

OWNER'S MANUAL



Econix DPF-A Owner's Manual

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Preface

Thank you for choosing SK Econix DPF-A, the most advanced and user-friendly Diesel Particulate Filter (DPF) with an independently activated regeneration system.

SK Econix DPF-A is capable of removing particulate matter (PM), including visible smoke, emitted from the tailpipes of most diesel powered vehicles and industrial machines.

Please read this Owner's Manual thoroughly before putting the SK Econix DPF-A into operation, especially when it is first installed. Improper operation may cause serious injuries and/or damage to the vehicle and/or the system. Please keep this manual in a safe place in the vehicle at all times for future reference.

In this manual warning symbols are used to emphasize special care and precaution:

 (Orange Warning Sign)	Cautiously follow instructions. Failure to do so may result in serious personal injury and/or fire.
 (Yellow Warning Sign)	Carefully observe instructions. Otherwise personal injury, malfunction and/or damage to the system may occur.

NOTE	Following is an important notice regarding the warranty coverage.
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SK Energy reserves the right to make changes or add improvements at any time without prior notice. This manual was prepared with the latest product information available at the time of printing.

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1. Overview

1.1. Overview of the Econix DPF-A

Econix DPF-A is a diesel emission control system, which reduces particulate matter (PM) emitted from diesel engines downstream of an exhaust manifold. It operates independently of the vehicle system and is not affected by emission gas temperature, because of a state-of-the-art, active regeneration technology. The manually triggered regeneration approximately takes 5 to 10 minutes to complete.

1.2. Summary of the Econix DPF-A Components

Econix DPF-A has three main parts: 1. Main Filter Body, which traps PM through a metallic diesel particulate filter (DPF) and burns it with a diesel burner; 2. Electronic Control Unit (ECU), which controls the Main Filter Body; and 3. Controller, which allows the operator to communicate with and control the DPF system.

1.3. Summary of the Econix DPF-A Regeneration Process

When the operator is notified by the Regeneration Alarm Signals, the operator must pull the vehicle over and come to a complete stop. Once stopped with the vehicle engine in idling condition, the operator must hold down (for about 3 seconds) the Regeneration Button on the controller to activate the regeneration cycle which is completed in approximately 5 to 10 minutes. By following these simple steps, the operator can reduce PM emissions by greater than 85% and clean the DPF system of all collected PM.

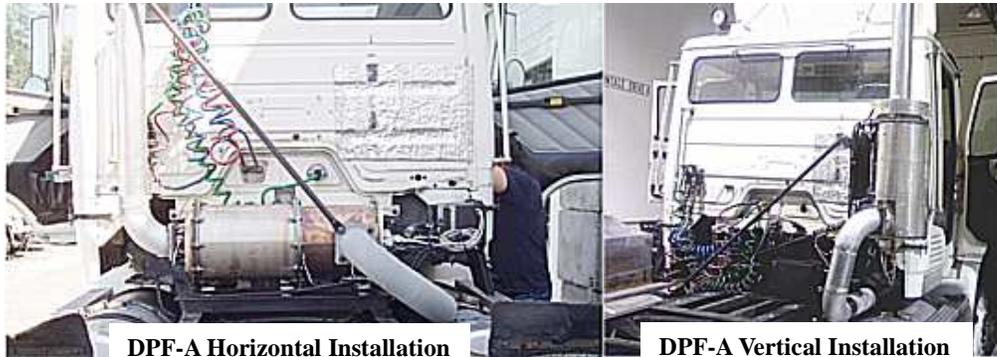


Figure 1: Econix DPF-A installed on a Detroit Diesel Series 60 Class 8 tractor



Figure 2: Econix DPF-A Main Filter Body, Electronic Control Unit (ECU) and Controller

2. General Instruction

2.1. Precautions

2.1.1. Vehicle Conditions, Maintenance and DPF Installation

Econix DPF-A works best with a diesel vehicle of which engine, transmission, intake and exhaust system are well maintained and in good condition, and of which engine idle RPM falls between 600 and 750.

Smoke emission from the vehicle must be equal to or less than the original vehicle manufacturer's emission specifications. In the event that the vehicle's smoke emission does not meet the specifications, the vehicle must be reconditioned or repaired prior to installation of the DPF system.

After installation of the DPF system, the vehicle should be serviced periodically to satisfy the original vehicle manufacturer's emission and performance specifications. Failure to do so may result in excessive power loss, fuel economy degradation, increase in noise, decrease in PM reduction efficiency and/or damage to the DPF system. Please keep a record and maintain a file of all maintenance and repairs.

It is advised that the installation be performed by a certified service partner in accordance with the Installation Manual. After completion of the initial installation and inspection, please fill out the "Installation Check List." The vehicle operator must review the "Installation Check List," item by item, and initial all necessary items before putting the DPF system into operation. A completed and initialed "Installation Check List" is conducive for the warranty coverage.

NOTE	Following is an important notice regarding the warranty coverage.
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2.1.2. Operation

White smoke may be emitted from the DPF system in a cold climate. The white smoke is a vapor consisting of condensed water that has accumulated in the exhaust pipe and DPF system. The white smoke may be prevalent after a long period of rest, extended idling time or the vehicle has operated without preheating. The white smoke may appear until all water vapor has been evaporated. This is especially prevalent in cold weather conditions.

Pay special care not to expose the DPF system to excessive moisture. In the event that the DPF system is submerged in water, such as in a flood or storm, do not try to resume operation, and contact a certified service partner for assistance.

Above-normal or excessive engine oil consumption by an engine that has not been properly maintained can lead to an increase in ash deposited into the DPF system. The additional ash deposited in the DPF system results in an increase in back pressure which

will cause more frequent regenerations, a decrease in PM reduction efficiency and premature replacement of the filter.

A vehicle's battery must be completely disconnected from the vehicle's electrical system and the DPF system if welding is to be performed on or nearby the vehicle.

The DPF system works with a 12 or 24-Volt vehicle battery system. Please note that a stable current and voltage supply is one of the most important constraints of the DPF system operation (Make sure the battery voltage matches the DPF system requirement). The vehicle's electrical system must be serviced if voltage supply is unstable or fluctuates.

Exhaust piping and electrical harness connections to and from the DPF system must be periodically inspected. If a problem is identified during an inspection, contact a certified service partner for support.

The ECU and the Controller calculate and record the PM accumulation in the filter by measuring the pressure upstream of the filter. When regeneration is required, the system sends signals to the operator in the form of LED illuminations and audible alarms. The operator must initiate regeneration by carefully following the procedure explained later in this manual. Failure to do so will result in excessive PM accumulation and cause consequential problems to the vehicle engine and DPF system.

If PM accumulation exceeds the limits determined by the preset values, the ECU will bypass the operator's regeneration command in order to protect the DPF system (If regeneration begins in the presence of an excessive amount of PM, the filter may be damaged due to high temperature generated from the PM burning). To safely regenerate the filter and reset ECU, call a certified service partner for assistance. In general, such service is not covered by the warranty. The vehicle operator is required to perform regeneration each time the DPF system's Regeneration Signals notifies the operator.

NOTE	It is the operator's responsibility to initiate timely regeneration when visual (LED) and audible (alarm) Regeneration Signals are given. Failure to do so will result in excessive PM accumulation and may cause consequential problems. Remedy to such problems is, in general, not covered by the warranty.
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2.1.3. Controller

The Controller stores operating and duty-cycle data for at least 200 days. The operator must call a certified service partner for support if the Controller's power LED is not illuminated when the engine ignition is turned to the "ON" position.

In the event that the vehicle operator intentionally disables the Controller or leaves it inoperable when the vehicle is operated, the warranty coverage may be voided. If recent operation data is not stored in the Controller and/or is not retrievable because of the vehicle operator's tampering or system neglect, the warranty may be revoked.



Do not wrongfully or unnecessarily tamper with the Controller for it will cause system malfunctions which may result in personal injury. If the seal on the Controller or the Controller itself is physically damaged, the warranty coverage may be void.

NOTE

It is the operator's responsibility to check and maintain the Controller in good condition. In case the Controller is not in operation, the operator must call a certified service partner for support. Warranty coverage may not be provided unless the Controller is properly maintained and the complete history of operation data in is fully retrievable.

NOTE

Following is an important notice regarding the warranty coverage.

2.1.4. Precautions during the Regeneration Cycle

During regeneration, the engine exhaust gases increase to very high temperatures. Prior to initiating regeneration, the vehicle operator must check for the presence of flammable substances. Regeneration should not be performed at or near gas stations, oil contaminated areas or otherwise potentially flammable environments. The vehicle operator must only perform regenerations after ensuring there are no flammable substances or objects near the vehicle.

Be aware that surface temperatures of the DPF system are high enough to cause burns and/or injuries upon contact. Avoid physical contact with the DPF system and adjacent exhaust pipes without proper protection. All persons and/or objects shall remain at least 2 meters or approximately 6 feet away from the DPF system before initiating and during regeneration.



Be alert for defective parts of the DPF system or vehicle that may result in possible fire conditions. In accordance with governing motor vehicle safety standards, maintain a fire extinguisher in the vehicle for emergency.

2.1.5. Ash Cleaning

As a result of regeneration, a small amount of ash will be accumulated in the metal filter. Over time the ash will accumulate and will need to be removed in order to maintain PM reduction efficiency.

SK Energy recommends the DPF system be cleaned once a year to remove ash accumulation that has been collected during the regeneration cycles. Regular annual cleaning will reduce back pressure caused by the DPF system and will maximize the life of the filter. Contact a certified service partner for scheduling to perform proper maintenance of the DPF system.

Ash cleaning may leave hazardous waste material. Disposal of this material must be performed in accordance with all applicable Federal, State and local laws governing hazardous waste disposal. Please contact a certified service partner for scheduling and to perform proper maintenance of the DPF system.

2.1.6. Additional Technical Information

Installation of the Econix DPF-A may exert an additional back pressure of 9.72 to 13.48 in. H₂O (24.20 to 33.56 mbar) on the retrofitted diesel engine. The increase in back pressure must not exceed the original vehicle manufacturer's specified maximum allowable back pressure limit.

Fuel consumption penalty from the DPF system installation is equal or less than 2%.

The DPF system does not use a catalyst formulated with precious metals. Sulfur content contained in diesel fuel is irrelevant to the performance of the DPF system. ULSD (Ultra-Low Sulfur Diesel) and LSD (Low Sulfur Diesel) may be used with this DPF system without causing harm or deterioration in performance.

No additives or Fuel-borne Catalysts (FBC) are used with the DPF system.

The engine must be well maintained and not consume lubricating oil at a rate greater than that specified by the original vehicle manufacturer.

2.1.7. Conditions That May Effect Performance or Damage Filter

The owner and operator should take notice of all conditions that damage the filter or affect vehicle performance. In the event any of these failures occur it is the owner and operators responsibility to contact Econix or a certified Econix dealer to ensure proper action be taken.

Impact or Puncture: While the main filter body is rather strong damage can occur due to improper handling, road debris, or work related incidents. In case an incident like this occurs, inspect impact or puncture area, and all connection points for leaks.

Engine Failure – Blown Turbo or Head Gasket: These events cause foreign debris to enter the filter body at potentially high speeds that may damage the filter. In the event this occurs, pull the vehicle over and turn off the engine as soon as possible.

Rain Entry on Vertical Stacks: Excessive water will damage the filter thus vertical stack must be equipped with rain caps or turn out stacks. Ensure the rain cap works properly and avoid objects that may knock of the rain cap or turn out stack.

Excessive Oil Consumption: Excessive oil entering the filter will not damage the filter but will increase the level of ash in the filter. This increase of ash will translate to the need for cleaning the filter earlier then commonly necessary.

Exhaust Tubing Removal and Replacement: If exhaust tubing is removed or replaced ensure that the gaskets are also replaced. Failure to do may cause exhaust leaks and DPF system performance.

2.2. Warranty

2.2.1. Overview of Warranty

This product is manufactured with the highest standards of quality control. SK Energy warrants that the goods are free from defects in material and workmanship. If a defect is found during the warranty period, repair will be provided by a certified service partner, subject to certain conditions, at no cost. SK Energy warrants the Econix DPF-A in accordance with the following:

PRODUCT WARRANTY

YOUR WARRANTY RIGHTS AND OBLIGATIONS

SK Energy (SK) warrants the diesel emission control system in the application for which it is sold or leased to be free from defects in design, materials, workmanship, or operation of the diesel emission control system which cause the diesel emission control system to fail to conform to the emission control performance level it was verified to, or to the requirements in the California Code of Regulations, Title 13, Sections 2700 to 2706 and 2710, for the periods of time listed in Table 1, provided there has been no abuse, neglect, or improper maintenance of your diesel emission control system, vehicle or equipment, as specified in the owner's manuals. Where a warrantable condition exists, this warranty also covers the engine from damage caused by the diesel emission control system, subject to the same exclusions for abuse, neglect or improper maintenance of your vehicle or equipment. Please review your owner's manual for other warranty information. Your diesel emission control system may include a core part (e.g., particulate filter, diesel oxidation catalyst, selective catalytic reduction converter) as well as hoses, connectors, a back pressure monitor (if applicable) and other emission-related assemblies. Where a warrantable condition exists, SK will repair or replace your diesel emission control system at no cost to you including diagnosis, parts and labor.

WARRANTY COVERAGE

For an engine used in an application listed in Table 1, the warranty period will be the years or hours or miles of operation shown in Table 1, whichever occurs first. If any emission-related part of your diesel emission control system is defective in design, materials, workmanship, or operation of the diesel emissions control system thus causing the diesel emission control system to fail to conform to the emission control performance level it was verified to, or to the requirements in the California Code of Regulations, Title 13, Sections 2700 to 2706 and 2710, within the warranty period, as defined above, SK will repair or replace the diesel emission control system, including parts and labor.

In addition, SK will replace or repair the engine components to the condition they were in prior to the failure, including parts and labor, for damage to the engine proximately caused by the verified diesel emission control strategy. This also includes those relevant diagnostic expenses in the case in which a warranty claim is valid. SK may, at its option, instead pay the fair market value of the engine prior to the time the failure occurs.

OWNER'S WARRANTY RESPONSIBILITY

As the vehicle, engine, or equipment owner, you are responsible for performing the required maintenance described in your owner's manual. SK recommends that you retain all maintenance records and receipts for maintenance expenses for your vehicle, engine, or equipment and diesel emission control system. If you do not keep your receipts or fail to perform all scheduled maintenance, SK may have grounds to deny warranty coverage. You are responsible for presenting your vehicle, equipment, or engine, and diesel emission control system to a SK dealer as soon as a problem is detected. The warranty repair or replacement should be completed in a reasonable amount of time, not to exceed 30 days. If a replacement is needed, this may be extended to 90 days should a replacement not be available, but must be performed as soon as a replacement becomes available.

If you have questions regarding your warranty rights and responsibilities, you should contact SK Energy at (877) 4Econix or at 1175 N. Del Rio Place, Ontario, CA 91764 or the California Air Resources Board at 800-363-7664 or 9528 Telstar Avenue, El Monte, CA 91731 or via e-mail at helpline@arb.ca.gov.

Contact in North America:

SK Energy
1175 N. Del Rio Place
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INSTALLATION WARRANTY

YOUR WARRANTY RIGHTS AND OBLIGATIONS

The SK authorized installer warrants that the installation of the diesel emission control system is free from defects in workmanship or materials which cause the diesel emission control system to fail to conform to the emission control performance level it was verified to, or to the requirements in the California Code of Regulations, Title 13, Sections 2700 to 2706. The warranty period and the extent of the warranty coverage provided by the SK authorized installer is the same as the product warranty provided by SK, and the same exclusions apply.

OWNER'S WARRANTY RESPONSIBILITY

As the vehicle, engine, or equipment owner, you are responsible for presenting your vehicle, engine, or equipment, and diesel emission control system to the SK authorized installer as soon as a problem with the installation is detected.

For the purpose of this warranty, abuse or neglect includes vehicle accidents, ignoring the system indicator lights, blending lubricating oil with fuel, or any engine failure or condition that allows excess lubricating oil, coolant, contaminants or debris to enter the exhaust system. The owner shall not use any fuel additive or lube oil additive that is not approved for use in diesel engines equipped with catalytic mufflers.

Table 1:

Engine Type	Engine Size	Minimum Warranty Period
On-Road	Light heavy-duty, 70 to 170 hp, Gross Vehicle Weight Rating (GVWR) less than 19,500 lbs.	5 years or 60,000 miles
	Medium heavy-duty, 170 to 250 hp, GVWR from 19,500 lbs. to 33,000 lbs.	5 years or 100,000 miles
	Heavy heavy-duty, exceeds 250 hp, GVWP exceeds 33,000 lbs.	5 years or 150,000 miles
	Heavy heavy-duty, exceeds 250 hp, GVWP exceeds 33,000 lbs., and the truck is: 1. Typically driven over 100,000 miles per year, and 2. Has less than 300,000 miles on the odometer at the time of installation.	2 years, unlimited miles
Off-Road (includes portable engines) and Stationary	Under 25 hp, and for constant speed engines rated under 50 hp with rated speeds greater than or equal to 3,000 rpm	3 years or 1,600 hours
	At or above 25 hp and under 50 hp	4 years or 2,600 hours
	At or above 50 hp	5 years or 4,200 hours

2.2.2. Warranty Period and Coverage

The warranty coverage is good in accordance with the years or miles defined below:

Engine Type	Engine Size	Minimum Warranty Period
On-Road	Light heavy-duty, 70 to 170 hp, Gross Vehicle Weight Rating (GVWR) less than 19,500 lbs.	5 years or 60,000 miles
	Medium heavy-duty, 170 to 250 hp, GVWR from 19,500 lbs. to 33,000 lbs.	5 years or 100,000 miles
	Heavy heavy-duty, exceeds 250 hp, GVWP exceeds 33,000 lbs.	5 years or 150,000 miles
	Heavy heavy-duty, exceeds 250 hp, GVWP exceeds 33,000 lbs., and the truck is: 1. Typically driven over 100,000 miles per year, and 2. Has less than 300,000 miles on the odometer at the time of installation.	2 years, unlimited miles
Off-Road (includes portable engines) and Stationary	Under 25 hp, and for constant speed engines rated under 50 hp with rated speeds greater than or equal to 3,000 rpm	3 years or 1,600 hours
	At or above 25 hp and under 50 hp	4 years or 2,600 hours
	At or above 50 hp	5 years or 4,200 hours

2.2.3. Warranty and Regeneration Requirements

One or two regenerations may be needed per day based on an operation duty-cycle of 8 hours per day. The regeneration frequency may increase if the vehicle's baseline emissions are greater than the range for which it was originally certified. The warranty coverage, as defined above, applies to all products regardless of the operation duty-cycle in which the product is used.

2.2.4. Warranty Period and Coverage When Assigned to a 3rd Party

If a vehicle that has a DPF system installed is sold or assigned to a third party, it is recommended that the new owner register with a certified service partner to help validate the warranty for the remainder of the warranty period. The warranty will be may not be validated or honored if the DPF system is tampered with, modified or installed to a different vehicle.

2.2.5. Warranty Requirements and Conditions

In order to maintain the warranty period, the following conditions are recommended. Failure to follow the recommendations below may cause the warranty to be voided:

- Only genuine parts, provided and made available by SK Energy or approved by a certified service partner, are to be used for installation, maintenance and/or repair;
- part modification(s) and/or design change(s) to the DPF system must be approved by SK Energy in written consent before they are performed;

- an original or photocopy of the “Post Install Check List” that is provided to the owner/operator by a certified service partner at the time of installation must be kept on file;
- an original or photocopy of the “Verification of Operation Tutorial,” which is issued by a certified service partner to the owner/operator after an introductory “Owner’s Manual” orientation is completed and each item in the list is checked and initialed, must be kept on file; and
- records of mandatory vehicle inspections required by law and service records from routine maintenance must be kept on file.
- Every filter will come with a product label already attached and a duplicate label to be attached to the engine that the filter will be installed on. The serial number of the filter must match the serial number that is on the engine label. Figure 3 is a schematic of the label that will come with the system.

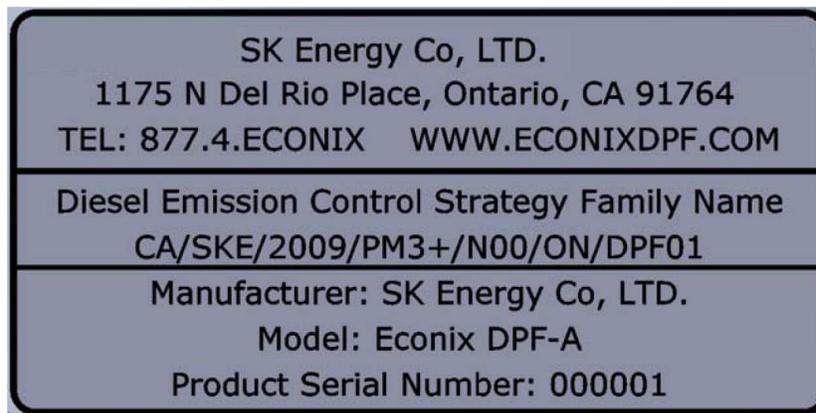


Figure 3: Econix DPF-A system label for filter and engine

2.2.6. Replacement of Parts Not Covered Under the Warranty

N/A

2.3. Product Specifications

Model		CAT 0		CAT I		CAT II	
Dimensions (Main Body)	A	1016 mm	40.00 in	1098 mm	43.23 in	1218 mm	47.95 in
	B	299 mm	11.77 in	390 mm	15.33 in	431 mm	16.95 in
	C	263 mm	10.35 in	296 mm	11.65 in	337 mm	13.27 in
Dimensions (Filter Module)	D	507 mm	19.96 in	588 mm	23.15 in	683 mm	26.89 in
	E	264 mm	10.37 in	339 mm	13.33 in	414 mm	16.28 in
Dimensions (Burner Module)	F	507 mm	19.97 in	509 mm	20.02 in	534 mm	21.01 in
	G	212 mm	8.36 in	172 mm	6.76 in	172 mm	6.76 in
	H	295 mm	11.61 in	337 mm	13.26 in	362 mm	14.24 in
Gross Weight	Main Body	38.4 kg	84.5 lbs	64.0 kg	140.8 lbs	74.3 kg	163.5 lbs
	ECU Box	13.8 kg		30.4 lbs			
	Controller	0.9 kg		2.0 lbs			
Dimensions (ECU/Control Box, W x H x D)		341mm x 213mm x 190mm			13.4in x 8.4 in x 7.5in		
Dimensions (Controller, W x H x D)		141mm x 90mm x 36mm			5.6 in x 3.5 in x 1.1in		
Diameter of the exhaust pipe		89 mm	3.50 in	102 mm	4.00 in	127 mm	5.00 in
Filter Capacity		9.88 liter		17.45 liter		27 liter	
Regeneration Time		5 to 10 Minutes					
Ambient Temperature		-20 to +50 °C					

Smaller or larger vehicles should consider additional Econix DPF-A models which will soon be available in medium and extra-large sizes.

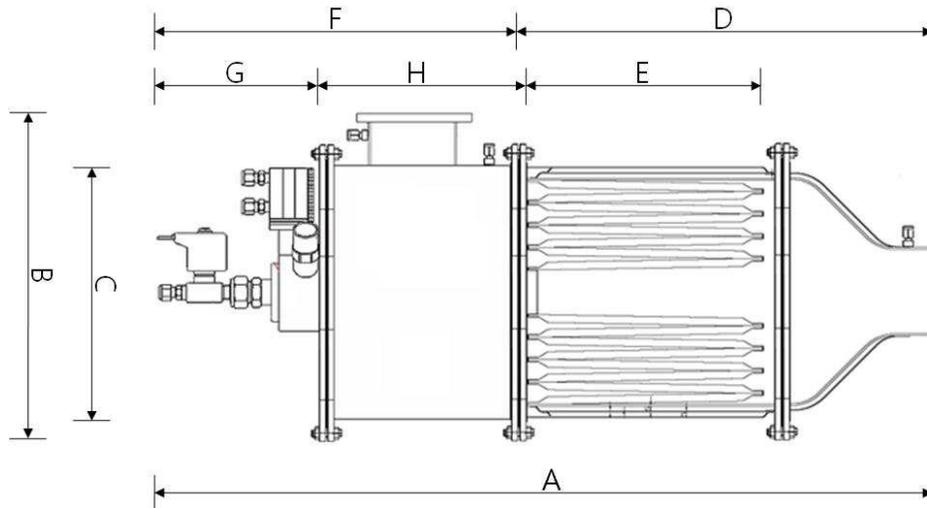


Figure 4: Schematic drawing of Econix DPF-A Main Filter Body

2.4. Installation

A separate Installation Manual is available and provided with the DPF system after installation. This section provides an overview of the key features regarding the installation process in order to provide a general understanding of the DPF system.

2.4.1. Main Filter Body Installation

A. Attach the Main Filter Body to a vehicle frame using the fixtures provided with the DPF system. (Picture is on the following page)

B. Install temperature sensors into the DPF system's Main Filter Body

C. Install pressure transducer into the DPF system's Main Filter Body

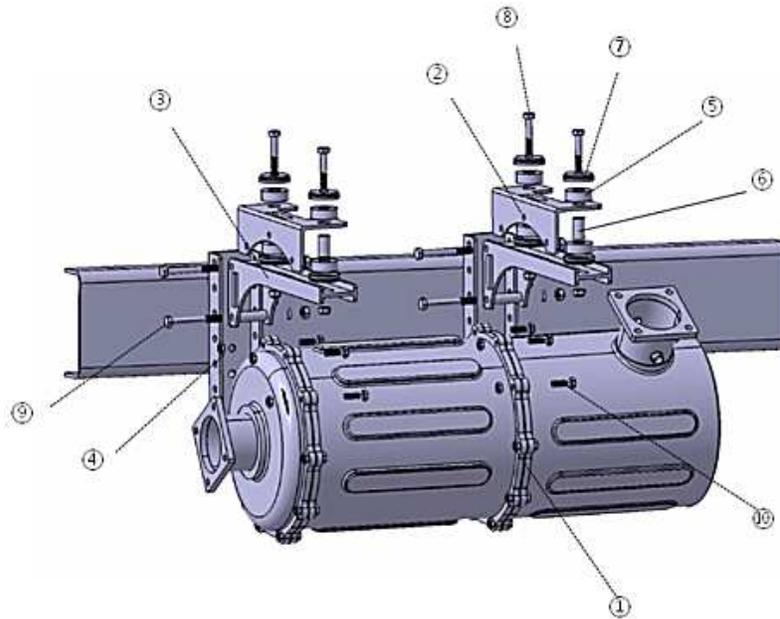


Figure 5: Exploded view of DPF system shown in a horizontal installation

No.	Component Name	Quantity
①	BMF-ML-C	1
②	Mounting Bracket	2
③	Support Bracket	2
④	Support Frame Bracket	2
⑤	Anti-vibration Rubber	8
⑥	Bolt	4
⑦	Cap	8
⑧	Hex Bolt & Nut	4
⑨	Hex Bolt & Nut	4
⑩	Hex Bolt & Nut	6

Table 1: Parts list for DPF system installation

2.4.2. ECU Installation

A. Position the ECU near the Main Filter Body but shielded in order to protect the ECU from any heat dissipated by Main Filter Body.

B. Connect the Air Line to the Air Cylinder of the Main Filter Body.

C. Connect the Fuel Line to the Solenoid Valve in the Main Filter Body

D. Connect the Sensors and the Harness (Total of 6, including two Temperature sensors, Pressure Transducer, Igniter Control Line, Shutter Control Line and Solenoid Valve Control Line)

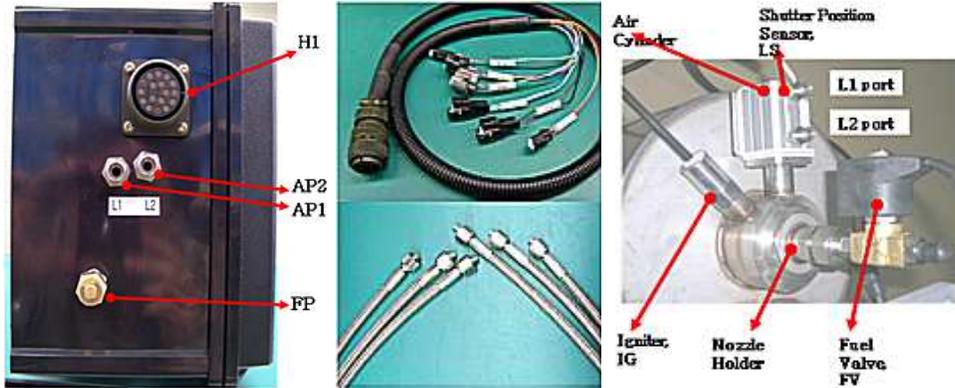


Figure 6: ECU and sensor and harness installation components

E. Connect the Fuel Return Line to the ECU

F. Connect the Harness to the Controller



Figure 7: ECU installation components

2.4.3. Controller Installation

A. Position the Controller within reach, and in plain visible sight of the operator. It is recommended to install the Controller at a convenient location near the instrument cluster.

B. Connect the Harness from the ECU

C. Connect the Power Line to the Controller's Key On socket

2.4.4. Inspection

A. Connect the Power Line to the vehicle's battery

B. Turn on the Power Switch on the ECU

C. Check and confirm that the ECU and the Controller are online and communicating with the DPF system by turning the DPF system on.

2.5. Maintenance and Repair

2.5.1. Maintenance Requirements

The following guidelines must be adhered to in order to ensure proper maintenance and performance of the Econix DPF-A. Prior to driving the vehicle, a daily inspection must be performed to ensure the DPF system is in proper operating condition.

Inspection Item	Daily Inspection Details
Engine	No bleeding or leaking of oil from engine joints No abnormal noises during idling
Main Filter Body	No abnormal levels of white smoke, black smoke, or odor during idling Exhaust pressure of reducing device is low No exhaust gas is leaking from any part of the Main Filter Body No exhaust gas is leaking from any part of the exhaust pipe
Diesel fuel supply device	No diesel fuel is bleeding or leaking from any part of the diesel fuel supply device. No diesel fuel is bleeding or leaking from the joints of the fuel hose.
Condition of bolts, nuts, and clamps	No loose or missing bolts and nuts for attaching the diesel fuel Main Filter Body. No loosening of clamps for the EGR line or any part of the exhaust pipe No loose or missing bolts or nuts for attaching the diesel fuel supply device.

Table 3: Daily Inspection Items

In order to ensure proper performance of the Econix DPF-A, a 3-month and 1 year scheduled inspection performed by a certified service partner is recommended. The scheduled inspections include system cleaning and inspection of the harness, fuel lines, controller, sensors and the diesel fuel injection device.

Ash from burning lubrication oil may be accumulated in the filter. Although ash deposit may not increase back pressure significantly, periodic ash cleaning is recommended to ensure maximum PM reduction efficiency and minimum increase in back pressure. Contact a certified service partner for ash cleaning. The filter should be inspected and cleaned in the event that the Yellow Warning LED remains turned on during or after regeneration.

Ash cleaning and filter cleaning involves removal of the filter from the can and is recommended that it be performed by a certified service partner. The Main Filter Body must be disassembled from the intake side (refer to the flow direction imprinted on the can) to provide access to the filter. The filter must be cleaned using high pressure compressed air (7kgf/cm², 685 kPa). Inject air across the entire filter surface at a distance of approximately 10-to-20 cm from filter, until no visible ash particles are observed. Pay close attention not to spray ash around and collect it in an appropriate container for proper disposal. The filter must be handled carefully to prevent damage. Be careful not to blow ash or PM into the surrounding environment which could

contaminate the area. After the Main Filter Body is reassembled, start the vehicle engine and push the accelerator pedal rapidly a few times to ensure that all connections are properly secured. The DPF system must also be inspected and be free of any exhaust gas leaks.

Proper maintenance of the DPF system also requires periodic vehicle fuel filter changes as specified by the original equipment manufacturer. Refer to the original manufacturer’s maintenance guideline. SK Energy recommends replacing the fuel filter no less than every 50,000 miles.

Routine maintenance, including lubricating oil and filter replacement, is important to ensure the DPF system’s trouble-free operation. Routine maintenance is critical for the successful operation of the Econix DPF-A system

2.5.2. Inspection Requirements

The table below describes the suggested inspection interval the Econix DPF-A system. Proper inspection practice will ensure the identification of problems before they become catastrophic.

Time (Month)	10	20	30	40	50	60
Mileage (Mile)	25,000	50,000	75,000	100,000	125,000	150,000
Operation Hours	500	1000	1500	2000	2500	3000
Physical Damage and General Conditions	●	●	●	●	●	●
Fuel Line	●	●	●	●	●	●
Pipe Leakage	●	●	●	●	●	●
Fasteners and Fixtures		●		●		●
Harness and Connector		●		●		●
Electrical Parts and Grounds		●		●		●
ECU and Fuel Reservoir	●	●	●	●	●	●
ECU Error Code	●	●	●	●	●	●
Shutter & Position Sensor	●	●	●	●	●	●
Igniter	●	●	●	●	●	●
Nozzle	●	●	●	●	●	●
Temperature sensors and Pressure Transducer	●	●	●	●	●	●

Table 2: DPF system inspection interval

The checklist that is provided to the operator by the certified service partner for a visual inspection at the time of service must be initialed by the owner/operator and must be kept on file. An example of these check lists are seen in Figure 8 and Figure 9.

The checklist must have separate columns for a certified service partner to record remarks.

Ash cleaning is recommended once every year.

2.5.3. Disposable Parts Replacement

N/A

2.5.4. Cleaning the Filter

Approximately every year the filter will need to be cleaned due to white ash build up. Some applications, i.e. higher emission engines, intense duty cycles, and dirty environments, may require a more frequent cleaning interval for optimal performance.

Ideally the filter should be cleaned by an authorized Econix dealer, however one can clean the filter oneself.

Equipment:

- Dust Mask, Gloves, and Safety Glass
- A source of compressed and dry air (i.e. shop air gun)
- A shop vacuum

Directions:

Find an open properly ventilated area for which to execute cleaning procedure. Use the compressed air to blow the ash out of the filter. Use the vacuum to capture the ash being blown out. The filter is clean when no more ash or soot is escaping. Dispose the ash in accordance with all local laws and regulations.



Caution

Do not Inhale ash or soot particles or dangerous respiratory problems may occur

Inspection is recommended 3 months after installation and is recommended that it be performed at an Econix DPF-A Service Partner facility. The Owner/Operator is to initial each inspection point below acknowledging that the service was performed.

Company: _____ Driver: _____

Inspection Location: _____

VIN#: _____ Vehicle Name: _____

Vehicle Model: _____ Body #: _____

Mileage at Installation: _____ Current Mileage: _____

Contact Information: _____

Component	Standard	Replacement
Fuel Filter	50,000 miles or 1 year	
Injector Nozzle	30,000 miles or 1 year	
Ignitor	30,000 miles or 1 year	

	Inspection Item	Standard	Result	Initial
Cleaning device	Mounting condition of cleaning device	Visually check for damage or loosening.		
Harness and fuel lines	Condition of securing fuel lines	Check that fuel lines are secured and that the lines are not damaged.		
	Condition of securing harness	Check that harness is secured and that the harnesses are not damaged.		
Controller	Controller warning lamp	Confirm that the lamp flashes for 2 seconds when the key is turned ON.		
	Controller buzzer	Confirm that the buzzer rings for 0.1 seconds		
Sensors	Temperature sensors	Confirm that the exhaust gas temperature increases after the engine has started		
	Exhaust pressure sensor	Compare the controller display value and the Pressure differential: + 10 mbar or less Check for contamination inside flexible hose		
Reducing agent injection device	Operation of reducing agents supply device	Fuel pressure: 0.5~1.5 bar (inspect while solenoid valve is open)		
	Function of solenoid valves	Fuel pressure: 0.5~1.5 bar (open) 3.5~5.5 bar (open)		
	Injectors spray condition	Mist spray condition		
Wiring	Wiring Secured	All wiring and cables should be secured to he brackets and out of the way for any of the system or vehicles functions		

Notes: _____

Certified Econix DPF-A Technician

Date

Figure 8: 3 month checklist (3 months from installation) that will be provided at time of service for the technician to go over with owner/operator

Inspection is recommended 12 months after installation and is recommended to be performed at an Econix DPF-A Service Partner facility. The Owner/Operator is to initial each inspection point below acknowledging that the service was performed

Company: _____ Driver: _____

Inspection Location: _____

VIN#: _____ Vehicle Name: _____

Vehicle Model: _____ Body #: _____

Mileage at Installation: _____ Current Mileage: _____

Contact Information: _____

Component	Standard	Replacement
Fuel Filter	50,000 miles or 1 year	
Injector Nozzle	30,000 miles or 1 year	
Ignitor	30,000 miles or 1 year	

	Inspection Item	Standard	Result	Initial
Cleaning device	Mounting condition of cleaning device	Visually check for damage or loosening.		
Harness and fuel lines	Condition of securing fuel lines	Check that fuel lines are secured and that the lines are not damaged.		
	Condition of securing harness	Check that harness is secured and that the harnesses are not damaged.		
Controller	Controller warning lamp	Confirm that the lamp flashes for 2 seconds when the key is turned ON.		
	Controller buzzer	Confirm that the buzzer rings for 0.1 seconds		
Sensors	Temperature sensors	Confirm that the exhaust gas temperature increases after the engine has started		
	Exhaust pressure sensor	Compare the controller display value and the Pressure differential: + 10 mbar or less Check for contamination inside flexible hose		
Reducing agent injection device	Operation of reducing agents supply device	Fuel pressure: 0.5-1.5 bar (inspect while solenoid valve is open)		
	Function of solenoid valves	Fuel pressure: 0.5-1.5 bar (open) 3.5-5.5 bar (open)		
	Injectors spray condition	Mist spray condition		
Wiring	Wiring Secured	All wiring and cables should be secured to he brackets and out of the way for any of the system or vehicles functions		

Notes: _____

Certified Econix DPF-A Technician

Date

Figure 9: 12 month checklist (12 months from installation) that will be provided at time of service for the technician to go over with owner/operator

3. Product Descriptions

3.1. PM Removal and Regeneration

3.1.1. Overview of PM Removal and DPF System

The DPF system reduces PM from diesel engine exhaust gas through a metal filter. The filter is regenerated by a diesel burner, which is triggered manually by the vehicle operator.

3.1.2. Overview of Regeneration Process

Periodic regeneration, daily or as often as necessary while the vehicle engine is at idle, will regenerate the filter (burn accumulated PM in the filter) and ensure PM removal performance and minimize back pressure across the DPF system.

3.2. Parts and Modules

3.2.1. Module List

Module	Function
Metal Filter	Trap PM contained in exhaust gas by filtration
Diesel Burner	Regenerate filter by burning accumulated PM
ECU	Monitors and records the level of PM trapped in the filter and controls regeneration (triggered by the operator) with the on-board computer, sensors and electric motors.
Controller	Monitors the whole DPF system and send a signals to the operator a system error if any; Records and stores operation data every second; Sends signals (LED and alarm) for regeneration to operator; and Communicates with ECU for vehicle operation.

Table 3: Overall system parts and module list

3.2.2. Schematic Drawing

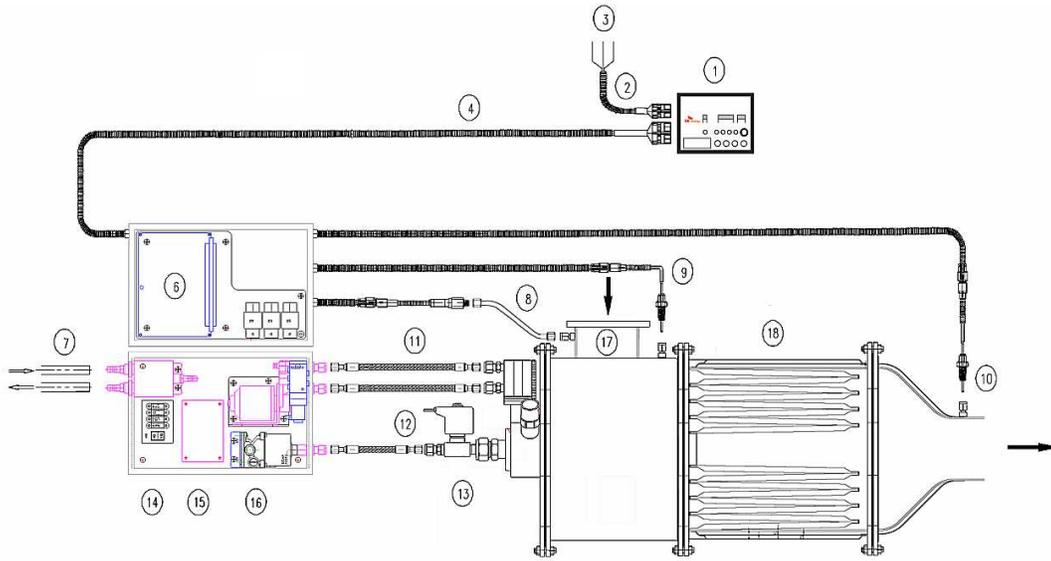


Figure 10: Econix DPF-A system schematic diagram

No.	Component Name	No.	Component Name
1	Controller	10	Outlet Cone Temperature Sensor
2	Power Line	11	Shutter Assy. w/ 2 Flexible Hoses
3	+12/24 V Power Line / Ground	12	Nozzle Assy. w/ 1 Flexible Hose
4	Controller Harness	13	Burner Assy.
5	Not Applicable	14	Fuel Reservoir
6	ECU	15	Air Compressor
7	Fuel Hose (Vehicle return line)	16	Fuel Pump
8	Pressure transducer Assy.	17	Inlet Port
9	Burner Temperature Sensor	18	Main Filter Body

*All the components will be adapted with 12-or-24 volt according to vehicle battery.

Table 4: Econix DPF-A component parts list

3.2.3. Main Filter Body

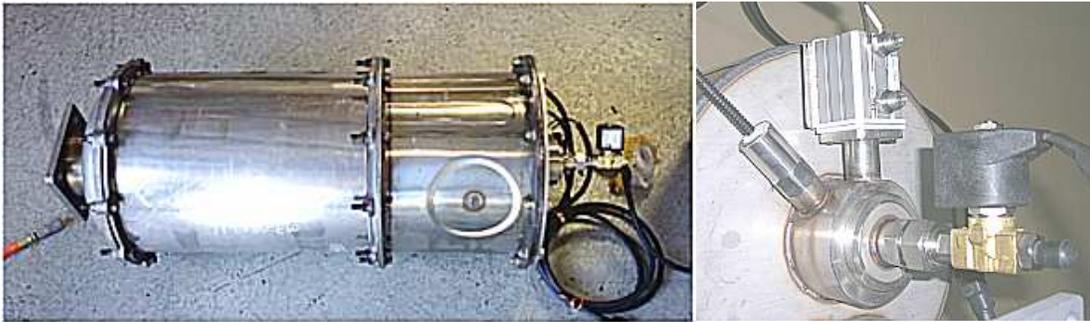


Figure 11: DPF system Main Filter Body

3.2.4. ECU Box

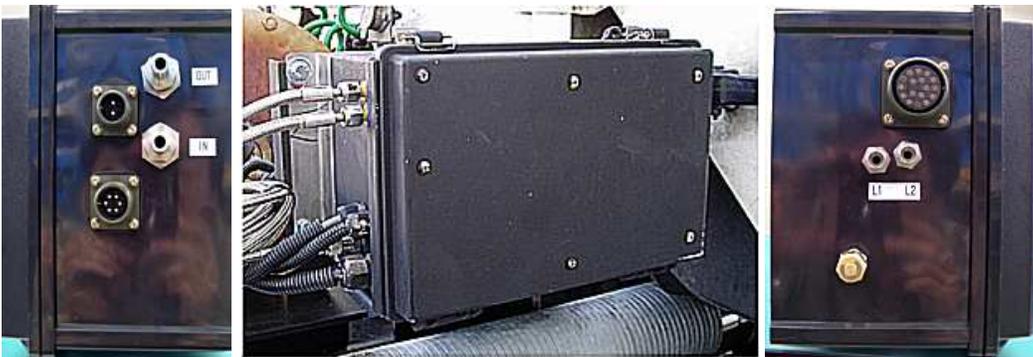


Figure 12: ECU Box

3.3. Controller

3.3.1. Controller

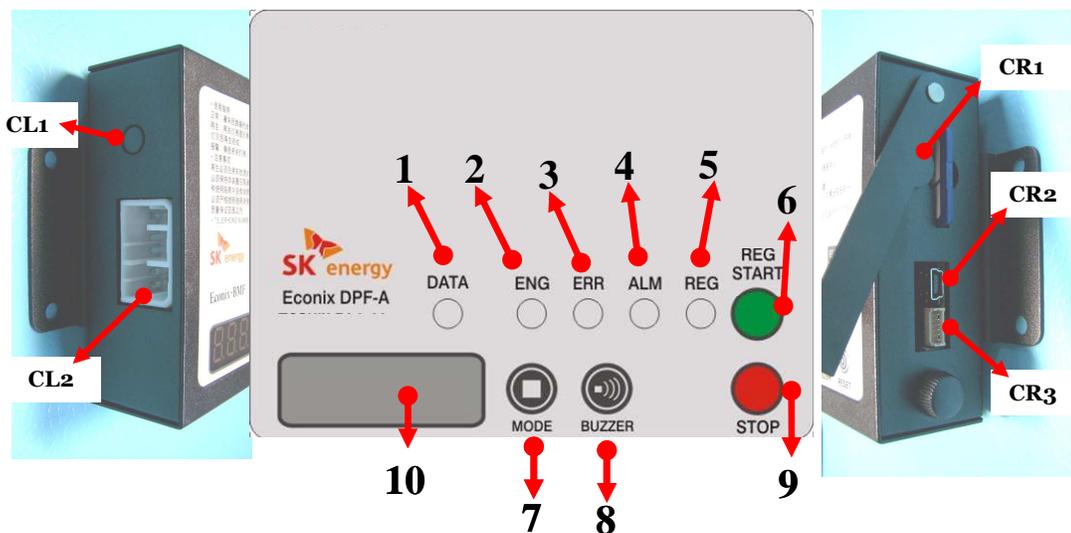


Figure 13: DPF system controller

3.3.2. LEDs and Buttons

	LED / Button	Color	Function
L1	Power Button		Turns the system power on and off (Embedded in the controller side panel and should not be changed by the operators)
L2	Connector		Connects controller to ECU/control Box.
1	DATA	Green/Red	Check the communication between Controller and ECU. Green means data storage is working properly and no illumination means there is an error in the data storage.
2	ENG	Green	Displays when vehicle engine is on.
3	ERROR	Yellow	Displays system error.
4	ALM	Red	Blinks when regeneration is needed
5	REG	Red	Signal for regeneration initiation by operator.
6	REG. ON	Green	Initiate regeneration or abort it.
7	MODE		Displays maximum back pressure, temperature or time since the last regeneration.
8	BUZZER		Turn Buzzer Off
9	STOP		Manual Regeneration Stop
10	Display Panel		Displays a sign, “---“, moving, for normal status. Displays a code if a system error occurs.
R1	SD Memory Card Slot		House a memory card, which stores operation data.
R2	Mini USB		USB port for laptop connect.
R3	Communication Port		External connector used only by a certified service partner.

3.4. System Interconnect Diagram

The System Interconnect Diagram below describes the all connections, fuel, air, and electrical, within the entire DPF system.

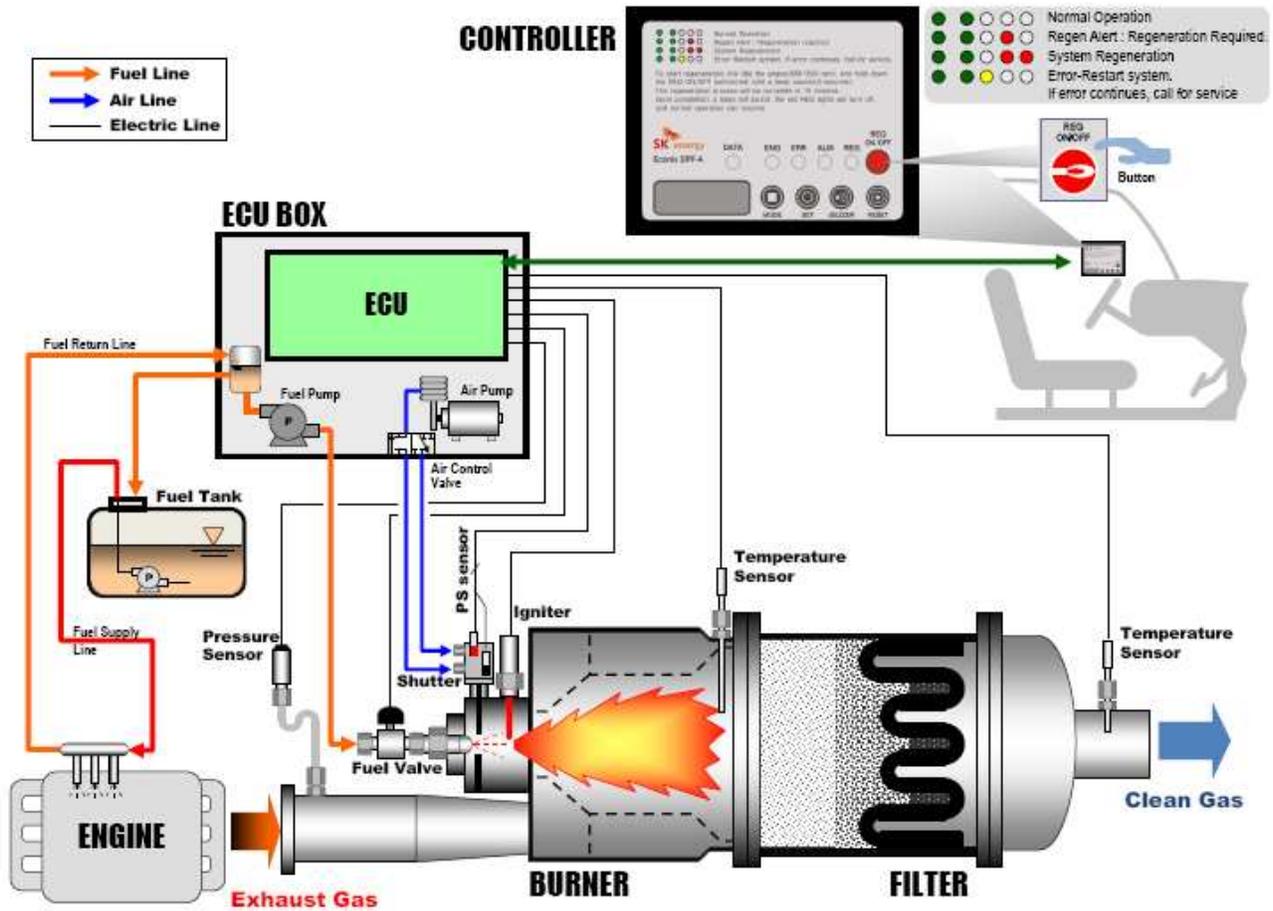


Figure 14: System Interconnect Diagram

4. Operation

4.1. Controller Operation

4.1.1. Controller Power Off

The Controller does not operate if vehicle engine is turned off.

4.1.2. Controller Power On

The Controller is automatically turned on when the key is switched to the “ON” position:

All LED’s are illuminated and blink for 3-5 seconds as the vehicle’s engine is started. A “----” sign appears in the Display Panel and DATA LED (Green) and ENG LED (Green) should be illuminated. If the DATA LED does not illuminate, it means an error has been detected in data storage function and must be inspected. If any of the LED’s do not illuminate as described above, the operator should call a certified service partner for support.

NOTE	<p>The Controller is designed to store operation data for 200 ~300 days. If the ENG power LED is not lit, the operator must call a certified service partner for support.</p> <p>If the operator intentionally turns the Controller’s power switch off, or there is recent operating data, the warranty coverage may be voided.</p>
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4.2. PM Trapping

4.2.1. PM Trapping Requirements

PM trapping (PM reduction) is continuously performed as long as the exhaust gas stream passes through the DPF system.

4.2.2. PM Accumulation

When the amount of PM trapped in the filter reaches a certain preset value determined when back pressure reaches a predetermined value, the Controller signals the operator to regenerate as explained Section 4.3 Regeneration.

4.2.3. 1st Stage Alarm

When the 1st stage alarm is triggered (LED and alarm), the operator must initiate the regeneration cycle before traveling no further than 30 miles from the point where the 1st stage signal was initially given.

4.2.4. 2nd Stage Alarm

If the operator does not react to the 1st stage signal, a 2nd stage alarm is triggered. When the 2nd stage alarm is triggered, the operator should immediately pull the vehicle over to a complete stop and initiate regeneration while the engine is running in idle.

4.2.5. 3rd and 4th Stage Alarm

If operator does not react to a 2nd stage alarm the 3rd stage alarm is triggered. The operator should immediately pull vehicle over to a complete stop and initiate regeneration while the engine is running in idle. Failure to do so will result in the triggering of the 4th stage alarm. In the event that the 4th stage alarm is ignored, regeneration cannot be initiated by the operator, in order to protect the filter from any possible damage. If this occurs the operator must call a certified service partner for support. (A certified service partner will safely regenerate the filter using special equipment. Such service, however, may not be covered by the warranty.)

4.2.6. Alarm Visual and Audible Signals

If the operator mutes the alarms, they will automatically return to the default setting, sounding if regeneration is required.

	LED Signal	Alarm Interval	Beeper Interval	Remark
Normal	DATA  ENG  ERORR  ALM  REG 			
1st Stage	DATA  ENG  ERORR  ALM  REG 	3 seconds	5 Seconds	
2nd Stage	DATA  ENG  ERORR  ALM  REG 	1 Second	2 Seconds	
3rd Stage	DATA  ENG  ERORR  ALM  REG 	1 Second	1 Second	
4th Stage	DATA  ENG  ERORR  ALM  REG 	1 Second	1 Second	Error code, 14 for ban on regeneration

NOTE	It is the operator's responsibility to initiate a timely regeneration once the alarm signals (visual LED and audible alarm) are given. Failure to do so will result in excessive PM accumulation and may cause consequential problems. Remedy to such problems is, in general, not covered by the warranty.
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	<p>LED lights may not be visible in direct sunlight.</p> <p>White smoke may be observed in cold climates. This is vapor from condensed water in the DPF system. It will gradually disappear as the engine heats up.</p>
---	---

4.3. Regeneration

4.3.1. Initiating the Regeneration Cycle

When the operator holds down the REG ON Button on the Controller for 3 seconds, the

regeneration cycle will begin. While regeneration continues, the first REG LED (red) stops flashing but remains on and REG ON Button turns off.

4.3.2. Conditional Requirements for Initiating the Regeneration Cycle

In order to initiate the regeneration cycle, the following conditions must be satisfied:

- Vehicle engine shall remain on and engine shall be running at idle condition;
- ENG LED (green) for “Engine” should be on; and
- ERROR LED (yellow) should be turned off to indicate no error is occurring.

4.3.3. Completion of the Regeneration Cycle

The REG LED (red) will turn off when regeneration is completed. Regeneration usually takes 5-to-10 minutes depending upon the amount of PM trapped in the filter.

	<p>During a regeneration cycle, do not step on an accelerator pedal. The abrupt change in RPM will cause the ECU and the Controller to terminate the regeneration cycle.</p>
	<p>Similar to precautions taken during the operation of the vehicle; Before and during a regeneration cycle, make sure there are no flammable substances on or around the DPF system. Failure to do so may create a potential risk of fire and/or injury because of an increase in temperature of the exhaust gasses.</p> <p>Once the Regeneration LED goes off, vehicle operation may be immediately resumed. During regeneration the DPF system should be away from people or flammable substances.</p>
	<p>During and immediately following regeneration, surface temperatures of the DPF system and adjacent pipes can become hot and should not be contacted. Stay alert for any objects that may come in contact during regeneration because of the unlikely possibility of fire or personal injury. A fire extinguisher must be placed in the vehicle in accordance with the governing motor vehicle standards.</p>
	<p>Carbon monoxide and carbon dioxide concentration can be increased during regeneration. Refrain from initiating regeneration in a closed area.</p>
	<p>White smoke may be observed in a cold climate. This vapor is from condensed water that has accumulated in the exhaust piping and DPF system. It will gradually disappear as engine heats up.</p>
	<p>Air conditioning or other auxiliary machinery may rev the engine and result in sudden RPM increase. This may terminate regeneration. Turn off any auxiliary machinery during regeneration.</p>
	<p>Frequent regeneration, prior to regeneration signal, may decrease fuel efficiency and shorten the life of the burner.</p>

4.4. Regeneration Abort

4.4.1. Aborting the Regeneration Cycle

Regeneration can be aborted during the regeneration cycle by holding down the REG OFF Button for approximately 3 seconds while the system is in a regeneration cycle.



In case of an emergency, regeneration can be aborted by turning the vehicle's engine off.

Aborting a regeneration cycle by turning the vehicle's engine off should only be performed in the event of an emergency. Suddenly aborting the regeneration cycle may cause white smoke and/or system errors.

When regeneration is aborted, try to reinitiate regeneration as soon as possible for thorough burning of PM and to reset the DPF system.

4.5. Error Codes

4.5.1. Errors during Vehicle Operation

If a problem arises in the DPF system, the ECU will send a signal to the Controller so the ERROR LED (yellow) begins blinking and the Error Codes will be displayed on the controller screen.

When the ERROR LED (yellow) is on, depending on the cause of the problem, regeneration and related functions may be disabled. Record the error codes and contact a certified service partner for support.

4.5.2. Errors during Regeneration

If a problem occurs during regeneration, the ERROR LED (yellow) and REG LED (red) will begin blinking. After the regeneration cycle is completed or aborted, these LED's will stop blinking. Call a certified service partner for support.

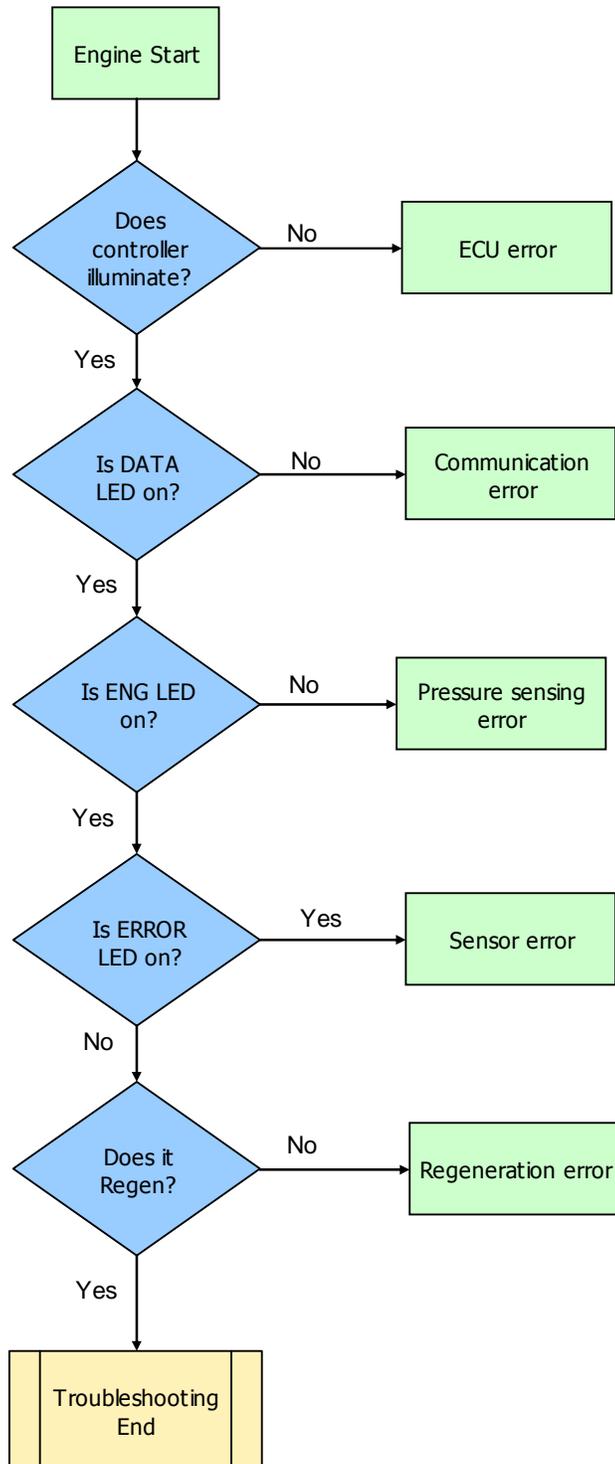


Contact a certified service partner if a problem occurs and/or if error messages are given.

When contacting a certified service partner, please record the error code displayed in the Display Panel.

5. Troubleshooting

5.1. Troubleshooting Guide



5.2. Error Code Definitions

Sensor Error Code	Part	Explanation	Possible reasons	Action
3	Tf	Tf range over	Sensor problem Harness	Check sensor
4	To	To range over	Sensor problem Harness	Check sensor
5	Pressure	Filter pressure over	Sensor problem Pipe Leak	Check sensor Check connecting pipe
10	Battery	Battery voltage over or Low	Harness	Check ground Check battery/Generator voltage
11	Igniter	Igniter voltage over or Low	Check igniter	Check harness
		Over current		
13	Shutter	Shutter problem	Sensor error Sensor location moved	Check position sensor
14	Back Pressure	The filter is too full of PM and it is unsafe to regenerate	The driver had not regenerated the filter in the appropriate time which allowed the PM to accumulate	Contact a service partner to undergo special regeneration procedure.
Function Error Code	State	Explanation	Possible reasons	Action
21	Shutter	Shutter problem	Position sensor location moved Shutter air line leakage Air compressor problem	Check sensor location Check air leakage Check air comp.
22	Pressure	Over filter pressure	Low temperature increase due to high filter pressure	
24	Tf/To	Temperature Too Low	Start Reg. at low temp. Temp. sensor error Harness	Check Sensor
28	Igniter	Igniter Error	Check igniter	Check Fuse 1, 2 and PTC Check igniter
29	Ignition	Ignition Fail (Tf, dTf)	Nozzle contamination Fuel supply not good Check Tf Sensor	Check igniter Check Fuel leaking Check nozzle contamination Check Tf Sensor
30	Flame Extinction	Flame Extinction (Tf, dTf)	Acceleration during Reg. Nozzle contamination Fuel supply not good Tf Sensor	Check igniter Check Fuel leaking Check nozzle contamination Check Tf Sensor
32	Over Heating	Heating time over (To)		Check pipe and exhaust gas leakage
33	Air Compressor	Compressor On -too long time		Check shutter line_ Air leakage

Glossary of Acronyms:

DPF: Diesel Particulate Filter; an emissions system that filters out particulate matter from diesel engine exhaust.

DOC: Diesel Oxidation Catalyst; an emission control device which uses a catalyst to convert toxic diesel combustion emissions into non-toxic gases.

ECU: Electronic Control Unit; the electronic brain of the DPF system.

IG: Igniter; used to ignite the diesel spray during regeneration.

LED: Light Emitting Diode; the lights used on throughout the system as indicators.

To: Outlet Temperature Sensor; the temperature sensor measuring exhaust temperature at the outlet cone.

Tf: Flame Temperature Sensor; the temperature sensor measuring the flame temperature in the burner assembly.

PM: Particulate Matter; a byproduct of diesel combustion that must be filtered out according to emissions regulation.

THE END



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