Aftertreatment System

2.1 Aftertreatment System Overview

2.1.1 Aftertreatment Variances

1-BOX™ Aftertreatment System

1. Selective Catalytic Reduction (SCR) Inlet NOx Sensor
2. Exhaust Inlet
3. Diesel Particulate Filter (DPF) Outlet Temperature Sensor
4. Diesel Exhaust Fluid (DEF) Dosing Unit
5. Selective Catalytic Reduction (SCR) Outlet Temperature Sensor
6. Selective Catalytic Reduction (SCR) Outlet NOx Sensor
7. Exhaust Outlet
8. Soot Sensor
9. Aftertreatment Control Module (ACM)
10. Diesel Oxidation Catalyst (DOC) Inlet Temperature Sensor
11. Diesel Oxidation Catalyst (DOC) Inlet Pressure Sensor
12. Diesel Oxidation Catalyst (DOC) Outlet Temperature Sensor
13. Diesel Particulate Filter (DPF) Outlet Pressure Sensor

2.1.2 Description and Operation of the Diesel Oxidation Catalyst

The Diesel Oxidation Catalyst (DOC) assists in elevating temperatures into the Diesel Particulate Filter (DPF) to
initiate the regeneration process. Fuel is injected into the exhaust by the fuel dosing system. The injected fuel is oxidized in the Diesel Oxidation Catalyst (DOC) which raises the temperatures above passive mode operating temperatures (up to 580°C (1076°F)).

**2.1.3 Description and Operation of the Diesel Particulate Filter**

The Diesel Particulate Filter (DPF) substrate is comprised of a ceramic material. The substrate consists of channels that run the full length and are blocked off at alternate ends to force the exhaust through the porous walls. As the DPF collects ash and soot and the exhaust temperature reaches the appropriate level, oxidation of the soot occurs. This process is called Regeneration.

The key to a successful regeneration is elevated exhaust temperatures for extended periods of time. This is achieved automatically by the engine electronic system while being driven over the road. Without adequate exhaust temperatures for regeneration, the filter will become saturated with soot and a parked regeneration will be requested. If the driver ignores this request and continues driving, the engine electronic system will initiate a derate and eventually will shut down the engine, therefore requiring a parked regeneration to continue driving. In cases where the DPF regen zone reaches zone 4, a parked regen is required. *Refer to section “Performing a Parked Regeneration”.*
2.1.4 Description and Operation of the Selective Catalytic Reduction (SCR) Catalyst

The Selective Catalytic Reduction (SCR) catalyst converts a mixture of nitrogen oxides and Diesel Exhaust Fluid (DEF) into nitrogen and water. DEF is pressurized by a pump and is then sprayed into the exhaust between the Diesel Oxidation Catalyst (DOC) / Diesel Particulate Filter (DPF) and the SCR catalysts within the DEF hydrolysis chamber.
2.1.5 Description and Operation of the Diesel Exhaust Fluid Flow

Diesel Exhaust Fluid (DEF) is stored in the onboard DEF tank manufactured by the vehicle Original Equipment Manufacturer (OEM). DEF is pulled through the DEF tank header to the DEF pump. DEF is then pumped to the dosing unit and is injected into the aftertreatment. DEF circulates back to the DEF tank from the dosing unit.

1. Diesel Oxidation Catalyst (DOC)
2. Diesel Particulate Filter (DPF)
3. DEF Hydrolysis Chamber
4. Selective Catalytic Reduction (SCR)
2.1.6 Description and Operation of the Diesel Exhaust Fluid Heating

Diesel Exhaust Fluid (DEF) is fluid that can freeze and must be heated in cold ambient conditions. The DEF tank (1) and DEF pump module (2) use coolant from the engine to heat the DEF. Coolant flows from the engine through the coolant hose (3) to the coolant valve (6). The coolant valve solenoid is controlled by the ACM. The ACM regulates coolant flow to thaw and maintain temperatures above the DEF freezing point of minus 11°C (12°F). From the coolant valve, the coolant flows through the DEF tank header (4) into the DEF tank. Coolant flows out of the DEF tank through the coolant hose to the DEF pump module. From the DEF pump module, coolant flows back to the engine (5).