



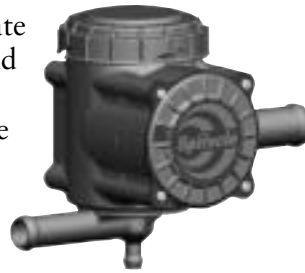
## Donaldson Closed Crankcase Ventilation (CCV) Filtration Systems



F I L T R A T I O N

### Eliminate Emissions & Improve Engine Compartment Cleanliness

Donaldson Spiracle™ filtration system will eliminate crankcase blow-by emissions for light, medium, and heavy-duty diesel engines without fouling turbochargers or aftercoolers, enabling trouble-free closed-crankcase operation.



This filtration system will also reduce engine oil consumption, underhood odor/fumes, road drips, and help to maintain a cleaner engine compartment.

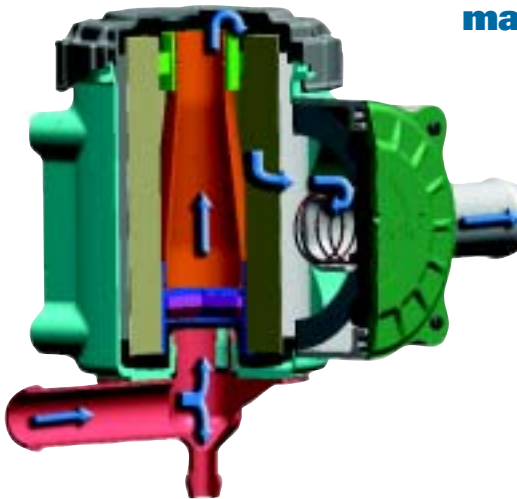
The Donaldson Spiracle filtration system will also reduce your overall total emissions to meet new emissions regulations.

### Open Crankcase Ventilation Systems

The combustion chamber's slight pressure leakage past piston rings form blow-by gases in the crankcase. These gases contain hydrocarbon vapor and aerosol, soot and other engine oil contaminants. Current turbocharged and many naturally aspirated diesel engines have open crankcase systems, often with non-serviceable breather filters that limit the number of "drips per hour" leaving their crankcases via draft tubes. Challenges arise in closing crankcases for turbocharged engines because the blow-by gases, when routed through turbochargers and aftercoolers, can cause fouling and engine performance degradation.



**Donaldson's Spiracle filtration system has a unique two-stage filtration design, offering the highest efficiency available on the market.**



**First Stage**

The first filter stage employs high-velocity impaction technology for eliminating the bulk of the hydrocarbon aerosol, soot and other engine oil contaminants. This stage provides an average efficiency in excess of 50%.

**Second Stage**

The second stage filter uses low velocity diffusion technology for extremely high efficiency, resulting in a 90+% total filtration efficiency. Both filter stages are integrated into a single, replaceable non-metallic filter cartridge.



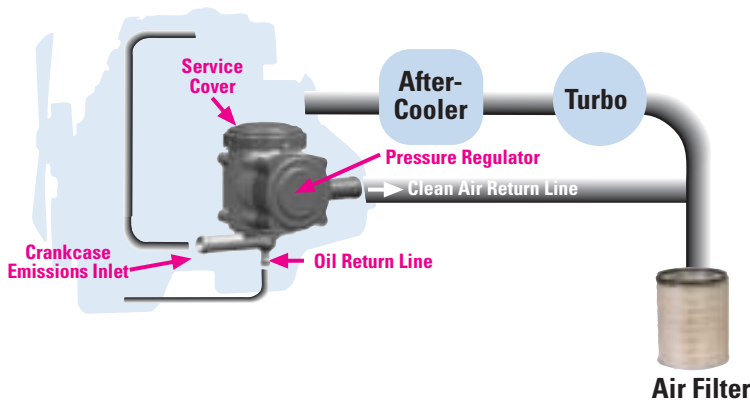
Filtration Technology by Donaldson

Donaldson Spiracle Filtration Systems are protected internationally by patents, trademarks, and design registrations, both issued and pending.

**The Challenge... Pressure Balancing the Crankcase and the Air Intake System**

The Donaldson Spiracle filtration system come with an integrated pressure regulator valve to solve this issue. The custom-designed pressure regulator has a large orifice plate to provide greater accuracy at low flows. The pressure setting of the regulator is tailored to specific crankcase needs through regulating spring designs. An optional pressure relief feature provides a bypass for venting crankcase emissions, while protecting the crankcase from over-pressurization.

As the crankcase pressure increases, the regulator valve opens to maintain crankcase pressures within a narrow range. When air intake system vacuum increases, the regulator valve closes to prevent the crankcase from reaching larger negative pressures. The regulator automatically adjusts crankcase pressures as the air filter loads and increases the intake system vacuum, and as the oil-coalescing Spiracle CCV filter loads with lube oil contaminant and increases the crankcase pressure. When the maximum crankcase pressure is reached, the filter must be changed. This event can be signaled using a crankcase pressure indicator or planned into routine maintenance schedules.



# Donaldson Delivers

*...tailored technologies that  
achieve the greatest  
economic benefit*

## Spiracle Performance

### Extensive efficiency and life tests on medium- and heavy-duty engines

- Tests conducted by independent contractors and Donaldson
- Fractional efficiency evaluations on heavy-duty engines from nanometer sized to 6 micron aerosols
- Valve durability testing far exceeding system design life
- Material compatibility tests for hot oil environment
- Heavy-duty transient cycle testing for PM emissions contribution

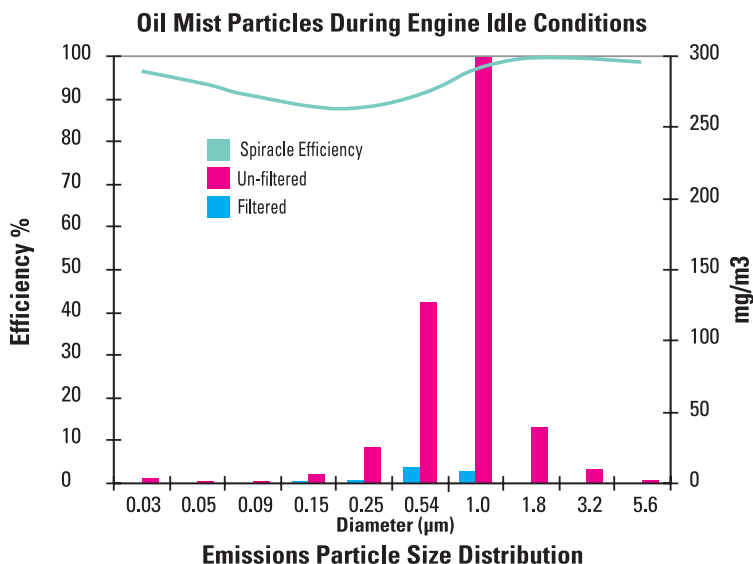
### Evaluated by 10 major global truck and engine original equipment manufacturers

- Lab and field life evaluations
- Lab efficiency determinations
- Field durability tests

### Typical Performance

- < 0.5 g/hr downstream carryover, depending on incoming oil mass flow rate
- Tunable crankcase pressure ranges
- Filter service life is 500+ hours or 15,000-25,000 miles depending on incoming oil mass flow rate.

**Spiracle is efficient over a broad range of oil mist sizes, and that the oil mist from engine blow-by range from 30 nanometers to 6 microns in size.**



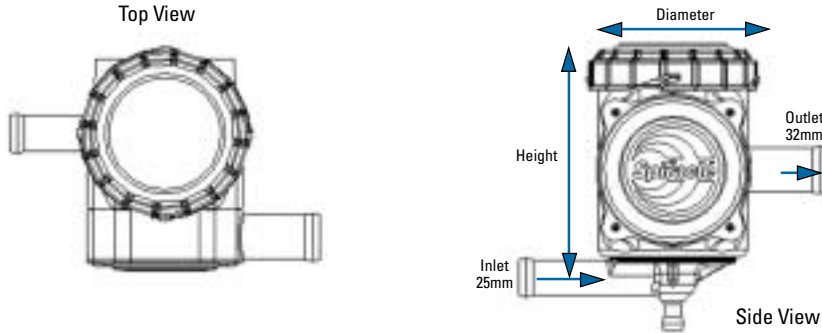
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## Features

- Top loading cartridge design to improve serviceability
- Bottom oil drain for the return of coalesced oil to the engine sump
- Bottom inlet to enable easy return of inlet-coalesced oil
- A replaceable two-stage filter cartridge that offers the highest level of filtration available (90+% efficiency). Filter service life is 500+ hours or 15,000-25,000 miles depending on incoming oil mass flow rate.
- Metal-free filter cartridge design
- Injection-molded filter housing made from glass-filled nylon for durability, chemical, and temperature resistance
- Flexible housing design offers multiple positions for inlet and outlet orientation
- Downstream-positioned pressure regulating valve for clean operation
- Optional design features include: over-pressure relief valve, oil drain check valve and service indicator

## Available System Sizes & Flow Ratings

Spiracle filtration systems are available in standard sizes for a wide range of engine blow-by flow ratings. Three standard sizes are available to meet a variety of air flows and filter life requirements. Custom designs can also be obtained to meet specific engine compartment and/or valve cover-integrated requirements.



Spiracle Model	Dia. (mm)	Height (mm)	Flow Rate (lpm)	Application
SPS040002	107	167	60-150 ( 90 nom.)	MD truck, mid-size off-road
SPS040004	170	262	110-300 (190 nom.)	HD truck, large-size off-road
SPS040005	170	369	260-690 (430 nom.)	HD truck, industrial, gen set

*A light vehicle model is planned for production. For availability and timing, contact Donaldson.*

*Note: A separate check valve is available from Donaldson to enable drainage of coalesced oil back to the engine sump, while preventing evacuation of oil from the sump. Connecting hoses are also available.*

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# Donaldson®

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