

NRF TECHNICAL ARTICLE

EXHAUST GAS RECIRCULATION (EGR), WHY WE NEED EGR COOLERS



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EGR BASICS

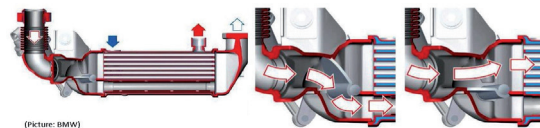
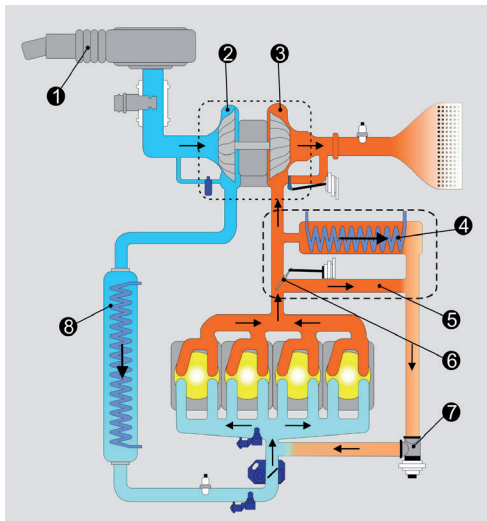
> The Exhaust Gas Recirculation (EGR) system is sometimes misunderstood as to its function and purpose. In many countries around the world, the emissions of Nitrogen oxide (NOx) from diesel and gasoline vehicles are restricted by legislation. EGR is an effective technical solution to control NOx values

> The principle of EGR is to work as a controllable proportion of the exhaust gas is recirculated back into the engine. The EGR is used as one of the key components in reducing exhaust gas emissions and pollutants into the atmosphere. Since the introduction of Euro 6 regulations with a reduction of 55% in nitrogen oxides from Euro 5. Between Euro 5 and Euro 6 regulations on diesel engines the drop in Nitrous Oxide (NOx) is from 180mg per driven kilometre to 80mg per driven kilometre.

The higher the exhaust gas temperature (over 1800°C), the higher the amount of nitrogen oxides! The EGR is designed to recirculate exhaust gas back in the inlet manifold, by doing so this can lower the gas temperature by up to 300c.

The Exhaust Gas Recirculation system is made up of two main components, the EGR valve and the EGR cooler. If part of the cooled exhaust gases is returned to the intake manifold, the combustion temperature of the fuel mixture will decrease. The lower the combustion temperature, the less nitrogen oxides are formed. This is what radiators are for in the EGR system. The cooler is designed to cool exhaust gases going back into the inlet manifold. The cooler is also fitted with a bypass valve that closes off the cooler and recirculate warm gases back into inlet manifold, aiding in increasing the engine temperature quicker up to ±60c before closing off.

And not far off Euro7...



(Picture: BMW)

The Egr valve controls the amount of exhaust gas being circulated into the inlet manifold. The modern vehicles EGR system is controlled by electronics - the Engine Control Unit (ECU) is responsible for opening the valve taking in measurements from many sensors (for example: the Airmass Sensor and Lambda sensor, Exhaust Gas Temperature Sensors (EGTS).

When comes to replacing the EGR value, it's also recommended that the cooler is replaced at the same time. The main reason for doing so is by putting a new EGR valve in a dirty cooler could shorten the life of the new valve.

- | | |
|--------------------------|-------------------------------|
| 1.Air filter | 5.Bypass channel |
| 2.Compressor wheel turbo | 6.Bypass valve(vacum control) |
| 3.Turbine wheel turbo | 7.EGR valve |
| 4.EGR cooler | 8.Intercooler |



EGR FAILURES

Signs that the EGR valve failure:

- › Check engine light is on (diagnostic codes usually in the low P0400s)
- › Reduced power
- › Increased fuel consumption
- › Pinging, tapping or knocking sounds
- › Rough idling engine

EGR INSTALLATION

When installing and after new valve and cooler, there are several things you need to do.

General check:

- › In some systems, the position of the EGR valve is controlled by the engine control unit. This is worth checking before fitment
- › With the engine running, it is possible to read out the EGR parameters with a diagnostic device and thus determine a correct function
- › The comparative values of the EGR control and the determined air mass also provide information about a correct function: If the EGR valve is activated, a smaller air mass must be measured

Visual inspection:

- › Check vacuum lines and/or electrical wiring with connectors.

Actuator diagnosis:

- › By feeling and/or hearing you can determine whether the electrical switching valve or the servomotor works

Note: Clear any fault codes relating to the EGR control

After replacement of the EGR valve, the engine control unit on many vehicles must be learned on the new component (basic setting/calibration)

Note: Always follow the manufacturer's instructions!

POSSIBLE PROBLEMS AFTER REPLACEMENT

There are several possible issues after installation:

- › New part is not functioning
- › New part is not detected by the engine control unit

Possible fault codes related to fitting a new EGR:

- › P0400 - Exhaust Gas Recirculation Flow Malfunction
- › P0401 - Exhaust Gas Recirculation Flow Insufficient Detected
- › P0402 - Exhaust Gas Recirculation Flow Excessive Detected
- › P0403 - Exhaust Gas Recirculation Circuit Malfunction
- › P0404 - Exhaust Gas Recirculation Circuit Range/Performance
- › P0405 - Exhaust Gas Recirculation Sensor A Circuit Low
- › P0406 - Exhaust Gas Recirculation Sensor A Circuit High

- › P0407 - Exhaust Gas Recirculation Sensor B Circuit Low
 - › P0408 - Exhaust Gas Recirculation Sensor B Circuit High
 - › P0409 - Exhaust Gas Recirculation Sensor "A" Circuit
- Some codes would show up if the EGR hasn't been coded/adapted correctly.

Often the valve replacement itself does not meet the expected results, because of carbon contamination in the system. The level of contamination of the system can be determined, among others on the base of the replaced EGR valve (see examples - it should be an indication for a mechanic).



fig. 1. Exemplary EGR valve (NRF 48323)



fig. 2 Original EGR valve removed from the vehicle

fig. 3 System permeability limited by excessive carbon contamination





The NRF range

NRF offers more than 35 EGR modules (includes valves and coolers), almost 80 EGR valves, and almost 70 EGR coolers for passenger cars and trucks for your high expectations and demands. For more information please ask your (local) supplier or visit www.nrf.eu

Technical questions or interested in trainings? Please contact our specialists from tech support team!

