Exhaust Catalyst And Exhaust System

Overview

The exhaust catalyst and exhaust system consists of the following components. For additional component information, refer to Engine Control Components in this section.

- Exhaust gas temperature (EGT) sensors that measure the exhaust gas temperature.
- An oxidation catalytic converter (OC) that reduces emissions and assists in diesel particulate filter regeneration.
- A selective catalytic reduction (SCR) catalyst that chemically reduces nitrogen oxides (NOx) to nitrogen (N_2) and water (H_2O).
- A reductant injector that sprays diesel exhaust fluid (DEF) into the exhaust system as a component of the NOx reduction reaction.
- A diesel particulate filter pressure sensor measures the gauge pressure of the exhaust gas before the diesel particulate filter.
- A diesel particulate filter that traps soot and ash particulates.
- A particulate matter (PM) sensor that monitors soot levels downstream of the diesel particulate filter.
- Two NOx sensors that detect levels of NOx in the exhaust stream, to monitor SCR efficiency.

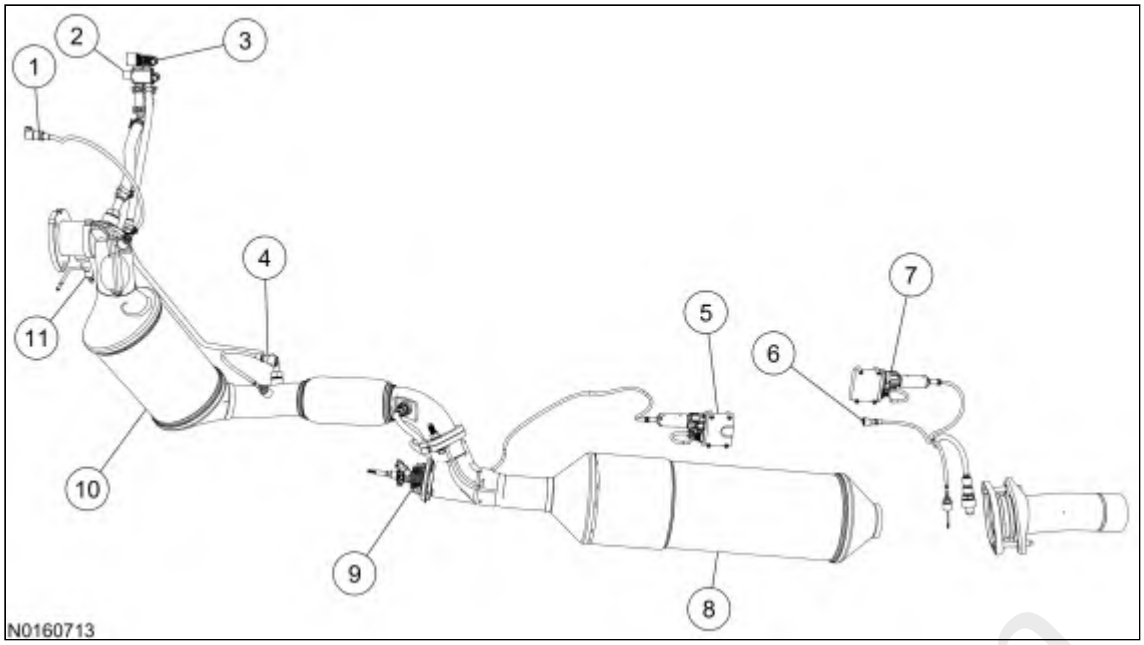
The purpose of the exhaust catalyst and exhaust system is to convey the exhaust gas from the engine to the atmosphere and reduce the tail pipe emissions of hydrocarbon (HC), carbon monoxide (CO), nitrogen oxides (NOx) and diesel particulates. The diesel particulates, soot and ash, are captured and periodically reduced by the diesel particulate filter regeneration cycle.

The exhaust gas and particulates are directed away from the engine through the exhaust manifold. The exhaust gas concentrations are then reduced to acceptable levels as the exhaust gas passes through the oxidation catalytic converter (OC). Since the particulates are components of the exhaust gas, some soot particulates may deposit on the OC. These particulates are removed during regeneration. The reduced emissions exhaust gas and particulates continue to the selective catalytic reduction (SCR) catalyst. As the exhaust gas enters the SCR catalyst, diesel exhaust fluid (DEF) is mixed into the stream and thermally decomposes to ammonia and carbon dioxide. The ammonia and NOx component of the exhaust gas are chemically reduced to nitrogen and water and the exhaust gas and particulates continue to the diesel particulate filter. In the diesel particulate filter, the exhaust gas and particulates flow through the channels of substrate filter. The channels of the substrate filter are alternately blocked, so the exhaust gas and particulates are forced to pass through the filter medium and into the adjoining channels to exit the filter. As the exhaust gas passes through the filter medium, any particulates larger than the pores of the filter are removed from the flow of exhaust gas and trapped for diesel particulate filter regeneration. The reduced emissions exhaust gas and any remaining particulates flow through the muffler and tail pipe into the atmosphere.

Diesel Particulate Filter Regeneration — Transit

The diesel particulate filter regeneration occurs during normal vehicle operation. The PCM may regenerate the diesel particulate filter at idle. During the diesel particulate filter regeneration, fuel is injected and combusted in the exhaust system by the fuel vaporizer system. The temperature of the exhaust gas increases to greater than 550°C (1,022°F) at the OC and diesel particulate filter. At this temperature soot burns. Soot particulates that may have accumulated in the diesel particulate filter are burned and the ash is trapped in the diesel particulate filter. The ash particulates that remain in the diesel particulate filter are mainly comprised of metallic compounds generated during combustion and from corrosion in the exhaust system.

Exhaust System (Transit)

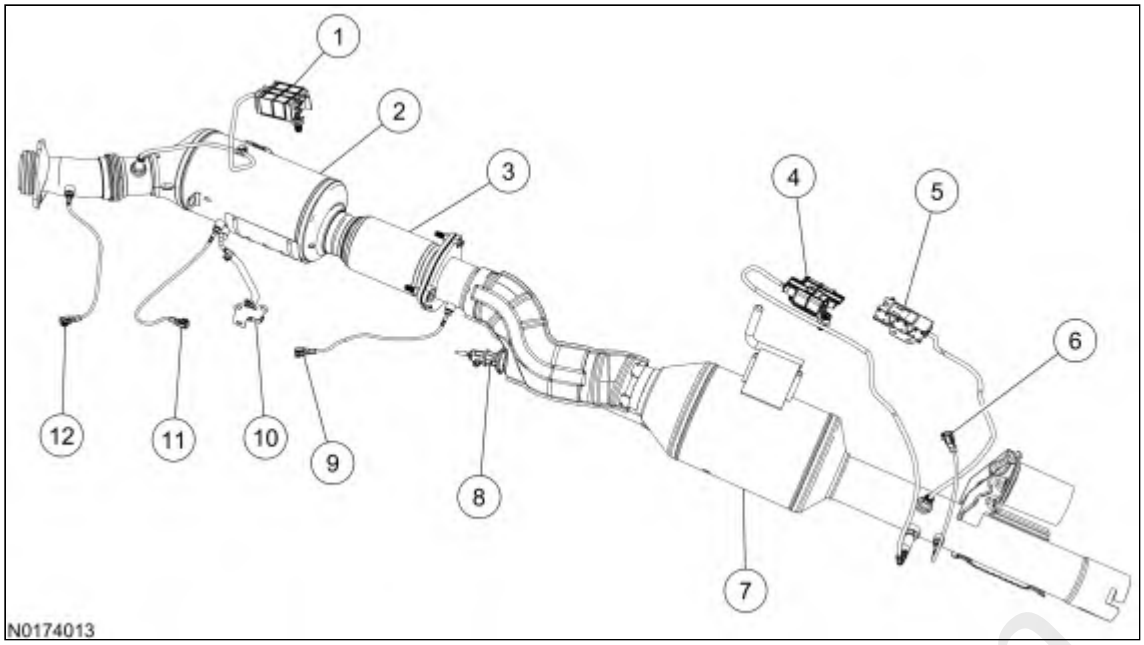


Item	Number	Description
1	—	Exhaust Gas Temperature Bank 1, Sensor 1 (EGT11)
2	—	Diesel Particulate Filter Pressure Bank 1, Sensor 2 (DPFP12)
3	—	Diesel Particulate Filter Pressure Bank 1, Sensor 1 (DPFP12)
4	—	Exhaust Gas Temperature Bank 1, Sensor 2 (EGT12)
5	—	Nitrogen Oxides Bank 1, Sensor 1 (NOx11)
6	—	Exhaust Gas Temperature Bank 1, Sensor 3 (EGT13)
7	—	Nitrogen Oxides Bank 1, Sensor 2 (NOx12)
8	—	Selective Catalytic Reduction (SCR) Catalyst
9	—	Reductant Injector
10	—	Diesel Particulate Filter
11	—	Fuel Vaporizer System Glow Plug

Diesel Particulate Filter Regeneration — All Others

The diesel particulate filter regeneration occurs during normal vehicle operation. The PCM may regenerate the diesel particulate filter at idle. During the diesel particulate filter regeneration, fuel is injected into the cylinder after the main combustion. The extra fuel increases the temperature of the exhaust gas and lights-off the OC. The temperature of the exhaust gas increases to greater than 550°C (1,022°F) at the OC and diesel particulate filter. At this temperature soot burns. Soot particulates that may have accumulated on the OC or in the diesel particulate filter are burned and the ash is trapped in the diesel particulate filter. The ash particulates that remain in the diesel particulate filter are mainly comprised of metallic compounds generated during combustion and from corrosion in the exhaust system.

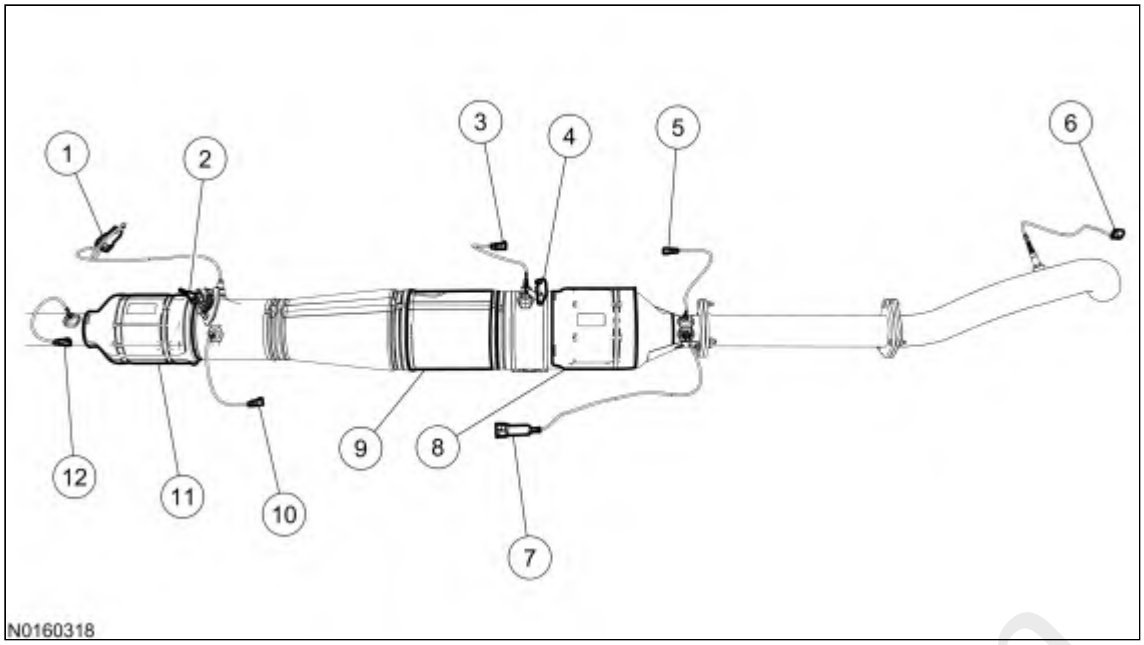
Exhaust System (F-150)



Item	Number	Description
1	—	Nitrogen Oxides Bank 1, Sensor 1 (NOx11)
2	—	Oxidation Catalytic Converter (OC)
3	—	Diesel Particulate Filter
4	—	Particulate Matter Bank 1, Sensor 1 (PM11)
5	—	Nitrogen Oxides Bank 1, Sensor 2 (NOx12)
6	—	Exhaust Gas Temperature Bank 1, Sensor 4 (EGT14)
7	—	Selective Catalytic Reduction (SCR) Catalyst
8	—	Reductant Injector
9	—	Exhaust Gas Temperature Bank 1, Sensor 3 (EGT13)
10	—	Exhaust Pressure Sensor
11	—	Exhaust Gas Temperature Bank 1, Sensor 2 (EGT12)
12	—	Exhaust Gas Temperature Bank 1, Sensor 1 (EGT11)

Typical Exhaust System (All Others)

Note: *F-Series Super Duty wide frame system shown. For F-650 / F-750 and F-Series Super Duty narrow frame applications, the locations of the SCR catalyst and the diesel particulate filter are switched.*



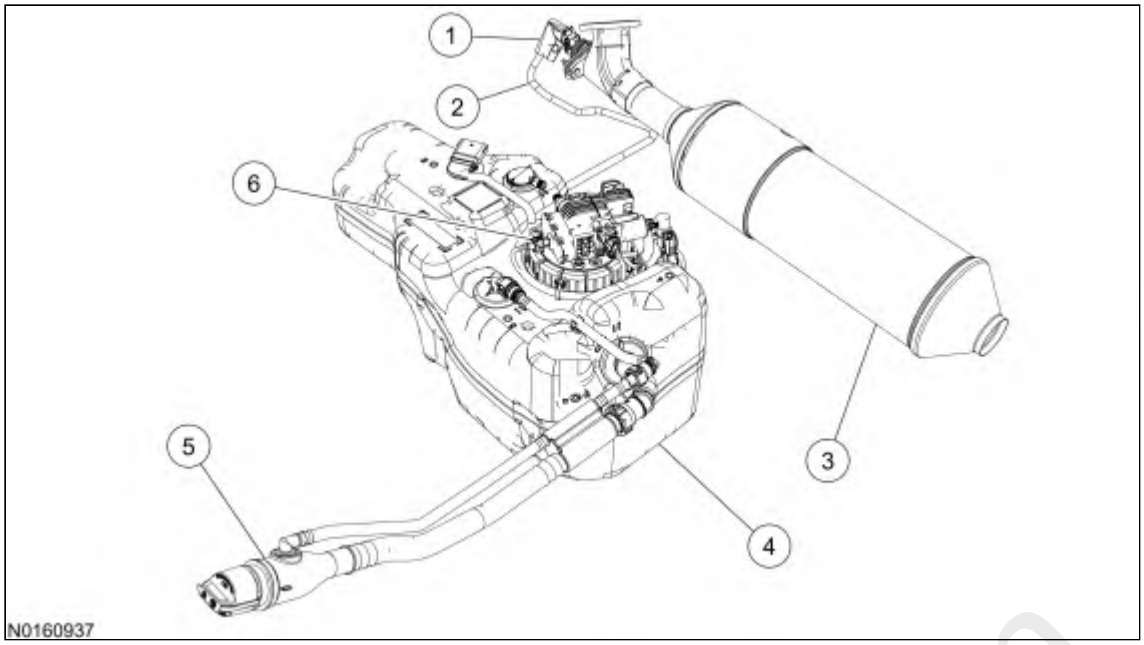
Item	Number	Description
1	—	Nitrogen Oxides Bank 1, Sensor 1 (NOx11)
2	—	Reductant Injector
3	—	Exhaust Gas Temperature Bank 1, Sensor 3 (EGT13)
4	—	Diesel Particulate Filter Pressure Bank 1, Sensor 1 (DPFP11)
5	—	Exhaust Gas Temperature Bank 1, Sensor 4 (EGT14)
6	—	Particulate Matter Bank 1, Sensor 1 (PM11)
7	—	Nitrogen Oxides Bank 1, Sensor 2 (NOx12)
8	—	Diesel Particulate Filter
9	—	Selective Catalytic Reduction (SCR) Catalyst
10	—	Exhaust Gas Temperature Bank 1, Sensor 2 (EGT12)
11	—	Oxidation Catalytic Converter (OC)
12	—	Exhaust Gas Temperature Bank 1, Sensor 1 (EGT11)

Selective Catalytic Reduction (SCR) System

Selective Catalytic Reduction (SCR) System — Transit

The SCR system reduces nitrogen oxides (NOx) in the exhaust stream by a chemical reduction process using the SCR catalyst and a reductant injection system that introduces diesel exhaust fluid (DEF) into the exhaust system upstream of the SCR catalyst. The reductant injection system is directly controlled and monitored by the reductant dosage control module. For additional information on the SCR system components, refer to Engine Control Components in this section.

SCR System (Transit)

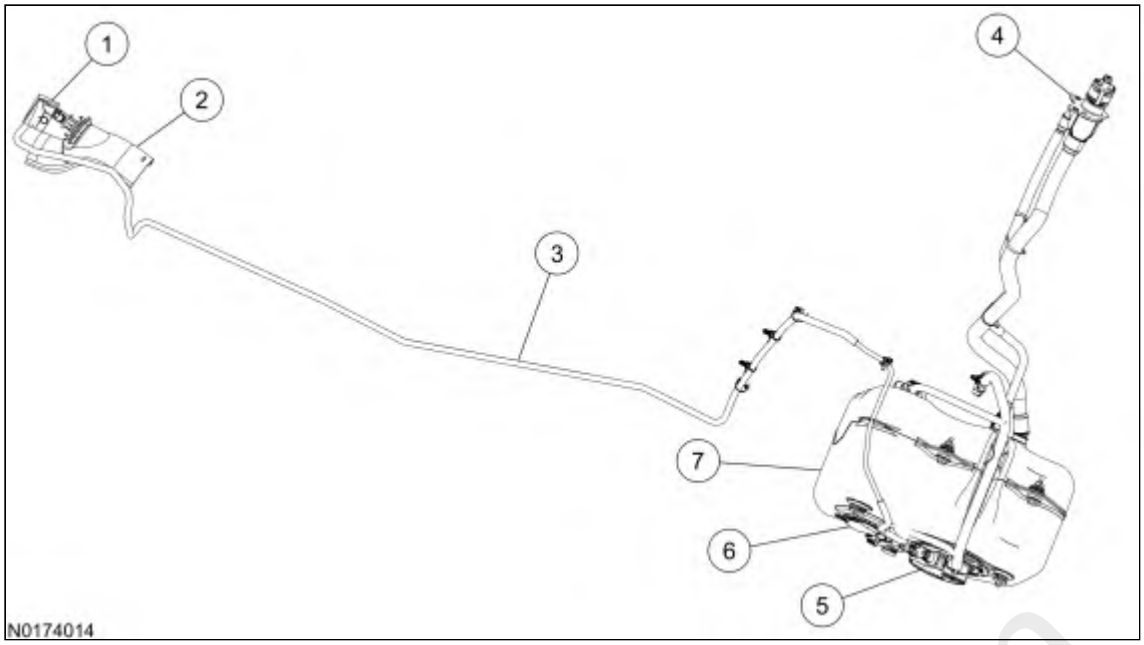


Item	Number	Description
1	—	Reductant Injector
2	—	Reductant Pressure Line
3	—	SCR Catalyst
4	—	Reductant Tank
5	—	Reductant Tank Filler Hose
6	—	Reductant Pump Assembly

Selective Catalytic Reduction (SCR) System — All Others

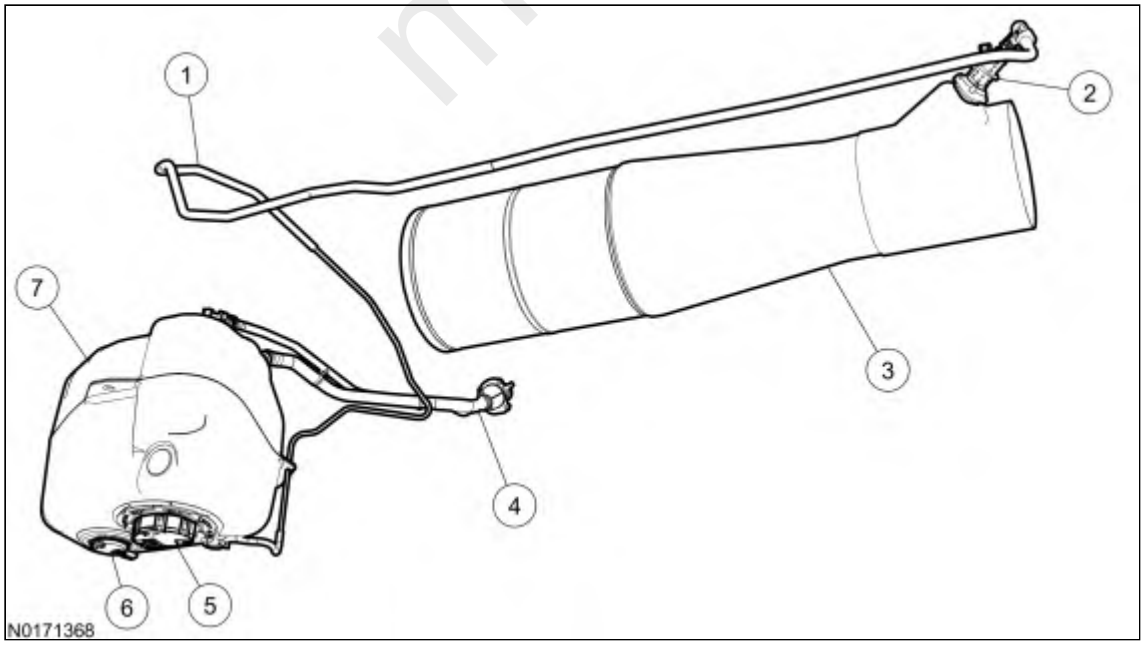
The SCR system reduces nitrogen oxides (NOx) in the exhaust stream by a chemical reduction process using the SCR catalyst and a reductant injection system that introduces diesel exhaust fluid (DEF) into the exhaust system upstream of the SCR catalyst. The reductant injection system is directly controlled and monitored by the PCM. For additional information on the SCR system components, refer to Engine Control Components in this section.

SCR System (F-150)



Item	Number	Description
1	—	Reductant Injector
2	—	SCR Catalyst
3	—	Reductant Pressure Line
4	—	Reductant Tank Filler Hose
5	—	Reductant Pump Assembly
6	—	Reductant Quality Module
7	—	Reductant Tank

Typical SCR System (All Others)



Item	Number	Description

1	—	Reductant Pressure Line
2	—	Reductant Injector
3	—	SCR Catalyst
4	—	Reductant Tank Filler Hose
5	—	Reductant Pump Assembly
6	—	Reductant Level Sensor
7	—	Reductant Tank