Exhaust Gas Recirculation (EGR) Systems

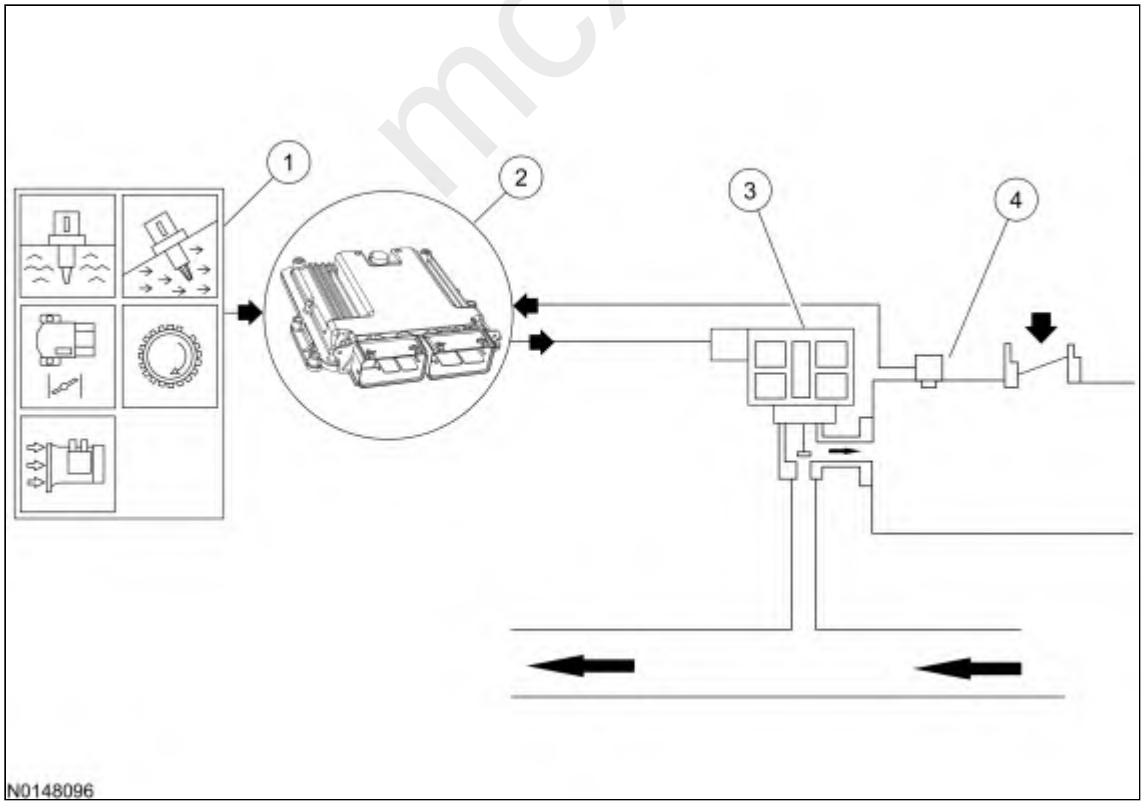
Overview

The EGR system controls the nitrogen oxides (NO_x) emissions. Small amounts of exhaust gases are recirculated back into the combustion chamber to mix with the air to fuel charge. The combustion chamber temperature is reduced, lowering NO_x emissions.

Electric Exhaust Gas Recirculation (EGR) System

The electric EGR system consists of an electric motor EGR valve integrated assembly, a manifold absolute pressure (MAP) sensor, PCM, and connecting wiring. For additional information on the EGR system components, refer to Engine Control Components in this section. Operation of the system is as follows:

1. The electric EGR system receives signals from the engine coolant temperature (ECT) or cylinder head temperature (CHT) sensor, throttle position (TP) sensor, mass airflow (MAF) sensor (if equipped), crankshaft position (CKP) sensor, and the MAP sensor to provide information on engine operating conditions to the PCM. The engine must be warm, stable, and running at a moderate load and RPM before the electric EGR system is activated. The PCM deactivates the EGR during idle, extended wide open throttle (WOT), or whenever a concern is detected in an EGR component or EGR required input.
2. The PCM calculates the desired amount of EGR for a given set of engine operating conditions.
3. The PCM in turn outputs signals to control the electric EGR motor to move (advance or retract) a calibrated number of discrete steps. The electric stepper motor directly actuates the EGR valve, independent of engine vacuum. The electric EGR valve is commanded from 0 to 52 discrete steps to get the EGR valve from a fully closed to a fully open position. The position of the EGR valve determines the EGR flow.
4. A MAP sensor measures variations in manifold pressure as exhaust gas recirculation is introduced into the intake manifold. Variations in EGR being used correlate to the MAP signal (increasing EGR increases manifold pressure values).



Typical Electric EGR System

Exhaust Gas Recirculation (EGR) System — Differential Pressure Feedback

The EGR system consists of an electric motor EGR valve integrated assembly, a manifold absolute pressure (MAP) sensor, differential pressure feedback EGR sensor, PCM, EGR cooler (if equipped), exhaust pressure (EP) sensor (if equipped), and exhaust gas recirculation temperature bank 1, sensor 2 (EGRT12) (if equipped). For additional information on the EGR system components, refer to Engine Control Components in this section. Operation of the system is as follows:

1. The EGR system receives signals from the engine coolant temperature (ECT) or cylinder head temperature (CHT) sensor, throttle position (TP) sensor, crankshaft position (CKP) sensor, and the MAP sensor to provide information on engine operating conditions to the PCM. The engine must be warm, stable, and running at a moderate load and RPM before the EGR system is activated. The PCM deactivates the EGR during idle, extended wide open throttle (WOT), or whenever a concern is detected in an EGR component or EGR required input. The PCM calculates the desired amount of EGR for a given set of engine operating conditions.

2. The EP sensor (if equipped) measures the exhaust pressure by comparing the EP sensor calibrated value to the actual EP sensor value. The EP sensor is used primarily to determine EGR cooler effectiveness and is also used for converting EGR flow to EGR valve position.

3. The EGRT12 sensor (if equipped) measures the exhaust gas temperature downstream of the EGR cooler and is monitored by comparing the EGRT sensor calibrated value to the actual EGRT sensor value. The EGRT12 sensor is primarily used for EGR flow caluculation and is also used for EGR cooler diagnostics.

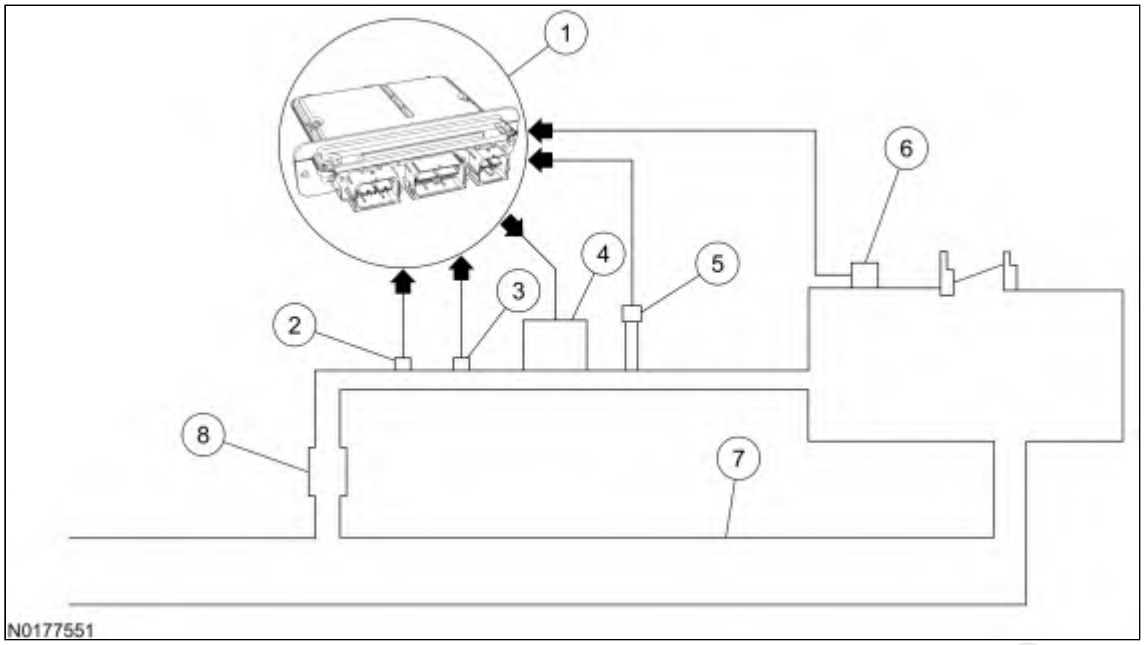
4. The monitor checks the electric EGR valve circuits for opens and shorts. The monitor compares the differential pressure feedback EGR sensor to a calibrated value and the electric EGR valve commanded position to determine if EGR flow is present.

5. The monitor checks for the differential pressure feedback EGR sensor for opens and shorts. The differential pressure feedback EGR sensor hoses are tested for connection and restriction at idle. The PCM commands the EGR valve closed and the monitor tests for the differential pressure feedback EGR sensor to indicate no flow is present. The PCM commands the EGR valve open and the monitor tests the differential pressure feedback EGR sensor voltage to indicate flow is present. The stop start option on some vehicles requires the hose tests to run during off idle conditions.

6. The intake manifold pressure is higher when the EGR is flowing than when it is not flowing. When the exhaust gas is delivered into the intake manifold, the MAP sensor reading increases.

7. The exhaust manifold provides a source of exhaust gas to the EGR cooler, EGR orifice tube and EGR valve.

8. The EGR cooler (if equipped) is monitored by comparing the EGRT12 and EP sensors calibrated value to the actual EGRT12 and EP sensor values. Under cooling and over cooling conditions are monitored.



Typical Differential Pressure Feedback EGR System