

# CRANK IT UP

As emissions legislation raises the stakes with respect to crankcase emissions, ventilation technology designed for individual engines is the way forward

The progressive inclusion of crankcase emissions in total engine emissions, along with the continuous tightening of legislation, is calling for new engineering solutions from suppliers. Both on- and off-highway engine manufacturers are facing emissions challenges. 'Blow-by' aerosols have to be filtered out of the crankcase with no compromise to engine reliability. Crankcase ventilation filtration suppliers are therefore faced with the challenge of integrating new engine components in confined spaces, while providing high efficiency and reliability.

Crankcase breathing systems play a vital role in ensuring adequate crankcase pressure. While systems that route blow-by gases to the engine intake provide more favourable crankcase pressure and reduced pollutant emissions, they also require higher levels of air/oil separation to prevent the risks of induction fouling.

Donaldson's long experience in crankcase ventilation technology, and the changing requirements for new heavy-duty diesel engines have led to the development of a specifically engineered technology for crankcase ventilation. Spiracle technology is a major step forward in crankcase filtration. Synteq XP media, Donaldson's proprietary Closed Crankcase Ventilation (CCV)-specific filtration media, provides a compact solution to the often-conflicting goals of:

- Long filter element life;



Donaldson Synteq XP media fibres: combination of synthetic and glass fibres and controlled dimensions and shapes

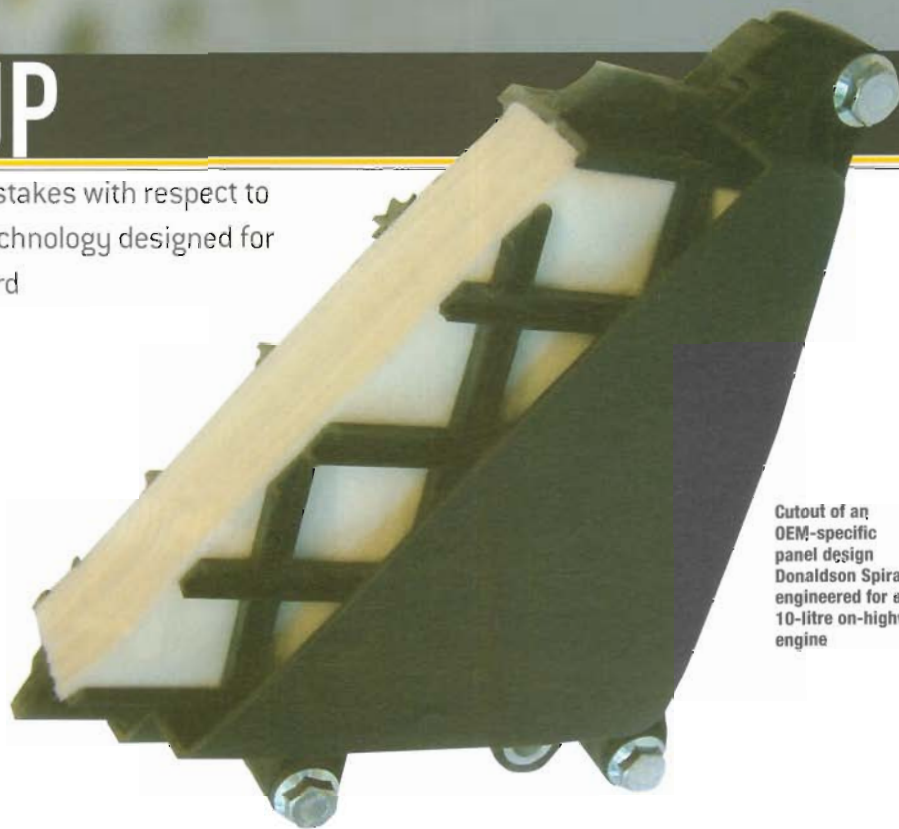
- Easy servicing;
- Low pressure drop;
- High air/oil separation efficiency in all conditions.

In controlled laboratory conditions, on engine testbeds and in production applications, Donaldson Spiracle filters have successfully demonstrated greater than 95% efficiency under the most extreme environmental conditions, while still meeting all other targets.

### Conflicting goals? No problem...

All new Spiracle filters use the revolutionary Donaldson Synteq XP media technology. The precise dimensions, shapes and innovative fibre bonding provide the ideal solution for the conflicting goals of high efficiency and low pressure drop:

- Larger particles, typically from 1-10µm, are efficiently separated by interception and inertial impaction.
- Sub-micron particles, often the most harmful for compressor blades, are efficiently separated by diffusion. Donaldson's Synteq XP media is specifically designed to combine interception, inertial impaction and diffusion, thereby offering high efficiency for all particle sizes.
- Large pore size reduces pressure drop to such an extent that multiple thick layers of media can be used. Therefore, Synteq XP filter cartridges offer extremely high air/oil separation



Cutout of an OEM-specific panel design Donaldson Spiracle, engineered for a 10-litre on-highway engine

efficiency at low pressure drop.

- The drainage within the media pack is also optimised. Pressure drop across the self-cleaning element is kept low and stable over time, and no engine downtime is required to drain the oil out of the media pack.

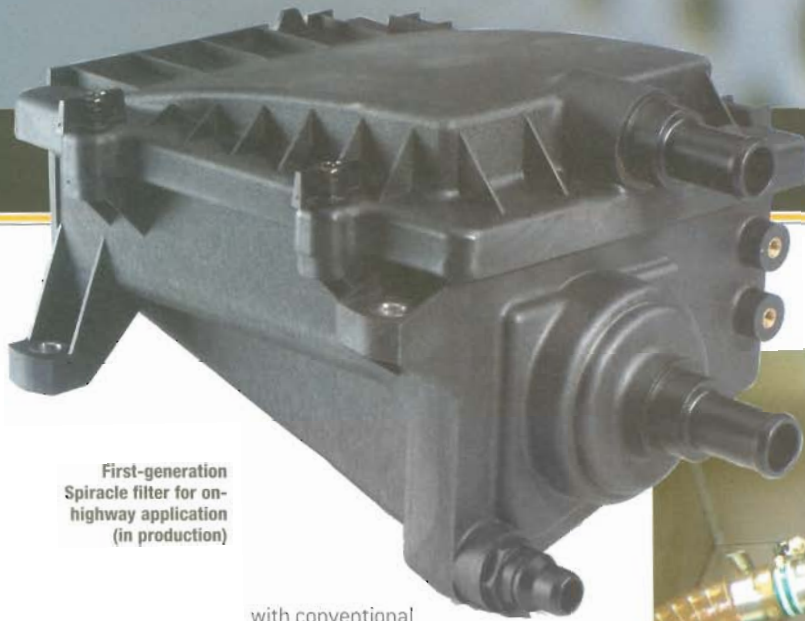
### Consistency and flexibility as standard

Spiracle's innovative media solution gives Donaldson's CCV system four different edges in the complex and diverse CCV market. High efficiency is consistently achieved for all blow-by flows, from idle to rated power with a worn engine and for all particle sizes. It remains consistent under the most severe climatic conditions, from Arctic to desert temperatures.

The optimisation of diffusion mechanisms in the Donaldson Synteq XP filtration media gives greater than 95% efficiency on particles smaller than 0.5µm. Larger particles (>1µm) are also coalesced in the media pack and drained back to the engine sump. The precise definition and control of pore sizes, offered by Synteq XP media, provide exceptionally low pressure drop across the filter. The optimised self-draining effects of the media pack further maintain the low pressure drop across Donaldson's Spiracle filters.

A further advantage is also provided by the large pore size and optimised self-draining mechanisms. Compared

## ENGINES



First-generation Spiracle filter for on-highway application (in production)

with conventional CCV systems, the Spiracle technology offers an extended life. Recently validated products have demonstrated that service intervals up to 2,000 hours can be achieved. The oil drainage within the filter element creates an additional self-cleaning effect and the result is a very low pressure drop that remains stable over time. As a result, service needs are dramatically reduced. The cartridge can be changed in a short space of time without any need for manual cleaning operations (such as cleaning the CCV system or the compressor/intercooler/engine induction).



Oil mist generator and particle counter for CCV filter evaluation and development

The manufacturing process and flexibility of the media technology allow for varied possible packaging. Cylindrical and panel (rectangular or any other shape) filters of different sizes have already been designed and tested. Spiracle filter technology offers great opportunities for engineering CCV filters in the most challenging shapes.

The final edge is the reliability that the Spiracle filters consistently deliver, as no hydraulic or electrical power is required. The risks involved with moving parts or a high-voltage power supply are avoided due to this innovative solution. The robustness of this technology makes it suitable for the most challenging applications.

### Complete solutions

Donaldson has been offering standard CCV filters for many years, but the focus has now moved towards delivering complete CCV solutions, engineered specifically for each engine manufacturer. The specifications of each engine type (blow-by flow, particle size distribution, operating temperature, packaging requirements, etc) are such



Engine blow-by analysis: particle size distribution measurement on engine dynamometer by Donaldson Leuven, Belgium



Donaldson Synteq XP CCV filter for off-highway application (in production) – test set-up for filter analysis

that only a customised, specific CCV design can guarantee the highest level of performance.

The CCV experience gained by Donaldson over the past years is now being applied to rapidly develop effective solutions for engine OEMs. Important investments in CCV-specific engineering capabilities in Europe, in addition to decades of filtration experience, give Donaldson an edge to develop the best solutions with the engine manufacturers.

In addition to the standard product range and the systems already in production, the first OEM-specific CCV filter using Donaldson Synteq XP technology was released for production in early 2007, after less than 12 months of full development and validation. Other developments have already been fully validated and will go into production during 2007 and 2008.

In fact, Donaldson is already working on a number of projects with an even higher level of integration. Complete filtration modules that include CCV filter, oil and other fuel or coolant liquid filters are being developed for engine OEMs.

### A partner for CCV

Donaldson's Spiracle filters have already been available for many years. Today, the filtration technology is available for OEM-specific developments. The company's strong European engineering team and European manufacturing facilities are working closely with engine manufacturers to develop tomorrow's CCV systems. That engine and filtration knowledge and experience, combined with global aftermarket presence, make Donaldson the engine OEMs' partner for CCV development.

Donaldson's Spiracle approach is an innovative, yet proven, CCV technology. It provides a solution to the conflicting goals of engine protection (through efficient air/oil separation), low pressure drop, easy maintenance and high engine integration. **ivt**

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