PENTAIR

OIL AND GAS SEPARATIONS

PENTAIR APEX ZENITH

INNOVATION IN SEPARATION

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For more than 25 years, Pentair UltiSep Technology featuring Pentair Apex separation media has enabled gas-processing facilities to achieve superior separation efficiency of aerosol contamination, leading to increased throughput and operational efficiencies. Building upon this legacy of separation expertise and industry-leading performance, Pentair Oil and Gas Separations has developed the next generation of liquid gas separation technology for midstream and downstream plants: Pentair Apex Zenith™ Element Filters.

Separation system efficiency is determined by the combination of gas velocity/flow rate, the amount of aerosol ingression in the gas, the operating pressure and internal element configuration. As the flow rate and/or liquid loading increase, efficient separation of liquids becomes more difficult.

The Pentair Apex Zenith coalescing technology is enabled by our proprietary advanced media delivering higher separation efficiencies at significantly elevated gas velocities and liquid concentrations within a reduced vessel envelope.

Pentair Apex Zenith Element Filters in housing

SYSTEM BENEFITS

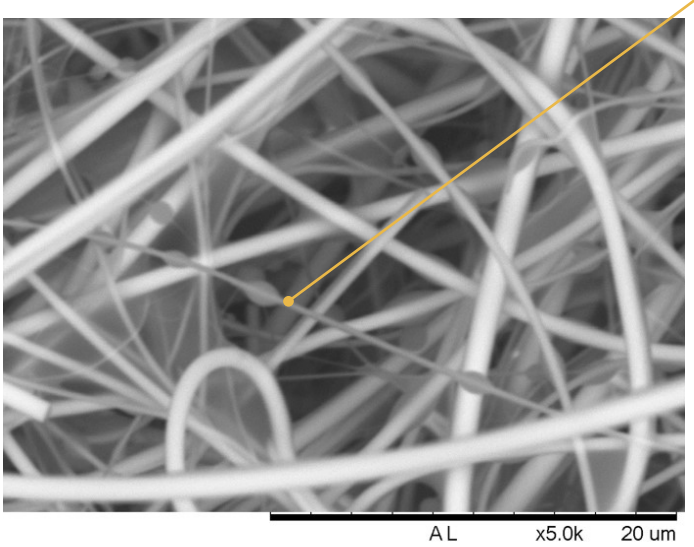
- Accommodate 50% greater gas velocity and liquid loading within a smaller vessel envelope, while maintaining or exceeding Pentair's established, high efficiency, sub-micron aerosol removal *
- Reduce capital expenditure through significantly minimized footprint compared to conventional systems, such as: horizontal, helical, filter-separator and demister pad separators
- Tested to greater aerosol removal standards compared to horizontal, helical, filter-separator and demister pad separators.
- Reduce separation system labor, operational and installation costs
- Improve performance of existing installations that experience upset flow or liquid loading rates

** 50% increase in gas flow and liquid load as compared common sizing principles common in the industry based on flow per element of approximately 85 to 130 ACFM and liquid loads between 40 and 500 mg/ml liquid suspended in aerosol form in a gas stream.*

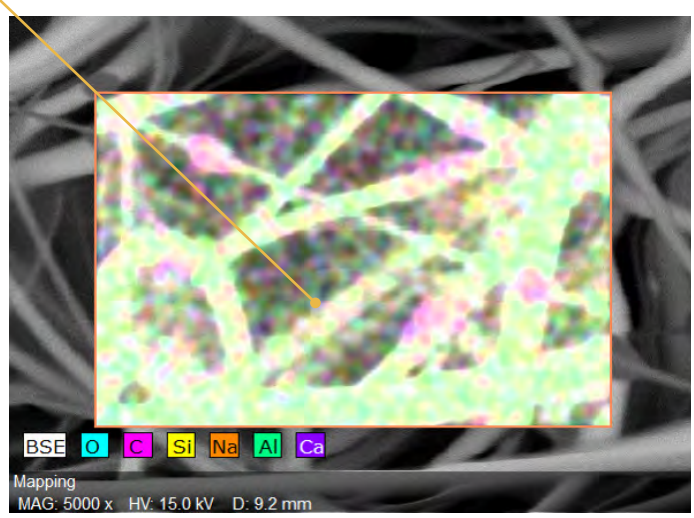
CAPITALIZE ON MORE VALUE WITHIN THE VESSEL

The performance of a vessel is highly dependent on the coalescing elements inside. Pentair Apex Zenith is designed to deliver high efficiency separation, with a smaller footprint.

With our extensive chemistry and process expertise, Pentair Oil and Gas Separations has taken a closer look into the chemical interactions between primary fluid, contaminate (both aqueous and hydrocarbon) and media material to bring you a higher performing solution. Pentair Apex Zenith consists of reduced surface energy material that lowers interfacial tension, exploiting the relationship across a variety of difficult-to-coalesce aerosols, even in the presence of elevated gas velocities.

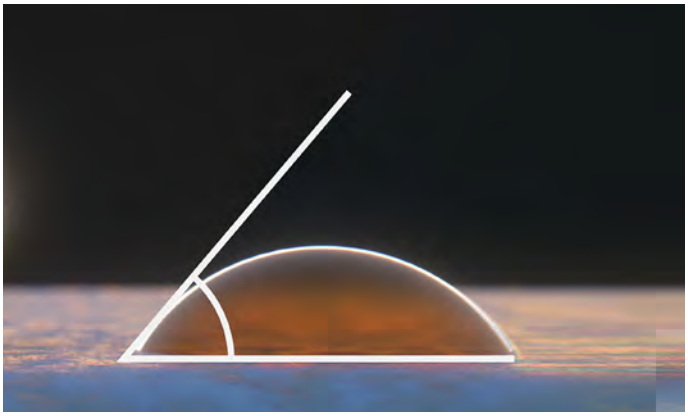


SEM of media surface on I.D. of cartridge



EDS of media showing droplets to be carbon based

High contact angle Apex Zenith Element



Low contact angle Conventional Element

PENTAIR APEX ZENITH FEATURES

- Designed to intercept droplets as fine as 0.1 micron in diameter, while achieving separation efficiencies of +99.99% at gas flows and liquid challenges greater than 50% percent compared to a conventional separator.
- Liquid Carryover Reduction: Specially designed materials accelerate the draining process for captured liquids, mitigating re-entrainment concerns for systems consisting of higher velocities and increased liquid loading.

PENTAIR PZ100 TEST SERIES: A HIGHER STANDARD FOR PERFORMANCE

In an effort to deliver greater performance excellence for our customers, Pentair Oil and Gas Separations has developed its own new coalescing test called the Pentair PZ100 Test Series.

The need for more robust and challenging coalescing filter test protocol is critical. In addition, it is essential that any testing standard is reflective of actual field conditions. Going beyond industry standards such as ISO 12500, Pentair PZ100 Test Series has implemented methods to address these critical needs to enable superior field performance. Pentair PZ100 Test Series utilizes widely accepted procedures based on several ISO methods, while incorporating an increased liquid challenge for simulating actual field conditions.

GAIN SUPERIOR PERFORMANCE ADVANTAGES WITH PENTAIR APEX ZENITH

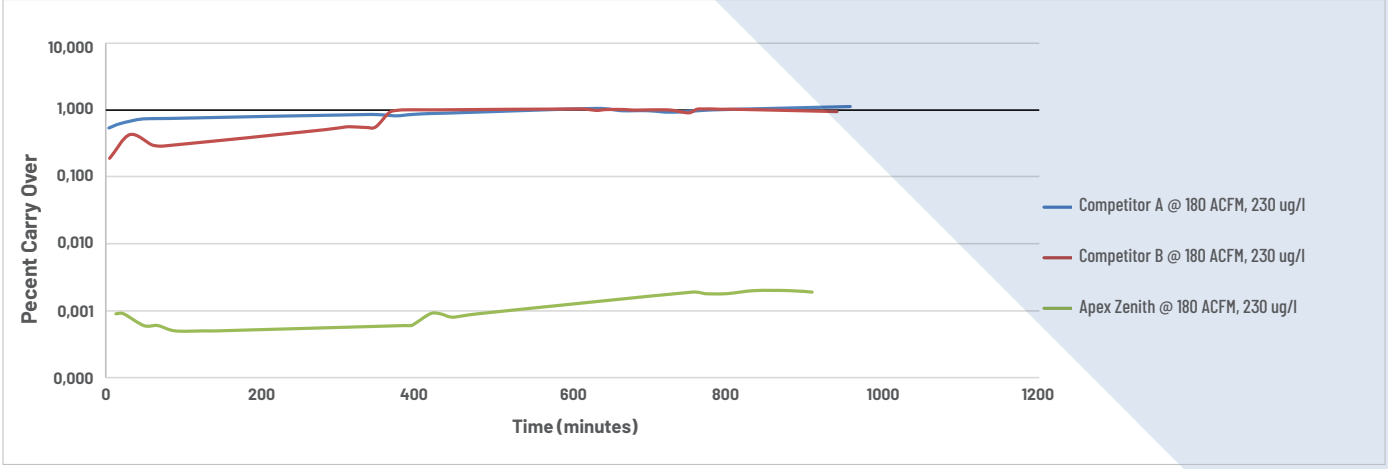
Pentair PZ100 Test Series* was used to evaluate the Pentair Apex Zenith coalescing element, along with two element models commonly found in the industry. Three different elements from each model were tested to create an average efficiency. Table 1 below shows the results of these tests in terms of separation efficiency.

Table 1: Test results of 3 different elements

	PENTAIR APEX ZENITH	COMPETITOR A	COMPETITOR B
Test Element 1	99,99%	99,49%	98,98%
Test Element 2	99,99%	99,10%	99,65%
Test Element 3	99,99%	99,69%	99,58%
Average PZ100 Photometric Efficiency	**99,99%**	**99,43%**	**99,40%**
Resulting Annual Liquid Carryover* (Gallons per year) at 200 MMSCFD	174	9893	10414
Resulting Annual Liquid Carryover* (Gallons per year) at 600 MMSCFD	521	29679	31241

* Assuming 0.09 ml/SCF Ingress Loading

Graph 1: Pentair Apex Zentih Element Filters vs Competitors Carry Over vs Time



ENHANCE YOUR EXISTING SEPARATION EQUIPMENT TODAY

Do not miss out on the benefits these advancements can provide to the gas process industry. Existing separation equipment may be upgraded with Pentair Apex Zenith technology for improved separation efficiency.

Contact your local Pentair Oil and Gas Separation Representative today or visit **www.oilandgasseparations.pentair.com** for more details.

* The Pentair PZ1000 testing concepts and procedures are based around the method outlined in Section 7 of ISO 12500-1 (2007) and ISO 8573-2. Test set up, measurement devices, and basic test procedure closely followed ISO method, with deviations made to flow rate parameters, liquid challenge rates, among others. For the results shown in Table 1 above, each coalescing element was subject to a constant gas flow rate of 180 ACFM, and a liquid aerosol contaminate challenge using liquid pao-4 oil. Aerosols were generated using laskin nozzle generators designed for pao-4 liquid, producing a droplet distribution between 0.1 and 0.6 um, mean droplet size 0.3 micron.

Test protocol begins with a one hour initial aerosol challenge using pao-4 oil at a liquid challenge rate of approximately 230 mg/m3 (referred to as the baseline challenge). Aerosol challenge was then increased to approximately 1200 mg/m3 maintaining 180 ACFM gas flow. These conditions were maintained until the element was brought to a state of saturated equilibrium. For the purposes of this test, equilibrium is considered to have been achieved when liquid oil is observed to be draining into the bottom of the element in the filter housing in which test is contained and the rate of change in pressure drop is less than 1% over the course of one hour. At this point, the liquid load was returning to initial challenge, or the baseline challenge conditions of 230 mg/m3, and efficiency measurements were carried out for no less than one hour. Efficiency data was recorded at discrete points in time taken every 15 to 30 minutes during this stage and combined to create a daily average for that filter model on that day.

The above procedure was repeated in its entirety three separate times on three separate days, and the daily average efficiency for each day was combined to create an overall average efficiency for each filter listed above in Table 1.

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