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Service

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Non-Catalyzed Diesel Particulate Filter (DPF)

M-254-001

June 2022

Valid for

All LEU & MRU Models with a MP7 and Non-Catalyzed DPF

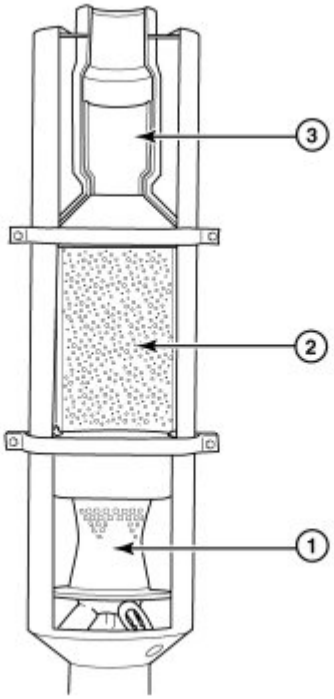
Case description

MACK LEU and MRU models equipped with MP7 engines, utilize a non-catalyzed Diesel Particulate Filter (DPF) to meet the stringent US07 emission standards. This DPF system mounts to the stanchion behind the cab and filters exhaust particulate matter, then regenerates it at a high temperature into carbon dioxide, water vapor and ash.

DESIGN, FUNCTION AND OPERATION

MACK Non-Catalyzed DPF — defined as a diesel particulate trap. Exhaust soot is trapped within the non-catalyzed (non-coated) ceramic filter elements, and regenerated actively at a high temperature generated in the DPF thermal regenerator. Soot is actually composed of carbon from the engine combustion process, and also oil particles from the cylinder walls. The carbon portion of the soot is completely oxidized, but some components of the soot remain as ash. Ash which accumulates in the filter must be cleaned at the intervals specified in the Maintenance and Lubrication Manual, TS494. The DPF system is composed of the following three major components:

Thermal Regenerator (combustion chamber) — Area where air/fuel mixture is injected and ignited during the regeneration process to generate the high temperature necessary for reducing the combustion soot to ash.
Diesel Particulate Filter — Where exhaust combustion particulates are trapped.
Outlet Module — Serves as the exhaust outlet for the DPF system. Incorporates a rain guard to prevent water from entering the particulate filter.



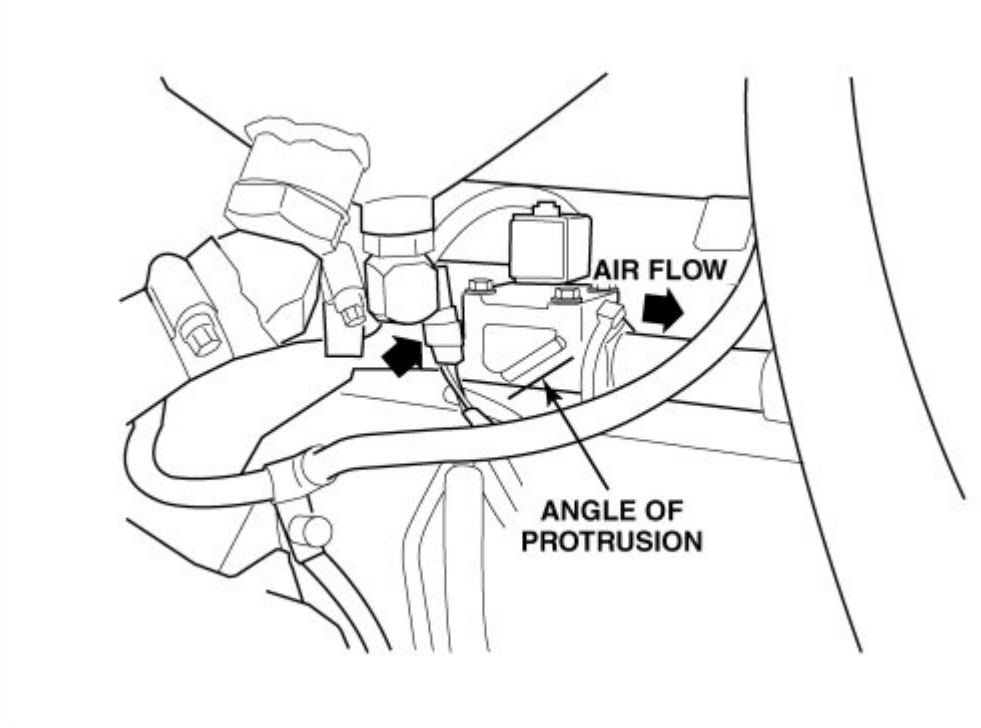
Concept View of Diesel Particulate Filter

1. Thermal Regenerator (Combustion Chamber)	3. Outlet Module
2 .Particulate Filter	

Particulate matter from the engine exhaust collects in the particulate filter. When a certain parameter (such as time, fuel used or exhaust back-pressure) is reached, an air/fuel mixture is injected into the combustion chamber and ignited to raise the temperature inside the DPF unit. The elevated temperature oxidizes the particulate matter into carbon dioxide, water and ash. This process is known as active regeneration.
When active regeneration occurs, a mixture of diesel fuel and high-pressure air is injected into the exhaust stream at the DPF combustion chamber. This air/fuel mixture is blended in the air atomization module and then injected into the thermal regenerator through an injection nozzle. Additional air is added to the combustion chamber, and the mixture is then ignited and the temperature inside the DPF raises significantly (up to the oxidation level) to oxidize the soot trapped inside the particulate filter. This active regeneration takes about 20–25 minutes and consumes approximately two liters of fuel.
The DPF system control module automatically activates regeneration upon commands received from the engine ECU where preset triggers (based on parameters such as time, fuel used or exhaust back-pressure) are monitored.

Combustion Air Solenoid

The combustion air solenoid valve allows a flow of boost-pressure air to the DPF thermal regenerator so that proper combustion can take place. DPF regeneration will not take place if the combustion air solenoid valve is installed backwards. The easiest method of determining proper valve orientation is by looking at the protrusion on the side of the valve body. The protrusion on the side of the valve body forms a 45-degree angle with the horizontal centerline of the valve body. The opened end of the 45-degree angle should be facing the rear of the chassis.

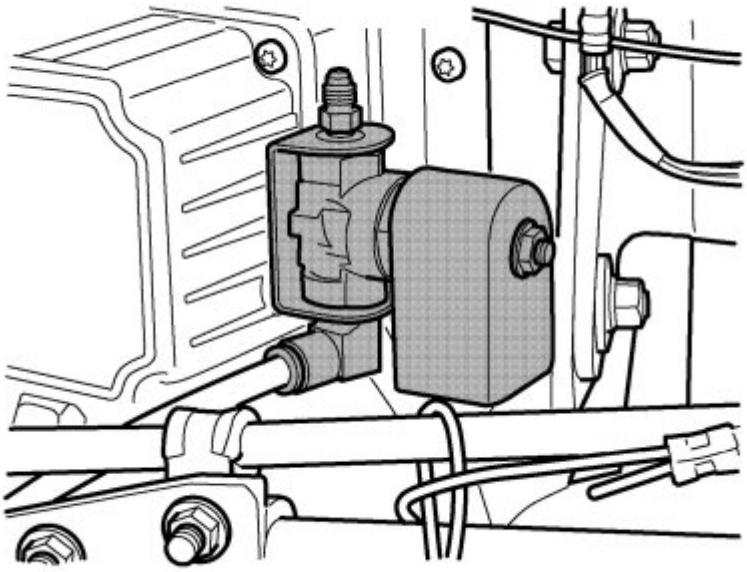


Combustion Air Solenoid Valve (Located on Left-Hand Side of Engine)

Supplemental Air Valve

In addition to the combustion air solenoid valve, a supplemental air valve is used to direct a burst of chassis air, up to 10 seconds in duration, from the secondary air system to the DPF thermal regenerator to ensure proper ignition of the

air fuel mixture at the beginning of a regeneration cycle. The valve is located at the bottom of the DPF unit, and connects to the combustion air line by a T-fitting.

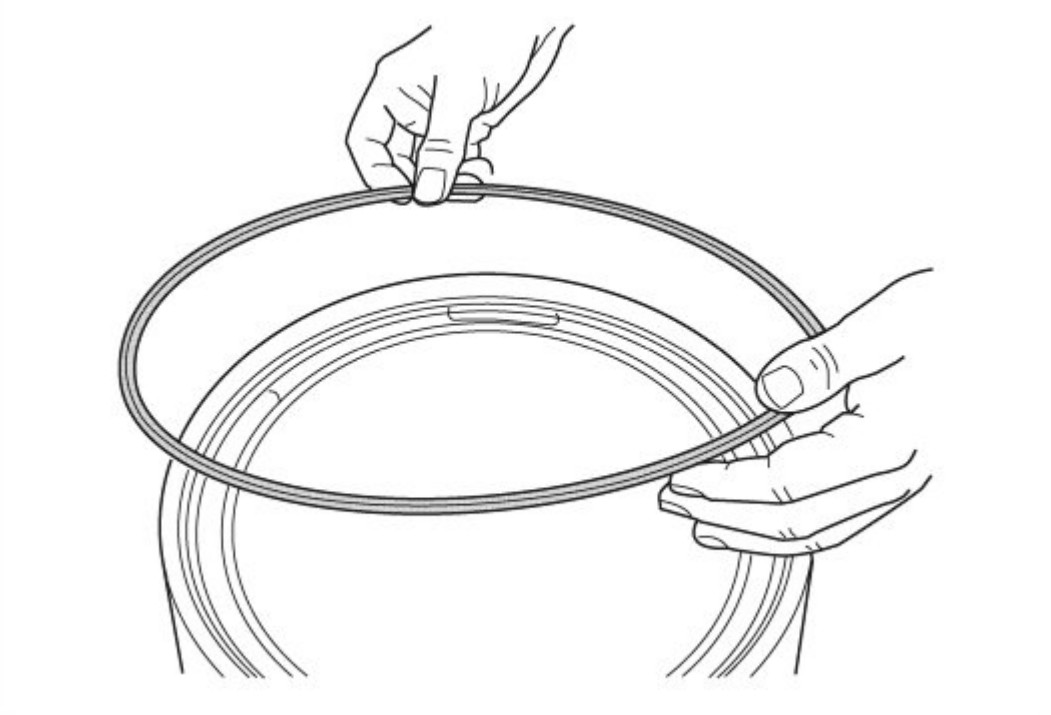


Supplemental Air Valve

DPF Module Gaskets

Non-catalyzed DPF units consist of three body sections (outlet module, particulate filter and thermal regenerator) which are retained together by two V-band clamps with a gasket (part No. 21048511) between each section. Should it be necessary to separate the sections for service or repair, the gaskets must be replaced with the most current design.

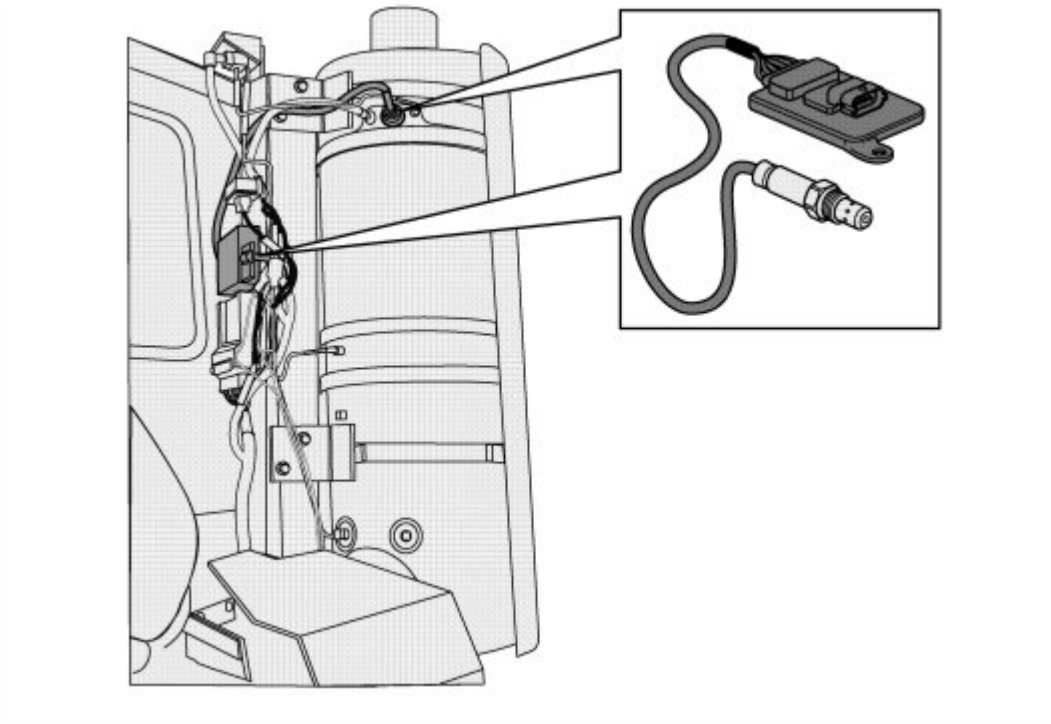
Note: Certain early non-catalyzed DPF units (manufactured by ArvinMeritor™) consisted of four body sections (outlet module, filter module, mixer and thermal regenerator) retained together by three V-band clamps. These units utilize gasket part No. 85111358. The gaskets used on these early DPF units are NOT interchangeable with the gaskets used on the later units.



DPF Section Gasket (Part No. 21048511)

NOx Sensor

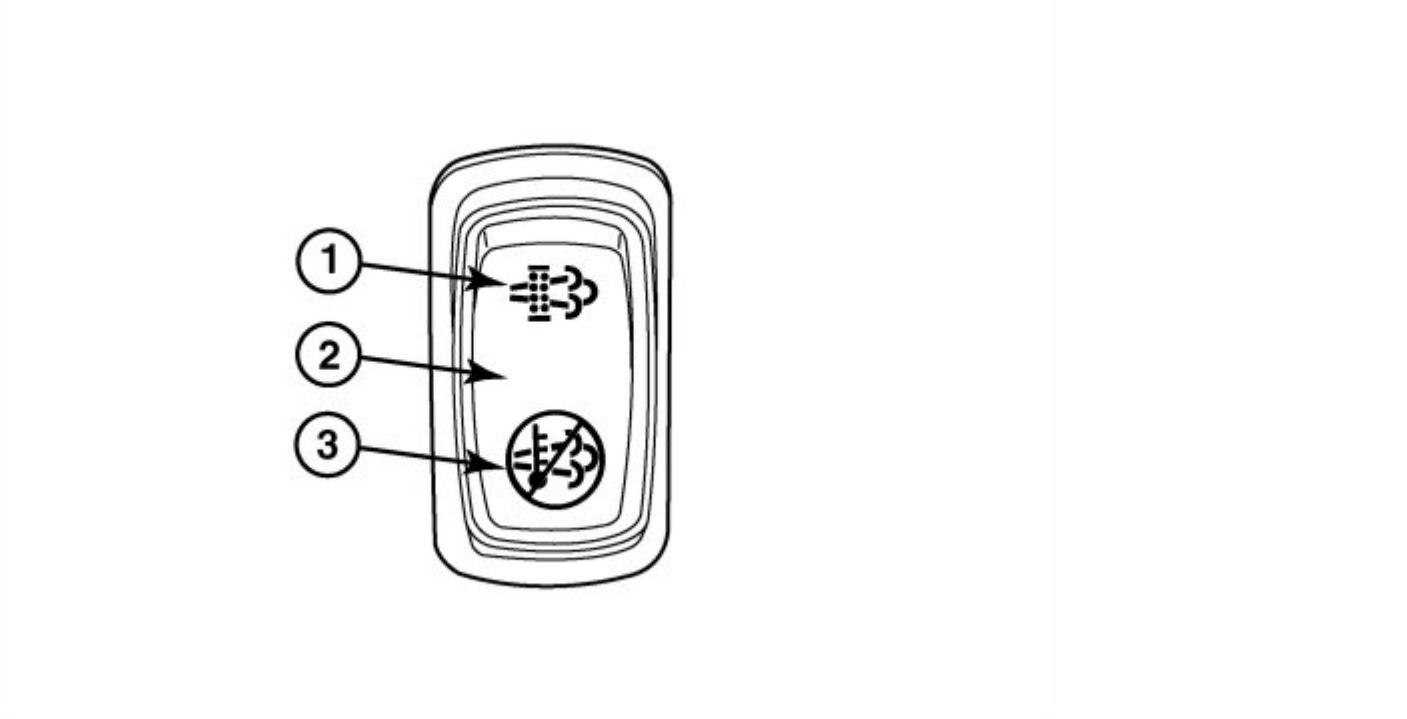
A NOx sensor (part No. 21069361) is located on the DPF housing, between the temperature sensor and the pressure tube on the outlet housing. This sensor measures the NOx content of the engine exhaust as it exits the particulate filter, and the data is then transmitted to the Engine Management System (EMS) over the CAN 2 line. Although the NOx sensor is mounted to the DPF outlet housing and shares the DPF harness, it is not a part of the exhaust aftertreatment system and does not report any data to the DPF control module.



NOx Sensor Location

DPF SMART SWITCH

The DPF Smart Switch, which allows the operator to interface with the DPF system, is a three-position rocker switch where UP is momentary and initiates manual regeneration, MIDDLE is the automatic regeneration mode and DOWN stops (or inhibits) regeneration. The Smart Switch must be in the MIDDLE position for automatic regeneration to occur, but the vehicle operator has the ability to stop (or inhibit) regeneration (by pushing the switch DOWN) until a later time if the vehicle is in a location where regeneration may present a hazard. The driver can also choose to activate a manual regeneration by momentarily pressing the top of the switch, if the top icon on the switch is illuminated and certain other pre-conditions are met. A summary of DPF Smart Switch functions are as follows:



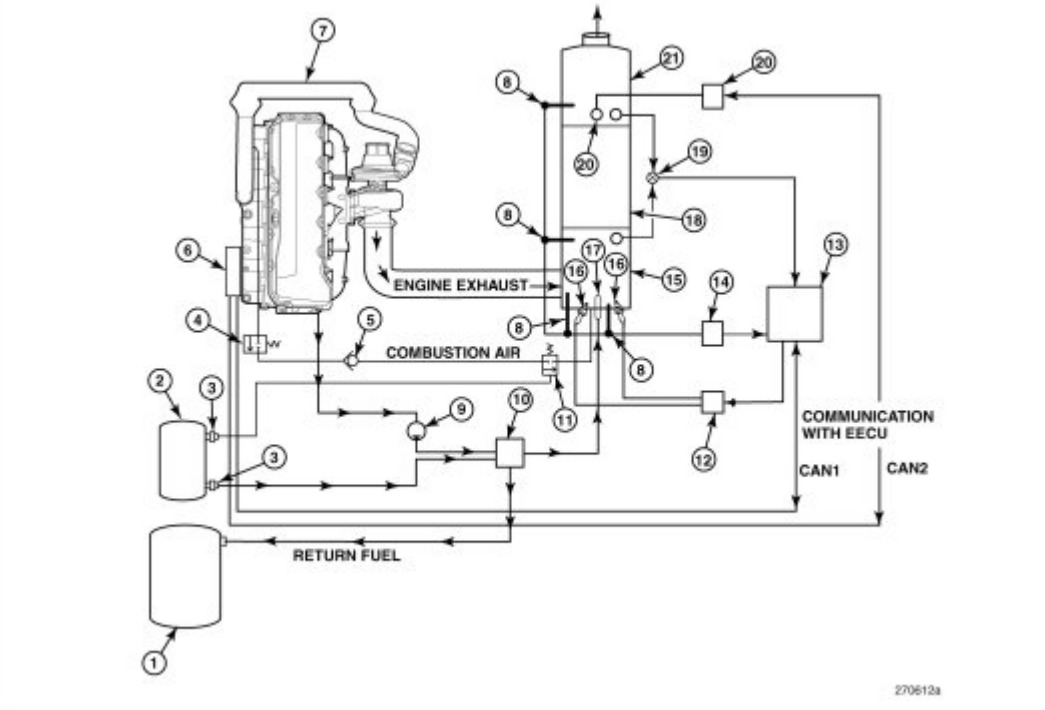
DPF Smart Switch

- TOP position — Indicates that regeneration is required when the top icon is illuminated. Momentarily pressing the top of the switch initiates a manual regeneration.
- MIDDLE position — Automatic regeneration mode. Regenerations occur as required when the switch is in this position.
- DOWN Position — When the switch is pressed and locked in the DOWN position, regeneration is stopped (or inhibited). The bottom icon illuminates, indicating that regeneration has been stopped (or inhibited). If the switch remains in the DOWN position, the system will NOT regenerate, and regenerations will not occur until the switch is moved to the MIDDLE (automatic mode) position, or the top of the switch is momentarily pressed to initiate a manual regeneration.

MANUFACTURERS OF THE MACK NON-CATALYZED DPF

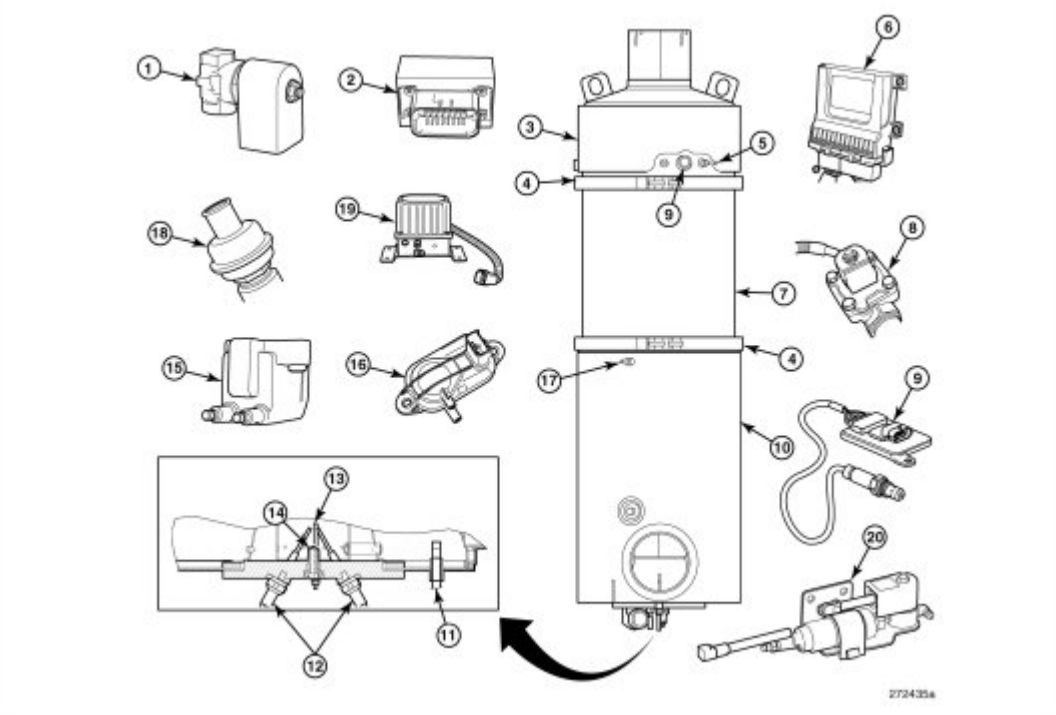
The original manufacturer of the non-catalyzed DPF was ArvinMeritor™ Emission Technologies Group. The Emission Technologies Group of ArvinMeritor™, however, was later acquired by EMCON Technologies. The original units produced by ArvinMeritor™ and all subsequent units produced by EMCON Technologies are very similar. For additional information on EMCON Technologies, and for service information concerning this system, visit the EMCON website at www.emcontechnologies.com.

MACK NON-CATALYZED DPF — COMPONENTS



DPF System Schematic Diagram

1. Fuel Tank	12. Ignition Coil
2. Secondary Reservoir	13. DPF Control Module
3. Pressure Protection Valve	14. Cold Junction Block (CJB)
4. Combustion Air Solenoid Valve	15. Thermal Regenerator (Combustion Chamber)
5. Combustion Air Check Valve	16. Ignition Electrodes
6. Engine Electronic Control Unit (EECU)	17. Nozzle
7. Charge Air Cooler	18. Particulate Filter
8. Temperature Sensor	19. Differential Pressure Sensor
9. Fuel Pump/Fuel Shut-Off Valve — Thermal Regenerator System	20. NOx Sensor /Module Assembly
10. Air/Fuel Atomization Module (AAM)	21. Outlet Module
11. Supplemental Air Valve	



DPF System Exploded View

1. Supplemental Air Valve	11. Exhaust Temperature Thermocouple
2. Cold Junction Block	12. Ignition Electrodes
3. Outlet Module	13. Flame Temperature Thermocouple
4. V-Band Clamps	14. Nozzle
5. Filter Outlet Thermocouple	15. Ignition Coil
6. DPF Control Module	16. Differential Pressure Sensor
7. Particulate Filter	17. Filter Inlet Thermocouple
8. Combustion Air Solenoid	18. Combustion Air Check Valve
9. NOx Sensor/Module Assembly	19. Air/Fuel Atomization Module
10. Thermal Regenerator (Combustion Chamber)	20. Fuel Pump/Fuel Shut-Off Valve Assembly

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