IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF DELAWARE

DIESEL TECHNOLOGIES, LLC, **Plaintiff,** **v.** **PACCAR, INC. d/b/a PETERBILT MOTOR COMPANY, and KENWORTH TRUCK COMPANY,** **Defendant.**	**Civil Action No. _____** **JURY TRIAL DEMANDED**

COMPLAINT FOR PATENT INFRINGEMENT

Plaintiff Diesel Technologies, LLC ("Diesel Tech" or "Plaintiff"), for its Complaint against Defendant Paccar, Inc. ("Paccar"), d/b/a Peterbilt Motors Company ("Peterbilt"), and Kenworth Truck Company ("Kenworth") (collectively "Defendant") alleges the following:

NATURE OF THE ACTION

1. This is an action for patent infringement arising under the Patent Laws of the United States, 35 U.S.C. § 1 *et seq*.

THE PARTIES

2. Plaintiff is a Limited Liability Company organized under the laws of the State of Delaware with a place of business at 717 N. Union Street, Wilmington, DE 19805.

3. Upon information and belief, Paccar is a Corporation incorporated and existing under the laws of the State of Delaware, with a place of business at 777 106th Avenue NE, Bellevue, Washington, 98004, and can be served through its registered agent, the Prentice-Hall Corporation System, Inc. at 251 Little Falls Dr., Wilmington, DE 19808. Upon information and belief, Paccar sells and offers to sell products and services throughout the United States,

including in this judicial district, and introduces products and services that into the stream of commerce and that incorporate infringing technology knowing that they would be sold in this judicial district and elsewhere in the United States.

4. Upon information and belief, Peterbilt is an unincorporated division of Paccar headquartered at 1700 Woodbrook Street, Denton, TX 76205. Upon information and belief, Peterbilt sells and offers to sell products and services throughout the United States, including in this judicial district, and introduces products and services into the stream of commerce that incorporate infringing technology knowing that they would be sold in this judicial district and elsewhere in the United States.

5. Upon information and belief, Kenworth is an unincorporated division of Paccar headquartered at 10630 N.E 38th Pl., Kirkland, WA 98033. Upon information and belief, Kenworth sells and offers to sell products and services throughout the United States, including in this judicial district, and introduces products and services into the stream of commerce that incorporate infringing technology knowing that they would be sold in this judicial district and elsewhere in the United States.

6. On information and belief, Defendant Paccar variously does business as "Peterbilt" and/or "Kenworth."

JURISDICTION AND VENUE

7. This is an action for patent infringement arising under the Patent Laws of the United States, Title 35 of the United States Code.

8. This Court has subject matter jurisdiction under 28 U.S.C. §§ 1331 and 1338(a).

9. Venue is proper in this judicial district under 28 U.S.C. §1400(b). On information and belief, Paccar is incorporated in the State of Delaware.

10. On information and belief, Defendant is subject to this Court's general and specific personal jurisdiction because Defendant has sufficient minimum contacts within the State of Delaware, pursuant to due process and/or the State of Delaware's Long Arm Statute because Defendant purposefully availed itself of the privileges of conducting business in the State of Delaware, because Defendant regularly conducts and solicits business within the State of Delaware, and because Plaintiff's causes of action arise directly from Defendant's business contacts and other activities in the State of Delaware. Further, this Court has personal jurisdiction over Defendant because it is incorporated in the State of Delaware and has purposely availed itself of the privileges and benefits of the laws of the State of Delaware.

COUNT I – INFRINGEMENT OF U.S. PATENT NO. 8,474,246

11. The allegations set forth in the foregoing paragraphs 1 through 10 are incorporated into this First Claim for Relief.

12. On July 2, 2013, U.S. Patent No. 8,474,246 ("the '246 patent"), entitled "METHOD OF OPERATING A PARTICLE FILTER IN THE EXHAUST SYSTEM OF A MOTOR VEHICLE'S INTERNAL COMBUSTION ENGINE," was duly and legally issued by the United States Patent and Trademark Office. A true and correct copy of the '246 patent is attached as Exhibit 1.

13. Plaintiff is the assignee and owner of the right, title and interest in and to the '246 patent, including the right to assert all causes of action arising under said patent and the right to any remedies for infringement of it.

14. Upon information and belief, Defendant has and continues to directly infringe at least claims 1-3 and 7 of the '246 patent by making, using, selling, importing and/or providing and causing to be used, for example, a Paccar PX-9 Engine in at least its Kenworth T440/T470 (the "Kenworth Infringing Instrumentalities") and a Cummins ISX 15 Engine in at least its

Peterbilt Model 389 trucks (the "Peterbilt Infringing Instrumentalities") (collectively the "Accused Instrumentalities").

15. The '246 patent generally recites a method of operating a diesel particle filter in an exhaust system of a motor vehicle with an internal combustion engine.

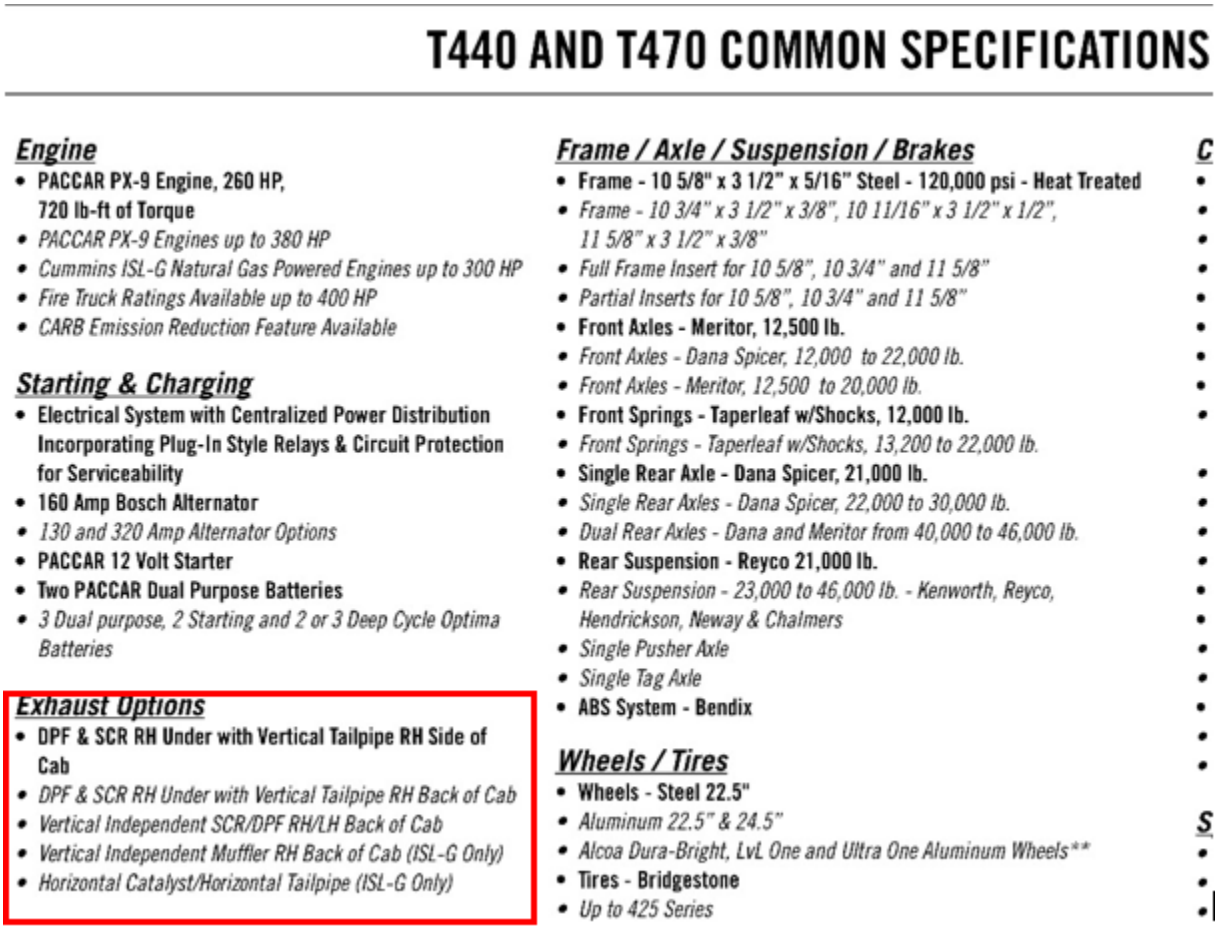
16. In particular, claim 1 of the '246 patent recites a method of operating a particle filter in an exhaust system of a motor vehicle internal combustion engine, wherein the particle filter, which collects soot particles and ashes, is re-conditioned, in intervals, by a soot-burn off procedure, but wherein, in addition to soot, also non-combustible ashes are deposited during operation of the internal combustion engine, said method comprising the steps of: reducing, in an ash reducing procedure, the mass of the ash deposits in the particle filter by heating the particle filter and supplying to the particle filter, together with the exhaust gas of the internal combustion engine, a reducing agent which reacts with the ash deposits so as to chemically convert the ash deposits such that at least non-metallic constituent parts of the ash deposits are carried out of the particle filter by the exhaust gas.

17. The Kenworth Infringing Instrumentalities, for example at least the Kenworth T440/T470 with a Paccar PX-9 engine, practice a method of operating a particle filter in an exhaust system of a motor vehicle internal combustion engine (*Figures 1-5*), wherein the particle filter, which collects soot particles and ashes (*Figure 6*), is re-conditioned, in intervals (*Figure 7*), by a soot-burn off procedure (*Figure 8*), but wherein, in addition to soot, also non-combustible ashes are deposited during operation of the internal combustion engine (*Figures 8-9*), said method comprising the steps of: reducing, in an ash reducing procedure (*Figure 10*), the mass of the ash deposits in the particle filter by heating the particle filter and supplying to the particle filter (*Figures 8-10*), together with the exhaust gas of the internal combustion engine

(*Figure 11*), a reducing agent which reacts with the ash deposits so as to chemically convert the ash deposits such that at least non-metallic constituent parts of the ash deposits are carried out of the particle filter by the exhaust gas (*Figure 12*).

https://paccarpowertrain.com/products/engines/paccar-px-9/

Figure 1



T440 AND T470 COMMON SPECIFICATIONS

Engine

- **PACCAR PX-9 Engine, 260 HP, 720 lb-ft of Torque**
- *PACCAR PX-9 Engines up to 380 HP*
- *Cummins ISL-G Natural Gas Powered Engines up to 300 HP*
- *Fire Truck Ratings Available up to 400 HP*
- *CARB Emission Reduction Feature Available*

Starting & Charging

- **Electrical System with Centralized Power Distribution Incorporating Plug-In Style Relays & Circuit Protection for Serviceability**
- **160 Amp Bosch Alternator**
- *130 and 320 Amp Alternator Options*
- **PACCAR 12 Volt Starter**
- **Two PACCAR Dual Purpose Batteries**
- *3 Dual purpose, 2 Starting and 2 or 3 Deep Cycle Optima Batteries*

Exhaust Options

- **DPF & SCR RH Under with Vertical Tailpipe RH Side of Cab**
- *DPF & SCR RH Under with Vertical Tailpipe RH Back of Cab*
- *Vertical Independent SCR/DPF RH/LH Back of Cab*
- *Vertical Independent Muffler RH Back of Cab (ISL-G Only)*
- *Horizontal Catalyst/Horizontal Tailpipe (ISL-G Only)*

Frame / Axle / Suspension / Brakes

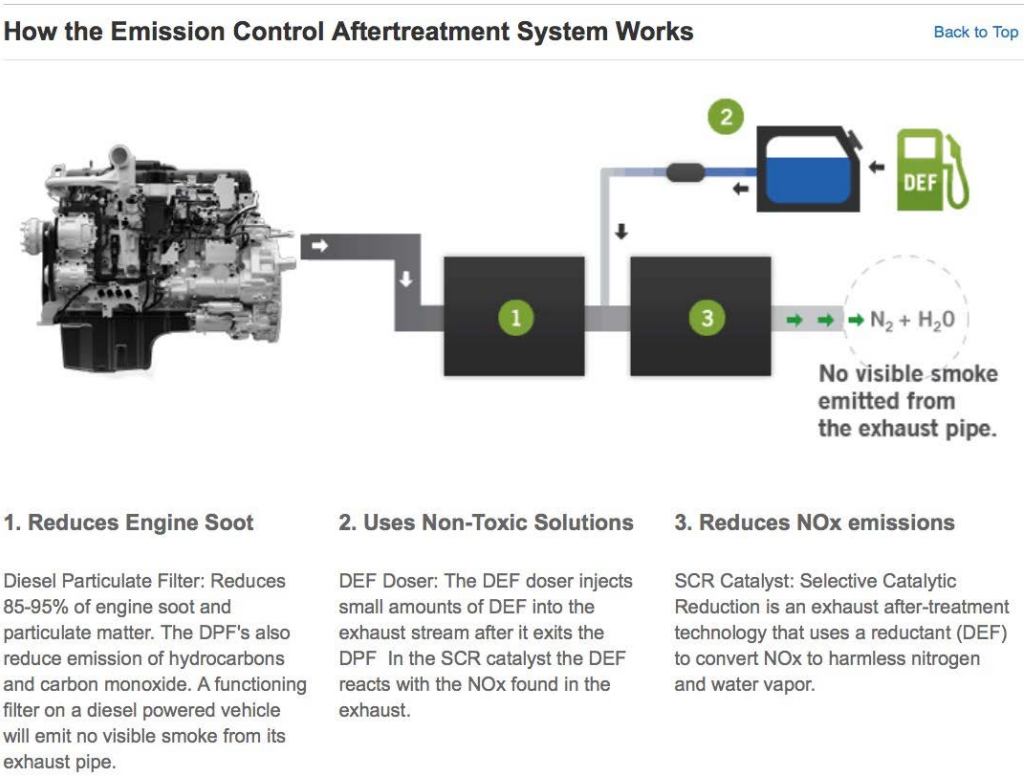
- **Frame - 10 5/8" x 3 1/2" x 5/16" Steel - 120,000 psi - Heat Treated**
- *Frame - 10 3/4" x 3 1/2" x 3/8", 10 11/16" x 3 1/2" x 1/2", 11 5/8" x 3 1/2" x 3/8"*
- *Full Frame Insert for 10 5/8", 10 3/4" and 11 5/8"*
- *Partial Inserts for 10 5/8", 10 3/4" and 11 5/8"*
- **Front Axles - Meritor, 12,500 lb.**
- *Front Axles - Dana Spicer, 12,000 to 22,000 lb.*
- *Front Axles - Meritor, 12,500 to 20,000 lb.*
- **Front Springs - Taperleaf w/Shocks, 12,000 lb.**
- *Front Springs - Taperleaf w/Shocks, 13,200 to 22,000 lb.*
- **Single Rear Axle - Dana Spicer, 21,000 lb.**
- *Single Rear Axles - Dana Spicer, 22,000 to 30,000 lb.*
- *Dual Rear Axles - Dana and Meritor from 40,000 to 46,000 lb.*
- **Rear Suspension - Reyco 21,000 lb.**
- *Rear Suspension - 23,000 to 46,000 lb. - Kenworth, Reyco, Hendrickson, Neway & Chalmers*
- *Single Pusher Axle*
- *Single Tag Axle*
- **ABS System - Bendix**

Wheels / Tires

- **Wheels - Steel 22.5"**
- *Aluminum 22.5" & 24.5"*
- *Alcoa Dura-Bright, LvL One and Ultra One Aluminum Wheels***
- **Tires - Bridgestone**
- *Up to 425 Series*

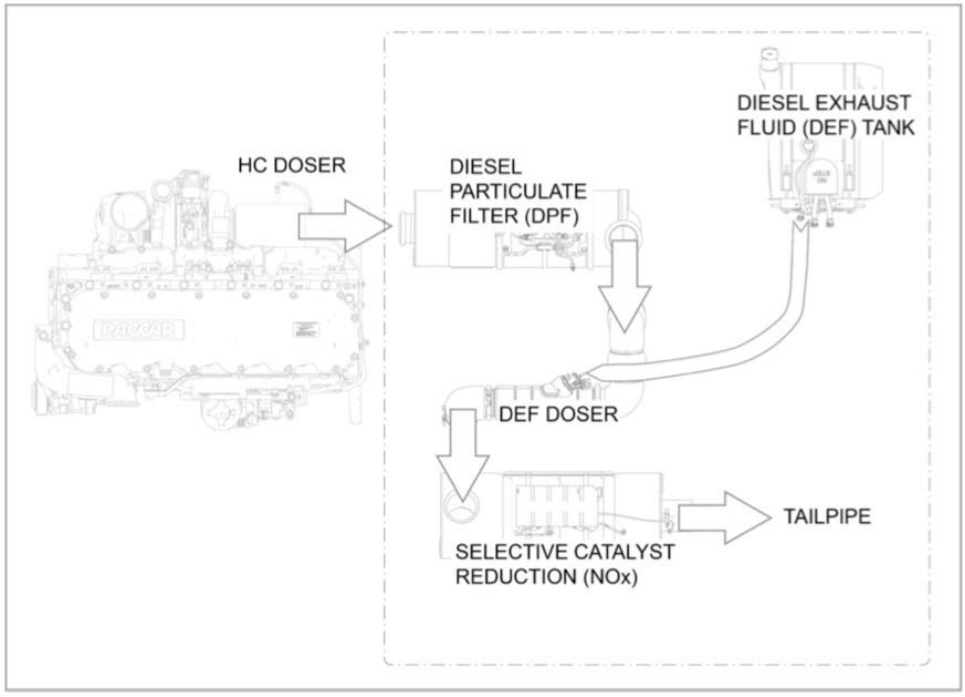
https://paccarpowertrain.com/products/engines/paccar-px-9/

Figure 2



https://paccarpowertrain.com/Products/Engines/technology/emissions-management/

Figure 3



For example, the Paccar particulate filter for PX-9 engines, shown above, with an Electronic Control Module (ECM) controller, practice a method of operating a particulate filter for a Paccar PX-9 engine.

http://www.dot.state.oh.us/Divisions/ContractAdmin/Contracts/PurchDocs/044-16/KenwofRich01/Operator%20Manuals/Paccar%20Engine%20Aftertreatment%20-%20Y53-1190-1C1_EN.pdf

Figure 4

OF COURSE YOU HAVE CHOICES. THIS IS YOUR KENWORTH.

As a custom truck builder, Kenworth offers more job-specific and factory-installed options than any other manufacturer of heavy and medium-duty vehicles. The result is an integrated, fully-engineered, job-ready solution you can depend on -- right from the start. Here are just a few of the choices you might consider when you order yours -- including some exclusive items you simply can't get anywhere else.

To meet your specific job requirement, you have the rugged PACCAR PX-9 engine rated up to 380 HP and 1,250 lb-ft of torque or the Cummins ISL-G at 320 HP and 1,000 lb-ft of torque.

Kenworth's T470 grille is made of stamped stainless steel – not plastic or pot metal. It's mounted to the radiator allowing the hood to swing clear of front mounted equipment. The bumper is constructed of three pieces for fast, economical installation of winches, PTOs and other front-end equipment.

When the schedule requires a layover, Kenworth's 38-inch AeroCab® sleeper provides a welcome sanctuary and the kind of versatility that keeps your operation on the move.

DEF tanks in three sizes complement your choice of fuel tank size and provide fill interval options appropriate for your application. Fuel tanks in 22" and 24.5" range in size from 56 to 150 gallons. Polished aluminum fuel tanks and polished stainless steel DEF tank covers are also available.

https://www.kenworth.com/media/52628/t440-t470-combined.pdf

For example, the Paccar PX-9 internal combustion engine, with an exhaust system containing an infringing diesel particulate filter system is found on at least the Kenworth T440 and T470

Figure 5

Aftertreatment System (ATS)

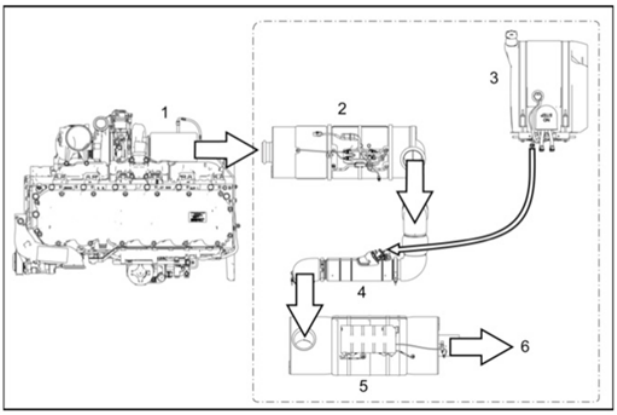
Introduction

The Aftertreatment System (ATS) on your vehicle is made up of two systems;

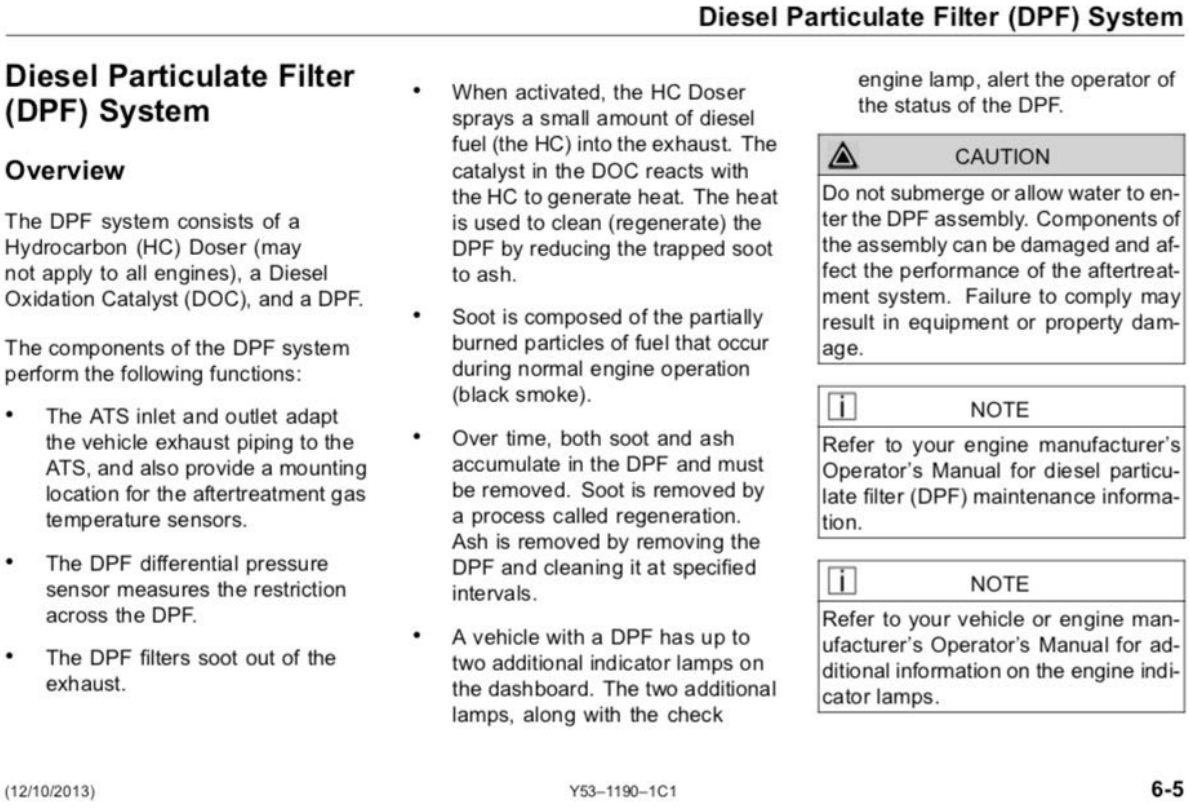
1. Diesel Particulate Filter (DPF) System
2. Selective Catalytic Reduction (SCR) System

They fulfill two primary functions; particulate reduction & nitrogen oxide (NOx) reduction.

This section of the manual describes how to interact and control these two systems. For more detailed information about the aftertreatment process and its components, see Information on page 6-3.



1. HC Doser
2. Diesel Particulate Filter (DPF)
3. Diesel Exhaust Fluid (DEF) Tank
4. DEF Doser
5. Selective Catalyst Reduction (NOx)
6. Filtered/Treated Exhaust



Diesel Particulate Filter (DPF) System

Overview

The DPF system consists of a Hydrocarbon (HC) Doser (may not apply to all engines), a Diesel Oxidation Catalyst (DOC), and a DPF.

The components of the DPF system perform the following functions:

- The ATS inlet and outlet adapt the vehicle exhaust piping to the ATS, and also provide a mounting location for the aftertreatment gas temperature sensors.
- The DPF differential pressure sensor measures the restriction across the DPF.
- The DPF filters soot out of the exhaust.
- When activated, the HC Doser sprays a small amount of diesel fuel (the HC) into the exhaust. The catalyst in the DOC reacts with the HC to generate heat. The heat is used to clean (regenerate) the DPF by reducing the trapped soot to ash.
- Soot is composed of the partially burned particles of fuel that occur during normal engine operation (black smoke).
- Over time, both soot and ash accumulate in the DPF and must be removed. Soot is removed by a process called regeneration. Ash is removed by removing the DPF and cleaning it at specified intervals.
- A vehicle with a DPF has up to two additional indicator lamps on the dashboard. The two additional lamps, along with the check engine lamp, alert the operator of the status of the DPF.

CAUTION

Do not submerge or allow water to enter the DPF assembly. Components of the assembly can be damaged and affect the performance of the aftertreatment system. Failure to comply may result in equipment or property damage.

NOTE

Refer to your engine manufacturer's Operator's Manual for diesel particulate filter (DPF) maintenance information.

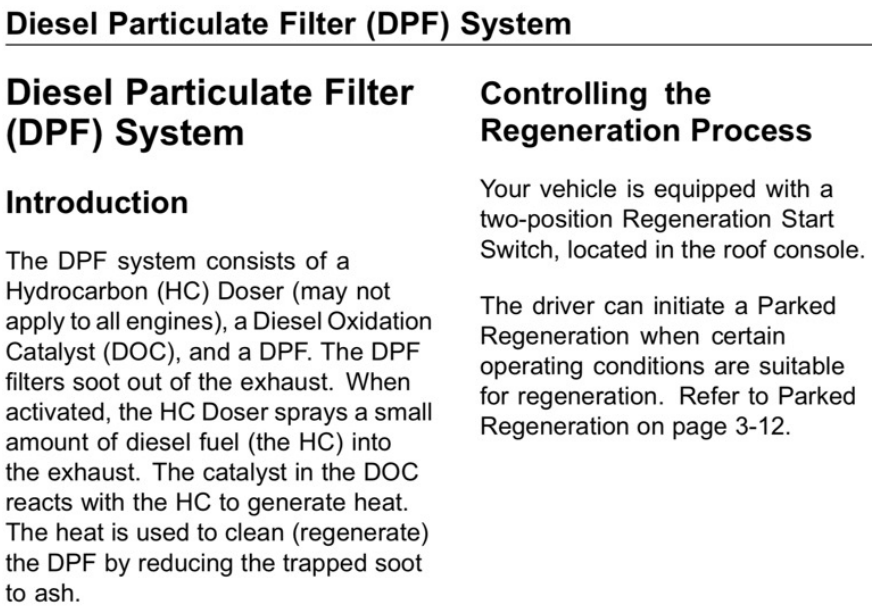
NOTE

Refer to your vehicle or engine manufacturer's Operator's Manual for additional information on the engine indicator lamps.

http://www.dot.state.oh.us/Divisions/ContractAdmin/Contracts/PurchDocs/044-16/KenwofRich01/Operator%20Manuals/Paccar%20Engine%20Aftertreatment%20-%20Y53-1190-1C1_EN.pdf

For example, upon information and belief, the Diesel Particulate Filter (DPF) collects soot particles and ashes.

Figure 6



Diesel Particulate Filter (DPF) System

Diesel Particulate Filter (DPF) System

Introduction

The DPF system consists of a Hydrocarbon (HC) Doser (may not apply to all engines), a Diesel Oxidation Catalyst (DOC), and a DPF. The DPF filters soot out of the exhaust. When activated, the HC Doser sprays a small amount of diesel fuel (the HC) into the exhaust. The catalyst in the DOC reacts with the HC to generate heat. The heat is used to clean (regenerate) the DPF by reducing the trapped soot to ash.

Controlling the Regeneration Process

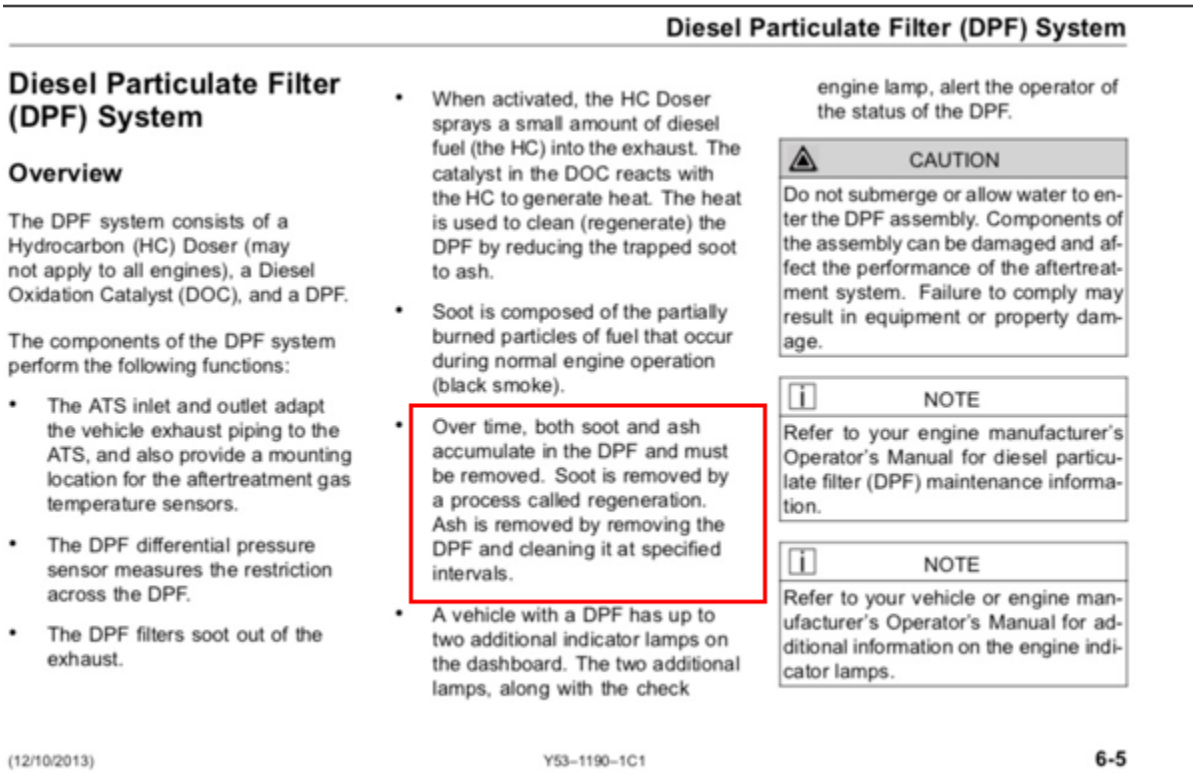
Your vehicle is equipped with a two-position Regeneration Start Switch, located in the roof console.

The driver can initiate a Parked Regeneration when certain operating conditions are suitable for regeneration. Refer to Parked Regeneration on page 3-12.

The reconditioning interval of the DPF in this context is activated when the exhaust gas flow restriction in the DPF reaches a predetermined level as measured by the DPF differential pressure sensor (as referenced in *Figure 6*).

http://www.dot.state.oh.us/Divisions/ContractAdmin/Contracts/PurchDocs/044-16/KenwofRich01/Operator%20Manuals/Paccar%20Engine%20Aftertreatment%20-%20Y53-1190-1C1_EN.pdfr

Figure 7



Diesel Particulate Filter (DPF) System

Overview

The DPF system consists of a Hydrocarbon (HC) Doser (may not apply to all engines), a Diesel Oxidation Catalyst (DOC), and a DPF.

The components of the DPF system perform the following functions:

- The ATS inlet and outlet adapt the vehicle exhaust piping to the ATS, and also provide a mounting location for the aftertreatment gas temperature sensors.
- The DPF differential pressure sensor measures the restriction across the DPF.
- The DPF filters soot out of the exhaust.
- When activated, the HC Doser sprays a small amount of diesel fuel (the HC) into the exhaust. The catalyst in the DOC reacts with the HC to generate heat. The heat is used to clean (regenerate) the DPF by reducing the trapped soot to ash.
- Soot is composed of the partially burned particles of fuel that occur during normal engine operation (black smoke).
- Over time, both soot and ash accumulate in the DPF and must be removed. Soot is removed by a process called regeneration. Ash is removed by removing the DPF and cleaning it at specified intervals.
- A vehicle with a DPF has up to two additional indicator lamps on the dashboard. The two additional lamps, along with the check engine lamp, alert the operator of the status of the DPF.

CAUTION

Do not submerge or allow water to enter the DPF assembly. Components of the assembly can be damaged and affect the performance of the aftertreatment system. Failure to comply may result in equipment or property damage.

NOTE

Refer to your engine manufacturer's Operator's Manual for diesel particulate filter (DPF) maintenance information.

NOTE

Refer to your vehicle or engine manufacturer's Operator's Manual for additional information on the engine indicator lamps.

http://www.dot.state.oh.us/Divisions/ContractAdmin/Contracts/PurchDocs/044-16/KenwofRich01/Operator%20Manuals/Paccar%20Engine%20Aftertreatment%20-%20Y53-1190-1C1_EN.pdfr

Figure 8

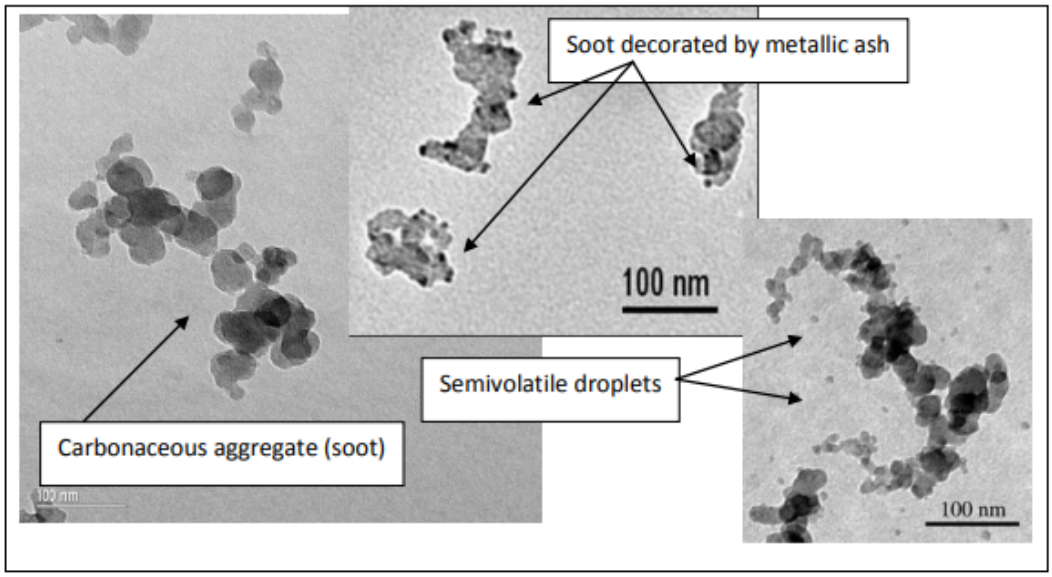


Figure 2: *Engine exhaust particles are very diverse in size, shape, and composition (adapted from Jung et al. [35] and Miller et al. [61]).*

Fig. 2: carbonaceous agglomerates that contribute most of the mass in the accumulation mode, semi-volatile droplets that usually comprise most of the number in the nucleation mode, and tiny ash particles that may either decorate existing particles as shown or form separate solid particles in the nucleation mode size range (Jung et al. [35]).

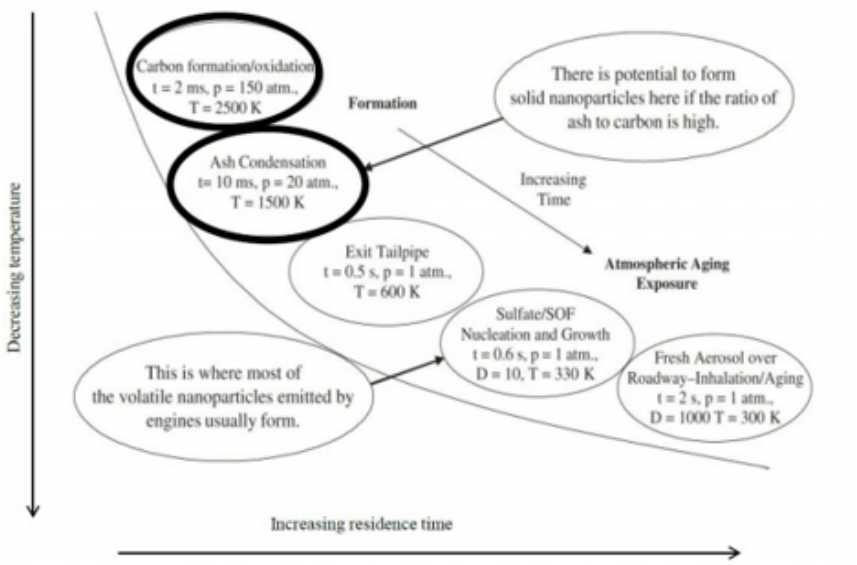


Figure 3: *History of particle formation in a compression ignition engine (adapted from Kittelson et al. [47]).*

Figure 3 shows the processes responsible for the formation of particles during combustion, dilution and cooling. These conditions are representative of a heavy duty diesel engine under typical cruise conditions. In an early stage carbonaceous particles are formed during combustion and most of them are oxidized. In addition lubricating oil is entrained into burning fuel jets and may also form carbonaceous particles as combustion products.

There is also evidence that metallic additives in the lube oil such as Ca and Zn may be converted to gas-phase compounds, and then undergo gas-to-particle conversion as products of combustion expand and cool. Most of the resulting particles end up decorating accumulation mode particles, but separate ash nucleation may form when the ratio of ash to carbonaceous accumulation mode particles is sufficiently high (Abdul-Khalek et al. [3]; Jung et al. [35]; Lee et al. [53])

For example, as shown above, soot and non-combustible (metallic) ash are deposited during operation of the internal combustion engine.

https://como.cheng.cam.ac.uk/preprints/c4e-Preprint-142.pdf

Figure 9

Diesel Particulate Filter (DPF) System

Functionality / Notification Information

The ATS will regenerate the DPF by using hot exhaust gases normally generated by the engine. Typically occurring during highway operation, this referred to as a "Passive" Regeneration and is transparent to the operation of the vehicle.

Occasionally, the exhaust gases are not hot enough for passive regeneration. When this occurs, the ATS will regenerate the DPF by increasing the exhaust temperature. This is referred to as an "Automatic" Regeneration and is also transparent to vehicle operation. An Automatic Regeneration event typically lasts 30 minutes. During and shortly after the event, the exhaust gases from the DPF may reach temperatures in excess of 650°C (1200°F). See the information in the following table on probable causes and recommended actions related to the warning lamps and indicator symbols of the ATS.

The ATS may not be able to regenerate the DPF when the vehicle is driven at extended low speeds or with frequent starts and stops. In such cases, warning lamps and indicator symbols will alert the operator to take action. The operator should be aware of whether the lamps are on alone or in combination with others. The following table will describe each warning lamp(s) and what actions are needed from the operator.

http://www.dot.state.oh.us/Divisions/ContractAdmin/Contracts/PurchDocs/044-16/KenwofRich01/Operator%20Manuals/Paccar%20Engine%20Aftertreatment%20-%20Y53-1190-1C1_EN.pdf

The soot that forms Diesel exhaust particulate can be burnt off at temperatures above 600 ◦C, whereas typical Diesel engine exhaust temperatures fall within the 200–500 ◦C range [10,11].

Debora Fino, Samir Bensaid, Marco Piumetti, Nunzio Russo, *A review on the catalytic combustion of soot in Diesel particulate filters for automotive applications: From powder catalysts to structured reactors, Applied Catalysis* A: General, Volume 509, 2016, Pages 75-96, ISSN 0926-860X, https://doi.org/10.1016/j.apcata.2015.10.016. (http://www.sciencedirect.com/science/article/pii/S0926860X15301939)

For example, soot-burn off occurs where the particulate matter collected in the DPF undergoes a reaction which raises the exhaust gas temperature high enough to oxidize (reducing) the particulate matter (includes ash and soot) from the filter (reconditioning in intervals by a soot burn-off procedure).

Figure 10

Diesel Particulate Filter (DPF) System

Overview

The DPF system consists of a Hydrocarbon (HC) Doser (may not apply to all engines), a Diesel Oxidation Catalyst (DOC), and a DPF.

The components of the DPF system perform the following functions:

- The ATS inlet and outlet adapt the vehicle exhaust piping to the ATS, and also provide a mounting location for the aftertreatment gas temperature sensors.
- The DPF differential pressure sensor measures the restriction across the DPF.
- The DPF filters soot out of the exhaust.

- When activated, the HC Doser sprays a small amount of diesel fuel (the HC) into the exhaust. The catalyst in the DOC reacts with the HC to generate heat. The heat is used to clean (regenerate) the DPF by reducing the trapped soot to ash.
- Soot is composed of the partially burned particles of fuel that occur during normal engine operation (black smoke).
- Over time, both soot and ash accumulate in the DPF and must be removed. Soot is removed by a process called regeneration. Ash is removed by removing the DPF and cleaning it at specified intervals.
- A vehicle with a DPF has up to two additional indicator lamps on the dashboard. The two additional lamps, along with the check engine lamp, alert the operator of the status of the DPF.

CAUTION

Do not submerge or allow water to enter the DPF assembly. Components of the assembly can be damaged and affect the performance of the aftertreatment system. Failure to comply may result in equipment or property damage.

NOTE

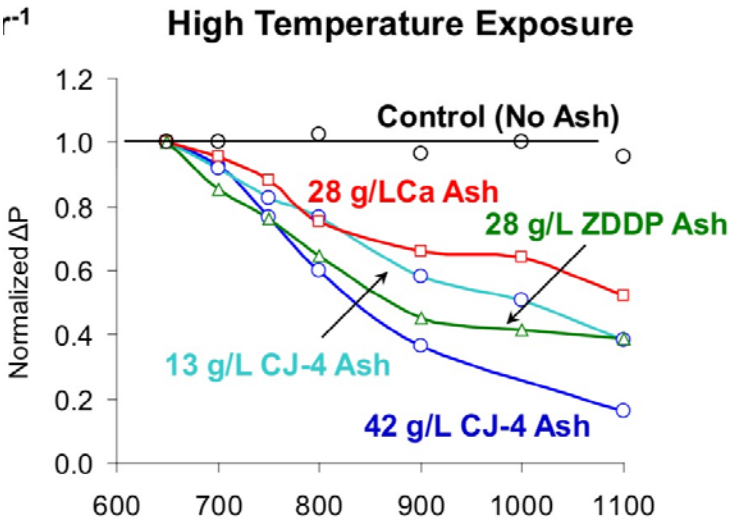
Refer to your engine manufacturer's Operator's Manual for diesel particulate filter (DPF) maintenance information.

NOTE

Refer to your vehicle or engine manufacturer's Operator's Manual for additional information on the engine indicator lamps.

For example, the DPF is located in the exhaust stream as part of the exhaust system, as indicated above, which supplies the DPF with exhaust gases from the internal combustion engine.

Figure 11



Key Parameters Affecting DPF Performance Degradation and Impact on Lifetime Fuel Economy, Alexander Sappok, Carl Kamp, Iason Dimou, Sean Munnis, Victor W. Wong Massachusetts Institute of Technology Sloan Automotive Laboratory Cambridge, MA October 4, 2011.

High Temperature exposure reduces metallic ash volume as shown in the pressure differential reductions across the DPF.

Diesel Particulate Filter (DPF) System

Overview

The DPF system consists of a Hydrocarbon (HC) Doser (may not apply to all engines), a Diesel Oxidation Catalyst (DOC), and a DPF.

The components of the DPF system perform the following functions:

- The ATS inlet and outlet adapt the vehicle exhaust piping to the ATS, and also provide a mounting location for the aftertreatment gas temperature sensors.
- The DPF differential pressure sensor measures the restriction across the DPF.
- The DPF filters soot out of the exhaust.
- When activated, the HC Doser sprays a small amount of diesel fuel (the HC) into the exhaust. The catalyst in the DOC reacts with the HC to generate heat. The heat is used to clean (regenerate) the DPF by reducing the trapped soot to ash.
- Soot is composed of the partially burned particles of fuel that occur during normal engine operation (black smoke).
- Over time, both soot and ash accumulate in the DPF and must be removed. Soot is removed by a process called regeneration. Ash is removed by removing the DPF and cleaning it at specified intervals.
- A vehicle with a DPF has up to two additional indicator lamps on the dashboard. The two additional lamps, along with the check engine lamp, alert the operator of the status of the DPF.

CAUTION

Do not submerge or allow water to enter the DPF assembly. Components of the assembly can be damaged and affect the performance of the aftertreatment system. Failure to comply may result in equipment or property damage.

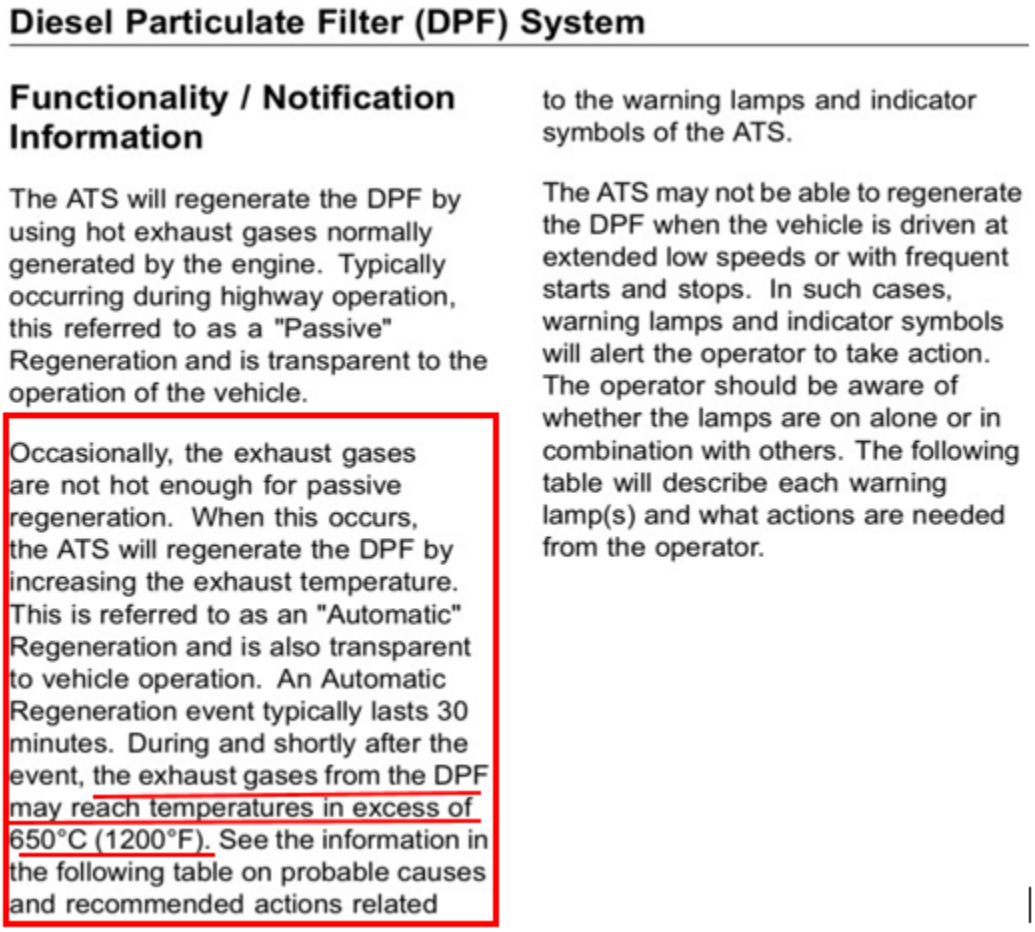
NOTE

Refer to your engine manufacturer's Operator's Manual for diesel particulate filter (DPF) maintenance information.

NOTE

Refer to your vehicle or engine manufacturer's Operator's Manual for additional information on the engine indicator lamps.

For example, as shown above, the reducing agent (diesel fuel) enters via a Hydrocarbon (HC) Doser as shown above, chemically reacting in the Diesel Oxidation Catalyst (DOC) by raising the temperature high enough to reduce ash in the DPF, which chemically converts the ash deposits.



Diesel Particulate Filter (DPF) System

Functionality / Notification Information

The ATS will regenerate the DPF by using hot exhaust gases normally generated by the engine. Typically occurring during highway operation, this referred to as a "Passive" Regeneration and is transparent to the operation of the vehicle.

Occasionally, the exhaust gases are not hot enough for passive regeneration. When this occurs, the ATS will regenerate the DPF by increasing the exhaust temperature. This is referred to as an "Automatic" Regeneration and is also transparent to vehicle operation. An Automatic Regeneration event typically lasts 30 minutes. During and shortly after the event, the exhaust gases from the DPF may reach temperatures in excess of 650°C (1200°F). See the information in the following table on probable causes and recommended actions related to the warning lamps and indicator symbols of the ATS.

The ATS may not be able to regenerate the DPF when the vehicle is driven at extended low speeds or with frequent starts and stops. In such cases, warning lamps and indicator symbols will alert the operator to take action. The operator should be aware of whether the lamps are on alone or in combination with others. The following table will describe each warning lamp(s) and what actions are needed from the operator.

A reducing agent (diesel fuel) reacts with ash deposits to chemically convert the ash deposits (taking place at least at 650 degrees Celsius) carrying out at least the non-metallic constituent parts of the ash deposits by the exhaust gas.

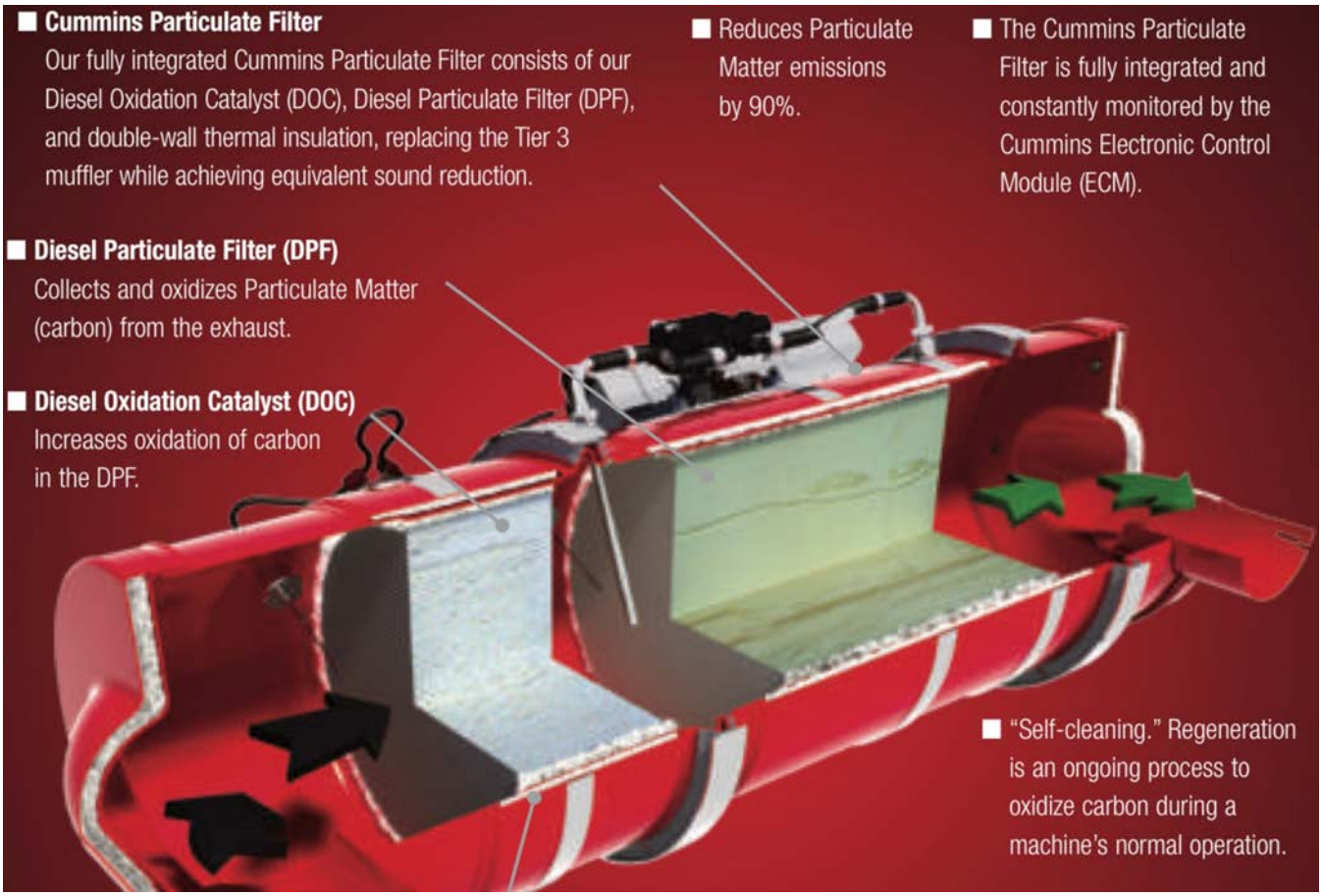
Figure 12

18. The Peterbilt Infringing Instrumentalities, for example at least the Peterbilt Model 389 with the Cummins ISX 15, practice a method of operating a particle filter in an exhaust system of a motor vehicle internal combustion engine (*Figure 13*), wherein the particle filter, which collects soot particles and ashes (*Figure 14*), is re-conditioned, in intervals (*Figure 15*), by a soot-burn off procedure (*Figure 16*), but wherein, in addition to soot, also non-combustible ashes are deposited during operation of the internal combustion engine (*Figure 16*), said method comprising the steps of: reducing, in an ash reducing procedure (*Figure 16*), the mass of the ash

deposits in the particle filter by heating the particle filter and supplying to the particle filter (*Figure 16*), together with the exhaust gas of the internal combustion engine (*Figure 16*), a reducing agent which reacts with the ash deposits so as to chemically convert the ash deposits such that at least non-metallic constituent parts of the ash deposits are carried out of the particle filter by the exhaust gas (*Figure 17*).

http://www.peterbilt.com/products/on-highway/389/#specifications

For example, the Peterbilt Model 389 configured with the Cummins ISX15 (an internal combustion engine) has an exhaust system with an infringing diesel particulate filter.



https://cumminsengines.com/brochure-download.aspx?brochureid=35

For example, the Cummins particulate filter, shown above, with the Electronic Control Module (ECM) controller, practices a method of operating a particulate filter for an ISX 15 engine.

Figure 13

How does the Cummins Particulate Filter remove particulate matter (PM)?

The Cummins Particulate Filter consists of four sections: an inlet, a Diesel Oxidation Catalyst (DOC), a Diesel Particulate Filter (DPF) and an outlet.

Exhaust flows out of the engine and into the Cummins Particulate Filter. It passes through the DOC and then into the DPF where PM (soot particles and ashes) is collected on the walls of the DPF.

https://cumminsengines.com/cummins-particulate-filter

Figure 14

The PM collected is then oxidized to remove it from the DPF. This is known as regeneration.

What is active regeneration?

Active self-regeneration occurs when there is not sufficient heat in the exhaust to convert the PM being collected in the DPF. Exhaust temperatures are raised by injecting a small amount of fuel (reducing agent) upstream of the Cummins Particulate Filter. The resulting chemical reaction over the DOC raises exhaust gas temperatures high enough to oxidize the PM from the filter (reconditioning in intervals by a soot burn-off procedure).

https://cumminsengines.com/cummins-particulate-filter

Figure 15

How does the Cummins Particulate Filter remove particulate matter (PM)?

The Cummins Particulate Filter consists of four sections: an inlet, a Diesel Oxidation Catalyst (DOC), a Diesel Particulate Filter (DPF) and an outlet.

Exhaust flows out of the engine and into the Cummins Particulate Filter. It passes through the DOC and then into the DPF where PM (soot particles and ashes) is collected on the walls of the DPF.

The PM collected is then oxidized to remove it from the DPF. This is known as regeneration.

What is active regeneration?

Active self-regeneration occurs when there is not sufficient heat in the exhaust to convert the PM being collected in the DPF. Exhaust temperatures are raised by injecting a small amount of fuel (reducing agent) upstream of the Cummins Particulate Filter. The resulting chemical reaction over the DOC raises exhaust gas temperatures high enough to oxidize the PM from the filter (reconditioning in intervals by a soot burn-off procedure).

https://cumminsengines.com/cummins-particulate-filter

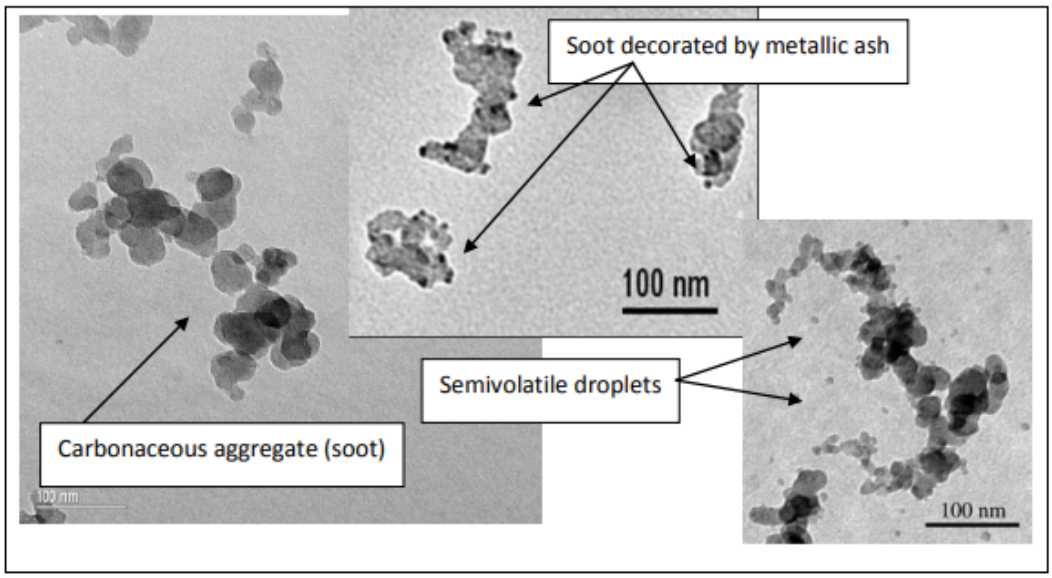


Figure 2: *Engine exhaust particles are very diverse in size, shape, and composition (adapted from Jung et al. [35] and Miller et al. [61]).*

Fig. 2: carbonaceous agglomerates that contribute most of the mass in the accumulation mode, semi-volatile droplets that usually comprise most of the number in the nucleation mode, and tiny ash particles that may either decorate existing particles as shown or form separate solid particles in the nucleation mode size range (Jung et al. [35]).

https://como.cheng.cam.ac.uk/preprints/c4e-Preprint-142.pdf

A soot burn off procedure occurs during the active regeneration process wherein, in addition to soot, non-combustible ashes (deposited during normal operation of the internal combustion engine). Active regeneration reduces the ash when the particulate matter is oxidized, which leaves a reduced amount of ash.

The exhaust gasses flow through the particulate filter while the internal combustion engine is operating. The DPF is located in the exhaust stream as part of the exhaust system as indicated below, which supplies the DPF with exhaust gases from the internal combustion engine.

Figure 16

What is active regeneration?

Active self-regeneration occurs when there is not sufficient heat in the exhaust to convert the PM being collected in the DPF. Exhaust temperatures are raised by injecting a small amount of fuel (reducing agent) upstream of the Cummins Particulate Filter. The resulting chemical reaction over the DOC raises exhaust gas temperatures high enough to oxidize the PM from the filter (reconditioning in intervals by a soot burn-off procedure).

https://cumminsengines.com/cummins-particulate-filter

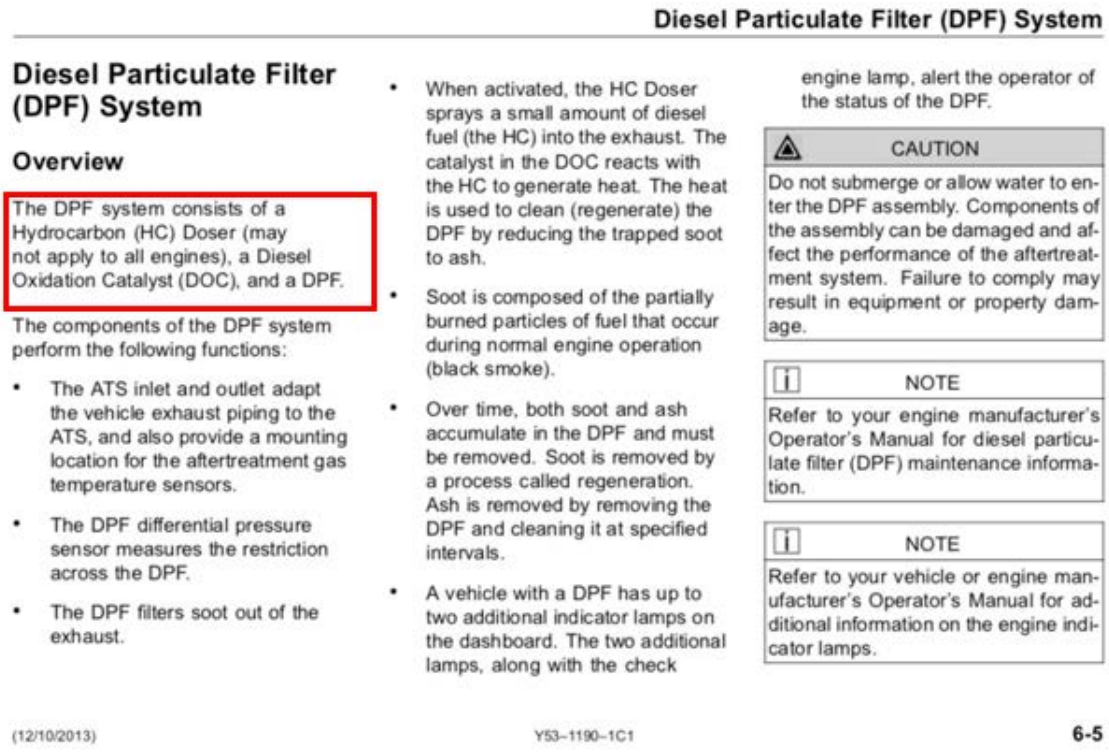
The reducing agent (diesel fuel) enters the exhaust system, as shown above, reacting with the ash by raising the temperature high enough to reduce the ash by oxidizing (chemically converting) the combustible portion of the ash deposits.

Figure 17

19. Claim 2 of the ’246 patent recites a method according to claim 1, wherein as reducing agent a fuel used for operating the engine is employed or the reducing agent is produced from the fuel on board of the motor vehicle.

20. The Kenworth Infringing Instrumentalities, for example at least the Kenworth T440/T470 with the Paccar PX-9, practice a method, as in claim 1 of the ’246 patent, wherein as reducing agent a fuel used for operating the engine is employed or the reducing agent is produced from the fuel on board of the motor vehicle (*Figure 18*).

21. The Peterbilt Infringing Instrumentalities, for example at least the Peterbilt Model 389 with the Cummins ISX 15, practice a method, as in claim 1 of the ’246 patent, wherein as reducing agent a fuel used for operating the engine is employed or the reducing agent is produced from the fuel on board of the motor vehicle (*Figure 17*).



Diesel Particulate Filter (DPF) System

Diesel Particulate Filter (DPF) System

Overview

The DPF system consists of a Hydrocarbon (HC) Doser (may not apply to all engines), a Diesel Oxidation Catalyst (DOC), and a DPF.

The components of the DPF system perform the following functions:

- The ATS inlet and outlet adapt the vehicle exhaust piping to the ATS, and also provide a mounting location for the aftertreatment gas temperature sensors.
- The DPF differential pressure sensor measures the restriction across the DPF.
- The DPF filters soot out of the exhaust.
- When activated, the HC Doser sprays a small amount of diesel fuel (the HC) into the exhaust. The catalyst in the DOC reacts with the HC to generate heat. The heat is used to clean (regenerate) the DPF by reducing the trapped soot to ash.
- Soot is composed of the partially burned particles of fuel that occur during normal engine operation (black smoke).
- Over time, both soot and ash accumulate in the DPF and must be removed. Soot is removed by a process called regeneration. Ash is removed by removing the DPF and cleaning it at specified intervals.
- A vehicle with a DPF has up to two additional indicator lamps on the dashboard. The two additional lamps, along with the check engine lamp, alert the operator of the status of the DPF.

CAUTION

Do not submerge or allow water to enter the DPF assembly. Components of the assembly can be damaged and affect the performance of the aftertreatment system. Failure to comply may result in equipment or property damage.

NOTE

Refer to your engine manufacturer's Operator's Manual for diesel particulate filter (DPF) maintenance information.

NOTE

Refer to your vehicle or engine manufacturer's Operator's Manual for additional information on the engine indicator lamps.

(12/10/2013) Y53–1190–1C1 6-5

For example, a reducing agent (i.e. the diesel fuel used to operate the engine) is employed (sprayed by the HC Doser) or the reducing agent is produced from the fuel on board of the motor vehicle (diesel fuel).

Figure 18

22. Claim 3 of the '246 patent recites a method according to claim 1, wherein the reducing is added to the exhaust gas upstream of the particle filter.

23. The Peterbilt Infringing Instrumentalities, for example at least the Peterbilt Model 389 with the Cummins ISX 15, practice a method according to claim 1, wherein the reducing agent is added to the exhaust gas upstream of the particle filter (*Figure 19*).

What is active regeneration?

Active self-regeneration occurs when there is not sufficient heat in the exhaust to convert the PM being collected in the DPF. Exhaust temperatures are raised by injecting a small amount of fuel (reducing agent) upstream of the Cummins Particulate Filter. The resulting chemical reaction over the DOC raises exhaust gas temperatures high enough to oxidize the PM from the filter.

https://cumminsengines.com/cummins-particulate-filter

Figure 19

24. Claim 7 recites a method according to claim 1, wherein an ash reducing procedure is performed in connection with a soot-burnoff procedure.

25. The Kenworth Infringing Instrumentalities, for example at least the Kenworth T440/T470 with the Paccar PX-9, practice a method according to claim 1, wherein an ash reducing procedure is performed in connection with a soot-burnoff procedure (*Figures 7-9*).

26. The Peterbilt Infringing Instrumentalities, for example at least the Peterbilt Model 389 with the Cummins ISX 15, practice a method according to claim 1, wherein an ash reducing procedure is performed in connection with a soot-burnoff procedure (*Figure 16*).

27. On information and belief, these Accused Instrumentalities are used marketed, provided to, and/or used by Defendant's partners, clients, customers and end users across the country and in this District.

28. Defendant was made aware of the '246 patent and had notice of the '246 patent and Defendant's infringement thereof at least as early as the filing of this Complaint.

29. Upon information and belief, since at least the time Defendant received notice, Defendant has induced and continues to induce others to infringe at least one claim of the '246 patent under 35 U.S.C. § 271(b) by, among other things, and with specific intent or willful blindness, actively aiding and abetting others to infringe, including but not limited to each of

Defendant's partners, clients, customers, and end users, whose use of the Accused Instrumentalities constitutes direct infringement of at least one claim of the '246 patent.

30. Upon information and belief, since at least the time Defendant received notice, Defendant is liable as a contributory infringer of the '246 patent under 35 U.S.C. § 271(c) by offering to sell, selling and importing into the United States trucks with aftertreatment systems which infringe of the '246 patent. The Accused Instrumentalities comprise material components for use in practicing the '246 patent and are specifically made and are not a staple article of commerce suitable for substantial non-infringing use.

31. On information and belief, since at least the time Defendant received notice, Defendant's infringement has been willful.

32. Plaintiff has been harmed by Defendant's infringing activities.

JURY DEMAND

Pursuant to Rule 38 of the Federal Rules of Civil Procedure, Plaintiff demands a trial by jury on all issues triable as such.

PRAYER FOR RELIEF

WHEREFORE, Plaintiff demands judgment for itself and against Defendant as follows**:**

A. An adjudication that Defendants have infringed the '246 patent**;**

B. An award of damages to be paid by Defendant adequate to compensate Plaintiff for Defendant's past infringement of the '246 patent, and any continuing or future infringement through the date such judgment is entered, including interest, costs, expenses and an accounting of all infringing acts including, but not limited to, those acts not presented at trial;

C. A declaration that this case is exceptional under 35 U.S.C. § 285, and an award of Plaintiff's reasonable attorneys' fees; and

D. An award to Plaintiff of such further relief at law or in equity as the Court deems just and proper.

Dated: May 15, 2018

DEVLIN LAW FIRM LLC

/s/ Timothy Devlin

Timothy Devlin (#4241)
tdevlin@devlinlawfirm.com
1306 N. Broom St., 1st Floor
Wilmington, Delaware 19806

Telephone: (302) 449-9010
Facsimile: (302) 353-4251

Attorneys for Plaintiff
Diesel Technologies, LLC