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Welcome to the International® 2007 MaxxForce™ Aftertreatment Web Based Training Course. The objective of this program is to provide you with specific information about the Aftertreatment (AFT) system used on the 2007 mid-range diesel MaxxForce™ engines.

To receive credit for completing this training course, you must take a post test on ISIS®/Education/Service/Online Testing.

Objectives

Upon Completion of this program, you will be able to:

- Identify AFT component locations
- Recall AFT system operation
- Utilize AFT system functions
- Perform AFT Diagnostic Procedures
Aftertreatment System

Overview

MaxxForce™ engines require an Aftertreatment system to reduce the amount of particulate matter in the engine exhaust to meet the 2007 emissions standards.

The Aftertreatment system is made up of a Diesel Oxydation Catalyst (DOC), Diesel Particulate Filter (DPF), Exhaust Gas Temperature (EGT) sensors, and an Exhaust Gas Differential Pressure sensor.

Both the DOC and DPF are constructed of ceramic materials with a wash coat of precious metals.

Components

The Aftertreatment system consists of the Fuel Injector, Intake Throttle Valve (ITV), Exhaust Gas Temperature (EGT) Sensor, Exhaust Gas Differential Pressure (EGDP) Sensor, Diesel Particulate Filter (DPF), and the Diesel Oxydation Catalyst (DOC).

Fuel Injector

During the active regeneration process,
the ECM commands the injectors to add fuel to the cylinder during the exhaust stroke. This causes a very rich mixture to pass through the AFT system, which fuels the catalyst and produces high amounts of heat in the DOC and DPF, causing soot particles to be reduced.

**Intake Throttle Valve (ITV)**

The Intake Throttle Valve (ITV) is installed on the air intake between the air filter housing and the Exhaust Gas Recirculation (EGR) mixer. The ITV is used to control the air/fuel mixture during a Regen process of the Aftertreatment system. The ITV is common for all medium duty MaxxForce engines.

**Exhaust Gas Temperature (EGT) Sensor**

The Exhaust Gas Temperature (EGT) Sensors are inserted into the exhaust system just in front of the Diesel Oxidation Catalyst (DOC) (sensor 1) and immediately before and just after the Diesel Particulate Filter (DPF) (sensors 2 and 3).

These sensors produce an electronic signal based on temperature. The signals are sent to the Engine Control
Module (ECM) and are used to regulate the Aftertreatment function.

**Exhaust Gas Differential Pressure (EGDP) Sensor**

The Exhaust Gas Differential Pressure (EGDP) Sensor utilizes two tap-offs downstream of the turbocharger. One tap-off is located before the DPF and one after.

The EGDP sensor provides a feedback signal to the ECM indicating the pressure difference between the inlet and outlet of the DPF. This signal is used to calculate the soot level in the DPF.

“The EGDP sensor provides a feedback signal to the ECM indicating the pressure difference between the inlet and outlet of the DPF.”

**Diesel Particulate Filter (DPF)**

The Diesel Particulate filter (DPF) is located in the exhaust system under the vehicle.

In the DPF, exhaust gases are forced to flow through small passages in the ceramic material. This allows the DPF to catch all ash and particulate matter leaving the DOC.

The DPF allows for oxidation or regeneration of the stored particulates once loading gets to a particular level. It also stores noncombustible ash.
Diesel Oxidation Catalyst (DOC)

The Diesel Oxidation Catalyst (DOC) is located in the exhaust pipe, downstream of the turbocharger and just before the Diesel Particulate Filter (DPF).

The DOC uses a series of small passages that route the exhaust gas to come in contact with the precious metals. The DOC reduces the unburned hydrocarbons and carbon monoxide (CO) by burning (oxidizing) them over a catalyst. This catalyst aids the reaction of the CO and hydrocarbons with the remaining oxygen in the exhaust gas. This process can be used to increase the temperature of the exhaust system.
Aftertreatment System

Operation


ECM Controlled Operations

During Aftertreatment operation the ECM monitors the Aftertreatment sensors for proper operation, controls the Active Regeneration Process, monitors the level of soot accumulation in the DPF, allows the operator to enter Parked Regen mode when directed by the indicator lamps, and allows the operator to override Parked or Active Regen mode (optional on ambulances, ect.).

Monitor Function

There are four levels of indication that the vehicle’s exhaust filter is accumulating soot and needs to be cleaned, each with an increasing
urgency for action.

Level 1: Regen required, drive at highway speeds or pull vehicle safely off the roadway and start Parked Regen to prevent loss of engine power.

Level 2: Pull vehicle safely off the roadway and start Parked Regen to prevent loss of engine power.

Level 3: WARNING! Pull the vehicle safely off the roadway and start Parked Regen to prevent loss of engine power.

Level 4: WARNING! Pull the vehicle safely off the roadway, turn on the emergency flashers, place warning devices. DO NOT USE Parked Regen. Call for Service.

Regeneration Function

Periodically, the soot and ash particulates in the DPF must be burned off. This process is called Regeneration and it can occur during passive or active Regen. It will also occur during a driver-initiated Parked Regen.

Passive Regeneration - Low Soot Load

When the AFT system reaches the
Low Soot Load level, the DPF indicator lamp will illuminate, indicating that DPF Regen is required. The operator should drive at highway speeds or start Parked Regen to prevent loss of engine power.

Passive Regeneration or Regen of the AFT System occurs when the exhaust system gets hot enough to ignite the soot particles in the DOC and the DPF. This automatically cleans, or regenerates, the ceramic material in the DPF. The advantage of Passive Regen is that soot is burned to ash without additional fuel being introduced into the system.

Passive Regen starts to occur at catalyst temperatures of about 270° C. Higher temperatures will increase the efficiency of Passive Regen with the most efficient Regen occurring anytime the temperature is above 550° C.

When passive Regen occurs, it does not necessarily mean the soot level in the DPF goes down.

**Active Regeneration - Moderate Soot Load**

During the Active Regeneration or Regen process, the ECM commands the injector to inject extra fuel into the cylinder during the exhaust stroke. The
catalytic reaction between the fuel and the precious metals in the DOC creates heat, raising the temperature in the DOC and the DPF. This increase in temperature will cause the soot particles to be turned to ash.

“Active Regen is initiated when the ECM senses Regen is required and the vehicle is within the correct operating conditions.”

Active Regen is initiated when the ECM senses Regen is required and the vehicle is within the correct operating conditions. Active Regen can be necessary in cold climates or during light duty cycles in which normal operating temperatures are not always reached.

When the Diesel Particulate Filter (DPF) becomes full, the DPF indicator lamp will begin to flash, notifying the operator to pull the vehicle safely off the roadway and start Parked Regen to prevent loss of engine power.

The Exhaust High Temperature (EHT) lamp illuminates to indicate that system temperatures are high enough to support Regeneration.

**Operator Notification - Full Soot Load**

When the DPF becomes so full that it causes engine performance to be limited, the yellow “CHECK ENGINE” lamp will illuminate and the DPF
indicator lamp will continue to flash. The engine may moderately de-rate or lose power.

The operator should pull the vehicle safely off the roadway and start Parked Regen to prevent the engine from stopping.

**Operator Notification - Over-Full Soot Load**

If the DPF is allowed to become over-full, a serious engine problem has occurred, the red STOP ENGINE lamp will illuminate, and the engine may shut down soon.

The operator must pull the vehicle safely off the roadway, turn on the emergency flashers, place warning devices, and STOP THE ENGINE.

Do NOT use Parked Regen, call for service.

**Parked Regen**

There is a third, driver-initiated method referred to as Parked Regen. When the opportunities for effective passive and active strategies aren’t adequate enough to reduce the soot level, Parked Regen is required. Parked Regen will raised the engine RPM, inject extra fuel

"If the DPF is allowed to become over-full, a serious engine problem has occurred, the red STOP ENGINE lamp will illuminate, and the engine may shut down soon."

into the cylinders, and close the Intake Throttle Valve as required to raise exhaust temperatures for Regen.

To perform a Parked Regen, you must park the vehicle safely off the roadway away from any flammable materials. Before initiating Parked Regen (by pressing the Parked Regen switch), you must set the parking brake, put the transmission in neutral (manual) or park (automatic), and have no foot pedals applied.

NOTE: If any of the above conditions are altered during the Parked Regen process, Regen will be halted and must be restarted.

Press and hold the PARKD REGEN switch for 2 seconds to initiate the Regen cycle. The engine speed will automatically ramp up to a preset RPM and the switch indicator will illuminate solidly when the cycle is started. If the indicator is blinking, check to be sure that all conditions in step 2 are met. Once started, the Regen cycle will last approximately 20 minutes under normal operating conditions. This will vary according to the vehicle drive cycle.

NOTE: In the event of an emergency situation where the vehicle must be moved after beginning Parked Regen,
press the PARKD REGEN switch OFF to cancel Parked Regen.

When the Regen cycle is complete, the switch light will go off, the engine RPM will return to normal idle and the AFT and EOT indicators should go off (this may take some driving as the ECM must sample the AFT Sensor signals over time). The vehicle may now be driven normally.

System Maintenance

The DPF is designed to last at least 150,000 miles before it must be removed from the vehicle and cleaned by the International dealer. Additional servicing may be required at 100,000 mile intervals.

Note: See vehicle Operator’s Manual for service and maintenance procedures for the DPF.

“The DPF is designed to last at least 150,000 miles before it must be removed from the vehicle and cleaned by the International dealer.”

Conclusion

This concludes the International® MaxxForce™ Aftertreatment WBT. The information and techniques presented here are pivotal when becoming a certified International® technician. You are now required to take a post-test via ISIS®/Education/Service/Online Testing.