



Owner's Manual
Donaldson Spiracle™
Crankcase Filtration Systems



E M I S S I O N S

Models: S040004 & S040005

Thank you for purchasing a Donaldson Spiracle CFS (Crankcase Filtration System) to reduce diesel crankcase emissions.

This owner's manual includes pre-installation instructions, warranty activation procedures and maintenance procedures.

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Read each section carefully prior to installing your Donaldson Spiracle™ Filtration System. To highlight important topics or steps regarding the installation, operation and maintenance, pay special attention to the callouts in the NOTE boxes.

Example:

NOTE	Mount Spiracle at Proper Height
It is important to ensure the bottom of the Spiracle unit is positioned at least 6" (152mm) above the engine oil drain-back location to ensure free oil flow to the engine.	

Consult your Donaldson distributor, dealer or Donaldson if you have questions regarding the installation and warranty.

Introduction

The Donaldson Spiracle™ filtration system is designed to eliminate emissions from open crankcase vents on all diesel engines. In addition to reducing emissions, the Spiracle filtration system eliminates underhood fumes, reduces engine oil consumption, eliminates oil drips on roadways and helps maintain a cleaner engine compartment.

Combustion chamber leakage past the piston rings creates blow-by gases that are vented out the crankcase vent. These gases contain several unwanted constituents, such as hydrocarbons, diesel soot, engine oil and various engine oil contaminants. Such emissions can range from 10 to 25% of total engine emissions.

The Spiracle filtration system is effective at eliminating 100% of the crankcase emissions over the varying flow and pressure ranges seen in today's engines, while preventing turbocharger and aftercooler fouling. Filter life is designed to coincide with the engine manufacturers oil change intervals or 500 hours, whichever comes first.

For optimum performance and warranty coverage, follow Donaldson's installation recommendations.

NOTE	Follow installation requirements
Installations must meet Donaldson requirements to obtain full warranty coverage.	

Pre-Installation Requirements

What you Get with Your Assembly

Part No. S040004

Qty.	Description
1	Assembly (housing and filter)
1	By-pass Valve
1	Mounting band
1	Check-valve, oil drain-back
1	Tubing, oil drain-back, ½" dia, 3' (0.91m) length
2	Clamps
1	Documentation package that includes this owner's manual, a warranty registration card, warranty and engine tag (for CARB requirement).

Part No. S040005

Qty.	Description
1	Assembly (housing and filter)
1	By-pass Valve
2	Mounting bands
1	Check valve, oil drain-back
1	Tubing, oil drain-back, ½" dia, 3' (0.91m) length
2	Clamps
1	Documentation package that includes this owner's manual, a warranty registration card, warranty and engine tag (for CARB requirement).

Additional Hardware

Additional hardware items are needed to complete the Spiracle system installation, including:

Qty.	Description
2	Tubing Clamps: 1½" (38mm)
2	Tubing Clamps: 1¼" (31mm)
1	Tubing: 1¼" I.D. (31mm)
1	Tubing: 1" (25mm) I.D. Wire-ties to secure tubing

NOTE	Components for Installation
Other components may be needed for your Spiracle assembly retrofit depending on your application.	

Selecting the Right Spiracle System

Be sure you have selected the proper model. Application of the wrong model will affect filter efficiency and life. Check the application guide located on Donaldson's website, www.donaldsonexhaust.com, for sizing recommendations by engine make, model and horsepower rating before installing this unit.

Spiracle Mounting Considerations

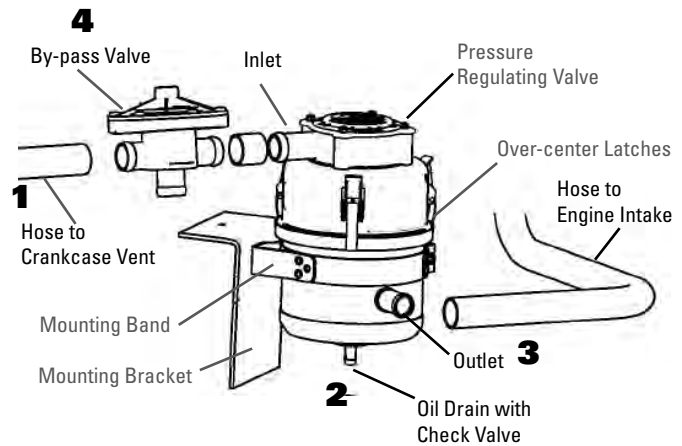
The Spiracle filtration system will provide the longest life when mounted independent of the engine due to vibration and movement typical during engine operation.

Donaldson recommends mounting the assembly on the firewall, fender or frame rail using existing or newly-fabricated brackets. Mounting bands are included with the unit (1 with S040004 and 2 with S040005). Consider serviceability and filter replacement space requirements in choosing the mounting location.

NOTE	Mount Spiracle in a Covered Location
It is important to ensure the top of the Spiracle unit is not directly exposed to rain or outside elements. This exposure can result in the malfunction of the regulator valve.	

NOTE	Mount Spiracle at Proper Height
It is important to ensure the bottom of the Spiracle unit is positioned at least 6" (152mm) above the engine oil drain-back location to ensure free oil flow to the engine.	

The Spiracle assembly must be mounted in a vertical orientation (as shown below), plus or minus 10°. Meeting these requirements will ensure the coalesced oil can drain back to the engine freely.



Typical Installation

The Spiracle filtration system unit requires four connections. A description of each follows:

- 1) *Spiracle Inlet (from the crankcase vent)*
 1¼" (31mm) diameter tubing is required to connect the Spiracle inlet port to the Spiracle by-pass valve, then from the by-pass valve to the crankcase vent. Retain the OEM breather when present. An adapter may be required to connect between the OEM breather port and the Spiracle inlet. Do not allow any dips or sharp bends in the tubing where coalesced oil can collect and block flow from the crankcase vent. The tubing must be able to withstand hot engine oil.
- 2) *Spiracle Oil Drain-back Line (to engine sump)*
 The bottom of the Spiracle housing must be positioned at least 6" (152mm) above the engine-oil drain-back location. ½" (13mm) diameter tubing is provided to drain coalesced oil back to the engine oil sump. The check valve (¼" NPT) provided must be connected to a drain-back location and mounted vertically, plus or minus 45°. Typical drain-back locations include available engine block ports or dipstick mounting plates. An adapter may also be welded onto an oil fill neck.
- 3) *Spiracle Outlet (to engine intake)*
 One inch (25mm) diameter tubing is required to connect to the Spiracle outlet port. Minimize the tubing length and avoid sharp bends. The tubing should be connected to the air intake duct between the air filter and the turbocharger. If an NPT port does not already exist, a 1" (25mm) tubing barb should be welded onto a metal intake duct. The weld must be leak-free and any debris must be removed before starting the engine to avoid damage.

4) *By-pass Valve Mounting (in-line with inlet tube)* This by-pass valve (see diagram) is used in the event of a plugged filter or malfunction in the system. It allows blow-by fumes to exit into the atmosphere where they can be detected by the user and the problem can be addressed. The valve must be mounted so that it is within +/-30° of horizontal to prevent oil from building up in valve. The by-pass valve is installed using the 1 ¼" Spiracle inlet tubing.



By-pass Valve

NOTE	Employ Oil-Resistant Tubing
Any tubing material used must be able to withstand hot engine oil. BunaN (Nitrile rubber) is an acceptable material.	

NOTE	Minimize Tubing Lengths/Sharp Bends
Minimize tubing lengths and avoid sharp bends to the Spiracle outlet port.	

NOTE	Avoid Dips and Valleys in Tubing
Valleys or low spots in the interconnecting tubing should be avoided to prevent condensed/coalesced oil from collecting and blocking flow paths. Blocked flow paths can result in increased crankcase pressure, which can lead to crankcase and oil pan seal leaks.	

NOTE	Check Dipstick Seal
If the engine uses a sealed dipstick, make sure the seal is good or oil may be forced out of it.	

Ensure Tubing/Connections are Leak-free

To maximize effectiveness, interconnecting tubing and connections should be structurally sound and leak-free. Inspect the tubing and connections regularly for damage, leaks, punctures or material defects, and replace defective components.

Change Filter Routinely

This assembly requires routing filter change. You will need to update your vehicle maintenance records to include a reminder to change the Spiracle filter on a routine basis.

Donaldson recommends that you change the Spiracle filter at every oil change or 500 hours of operation, whichever comes first.

A dirty filter, or one left unchanged, can also result in low efficiency and fouling of the turbocharger and aftercooler. A plugged filter can cause a pressure build-up in the crankcase, resulting in leaking crankcase seals and degraded engine performance.

NOTE	Change Filter Regularly
The Spiracle filter must be replaced in accordance with engine manufacturer's recommended oil change interval or 500 hours of operation, whichever comes first.	

Spiracle Filtration System Warranty

The statement of warranty for the Spiracle filtration system is in the documentation package.

Activating the Warranty

A Warranty Registration Card is included in the documentation packet. Furnish the information requested and answer all questions immediately after completing the installation. Return the postage-paid card to Donaldson to activate the warranty.

NOTE	Submit Warranty Information
Failure to complete the warranty information requested by Donaldson within 30 days of installation of the emission control system may void this warranty.	

Spiracle Unit Installation

The following section identifies installation procedures for the Spiracle filtration system.

Review all pre-installation requirements before proceeding with the installation.

Locate and Mount the Spiracle Assembly

- 1) Identify prospective spaces for mounting the Spiracle assembly and locate potential oil drain-back locations. The bottom of the Spiracle assembly should be at least 6" (152mm) higher than the desired oil drain-back location. The unit must be mounted vertical, plus or minus 10°. Before selecting the best location, ensure the unit will be accessible for service.

NOTE	Mount Spiracle at Proper Height
<p>The bottom of the Spiracle assembly must be at least 6" (152mm) higher than the oil drain-back location to facilitate the draining of coalesced oil back to the engine sump.</p>	

NOTE	Mount Spiracle in a Covered Location
<p>It is important to ensure the top of the Spiracle unit is not directly exposed to rain or outside elements. This exposure can result in the malfunction of the regulator valve.</p>	

NOTE	Mount Spiracle Away from Hot Surfaces
<p>The Spiracle system and hoses must remain at least 6" (152mm) away from the turbocharger, exhaust pipes, or other hot surfaces.</p>	

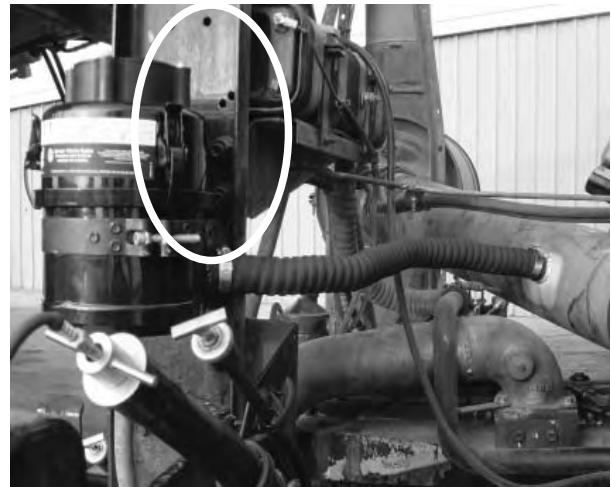
- 2) Secure the supplied mounting band(s) to a new or existing bracket on the firewall, fender or other independent structure. A custom-fabricated mounting bracket may be needed for installation.
- 3) Tighten mounting bolts securely.

Examples of different mountings:

Example 1: Using existing mounting brackets



Example 2: Fabricated new mounting bracket



Example 3: Mounted on an existing stanchion

Example 4: Mounted on back of cab stanchion

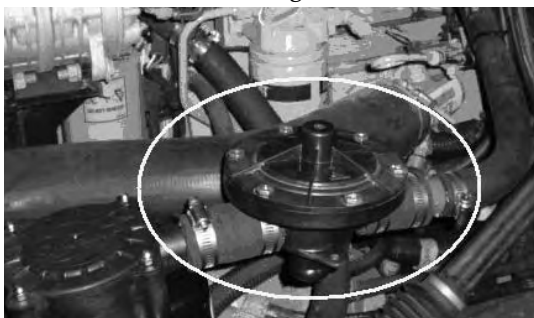


Example 5: Fabricated mount to existing power steering reservoir bracket



Make Spiracle Inlet and By-pass Valve Connection

- 1) Determine length and routing of Spiracle inlet tubing needed to connect the current engine breather port to the Spiracle inlet. Minimize the tubing length and avoid dips or sharp bends when determining routing.
- 2) The by-pass valve must also be installed in-line with the inlet tubing. The by-pass valve is non-directional so either side may be installed in-line with the breather port. This valve must be mounted so that it is within $\pm 30^\circ$ from horizontal. This will prevent oil from building up within the valve. See image below.



- 3) Cut a short (3-6" / 76-152mm) section of 1 1/4" (32mm) tubing to be installed from the Spiracle unit to the by-pass valve inlet. Cut a second section of 1 1/4" (32 mm) hose to go from the by-pass valve to either the engine crankcase vent, or to a reducer where further hose will need to be installed to the engine crankcase vent. Use 1 1/2" (38mm) hose clamps to secure the hose sections. Tighten each clamp securely. Place the by-pass valve (with tubes) and into position, use wire ties to prevent movement.
- 4) Attach the 5-6" (127-152mm) section of tubing to Spiracle inlet using 1 1/2" (38mm) tubing clamp. Tighten clamp securely.
- 5) Remove the drop tube from the OEM engine breather port, if present. Attach the other end of the Spiracle inlet tubing to the OEM engine breather port. An adapter may be required to transition between different diameter connections. Secure the tubing to the crankcase breather port using a 1 1/2" (38mm) tubing clamp.

Example of connection to crankcase vent.



Connect Spiracle to the Air Intake System

- 1) Determine length and routing of tubing necessary to connect Spiracle outlet to the air induction piping between the air filter and turbocharger. Minimize the tubing length and avoid sharp bends when planning routing.

NOTE	Verify Existing NPT is Greater Than 3/4" (19mm)
Make sure the existing NPT fitting is greater than 3/4" (19mm) to ensure proper flow.	

- 2) Locate NPT port on air intake piping.
 - a) If NPT port is present, remove the NPT plug and install 1" (25mm) diameter tubing adapter.
 - b) If no NPT adapter is found, weld 1" (25mm) diameter tubing adapter onto air intake piping.
- 3) Cut 1" (25mm) diameter Spiracle outlet tubing to length and lay into position. Fasten tubing with wire-ties to prevent movement.
- 4) Attach one end of tubing to Spiracle outlet using 1 1/4" (31mm) tubing clamp.
- 5) Attach other end of Spiracle outlet tubing to air intake piping adapter using second 1 1/4" (31mm) tubing clamp.
- 6) Tighten both clamps securely.

Example 1: Existing NPT adapter on clean air duct.



Example 2: Tubing with beaded end welded onto intake pipe



NOTE	Remove Debris from Clean Air Ducts
Welds on air intake piping must be leak-free to avoid engine contamination. Metal shavings and/or welding debris must be removed from inside of clean air piping after installation. Disconnect clean air piping and remove any debris located inside before operating engine.	

Connect Spiracle Drain to Engine Sump

- 1) Determine the location for oil drain-back. Consider available unused engine block ports, dipstick holes or mounting plates, or weld 1/4" NPT adapter onto oil fill neck (see photos).
- 2) Install the threaded end of the check valve directly into the drain-back location with a vertical orientation, plus or minus 45°.
- 3) Determine length of drain-back tubing necessary to connect the Spiracle bottom drain to the check valve. Minimize dips and sharp bends that may inhibit the flow of coalesced oil. Secure the tubing with wire-ties, if appropriate.
- 4) Connect one end of the 1/2" (13mm) diameter drain tubing to the bottom of the Spiracle unit. Secure the tubing with a 3/4" (19mm) tubing clamp.
- 5) Attach the other end of the drain tubing to the check valve. Secure the tubing with the second 3/4" (19mm) tubing clamp.
- 6) Tighten both clamps securely.

Examples of oil drain-back locations.

Example 1: Check valve installed on oil fill cap



Example 2: Check-valve adapter welded onto fill tube



Example 3: Check valve installed in existing engine block port.



Example 4: Unused dipstick drain hole used for Spiracle oil drainback.



System Checks

- 1) Verify all bolts/fasteners/clamps are tight.
- 2) Start the engine and allow it to idle.
- 3) Check for leaks in the inlet, outlet, and drain lines and tighten connections as necessary.
- 4) Turn off engine.
- 5) If a weld leak exists, repair the leak.
- 6) To meet CARB requirements, permanently attach the product identification tag (supplied in documentation package) in a clearly visible location on the engine. CARB regulations require a product identification tag be permanently installed on the engine in a clear, visible location. Application of the engine tag is not necessary for U.S. EPA regulations.

NOTE	CARB Requirement
California ARB regulations require a product identification tag be permanently installed on the engine in a clear, visible location.	

- 7) Fill out and return the Warranty Registration Card (provided in the documentation packet).

Please contact Donaldson, at the phone number provided on the back cover, with any installation questions or problems.

Activating the Warranty

A Warranty Registration Card is included in the documentation packet. Furnish all information requested and answer all questions immediately after completing the installation. Return to Donaldson via the postage-paid card.

NOTE	Complete Warranty Registration Card
Failure to complete the warranty information requested by Donaldson within 30 days of installation of the emission control system may void this warranty.	

Operation, Maintenance and Service Guide for Spiracle Filtration Systems

Operation

Under normal operation, the crankcase pressure in a diesel engine should be maintained between approximately +/- 4" H₂O (this may vary from engine to engine). High pressure can cause oil leaks in the crankshaft seals or oil pan gasket. Excess vacuum can cause contaminants to be drawn into the engine.

The Spiracle filtration system has an integrated pressure-regulating valve that automatically maintains a neutral crankcase pressure. It closes when the intake vacuum is high (high engine load) and opens under high crankcase pressure conditions to relieve the pressure.

NOTE	Do Not Tamper with Regulating Valve
Do not tamper with pressure-regulating valve. An improperly operating valve may cause excessive pressure or vacuum in the engine crankcase, resulting in leaking seals and degraded engine performance.	

The Spiracle assembly has two check valves to prevent the flow of engine oil from the engine sump: an integrated valve in the bottom of the assembly and a remote valve to be installed in the drain-back location. If oil does not drain properly from the assembly, verify that the unit was installed properly, then clean each check valve with diesel fuel or solvent.

Maintenance and Service

Donaldson Spiracle filtration systems are designed and approved for use on most medium and heavy-duty truck and bus engines. To ensure efficient operation of this product, the following preventive maintenance procedures must be incorporated into your regular vehicle maintenance routines.

During normally scheduled vehicle maintenance, inspect the Spiracle assembly, tubing, clamps, and mounting bracket. Look for leaks, structural failures (cracks), and loose connections. Repair or replace any defective parts, as appropriate.

Add Filter Change into Maintenance Schedule

The filter must be changed at the engine manufacturer's recommended oil change interval or every 500 hours of operation, whichever comes first.

NOTE	Replace Filter Regularly
The Spiracle assembly is designed to have the filter replaced at the engine manufacturers recommended oil change interval or every 500 hours of operation, whichever comes first. Replace the filter regularly to avoid turbocharger and/or intercooler fouling.	

Spiracle filtration systems are subject to shortened service life under the following conditions:

- Improper engine maintenance.
- Engine operation with excessive oil consumption and excessive blow-by due to worn piston rings.
- Improper and oversized air cleaner, resulting in insufficient vacuum at the spiracle outlet.
- Engines with dual air cleaners may cause insufficient vacuum at the Spiracle outlet.

To prevent the reoccurrence of short filter life, engine performance concerns must be resolved before operating with a new Spiracle replacement filter.

Use the following procedures to perform routine service of the Spiracle filtration system.

Routine Filter Service Procedure

Replace the Spiracle filter during regularly scheduled oil changes or every 500 hours of operation, whichever comes first, in accordance with the procedure below.

- 1.) Release over-center latches and separate upper and lower sections of Spiracle assembly (lower section is held in position with mounting band[s]). Lift the upper section of Spiracle assembly (still connected via inlet tube) out of the way.
- 2.) Remove old filter.
- 3.) Apply (rub) clean engine oil around the inner diameter of new Spiracle filter seal to ease installation and improve sealing.
- 4.) Install the new filter (using a rotating motion) in upper section of Spiracle assembly by pushing it upward in the housing until fully seated on the seal tube.
- 5.) Hold over-center latches up and position filter/ upper section of assembly onto lower section of the housing. Align filter inside of sealing cup and push downward until filter is fully seated in bottom of housing.
- 6.) Fasten over-center latches to secure Spiracle sections together.
- 7.) Note engine mileage/hours in your maintenance records and schedule next filter replacement period.
- 8.) If there is moisture in the lower section of the Spiracle assembly, remove with a clean shop rag. Moisture can build up through the normal combustion process.

The oil dipstick may act as a pressure relief vent by dislodging from its fully installed position. If the dipstick is found dislodged, the filter may need service. Inspect the filter and replace if it appears dirty or plugged.

The Spiracle filtration system uses check valves to prevent engine oil in the sump from being drawn into the Spiracle filtration system. This prevents the engine from drawing oil out of the sump and from a run-away engine in the event of an engine roll-over (from an accident or by other means). Inspect the Spiracle system, mounting bands and interconnecting tubing in the event of an engine rollover. Replace the filter to ensure high efficiency and prevent turbo fouling.

Spiracle Filter Disposal Information

With proper use, Spiracle filters become loaded with engine oil, combustion by-products, diesel particulate matter, and engine wear debris. These materials may be classified as hazardous waste in certain areas. Please dispose of the used Spiracle filters in accordance with your local regulations. Treating the filter similar to a used oil filter will typically meet local regulations.

NOTE	Use Only Donaldson Replacements Filters
Use only Donaldson replacement filters in the Spiracle unit. Do not operate the engine without a filter to avoid turbocharger or aftercooler fouling.	
Filter for S040004 Model is P603746 Filter for S040005 Model is P603568	

NOTE	Do NOT Clean Spiracle Filters
Do not attempt to clean or recondition the filter. Reconditioned filters may provide low efficiency, resulting in fouled turbocharger and intercooler components.	

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Actions and Improper Maintenance That May Void Your Warranty

The following conditions are considered to be abuse, neglect or improper maintenance that may void your warranty.

- Misapplication or improper installation of the Spiracle CCV filtration system (failure to adhere to Donaldson owners manual)
- Failure to change the Spiracle element at every engine manufacturer's recommended lube oil change or 500 hours (whichever is more frequent)
- Failure to perform routine and normal system maintenance practices during service intervals, including an inspection of all tubing connections and a tightening of all clamps as necessary to avoid contamination of the engine through unfiltered leaks into the air intake system connection
- Failure to return the warranty registration card within 30 days of installation.
- The use of a non-Donaldson Spiracle replacement filter or the reuse of a cleaned Spiracle filter (Spiracle filters are not cleanable)
- The operation of a Spiracle system (engine operation) without a filter in place
- Tampering with a filter resulting in bypassing either the first or second filtering stage
- The use of a Spiracle replacement filter size other than that intended for the system
- Any other practice that would cause the system to leak unfiltered flow to the engine, resulting in turbo charge or aftercooler fouling
- Tampering with the Spiracle pressure regulating valve
- Any practice that would cause excessive pressure or vacuum in the crankcase
- Failures or damage caused by mounting system failures
- Physical damage caused by misuse, abuse or road hazards including (but not limited to) dents, cuts, or fractures to the exterior or interior of the Spiracle filtration system
- Modifications, alteration or attempted repair of the Spiracle filtration system
- Damage due to shipping
- Failure to service the Spiracle system in the event of an vehicle roll-over (from an accident or by other means), including a filter element change and an inspection and draining of lube oil from all tubing
- Progressive engine failures that allow the presence of fuel or coolant in the lube oil sump or blow-by gas stream in excess of Engine manufacturer's specifications



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