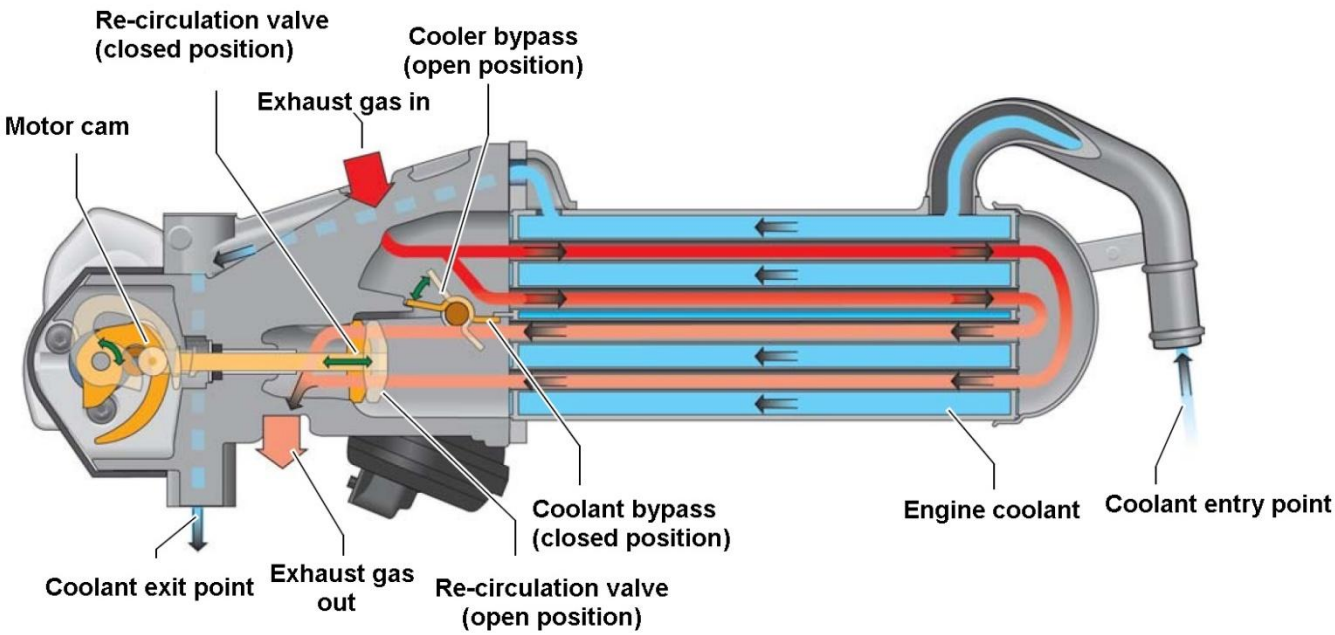
Exhaust Gas Recirculation (EGR) valves are now commonplace on all modern vehicles. The EGR valve feeds back a proportion of the exhaust gas back into the inlet of the engine in a controlled and regulated way. The primary reason for this is to reduce the Nitrogen Oxide (NOx) levels at the combustion stage. When the air/fuel mixture is burnt in the combustion chamber, the formation of NOx increases at a high level as the temperature rises. Recirculating a proportion of the exhaust gas back into the air/fuel mixture lowers the combustion temperature in the cylinder, reducing the rate of NOx formation. A modern EGR valve feeds the inlet with exhaust gas in an accurate, electronically controlled way. Most EGR valves now incorporate a cooler to increase exhaust gas cooling. This is also controlled so that it can be shut off to increase engine warm up at cold start.



The above diagram shows the functionality of this type of EGR valve

Exhaust gas flows through the valve, and most of the time it is diverted to the cooler, where coolant from the cooling system is flowing through the water jacket. This helps to cool the exhaust gas before it exist the valve and flows back into the inlet. The cooler bypass (operated by a vacuum diaphragm) is only in the closed position when the engine is cold. This helps to warm the engine the optimum operating temperature quickly. The motor cam moves the recirculation valve in and out to control how much exhaust gas is allowed back into the inlet.

Although not pictured on the diagram, behind the cam is an electronic circuit board incorporating a hall effect IC. A magnet is mounted on the cam, and the rotation of this is detected by the hall effect IC. This provides the ECU with very accurate feedback of the position of the valve, and the amount of exhaust gas being recirculated.

Common failures

The most common cause of failure is excessive carbon build up inside the EGR valve and cooler. This is unavoidable over a long period of time, but is significantly increased with city driving and short runs. Blocked or partially blocked Diesel Particulate Filters (DPF) compound this issue. The valve position signal to the ECU has to be very accurate, and any wear in the sensor system is detected by the ECU and will cause a warning light to be displayed on the dashboard. The vacuum diaphragm for the cooler system is also prone to failure, as well as external leaks from the cooler itself.