU can modify the fan's speed sending certain current to it, giving us what we know as "fan speeds". The ECU also can vary the fan's speed depending of the vehicle's speed and exterior temperature.

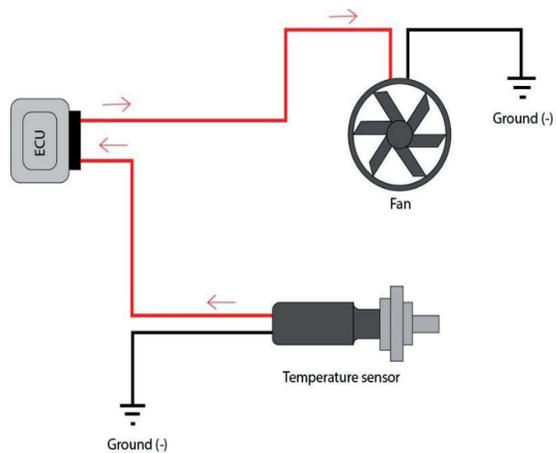


Photo 2. ECU-controlled fan basic working principle scheme. Red arrows marks the info flow as electric current

It exists some others types of fan controlled by PWM signals, fully adaptable to the sensor's temperature signals, and even others that can work as driver's desire (mostly used in competition vehicles).

## Let's suppose a few working cases:

- > Vehicle at iddle in a hot day

Vehicle at iddle (started but not moving) starts to heat. There is not an air flow in the radiator, so it reach a certain temperature which set on the fan, but it doesn't work at full power. This is what we know as "first speed" and it starts with the engine at low charge or iddle, because the power demand to the engine is minimun.



- › Vehicle climbing up a port with load.

In this case, let's suppose a vehicle with load climbing up a mountain port. Usually, it can drive around 2500 and 3500 in a diesel vehicle, and around 3500 and 5000 in a petrol engine, with load and climbing up a road, what it means that there is a high power demand to the engine. Vehicle starts to heat quickly and the "first speed" is not enough to cool it.

Once detected, the ECU sends a higher electric current, setting on what we know as "second speed". In this mode, the fan works at full power, forcing a much higher air flow to cool the radiator in a much more effective way.

- › Vehicle in half load in a straight road.

To drive in a straight road without ramps it's not a huge charge for the engine. Let's suppose we are driving in a speed between 80 and 120km per hour. At this speed, the vehicle is receiving all the exterior air, that is canalized to the radiator. The temperature doesn't reach critical levels, so the fan gets off.

#### TYPICAL PROBLEMS AND SYMPTOMS OF A DEFECTIVE FAN

There are few symptoms of a fan that doesn't work properly:

##### 1. Too much temperature at iddle, driving in city or climbing up a port:

In this case, the fan is not working or only works in the first mode. If the vehicle heats and only starts the second speed, the first one doesn't work, so you have to replace the fan. By the other way, if the vehicle heats climbing up a port, maybe the first speed is working but not the second one.

##### 2. Low temperature at iddle or driving in a highway:

In this case, it means that the fan is always working, cooling too much the engine, what can be harmful for the engine's durability, fuel consumption and higher levels of contaminating emissions.

#### RECOMENDATIONS TO KEEP IN MIND:

##### 1. Respect the engine cooling period:

Some fans are working once the engine is stopped. In those cases, the ECU decides when the fan stops. In old vehicles, the fan doesn't work when the engine stops, so it can be necessary to keep the engine started with the fan working for some minutes.

##### 2. Inspect the blades condition:

It is necessary to revise the blades condition, much more in blowing fans (in contact with the exterior ambience) because they are more susceptible to have some impacts that can break, crack or split the blades.

