



CASE STUDY AIR FILTERS SUPPORT LONG COMPRESSOR LIFE AND EFFICIENT OPERATIONS

By Scott Galloway, Global Sales Manager, Donaldson Company, Inc.

How a Textile Plant Benefited from Upgrading Filters

Air compressors serve vital roles in manufacturing facilities, driving various machinery and performing countless other functions. The dustier the plant environment, the more taxed are the air filters that clean intake air for the compressor. Traditional cellulose filters can clog quickly, while newer filter technologies from Donaldson can quickly reap a return on investment.

One instance of this occurred at a dusty textile plant in China. The downtime of air compressors in the plant was greatly reduced when conventional air filters were replaced with high-efficiency filters employing Donaldson's proprietary fine-fiber technology. The Donaldson filters extended the service interval for the air filters at this plant by a factor of five, significantly reducing their maintenance costs and improving system reliability for the plant owner.

A Challenging Environment

The textile plant in Shandong Province, China relies on approximately 600 compressors to drive various machinery and operations. With a variety of fibers and other particulate matter in the air, the compressor air filters were becoming clogged and triggering restricted-airflow alarms after less than 200 hours of service, in some cases only 50 hours. Workers attempted to clean the filters by reversing air flows, but had limited success, sometimes only adding another 100 hours of service life to the filter. In addition, cleaning the filters with high-pressure air was not a practical solution. Using high-pressure air to remove dirt from an air filter inevitably damages the delicate filter media, leading to small tears that allow more and larger particles to pass through.

To improve the situation, the air compressor vendor discussed with Donaldson the possibility of replacing the cellulose air filters with surface-loading fine-fiber filters employing Donaldson's Ultra-Web® technology. Whereas traditional cellulose filters provide efficiencies of approximately 99 percent, the fine-fiber technology can provide efficiencies of 99.99 percent.

How the Technology Works

Inlet air filter media have traditionally been made from cellulose fibers or a cellulose-synthetic blend. Donaldson's Ultra-Web technology uses a fine-fiber media made with an electrospinning process that produces a fine, continuous, resilient synthetic fiber ranging from 0.2 to 0.3 microns in diameter. Ultra-Web technology provides high efficiency by establishing fine inter-fiber spaces that trap dust on the surface of the media, as shown in Figures 1 and 2. Dust trapped at the surface of the media forms a "dust cake" which remains permeable to air, meaning restriction across the filter will rise more slowly compared to a cellulose depth-loading media, where dust gets trapped deep in the media and can block air flow passages.

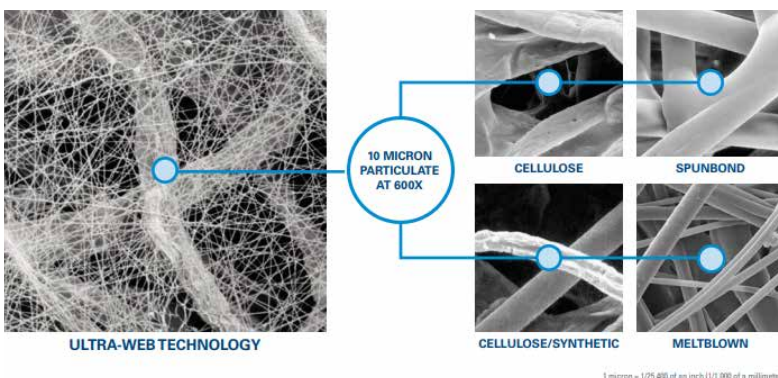


Figure 1: Ultra-Web technology forms a fine fiber web that traps dust on the surface of the media.

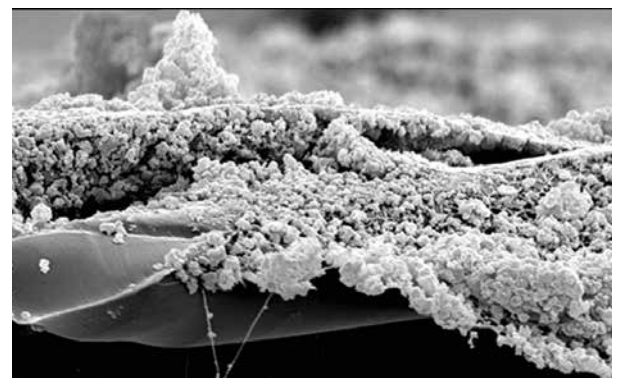


Figure 2: Dust on the surface of a fine fiber filter.

Trying the Alternative

To determine the effect of high-efficiency filters, workers installed the fine-fiber filters on five compressors that had previously used a traditional cellulose media. The filter assemblies were changed from the original, vertically mounted assemblies to new Donaldson assemblies, which housed the Ultra-Web filters in a horizontal configuration. Workers monitored operations, comparing the times when airflow restriction alarms were triggered on both types of filters. The results were remarkable. As shown in Figure 3, the Ultra-Web filters increased the average time when alarms were triggered from approximately 300 hours to over 1,500 hours, a five-fold increase. Figure 3 shows the number of running hours to reach a certain level of pressure drop. Surface loading contributes to the slower rise in restriction and thus a long life for the filters.

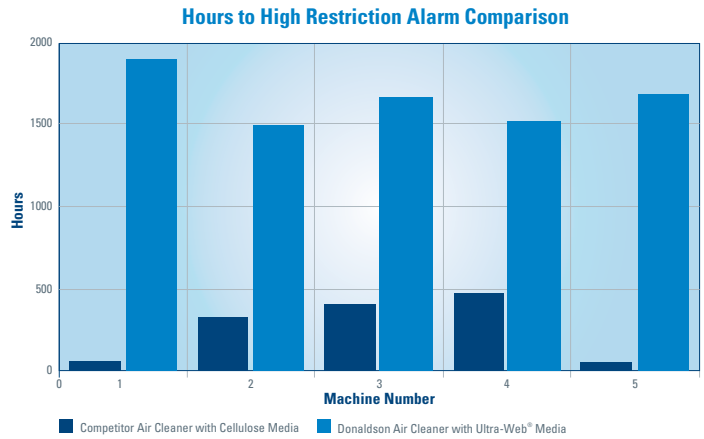


Figure 3: Ultra-Web technology significantly extended the time in which restriction alarms were triggered.

The high efficiency of the filters was also evident in visual inspections. As shown in Figure 4, a significant amount of dust and other particulate matter was captured on the exterior of the filter at the end of the test period, while the interior showed significantly less dust, such that it appeared almost as clean as a new filter.



Figure 4: Exterior view of the filters (left) showed significant particulate matter, while the interior (right) appeared very little.

Post-Test Actions at this Plant

Following the test, the textile plant operator replaced all air cleaners on their 600 machines with Donaldson Ultra-Web filters, saving more than \$1 million per year in operating costs, as shown in Table 1. The filter replacement also resulted in annual labor savings of more than 7,000 person-hours, as shown in Table 2. This is equivalent to approximately 3.5 full-time employees.

Element	Cellulose Filter	Ultra-Web Filter	Annual Savings
Alarms per year	17,520	3,504	14,016
Element unit cost	\$85	\$120	--
Element cost per year	\$1,489,200	\$420,480	\$1,068,720

Table 1: Annual cost savings for replacing air filters in 600 compressors.

Element	Cellulose Filter	Ultra-Web Filter	Annual Savings
Hours of operation	8,760	8,760	--
Average hours to alarm	300	1,500	--
Alarms per year	17,520	3,504	14,016
Labor to replace element (hours)	0.5	0.5	--
Labor hours per year	8,760	1,752	7,008

Table 2: Annual labor savings for replacing air filters in 600 compressors.

Other Considerations

The Chinese textile plant provides a prime example of how improved air filtration can have a significant impact on overall system efficiency. The air filter must be viewed as an important part of a filtration “ecosystem”, which also includes an oil filter and an air-oil separator, as shown in Figure 5. Improved performance in one filtration component directly impacts the performance of other filtration components.

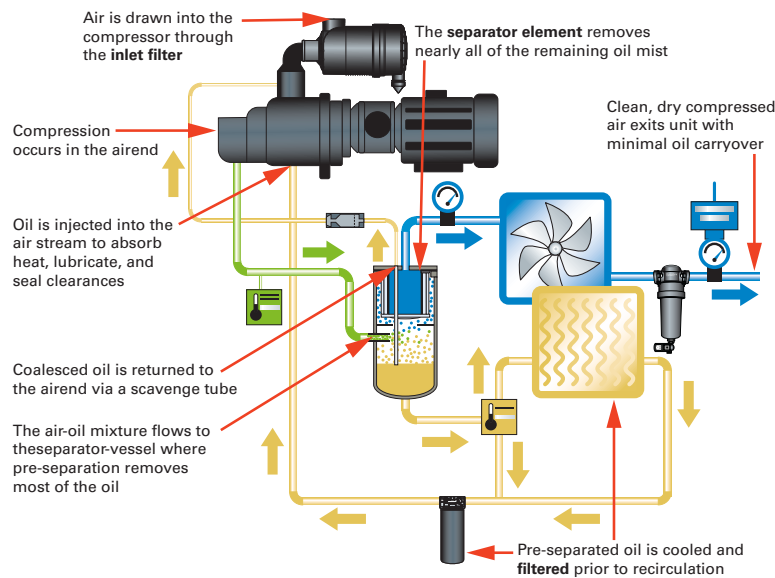


Figure 5: Schematic of an oil-flooded rotary screw air compressor.

benefit of selecting a high-performing, high-efficiency filter. In addition to textile plants, other industries that could benefit from high quality filtration include concrete plants, wood processing plants, and virtually any other facility where dust and particulates are present. A key point to remember is that a system is only as good as its weakest link, and the entire ecosystem should be considered when selecting filtration equipment. The Donaldson team can help you find ecosystem-based solutions for your unique system requirements.

About Donaldson

Donaldson provides industry-leading, end-to-end technology for inlet air filters, lube filters and air-oil separators. Our engineers can work with customers to develop custom filtration solutions that work together for peak efficiency and performance, and lower operating costs. Founded in 1915, Donaldson Company, Inc. (NYSE: DCI) is a global leader in the filtration industry, with approximately 140 sales, manufacturing and distribution locations in 44 countries. Donaldson’s innovative filtration technologies improve people’s lives, enhance customers’ equipment performance and protect the environment. For more information, visit Donaldson.com.

About the author

Scott Galloway manages sales globally for Donaldson Company’s Compressor Filtration Division. He has 25 years of experience working in and with the Compressor industry, focusing on energy-saving solutions and building long term strategic partnerships.

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Donaldson Company, Inc.
Compressor
PO Box 1299
Minneapolis, MN 55440-1299 U.S.A.

shop.donaldson.com
donaldson.com

United States of America:
866-933-4648
grpocompressor@donaldson.com

China:
+86 510 85285123
compressor-cn@donaldson.com

Europe, Middle East, and Africa:
+32 16 38 3811
CustomerServiceCOMP@Donaldson.com

India:
+91 (124) 4807 400
difsCompressor@donaldson.com

Japan:
+81 42 540 4123
jp-ndl.comp@Donaldson.com

Korea:
82-2-517-3333
GRPKCLCS@Donaldson.com

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