

Owner's Manual

Operation, Installation, and Maintenance



RYPOS

Diesel Particulate Filter with Oxidation Catalyst HDPF/C RH4XXM-C

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CAUTION

Read the entire installation manual and any other documentation relevant to this project prior to installing, modifying, or operating the equipment described here within. Follow safe best practice standards, observe all local, state and federal codes and laws, plus use this manual for proper installation. Failure to do so could result in any combination of poor performance, equipment damage, injury, or potential death.

YOUR RIGHT TO MAINTENANCE INFORMATION

The Air Resources Board requires that Rypos, Inc. provide detailed maintenance information for the diesel emission control system upon delivery to the end-user pursuant to section 2706(h)(2), Title 13, California Code of Regulations, at no additional cost to the owner. If you do not already have this information, contact the Rypos hotline at 1-800-609-4021.

THE IMPORTANCE OF ENGINE MAINTENANCE

Proper engine maintenance is critical for the proper functioning of your diesel emission control strategy. Failure to document proper engine maintenance, including oil consumption records, may be grounds for denial of a warranty claim for a failed component of a diesel emission control strategy.

THE IMPORTANCE OF PROPERLY MAINTAINING A DIESEL EMISSION CONTROL STRATEGY

Proper maintenance is critical for the diesel emission control strategy to function as intended. Failure to document proper diesel emission control strategy maintenance, including cleaning and/or ash removal of the system, replacement of consumables, and replacement of broken/failed parts, may be grounds for denial of a warranty claim for a failed component of a diesel emission control strategy.

This manual is the sole property of RYPOS, Inc. (RYPOS). Copying, faxing, e-mailing, altering or in any way reproducing this manual in whole or in part is forbidden without the express written consent of RYPOS. RYPOS reserves the right to change or alter any and all specifications at any time without prior notification and without incurring any obligation to such changes. The information included in this publication is believed to be accurate at the time of publication; however, no responsibility is taken by RYPOS unless expressly given.



Definitions

Cartridge – the smallest building block with filtration capability, a single strip of medium in a metal enclosure.

Element – the individually-switched resistive heating component, two cartridges in series in existing DC systems operating at 72 VDC and higher.

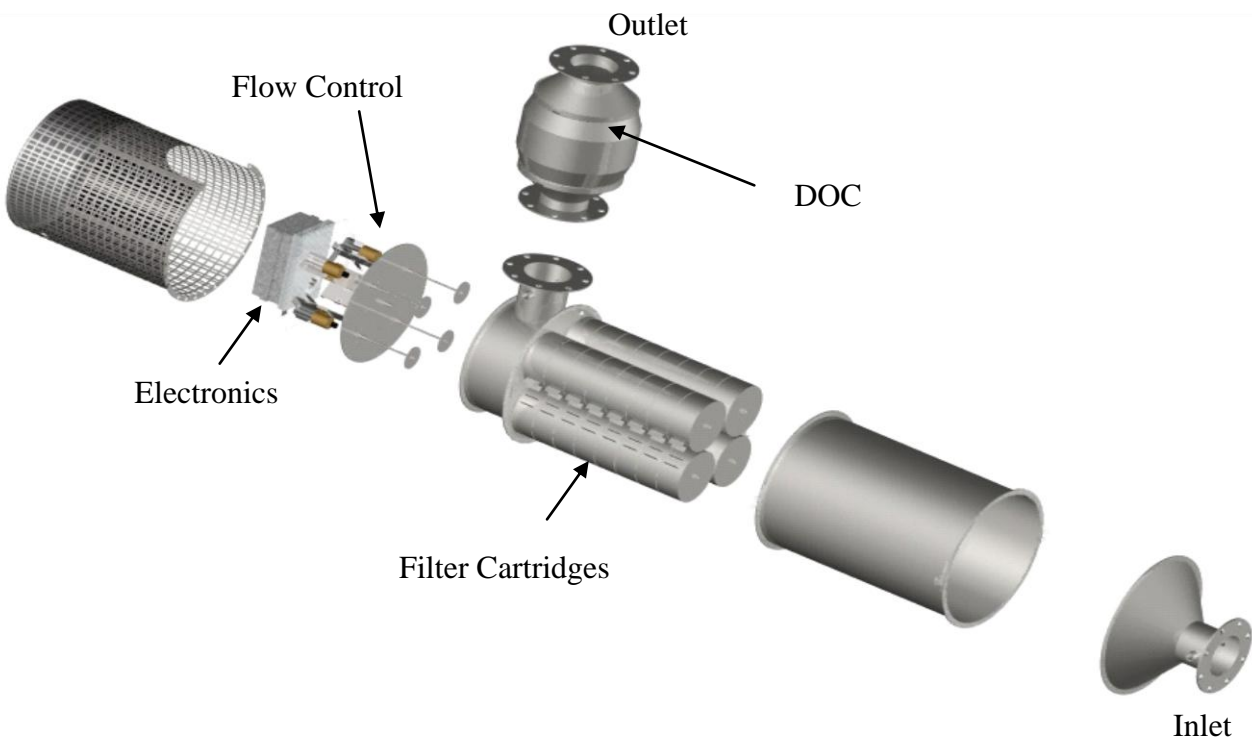
Filter – the complete DPF system in an overall metal housing.

RYPOS HDPF/C: Principles of Operation

The Diesel Particulate Filter (DPF) operation of the RYPOS HDPF/C RH4XXM is controlled by one independent microprocessor controller. The controller monitors the backpressure and sequentially energizes the filter cartridges, turning the cartridges into resistive heating elements. Power is taken directly from the generator set. A single transformer provides the required electrical current to heat the filter element to the temperature required to oxidize the captured particulate matter (PM). During this regeneration cycle, the exhaust flow through the energized filter elements is restricted, to minimize the cooling effect of the engine exhaust. Filter regeneration is performed automatically while the generator is running, without any operator interaction, and completely independent of engine exhaust temperature.

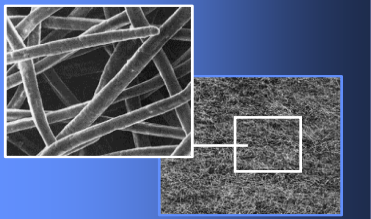
When supplied, the Diesel Oxidation Catalyst (DOC) oxidizes unburned hydrocarbons, carbon dioxide, formaldehyde, and other harmful constituents. The operation is achieved by adding a coating to a bare substrate which will light-off via the exhaust temperature.

RYPOS HDPF/C: Schematics Depicting Operations



Particulate Filter Medium

The filter medium is made of sintered metal fibers, which are electrically conductive and is capable of capturing the fine particles in the exhaust system. The proprietary filter material is designed specifically to act as both a filter and as a resistive heating element. The filter media consists of porous sintered layers with different fiber sizes. This medium is designed for maximum PM holding capacity and high filter efficiency.



- o Electro-conductive
- o High porosity
- o Low back pressure
- o Withstands high temperatures (1000°C)
- o Fast heating (low thermal mass)
- o High filtering efficiency

Description of Regeneration Method

Requirements for Regeneration

No specific conditions are required for regeneration, other than a source of electric power to heat the filter elements as required. The maximum line power consumption for normal filter regeneration is 4.2 kVA; average power is 2.1 kVA. One 480 VAC or 208 VAC three-phase transformer power supply is used to provide 60 A at 72 VDC to an independent electronic control unit that governs system operation. It is recommended that the transformer be connected to the generator through circuit protection means specified according to the local electrical code, so that the HDPF/C RH4XXM is powered only when the generator is running.

Thresholds and Control Logic to Activate Regeneration

The regeneration cycle is initiated by monitoring the average pressure drop across the filter system, which is directly related to the rate at which the filter elements are accumulating particulate matter. The control strategy is designed to keep this average pressure drop within the engine specification. The controller accomplishes this by varying the regeneration rate, i.e., speeding up or slowing down the regeneration cycles. The regeneration rate is a function of the number of filter cartridges heated per hour. It takes approximately two minutes to heat and clean two cartridges, a “regeneration cycle.” Even though the regeneration cycle is fixed, the time between regeneration cycles, the “gap”, can be varied from 5 seconds to 600 seconds.

The following table provides examples of how the backpressure, the gap and the number of regeneration cycles per hour are related:

Gap (seconds)	Number of Regeneration Cycles/Hour
600	5
200	11
50	21
5	29

The regeneration strategy is designed to keep the average backpressure below 15 inches of H₂O.

Description of Backpressure Monitor Including Threshold and Control Logic

During normal operation, the filter elements accumulate particulate matter and the measured backpressure rises in accordance with the rate of PM accumulation. The regeneration strategy keeps the backpressure within the engine specification. Engines with higher particulate concentration in the exhaust stream will reach the backpressure set point sooner than engines with a lower concentration of particulate matter. The regeneration rate or the number of regeneration cycles per hour is a function the emissions output, and is controlled by monitoring backpressure. In any event, the regeneration cycle occurs automatically during normal engine operation, and no down time or operator interaction is required for regeneration.

The electronics are designed with smart diagnostic software that keeps track of and adjusts the system operation. To alert the owner/operator, a status panel is installed as part of RYPOS HDPF/C. During each startup, the system performs a self-diagnostics test and all lights will flash initially but then turn off. The system continues its diagnostics and can take up to 60 seconds before the test is complete and a light illuminates permanently.

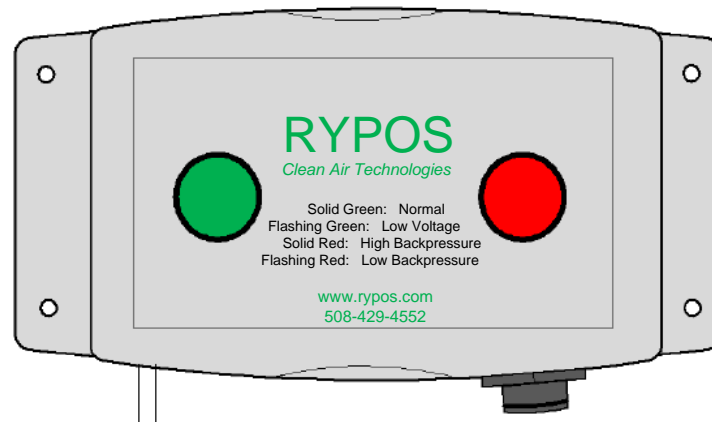


Figure 1: Single Controller Status Panel

- A solid green light indicates the power is ON and the controller is operating properly.
- A flashing green light indicates a problem with the power going to the electronics.
- A solid red light indicates the backpressure is high.
- A flashing red indicates the backpressure is low.
- No lights while the genset is operating indicate no power is supplied to the electronics.

Operating Environment

The air temperature around all DPF components must be maintained between -40°F and +150°F. Additional heat shielding or insulation may be required between the DPF and other exhaust components to ensure that temperatures stay below +150°F. Conditions not disclosed by customer drawings, or subsequent changes to the genset system, may cause ambient temperatures to go outside the DPF operating limits and damage the DPF.

RYPOS HDPF/C RH4XXM housings are manufactured from 304 Stainless Steel. The system is suitable for mounting outdoors, provided that the ambient air temperature around all components is kept between -40°F and +150°F.

Genset Output Voltage Limits	Regulated Between Nominal And Nominal Minus 4% (I.E. Nominal = 480 VAC; Limits 480-461 VAC)
System Ambient Temperature Limits	-40° F (To) +150° F
Weather Conditions	All Enclosures Designed To NEMA 3R
Ventilation Requirement	The Rypos DPF Requires Sufficient Airflow To Maintain Ambient Temperatures Within System Limits.
Filter Heat Load Into Environment	Heat Load Depends On The Application. Please Contact Rypos For An Engineering Evaluation.

Installation

Step 1: The DPF must be bolted to a stable platform, with the installation supports on the round portion of the DPF housing, shown in Figure 2. The DPF is required to be mounted horizontally.



Figure 2: Installation Mount

Step 2: Orientation and configuration are critical components to install the DPF correctly.

- a. For end out designs, two of the three solenoid valves must be positioned closest to the ground with the outlet flange located higher than the valves, shown in Figure 3.
- b. For side out designs, the outlet flange must be oriented either in the 3 o'clock or 9 o'clock positions as shown in Figure 4. To determine which orientation, the electrical wiring must be located on the ground side of the filter (protruded out the bottom). If the wiring is on the top, the DPF is oriented incorrectly.
- c. For top out designs, the outlet flange must be oriented vertically upward as shown in Figure 5.

Note: The 3 o'clock and 9 o'clock side out designs are not interchangeable. The top out design is also not interchangeable with the side out options. At time of sale, the orientation must be determined prior to build release.

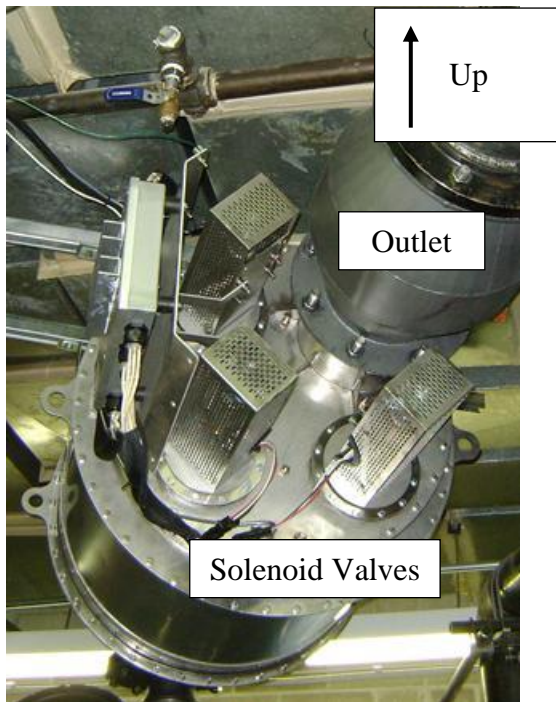


Figure 3: End Out Orientation

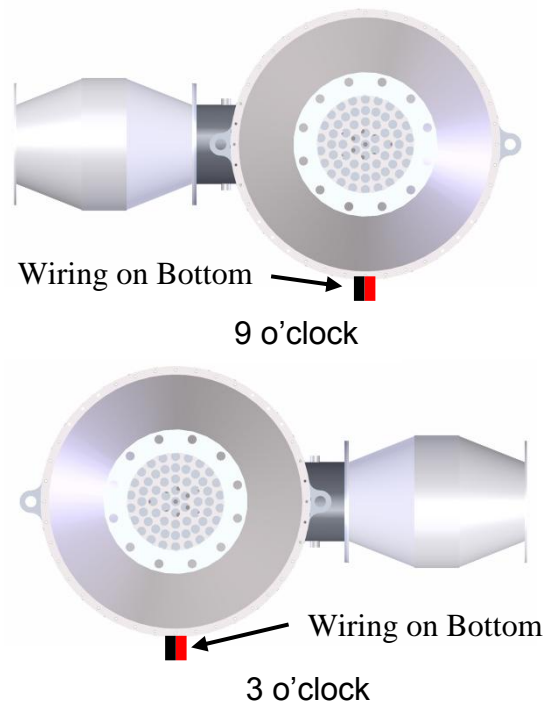


Figure 4: 3 o'clock & 9 o'clock Side Out Orientations (looking at inlet upstream of unit)

Step 3: The DPF is designed to flow only in one direction. The inlet to the RH4XXM is opposite of the solenoid valves. The outlet is on the same side, either next to the solenoids for an end out configuration or normal to on a side out configuration but closest to the solenoids. See Figure 5 for details.

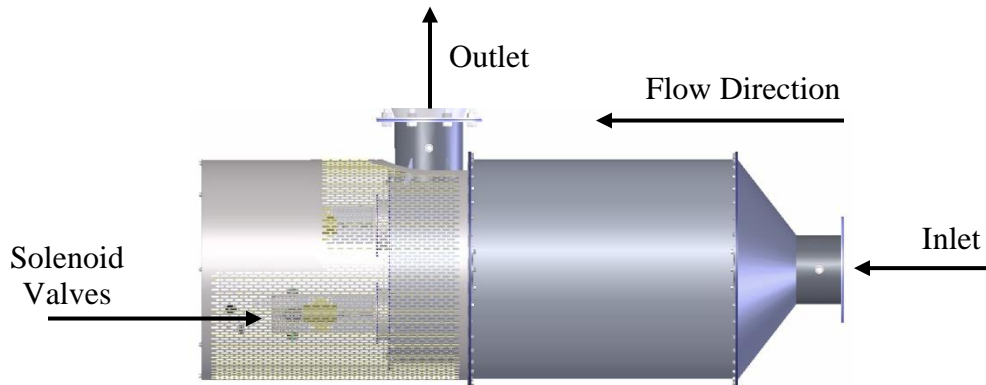


Figure 5: Flow Direction and Inlet/Outlet Identification

Step 4: When applicable, mount the Diesel Oxidation Catalyst (DOC), Figure 6, to the outlet end of the DPF. It is important to install a gasket between the DOC and the DPF flanges.

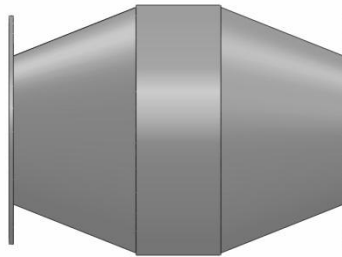


Figure 6: Diesel Oxidation Catalyst

Step 5: The transformer must be mounted on a wall/structure in the vertical direction at least two feet off of the ground/next lowest surface. The wall must be able to handle up to a 275 pound transformer. A wall is defined to be a solid, vertical wall or plate that must cover the entire rear transformer surface.

Step 6: Mount the transformer via 3/8" diameter bolts using the existing four slots. See Figure 7 for details.

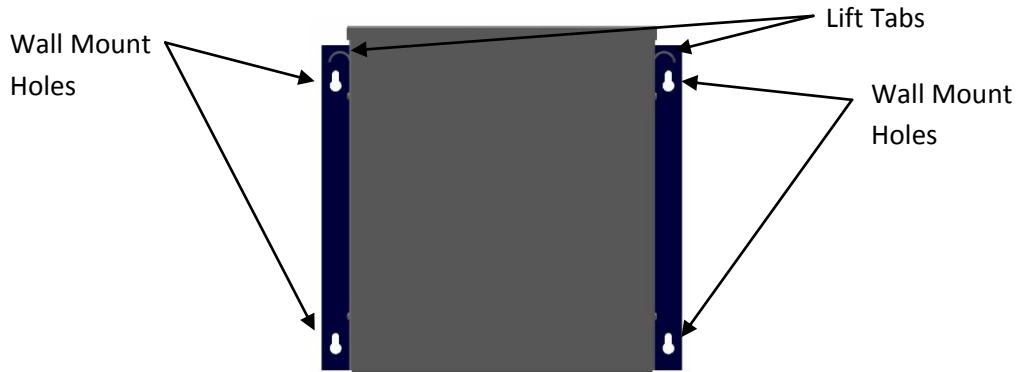


Figure 7: Transformer Mount Positions

Step 7: To make the electrical connections from the AC source to the transformer, insert the non-metallic conduit with wiring into the left hand hole of the transformer enclosure, plus the electrical cable clamp. See Figure 8 for details. The external cover must be removed at this point via four screws.

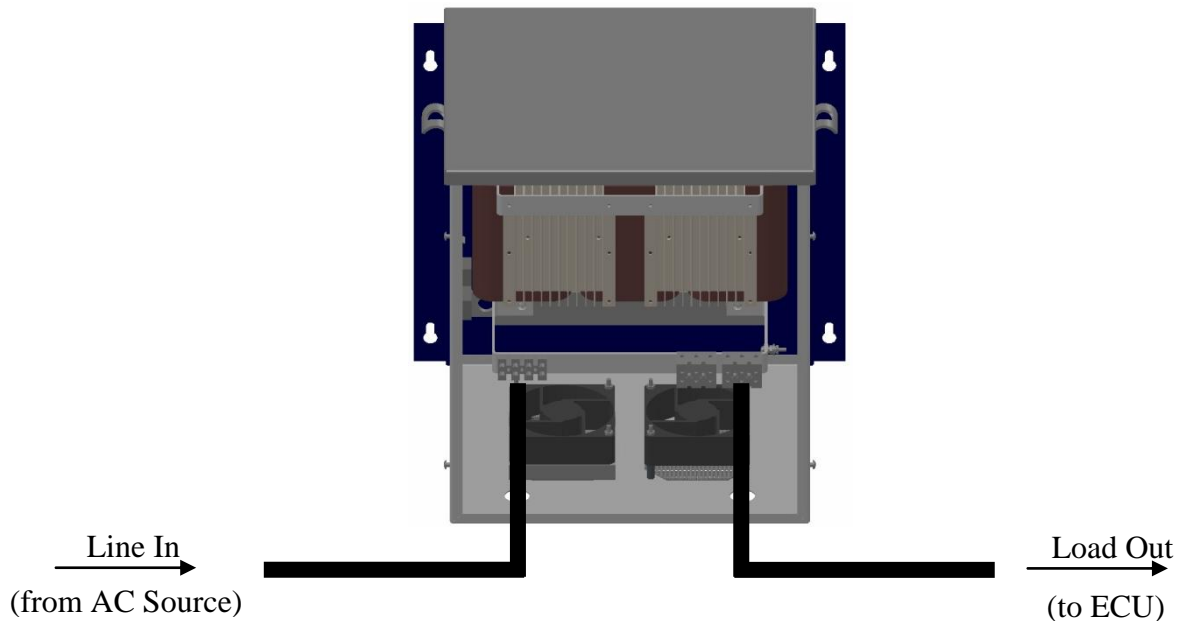


Figure 8: Line/Load Cable Routing

Step 8:

Table 1 references the hookups to the AC mains within the transformer.

Table 1: AC Source Line Connection to Transformer

#	Description
H0	Neutral
H1	Load – L1
H2	Load – L2

H3	Load – L3
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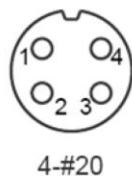
Step 9: The DPF housing must be electrically bonded to the building bonding grid. The recommended ground strap is No. 8 AWG minimum and must meet NEC and local electrical codes.

Step 10: Make each of the electrical connections from the electrical control unit (ECU) to the transformer. The wiring and connections are plug and play and supplied by Rypos. The total harness length is limited to 15 feet. The ECU is electrically bonded to the filter housing at the factory using a No. 8 AWG cable. The installer must visually inspect this bonding cable for damage and looseness at delivery and the cable must not be disturbed.

Step 11: The status display panel can be mounted remotely from the HDPF main housing, using either a 15' or 25' wire harness length. Refer to Figure 1 for details.

Step 12: Connect the display panel using the attached wire harness on the display and connect it to the harness exiting the ECU panel. The harness connection is a four pin, rectangular connector and is designed to be water resistant. It can be in the open environment but not immersed in water.

Optional: A separate indicator can also be installed remotely by connecting to the auxiliary connector on the display panel. The details of the connection are in Figure 9 and Figure 10.



Pin arrangements shown are wiring view of cable end sockets. Key shown for orientation only.

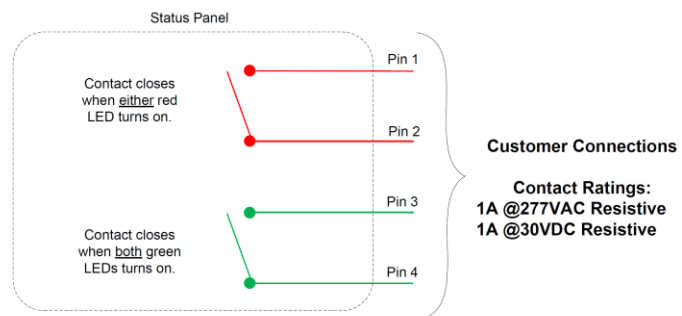


Figure 9: Customer Connector #6282-4SG-3DC Cable End

Figure 10: Customer Connection Pin Details

Installation Complete.

Maintenance

Regular routine engine maintenance as specified by the engine manufacturer's guidelines is required. The engine should not consume lubricating oil at a rate greater than that specified by the engine manufacturer. Only low ash lubricating oil recommended by the engine manufacturer should be used.

The following simple maintenance of the RYPOS HDPF/C RH4XXM should be performed annually.

1. Observe a complete system regeneration and verify the operation of the flow control solenoids.

Note: Prior to initiating a regeneration cycle, disconnect the electrical connection to each differential pressure transducer (DPT). This will allow uniform regeneration cycles at the minimum gap period.

- a. To remove the electrical connection, remove the plate mounted to the perforated cover. This allows access to the DPT connection. Figure11 shows what should be seen after the plate is removed.

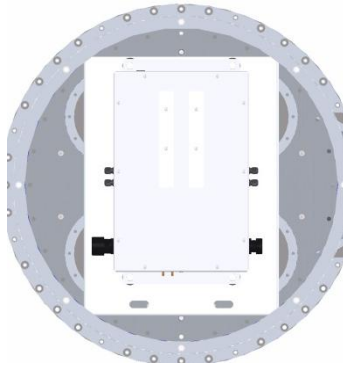


Figure11: Rear View with Perf Cover Plate Removed

- b. Reach behind the ECU mount plate on the top and locate the red lock mechanism. Push downward to disengage the lock. Figure12 and Figure13 show the locked and unlocked positions.

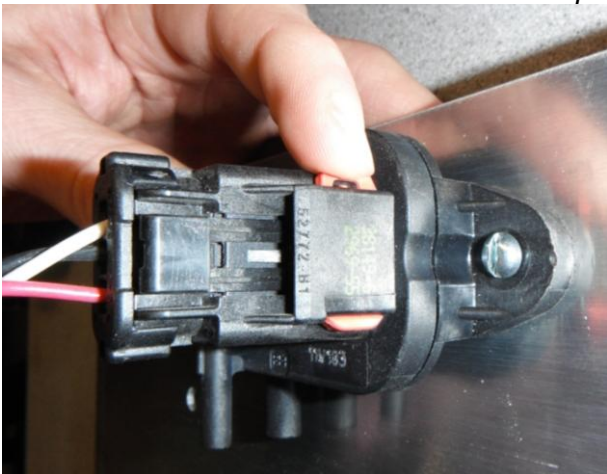


Figure12: DPT Locked Position

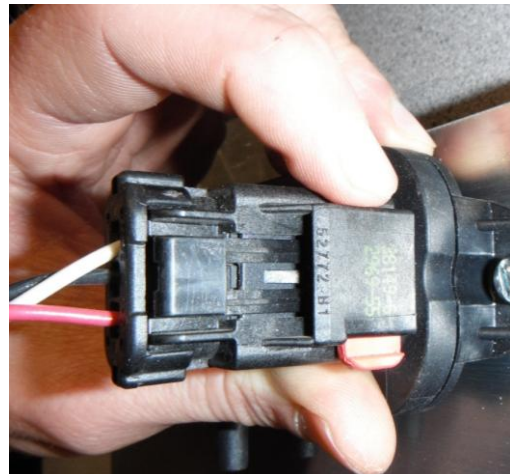


Figure13: DPT Unlocked Position

- c. *Depress the button and push away from the ECU. This will remove the DPT connection and allow min gap regeneration. Drape the DPT connector over the ECU mount plate to reconnect later. See Figure14 and Figure15 for details.*

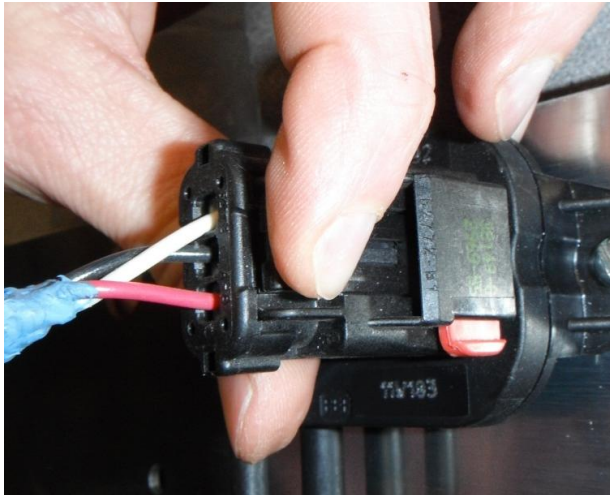


Figure14: DPT Button Release

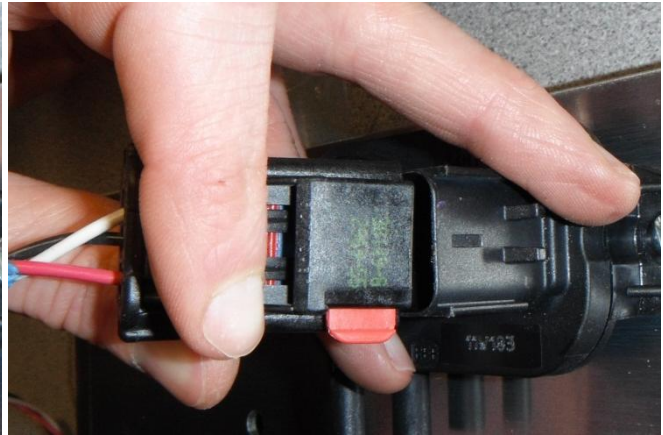


Figure15: DPT Disconnected

The normal operating profile should be as follows:

- a. Power up delay – one minute.
- b. Solenoid activates – will remain closed for two and a half minutes.
- c. Solenoid deactivates – five second gap.
- d. Cycle repeats through all solenoids as long as power is on.

Note: Once the system is finished, reconnect each of the DPT electrical connections.

- a. *Reverse the steps used to disconnect the DPT. Rather than pressing down on the red lock mechanism, press the lock upwards to engage it.*
2. The pressure transducer should be free of water in the lines. The pressure piping design is self-draining. Visual inspection of the silicone tubing should show no moisture. If moisture is present, disconnect the lines and drain water.
 3. Every 1000 hours, with the generator shut down and the power to the filter system OFF, inspect for ash and remove if excessive accumulation is present.
 - a. Remove the facility inlet pipe from the inlet flange on the RYPOS HDPF/C RH4XXM.
 - b. Inspect for signs of accumulated ash inside the DPF. A lighted borescope is recommended.
 - c. If excess ash is found and while the inlet pipe is removed, disconnect the either the inlet cone or the inlet end cap, an example of each shown in Figure16 and Figure17.

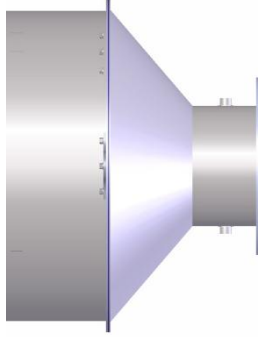


Figure 16: Inlet Cone Assembly

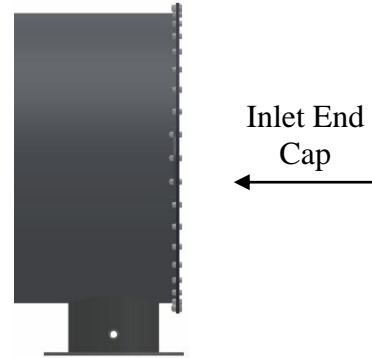


Figure 17: Inlet End Cap

- d. Remove and dispose of ash according to local, state and federal guidelines.
- e. Reinstall the inlet assembly. A new gasket is required and a new set of hardware is recommended to reconnect the inlet to the DPF housing body. Call Rypos at (508) 429-4552 to order replacement parts.
- f. Reconnect the inlet pipe to the inlet flange on the RYPOS HDPF/C RH4XXM.

Troubleshooting

* Note: During each startup, the system performs a self-diagnostics test and all lights will flash initially but then turn off. The system continues its diagnostics and can take up to 60 seconds before the test is complete and a light illuminates permanently.

Lamp Mode	System Status	Troubleshooting	If Problem Persists
Green On Solid	System ON, Functioning Normally	Not Required	No action required
Green On Flashing	System ON but low voltage condition to electronics.	Verify +12v connection to the transformer.	Call for service.
Green Off	System is inoperable.	Check circuit breaker to the transformer and the connection from the transformer to the electronics.	Call for service.
Red On Solid	System is in overpressure condition.	Turn off genset and inspect DPF for damage. Remove inlet access panel and inspect for ash accumulation. Perform ash removal procedure. Restart DPF and run for 15 minutes. If lamp remains on call for service.	Call for service
Red On Flashing	Low pressure condition.	Check entire exhaust system for leaks and repair/seal as necessary. Inspect pressure tubing from DPF to the controllers.	Call for service.
Red Off	System Operating Normally.	No action required.	No action required.

Limited Warranty On New Rypos HDPF/C™ Filter
Used In Backup Diesel Generators and Pumps

WARRANTY RIGHTS AND OBLIGATIONS

RYPOS, Inc. warrants the diesel emission control system in the stationary backup generator and pump 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 causes 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, provided there has been no abuse, neglect, or improper maintenance of your diesel emission control system or equipment, as specified in the owner's manuals. Where a warrantable condition exists, this warranty also covers other equipment parts 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 includes a particulate filter, hoses, connectors, a back pressure monitor, and other emission-related assemblies. Where a warrantable condition exists, Rypos, Inc. will repair or replace your diesel emission control system at no cost to you including diagnosis, parts, and labor.

WARRANTY COVERAGE:

For a 50 horsepower or larger engine used in a stationary backup generator or pump application, the warranty period will be 5 years or 4200 hours, whichever occurs first. If any emission-related part of Rypos diesel emission control system is defective in design, materials, workmanship, or operation of the diesel emission 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, Rypos, Inc. will repair or replace the diesel emission control system, including parts and labor. In addition, Rypos will replace or repair the equipment, or engine components to the condition they were in prior to the failure, including parts and labor, for damage to the engine or other vehicle components proximately caused by the verified diesel emission control strategy. This also includes those relevant diagnostic expenses in the case a warranty claim is valid. Rypos, Inc. may, at its option, instead pay the fair market value of the vehicle, equipment, or engine prior to the time the failure occurs.

INSTALLER WARRANTY RESPONSIBILITY

The installer will warrant that the installation of a 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 installer must be the same as the warranty provided by the product manufacturer, and the same exclusions must apply.

OWNER'S WARRANTY RESPONSIBILITY

As the engine owner, you are responsible for performing the required maintenance described in your owner's manual. Rypos, Inc. 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, Rypos, Inc. may have grounds to deny warranty coverage. You are responsible for presenting your engine, and diesel emission control system to a Rypos 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 Rypos, Inc. at 1-508-429-4552 or the California Air Resources Board at 9528 Telstar Avenue, El Monte, CA 91731, or (800) 363-7664, or electronic mail: helpline@arb.ca.gov. THE FOLLOWING LANGUAGE DEFINES AND DOES NOT AFFECT THE PRECEDING WARRANTY COVERAGE IN ANY WAY.

REPAIRS

To obtain warranty repairs, you must request the needed repairs within the WARRANTY PERIOD from Rypos or an authorized Rypos service outlet. Only new genuine parts or remanufactured parts or components supplied or approved by Rypos will be used. Rypos may, at its discretion, replace rather than repair components. A reasonable time must be allowed to perform the warranty repair. Repairs will be performed during normal business hours.

LIKE REPLACEMENT SYSTEM

System(s) supplied by Rypos as a replacement for a System still under warranty will assume the identity of the System being replaced and be entitled to the remaining warranty coverage.

THIS WARRANTY DOES NOT COVER:**REPAIRS DUE TO ACCIDENTS, MISUSE, ALTERATION, STORAGE DAMAGE, NEGLIGENCE OR CERTAIN MODIFICATIONS**

REPAIRS DUE TO AN ACCIDENT, MISUSE, ALTERATION, MISAPPLICATION, STORAGE DAMAGE, NEGLIGENCE OR MODIFICATION EXCEEDING RYPOS SPECIFICATIONS, ARE NOT COVERED BY THIS WARRANTY. Misuse that is excluded from warranty coverage includes, but is not limited to, operating a Rypos diesel emission control system, or an engine on which a Rypos system is installed, under any of the following circumstances:

- Running the engine for any period while the Rypos system is unpowered or otherwise inoperative,
- Powering the Rypos system for any period while the engine is not running,
- Operating the engine contrary to the engine manufacturer's recommendations for any period, or
- Running the engine with anything other than a solid green light on the Rypos status panel. If the red light is on or flashing, the green light is flashing, or no lights are present while the engine is in operation, contact Rypos immediately.

System Removal and Reinstallation

Labor and material costs for System removal and reinstallation, when necessary to make a warranty repair, are not covered by this warranty.

Non-Rypos Supplied/Manufactured Components

Rypos is not responsible for repair of components and/or assemblies which are manufactured or supplied by another manufacturer. Such items may be covered by the manufacturer or supplier.

Maintenance

Rypos is not responsible for the cost of maintenance or repairs due to lack of performance of required maintenance services as recommended by Rypos, or the failure to maintain the engine according to the engine manufacturer recommended specifications. Performance of the required maintenance of the Rypos HDPF/C™ Filter and the diesel engine is the responsibility of the owner.

Incidental or Consequential Damages

Rypos is not responsible for incidental or consequential costs or expenses which the owner may incur as a result of a malfunction or failure covered by this warranty, such loss of time, inconvenience and other similar costs and expenses.

Other Limitations

The performance of REPAIRS is the exclusive Owner's remedy under this warranty. Rypos does not authorize any person to assume or create for it any other obligation or liability in connection with the System.

THIS LIMITED WARRANTY IS THE ONLY WARRANTY APPLICABLE TO RYPOS HDPF/C™ AS USED IN BACKUP DIESEL GENERATORS AND PUMPS. RYPOS MAKES NO OTHER WARRANTIES EXPRESS OR IMPLIED, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. RYPOS SHALL NOT BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES AS DESCRIBED ABOVE.

WARRANTY PERIOD BEGINS AT COMMISSIONING

DO NOT OPERATE THE ENGINE WITH A RYPOS SYSTEM CONNECTED UNTIL RYPOS HAS COMMISSIONED THE SYSTEM AND RELEASED THE UNIT FOR OPERATION. THE PERIOD OF WARRANTY COVERAGE OF A RYPOS DIESEL EMISSION CONTROL SYSTEM BEGINS WHEN RYPOS AUTHORIZED PERSONNEL PERFORM AND APPROVE THE COMMISSIONING OF THE RYPOS SYSTEM. FOR EXAMPLE, ANY REPAIRS DUE TO OPERATION OF THE RYPOS SYSTEM, OR OF THE ENGINE ON WHICH IT IS INSTALLED, PRIOR TO ITS APPROVED COMMISSIONING WILL NOT BE COVERED BY THE RYPOS WARRANTY.