Basic Operation of the After Treatment Device

2007 engines are required to use an After Treatment Device (ATD) for controlling emissions. This means a special canister assembly has replaced the typical muffler. This assembly contains a Diesel Oxidation Catalyst (DOC) and a Diesel Particulate Filter (DPF). The DPF is a ceramic filter that captures soot and ash from the exhaust. Over time soot and ash build up in the filter and **must** be removed. Soot buildup is removed by heating the filter until the soot oxidizes and turns into carbon dioxide gas. This process is commonly known as regeneration. Ash buildup is removed from the filter by periodic cleaning in a special cleaning machine. The Cummins DPF assembly is equipped with a differential pressure transducer and three (3) temperature transducers. These sensors allow the engine to monitor soot buildup for cleaning requirements. Exhaust temperatures during a normal regeneration event can get to 600 degrees C (1112 degrees F).

Fluid Requirements

2007 engines require the use of specific oil and diesel fuel. The diesel fuel to be used in any 2007 engine shall be Ultra Low Sulfur Fuel containing 15 PPM sulfur content or less. Make sure the pump station being used has the proper fuel type when filling your fuel tank. If ultra-low-sulfur fuel is **not** used, the engine might **not** meet emissions regulations and the ATD can be damaged. Cummins Inc. recommends that 2007 engines use a high quality 15W-40 multi viscosity heavy-duty engine oil that meets the requirements of Cummins Engineering Standard CES20081/API CJ-4 for maximum DPF maintenance intervals. Cummins allows the use of CES20078/API CI-4 oil with no change in oil drain intervals. However, the after-treatment maintenance interval will be reduced with the use of CI-4 oil.

Instrument Panel Lamps

Chassis built with 2007 Cummins engines have four instrument panel lamps to monitor ATD activities. The two new lamps are the DPF lamp and the High Exhaust System Temperature (HEST) lamp. The following describes the four (4) lamps and their functions

The amber Engine Warning lamp indicates a non-critical system fault with the engine has occurred. The operator can drive the vehicle to the end of their shift and call service to remedy the problem.

The red Engine Stop lamp indicates a serious engine fault that may result in engine damage has occurred. The operator should move the vehicle to a safe location and shutdown the engine.

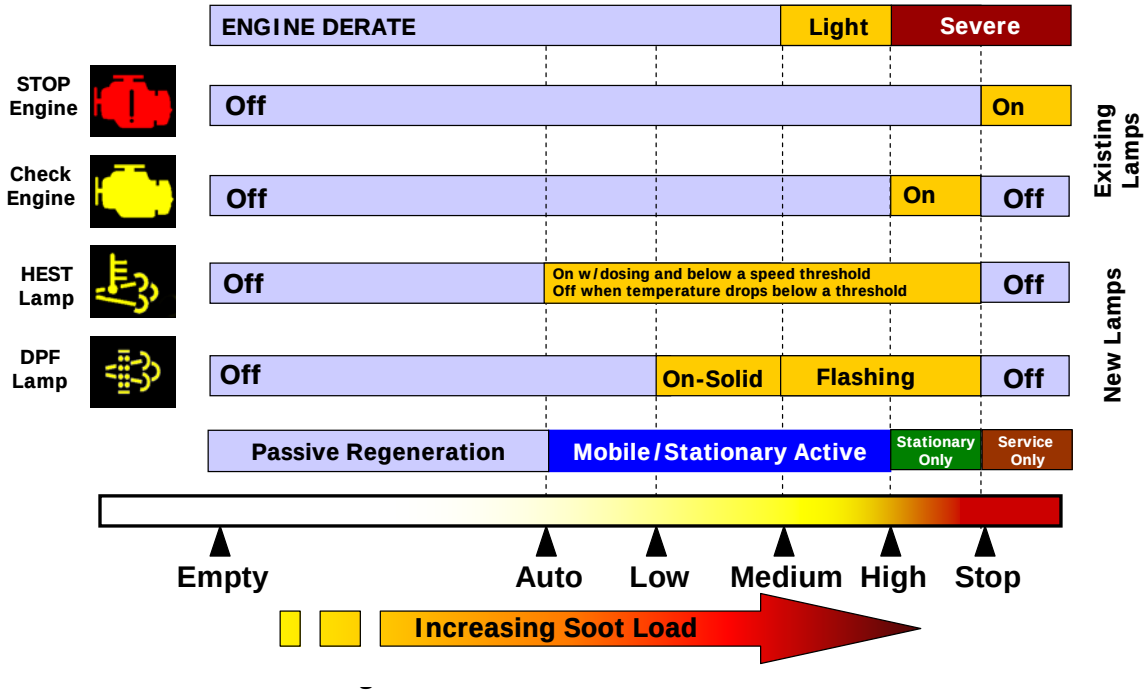
The Diesel Particulate Filter (DPF) lamp provides an indication that the filter has not been able to regenerate under the previous engine operating conditions and is in need of assistance in order to perform an active regeneration. There are progressive stages of need for regeneration indicated by this lamp as depicted in the following points.

- Solid lamp indicates low to medium levels of particulate buildup.
- Flashing lamp indicates medium to high levels of particulate buildup and a signal that a DPF regeneration is needed.
- Flashing lamp with amber Engine Warning lamp indicates a high level of particulate buildup and a DPF cleaning is required immediately.

The first stage (solid) should allow the vehicle to complete a typical shift of operation depending on vehicle duty cycle. This provides time for a vehicle to return to a maintenance facility or change duty cycle (increase exhaust temperatures by normal truck use) without impacting the current mission. The DPF lamp will turn off to acknowledge when effective assistance (changing duty cycle or initiating a stationary regeneration) has been provided. However, if assistance has not been provided long enough to complete the regeneration, the lamp will return to the appropriate indication stage.

The High Exhaust System Temperature (HEST) lamp provides an indication to the vehicle operator that an active regeneration has been initiated and that exhaust system temperatures will be elevated above normal levels for the operating condition. The HEST lamp will remain on until the exhaust system temperatures have dropped below 977 degrees Fahrenheit. If the HEST lamp is ON and the vehicle speed has dropped below the threshold of five (5) mph, the lamp will remain ON until the vehicle speed increases three (3) mph back above the speed threshold and the regeneration process finishes.

AT Regeneration Lamp Behaviors



Passive Regeneration
The passive regeneration process removes collected soot in the DPF under normal truck operations and does not require operator interaction. The operator will see no difference in vehicle performance during the passive regeneration process. When the engine is operating at higher speeds and loads, there is enough energy in the exhaust to remove the collected soot in the filter. This happens naturally and does not require any action by the engine control system or the operator. No extra fuel will be used, nor will excessive exhaust temperatures occur during passive regeneration. Operators may see the DPF light illuminate and turn off while operating the vehicle. This indicates that the soot level in the DPF temporarily reached a moderately high level, but because the engine operating conditions were right the passive regeneration process reduced the soot load.

Active Regeneration
The active regeneration process removes collected soot in the DPF through the addition of hydrocarbons (unburned fuel) to the exhaust stream. When the hydrocarbons enter the DPF assembly, the temperature is elevated to a point where removal of the collected soot can occur. This can happen while the truck is being driven, when in stationary truck operations or during pumping operations. The operator will be notified of the need for regeneration by illumination of the DPF lamp located in the cab. When the DPF lamp goes on, the operator can provide assistance by either changing the duty cycle or initiating a stationary regeneration using the initiate switch, which is located in the cab within reach of the driver.

Active Regeneration During Stationary Operations
The following vehicle conditions must be satisfied before a stationary regeneration can be started using the initiate switch.

1. Zero vehicle speed
2. Accelerator pedal/remote accelerator at idle
3. Service brake released (brake pedal not depressed)
4. The transmission must be in neutral (confirmed by looking at the Allison Transmission Shift Selector and seeing current gear and selected gear are neutral “N”).
5. Engine control mode from accelerator pedal (not PTO, remote PTO, cruise control, etc.)

When a stationary regeneration event is initiated, the DPF lamp will go off. As the engine adds hydrocarbons to the exhaust stream, the exhaust system temperature goes up. When the exhaust temperature goes above 525°C (977°F), the HEST lamp will illuminate. Engine speeds will be increased and the sound coming from the turbocharger will change during the stationary active regeneration process. ISM engines will increase speed to 1400 RPM and ISL/ISC engines will increase speed to 1000 RPM. The procedure will take 20 to 40 minutes (depending on the amount of soot accumulated in the filter). Breaking any of the required conditions will stop the regeneration process and engine operation will return to normal. If excessive soot buildup remains in the DPF, the DPF light will return to the appropriate indication stage until an adequate regeneration occurs.

After completion of regeneration, the HEST lamp will remain illuminated until the exhaust outlet temperature is below 525°C (977°F) or the vehicle speed exceeds five (5) mph.

Automatic Active Regeneration During Driving or Pumping Conditions
The following vehicle conditions must be satisfied before the engine will initiate an automatic active regeneration:

1. Accumulation of soot in the filter to the point where the engine control system looks for opportunities to actively regenerate the DPF.
2. Sufficient exhaust flow and temperature conditions (typical pumping or driving conditions should be adequate).
3. Speedometer showing five (5) mph or higher vehicle speed.

When the engine determines that it is appropriate to initiate an active regeneration, it adds hydrocarbons to the exhaust stream. When the exhaust system temperature goes above 525°C (977°F), the HEST lamp will illuminate. Breaking any of the required conditions will stop the regeneration process. If excessive soot buildup remains in the DPF, the DPF light will return to the appropriate indication stage until an adequate regeneration occurs. No engine speed or load changes will occur during regeneration in pumping or driving modes.

Regeneration Activation Switch
Activating the Regeneration process requires the operator to press the Regeneration Switch under the previous described conditions. The location of the Regeneration Switch is outlined below.

- Quantum® – located next to the engine diagnostic connector and diagnostic switch below the dash panel.
- Velocity™ and Impel™ – located next to the engine diagnostic connector and diagnostic switch below the dash panel.
- Saber® and Contender® – Same switch as the diagnostic switch and located on the right-hand side of the steering column below the dash panel.

DPF Build Up Without Regeneration
If the soot load in the DPF builds up and the necessary conditions for regeneration cannot be achieved, the engine lamps will indicate a more serious condition. If this occurs operators should be mindful of the potential for gradual power derates due to higher soot loading. If the DPF lamp begins to flash along with a solid check engine light, the operator may need to take action. This action could be: remove the truck from a mission that requires very high load operation, change the duty cycle to allow a regeneration to occur or initiate a stationary regeneration. When the soot load is reduced through effective regeneration the engine will return to full torque output.

Maintenance
As the soot in the filter is removed in the regeneration process a small amount of ash is left behind in the filter. Over time this ash will build up to the point where it must be removed. The engine control system can differentiate between soot buildup and ash buildup. The ash is removed by disassembling the DPF and cleaning the filter in a special machine. The target for regular maintenance is a 200,000 – 400,000 mile interval, which is dependent on duty cycle, type of oil used and oil consumption rate. Using CES20081/API CJ-4 oil will maximize the DPF maintenance interval. When the engine senses a buildup of ash it will light the check engine light and activate a fault code. The ash removal service event is expected to take less than 30 minutes, not including removal and installation.

Diagnostic Software
2007 Cummins engines will require updating Cummins Insite software to version 6.5.2 for diagnostic support.

General Notes For All 2007 Engines
No modification of the exhaust between the engine and DPF is allowed per the EPA. Only tailpipes after the DPF are allowed to be changed.

Pierce custom chassis will be outfitted with diffuser exhaust tips. These devices lower exhaust gas temperatures as they exit the tailpipe. Customers should not remove any diffuser items from their apparatus. Consult your Pierce dealer for exhaust extraction systems that are compatible with the Pierce diffuser tips.

Pierce custom chassis will be configured with the fan locked on during stationary operations. All 2007 engines are configured to engage the fan clutch during “parking brake and neutral” or “parking brake and pump in gear” situations. This is done to prevent overheating of steering systems, air conditioning

systems and exhaust components, particularly when trucks are operating at elevated high idles for extended periods of time.

Any customer-installed hardware needs to be kept a minimum of six (6) inches away from any exhaust pipe and after-treatment device housing. Installation of aftermarket components shall follow this to prevent heat related damage.