New Gas Turbine Inlet Filter from Donaldson

Donaldson has developed a new gas turbine air filtration system designed to provide highly efficient filtration in a smaller package. The new XLR self-cleaning filter systems have a 40% smaller footprint than the company's GDX system and features the company's PowerCore filter media.

by Mike Brezonick

Donaldson Co. Inc. has developed a new filter technology for gas turbine air intake air systems designed to provide highly efficient filtration in a smaller, more manageable package. The new XLR self-cleaning filter systems featuring the company's PowerCore filter media will be unveiled by the Minneapolis, Minnesota, U.S.A., manufacturer at the Power-Gen International show.

The XLR system reduces the three-dimensional footprint of the filter unit by 40%, Donaldson said, with no loss in filtration efficiency. Resulting benefits also include more simplified shipping and field installation.

The key to the more compact size of the XLR unit is the PowerCore media design. Originally developed in diesel engine applications — Donaldson is a global supplier of filtration technology for trucks and off-highway equipment — the PowerCore media allows twice the airflow per filter at the same initial pressure loss and filtration efficiency as the company's well-accepted GDX self-cleaning filter system.

Donaldson has marketed a media similar to PowerCore in the past as part of an aftermarket replacement panel filter, but this is the first application for the XLR unit as an OEM product.

PowerCore is a high-density corrugated flute media technology, in this case, packaged in a V-shape. The high density of the media pack, as compared to a pleated sheet of media, allows for a greater amount of filter media to be packaged into a given volume of space, Donaldson said. This high density construction has the ability to reduce pressure losses due to the flow path changes of air through a filter.

The corrugated configuration is constructed by layering alternate rows of flat sheet and corrugated media. The result is a dense honeycomb-like structure. The resulting media pack consists of parallel rows of flutes that are open at only one end. To create a filter from this media pack, the ends of the flutes are sealed at alternating ends with an adhesive bead. The bead creates a barrier to air on the upstream side of alternating flutes within the media pack, and a corresponding barrier on the adjacent flute at the downstream end.

When placed in an air stream, the air is allowed to enter 50% of the flute chambers on the upstream side of the media pack, but blocked from exiting those flute chambers on the downstream side. Because of the permeable nature of filter media, the airflow passes through the media fibers into the adjacent chamber and exits on the open downstream end.

When placed in line with the airflow, the air enters the flute chamber and performs a 90° turn to pass through the walls of the media flute chamber. After another 90° turn in the airflow, the air exits the media pack in line with the flute chamber. This axial "Z" flow path reduces the number of turns that the airflow has to make when passing through a filter, as compared to a radial flow cylindrical cartridge filter.

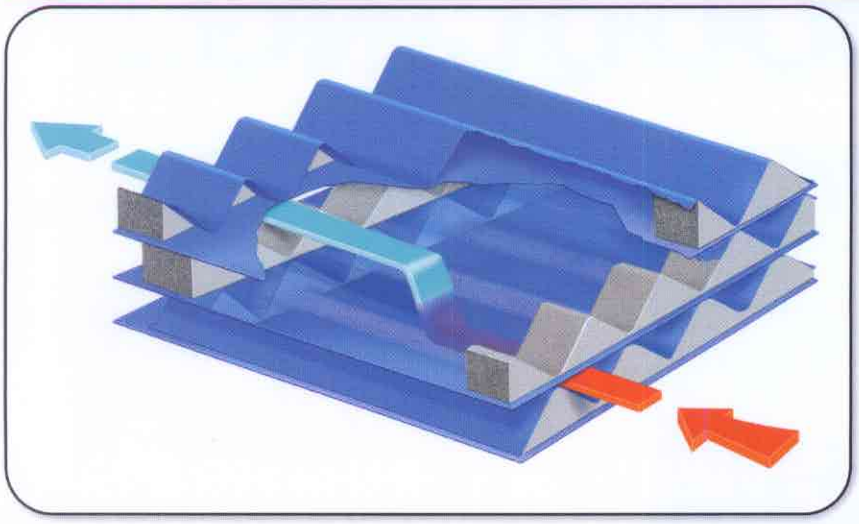
"The initial pressure loss through the media pack is dependent on the entering and exiting losses of air as it enters the flute chambers, and the restriction of the air as it passes through the walls of the chamber," said Tod Carpenter, general manager of Donaldson's Gas Turbine System business unit. "This means that the corrugated flute media concept can be applied in a variety of corrugation depths and flute lengths to affect a diverse range of pressure loss versus airflow possibilities.

"For the purposes of the gas turbine application, we selected the flute shape and depth based on what was determined to be an optimal cost versus pressure loss versus manufacturability ratio."

A comparison of the initial pressure restriction versus airflow through a comparable amount of filter media in a corrugated flute and cylindrical pleat pack *(see accompanying table)*. When packaged in a

Equivalent Media Surface Area Test

	High-Density Media PowerCore	Cylindrical Cartridge
Airflow/Filter	3600 cfm	1670 cfm
Pressure Drop	1.0 in H_2O	1.0 in H_2O



The key to the XLR filter system is the PowerCore high-density corrugated flute media technology, which consists of parallel rows of flutes that are open at only one end. When placed in an air stream, the air is allowed to enter 50% of the flute chambers on the upstream side of the media pack, but blocked from exiting those flute chambers on the downstream side. Because of the permeable nature of filter media, the airflow passes through the media fibers into the adjacent chamber and exits on the open downstream end.

high-density corrugated media pack, a given amount of media is capable of handling 115% more airflow at the same initial pressure loss than it could in if packaged in a cylindrical pleat pack arrangement, according to the company.

In the XLR system, PowerCore is offered with a choice of Donaldson Duratek or synthetic base media, both of which incorporate Donaldson's Spider-Web nanofiber technology.

Airflow through the XLR filter system is horizontal with the filter elements mounted horizontally against a vertical tubesheet plenum. The number of turns the air has to make has been reduced by 25%, helping to keep pressure loss low. The filters are protected from direct exposure to rain and sun with an enclosed access area on the dirty air side. Incoming air is pretreated with either weather louvers or weather protection hoods with optional inertial moisture separators. The incoming air is cleaned by pairs of PowerCore filters in an outside-to-inside airflow path.

The XLR system is designed for very low maintenance making it suitable for remote installations. Filter cleaning is accomplished in the same manner as Donaldson's current GDX: a strong reverse pulse-jet of air is automatically initiated when the pressure loss through the system exceeds a preset limit (per the conditions of the environment.) The filters are then cleaned on a cycle from top to bottom until the system pressure loss returns below the automatic set point.

The ejected dust settles to a collection hopper at the bottom of the unit for dust evacuation. And because the pulse cleaning operation keeps system pressure loss low, the turbine can run at peak efficiency to maximize power output, the company said.

A walkway behind the louvers or inlet hoods provides easy service access to the filters and pulse valves. The XLR is modular in construction, with module width limited for shipping purposes, and heights varying from 8 filters to 20 filters to accommodate a diverse range of large turbine airflows. The modular design allows for on-site assembly, and the system uses 40% fewer fasteners than the GDX system, Donaldson said.

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