Arioso™
High Performance Air Filtration Composite Media
Engineered with Solupor® Membrane Technology

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Initial Pulse Testing of Cartridge Medias in Accordance with Accelerated VDI 3926

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Overview

This research was undertaken to get initial results on the performance of *Arioso*™ high performance composite air filtration media designed for use in pulse-cleanable cartridges. These tests compared *Arioso* M7001-11 (designed for F9 efficiency) against M3203-11 (designed for H12 efficiency) and Sample A, an industry leading ePTFE media using pulse testing equipment built in accordance with VDI/DIN 3926. The first test rig was of the Type 1 (vertical duct) style and second rig was of the Type 2 (horizontal duct) style.

The tests, when performed in accordance with VDI/DIN Guideline 3926, are meant to simulate repetitive dust loading and pulse cleanings to evaluate media performance. The standard tests consist of 30 cycles of standard loading and pulsing at a fixed pressure drop, followed by an aging period, which subjects the media to 10,000 cycles of dust loading and pulsing at 5 seconds intervals. After aging, the media undergoes a stabilization phase of 10 dust loading and pulsing cycles, followed by a final test of 30 cycles of dust loading and pulsing. Pulse cleanings were executed at a pressure of 6 bar (85 psi), with a valve opening time of 60 ms.

Due to time constraints, the media was only subjected to 10 cycles on the Type 2 rig at greatly increased dust loading, and subjected to 30 cycles on the Type 1 rig at increased dust loading and increased velocity.

The *Arioso* M7001-11 was subject to overnight aging tests on both rigs roughly in accordance with VDI 3926 procedures, but the other samples were subject only to the first cycles of dust loading and pulse cleaning.

The resulting trends from both test rigs were similar, so to simplify this discussion only the results of the Type 1 (vertical rig) testing will be presented.

Deviations from VDI 3926 Standards

In order to complete the testing in an accelerated timeframe, the tests had to deviate from the VDI 3926 standards. The standard VDI test calls for dust loading of 5.0 g/m^3, and a velocity of 3.3 cm/second (2.0 m/min). For these tests, dust loading was increased to 8.3 g/m^3 and velocity increased to 5.0 cm/second so these tests were in more severe conditions than are typical. ISO A2 Fine test dust was also substituted for Pural NF test dust.

Dust Selection

Dust selection is critical to understanding an individual application, as filter media can perform differently depending upon the type of dust that has been selected to challenge the media. VDI standards were revised in 2004 to use one single test dust (Pural NF). This dust has very fine particles and does not agglomerate much, making it a challenging test dust. For these tests, however, ISO A2 Fine test dust was used due to its common use across North America and Europe. Theoretically, the ISO A2 Fine is an easier dust to filter than the recommended Pural NF test dust due to larger particle sizes and a tendency to agglomerate more.

Media Selection

For these initial tests, three media were selected for comparison. These structures are all designed for use in pulse-cleanable cartridges, with processing on blade pleaters. *Arioso* M7001-11 is a *Solupor*® ultra-high molecular weight polyethylene (UPE) membrane designed for F9 efficiency at very low resistance laminated to a 200 gsm, stiff, high permeability spunbond polyester functional support layer. *Arioso* M3203-11 is a *Solupor* UPE membrane designed for H12 efficiency laminated to the same polyester functional support layer. Sample A is an industry leading ePTFE membrane coupled with a stiff, calendared spunbond polyester structure.

Comparison of Medias, Flat Sheet

Flat sheet analysis of *Arioso* M7001-11 showed similar efficiency to Sample A but with almost 80% reduction in initial pressure drop. *Arioso* M3203-11 showed significantly higher efficiency with a 30% reduction in initial pressure drop. All the structures were similar in thickness.

	M7001-11	M3203-11	Sample A
Resistance (5.3 cm/s)	5.1 mm	17.4 mm	24.9 mm
Efficiency (MPPS, 5.3 cm/s)	79.9%	98.4%	81.6%
Efficiency (0.3µ, 5.3 cm/s)	91.2%	99.9%	92.9%
Thickness (Caliper, 8 psi)	0.55 mm	0.60 mm	0.53 mm

Fig. 1: Flat Sheet Properties

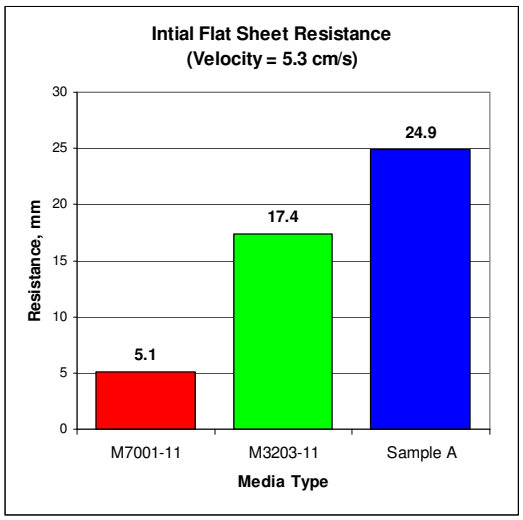

Fig. 2: Flat Sheet Resistance Comparison

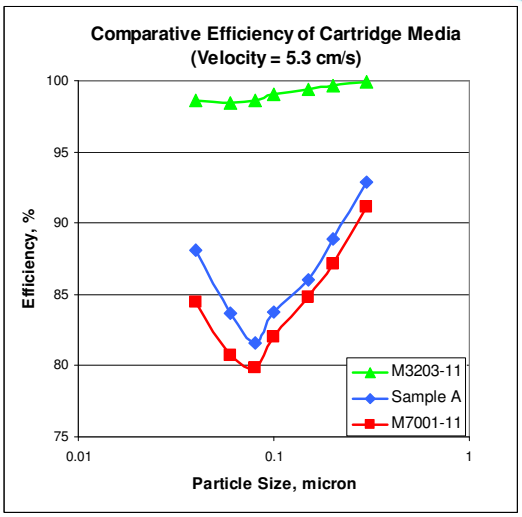

Fig. 3: Flat Sheet Efficiency Comparison

Residual Pressure Drop

One of the key parameters measured by this testing is the increase in residual pressure drop over time. As the media is subjected to dust loading and pulse cleaning cycles, particles gradually build up on and in the media. Media that releases dust more effectively will see less buildup in residual pressure drop, leading to longer times between pulsing, potentially longer media life, and potential energy savings.

As seen in Figure 4, both *Arioso* media samples start with lower initial pressure drop as compared to Sample A. More testing is required, but the *Arioso* media samples also seem to be adding residual pressure drop more gradually than Sample A. One item of note is that the aged M7001-11 (having withstood 8600 loading/pulse cycles) is not increasing residual pressure drop following its aging cycle, and at this stage in its life has lower residual pressure drop than the relatively new Sample A.

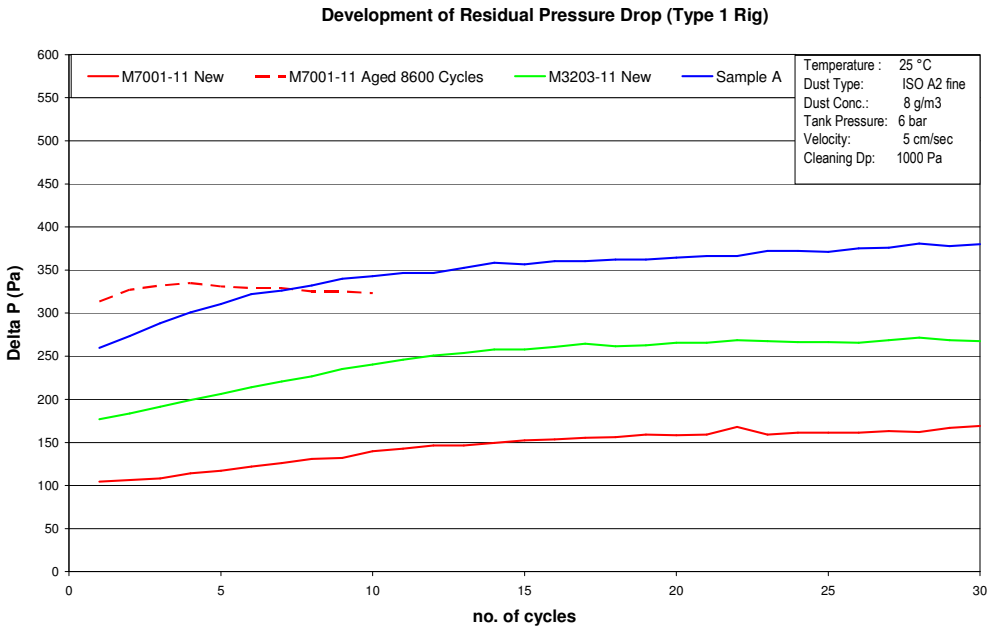

Fig. 4: Development of Residual Pressure Drop

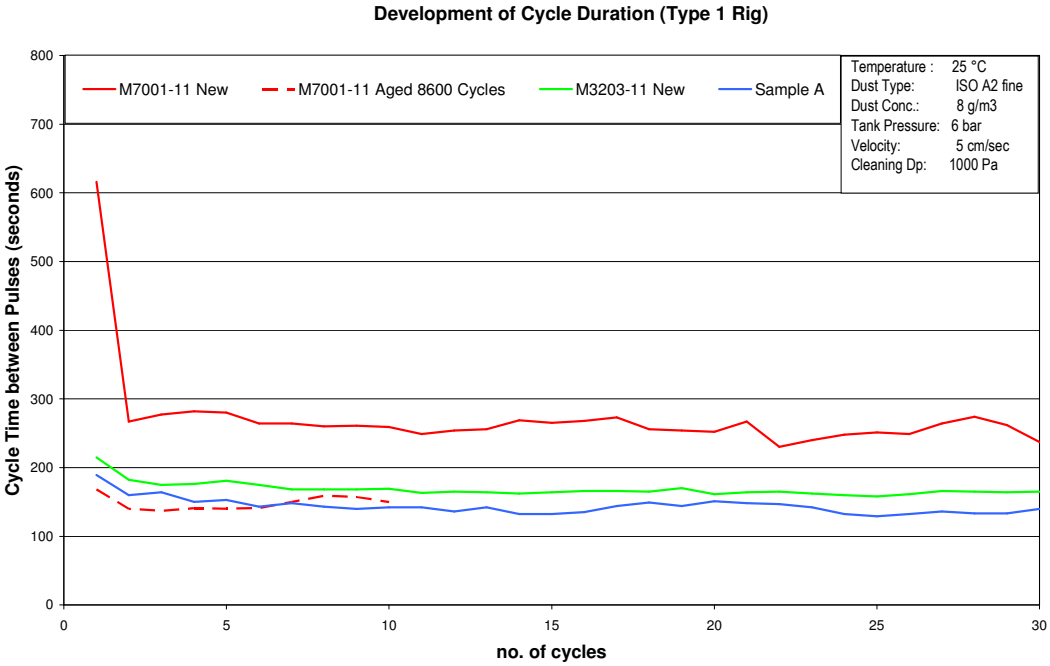

Fig. 5: Development of Cycle Duration

Cycle Duration

During the initial and final cycles of the VDI tests, the media is pulsed when it reaches a pressure drop of 1000 Pa. The cycle duration is measured as the time between pulse cleanings. Media that starts with a lower initial pressure drop will initially see a much longer cycle time, as it builds up to the 1000 Pa limit. Media that remains clean should see comparatively less reduction in cycle duration over its lifespan when compared with media that entrain dust.

As the *Arioso* media samples start at a much lower initial pressure drop, they are automatically at an advantage over Sample A, as seen in Figure 5. Note the relative flatness of the cycle duration curves across all media, including the aged *Arioso* M7001-11.

Conclusion

It should be noted that these results are very preliminary, and artificially accelerated, but both types of VDI 3926 test rigs showed similar trends.

To summarize, the tests and visual media inspections showed that the *Arioso* media samples maintained their full integrity during pulse cleanings at 6 bar (85 psi) over 8,000 pulse cycles and showed strong performance when compared to competitive ePTFE media designed for use in pulsed cartridges.

At similar or better efficiency, *Arioso* media has lower initial pressure drop, and seems to develop residual pressure drop at the same rate as, or slightly slower than, ePTFE Sample A.

The *Arioso* media samples also have more time between pulse cycles (due to the initial pressure drop difference), and this changes at the same rate as Sample A as well.

Further testing in full accordance with VDI 3926 should be undertaken to fully characterize performance over time of all these media, and to compare the performance of *Arioso* media with other media as well.

Incorporating particle counters downstream of the filter media should also demonstrate comparative filter efficiency over the range of testing. This will be considered for future testing.

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