## General Description

The Environmental Protection Agency (EPA) mandated that all engines built after December 31, 2009 must reduce the level of emissions exhausted by the engine to 0.2 grams per brake horsepower hour (g/bhp-hr) of nitrogen oxides (NOx).

To meet the EPA10 and newer requirements, Daimler Trucks North America is using technology known as Selective Catalytic Reduction (SCR) in the exhaust aftertreatment system (ATS). See **Fig. 1**.

The SCR process requires the introduction of diesel exhaust fluid (DEF) into the exhaust stream. DEF is colorless, non-toxic, and biodegradable. In the ATS, the exhaust gases pass through the ATD, then are treated with precisely-controlled quantities of DEF, and then pass into the SCR catalyst. DEF consumption is dependent on ambient conditions and vehicle operation.

DEF is drawn from the tank by the DEF pump. The DEF is then filtered and, from the pump, transported through the DEF lines to the metering unit. The metering unit measures the correct amount of DEF, which is then injected into the hot exhaust flow after exhaust gases have passed through the ATD. In the presence of heat, DEF is converted to ammonia gas, which reacts with NOx in the selective catalyst chamber to yield harmless nitrogen and water vapor, which exit out the tailpipe.

DEF causes mild discoloration to aluminum, but will not affect its strength or structure. White crystals may be noticeable around components that come into contact with DEF. The crystals can be easily removed using water.

DEF freezes to a slush consistency at 12°F (-11°C). Because DEF can freeze, the DEF lines and metering unit are designed to purge whenever the engine is shut down to prevent damage. Complete purging of the DEF lines requires approximately five minutes after the engine is shut down.

DEF in the tank is allowed to freeze while the vehicle is non-operational. The DEF temperature sensor detects when the temperature of the DEF in the tank is approaching its freezing point. After the engine has been started and the engine coolant reaches a certain temperature, the coolant valve opens, allowing the coolant to flow through the coolant lines inside the DEF tank. The lines transfer heat, causing any frozen DEF in the tank to thaw and preventing liquid DEF from freezing during operation in cold weather. After flowing through the tank, the coolant is redirected back to the engine.

DEF will degrade over an extended period of time; shelf life is between twelve and eighteen months in standard operating conditions and temperatures. As DEF begins to degrade, it is usable but may be consumed at a slightly higher rate than normal.

A minor engine derate (approximately 25%) will occur when the DEF level registers below 5% on vehicles with Detroit Diesel engines, or 2.5% on vehicles with Cummins engines. If the DEF tank is empty, a major engine derate (vehicle speed is limited to 5 mph) will occur after an engine shut down and restart if the diesel tank has been refueled and the DEF tank is not refilled.

There are also safety controls that derate the engine if a contaminant has been introduced into the DEF tank. When a contaminant is detected, a minor engine derate will occur. When the vehicle has operated for 20 hours or 1000 miles with a contaminated tank, the vehicle will experience a major engine derate once the system determines that the vehicle is in a safe situation. Once the DEF tank has been filled with clean DEF, engine performance will return to normal.

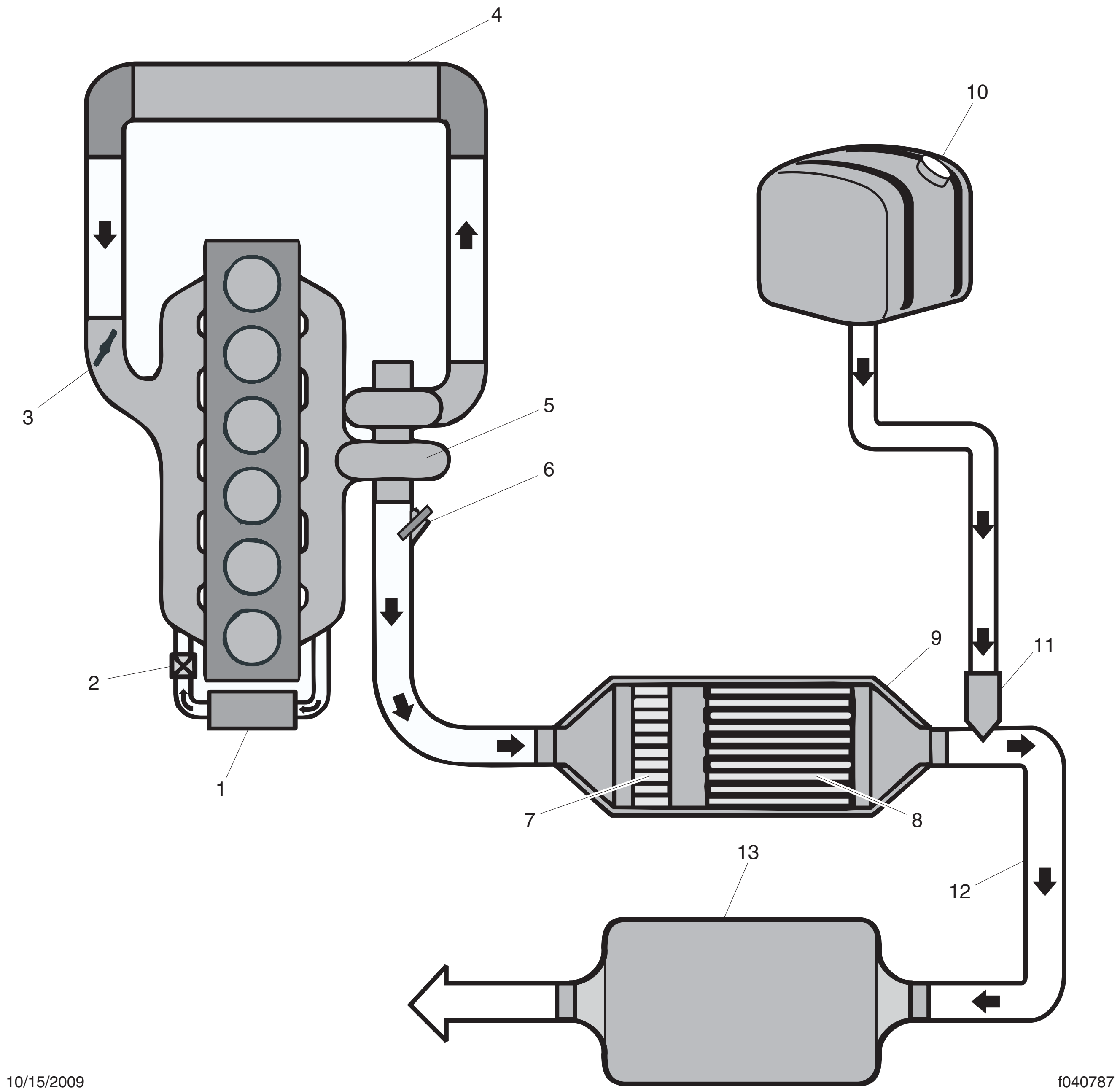
DTNA-covered components of the DEF system include the DEF tank, tank header unit, pump, and coolant, DEF, and air lines between these components. See the engine manufacturer's service literature for information regarding other DEF system components such as the metering unit and injector, and DEF system maintenance instructions and intervals.

For additional operating information, see the *Business Class M2 Driver's Manual*.

For additional information on and definitions for EPA10-compliant systems and components, see **Section 01.02**, EPA07/EPA10 Engine Information.

For additional information on the ATS, see **Section 49.02**, Aftertreatment System, EPA10.

## General Information




1. Exhaust Gas Recirculation (EGR) Cooler
2. EGR Valve
3. Intake Throttle Valve
4. Charge Air Cooler (CAC)
5. Turbocharger
6. Hydrocarbon Doser
7. Diesel Oxidation Catalyst (DOC)
8. Diesel Particulate Filter (DPF)
9. Aftertreatment Device (ATD)
10. DEF Tank
11. DEF Injector
12. Mixing Tube
13. SCR Catalyst Chamber

**Fig. 1, EPA10 Aftertreatment System**