Optimal Priming Method for Impact® 8G 3 nm

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Impact® 8G with its unique core-fill design has been developed to improve filter priming, which ultimately reduces chemical waste and unnecessary track downtime. The Impact 8G was designed to fit the Impact 2 manifold to allow customers to upgrade to the latest filter technology without spending time changing manifolds. With the usual operation of the IntelliGen® Mini (MINI) and the IntelliGen AFS (AFS) pumps, end-users can smoothly utilize the Impact 8G as a point of use filter.

However, the filter priming procedure,which is generally performed when installing a new filter,cannot be identically transferred from an Impact 2 V2 to an Impact 8G filter. This application note introduces the optimal priming sequence developed to give the best Impact 8G performance.

The new priming sequence presented enables the fastest priming time and the least amount of chemical waste.

The Difference in Structure of Impact 8G and Impact 2 V2

The main difference between Impact 8G and Impact 2 V2 is the liquid flow path. For Impact 8G, liquid flows into cartridge from the core and then flows to fill the bottom part of the filter before flowing through the membrane. These structural differences between Impact 2 V2 and Impact 8G lead to the difference in fluid dynamics of liquid when it flows through those two filters. Based on this fact, one must not assume that the priming sequence will also be the same.

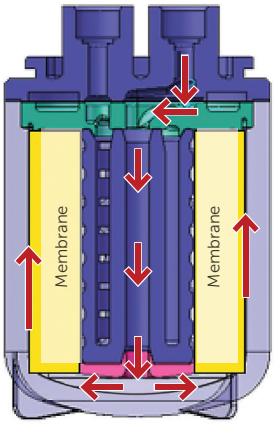

Figure 1. Demonstration of fluid flow path of Impact 8G.

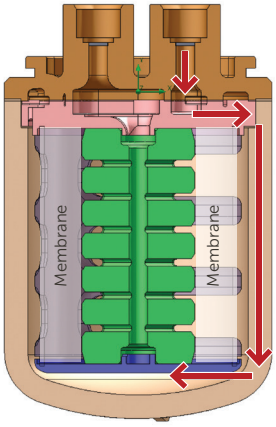

Figure 2. Demonstration of fluid flow path of Impact 2 V2.

EXPERIMENT

Testing was performed in the Entegris facility in Tokyo, Japan. A Mini pump connected to a Rion® KS-42A particle counter and syringe sampler were employed in the testing. The chemical used was PGMEA and an Impact 2 V2 3 nm UPE filter was chosen to establish the baseline particle counts.

After a low baseline was achieved, testing was conducted with filters and priming recipe of interest. The best known double soak (see Figure 5) is the method to be tested on each filter.

The comparison of priming performance of the double soak method on the two different filter types was made. The observed results were used as a reference for developing an optimal priming recipe for Impact 8G.

Pump Recipe and Priming Method used in the Testing

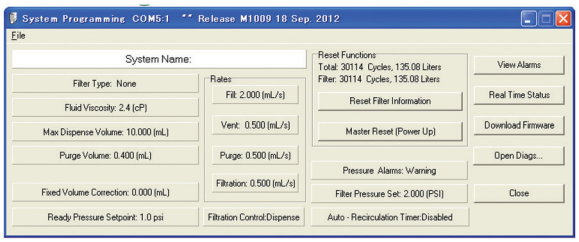

Figure 3. System page of IntelliGen MMI.

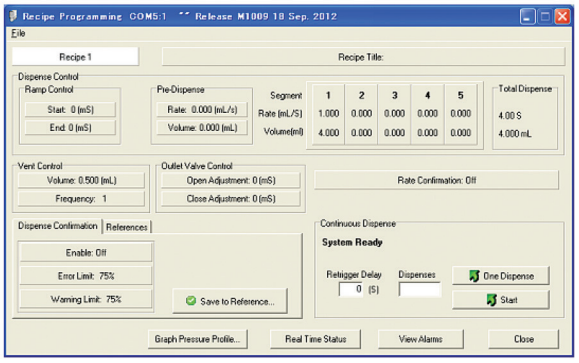

Figure 4. Recipe page of IntelliGen MMI.

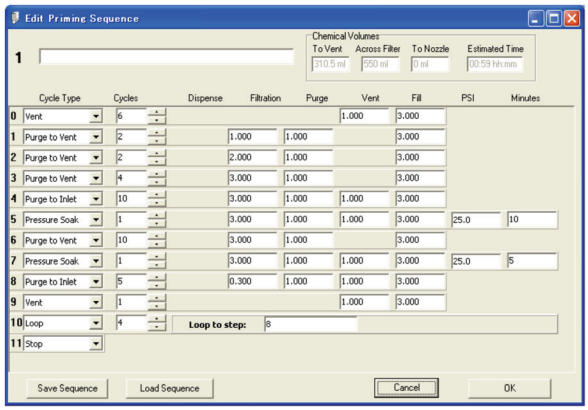

Figure 5. Double soak priming method.

TEST RESULTS

Test results showed that the best known double soak method could not give a good priming performance on Impact 8G compared with Impact 2 V2 (see Figure 6). When the two types of filters were primed with the double soak method, a more rapid decline of particle was obtained in Impact 2 V2.

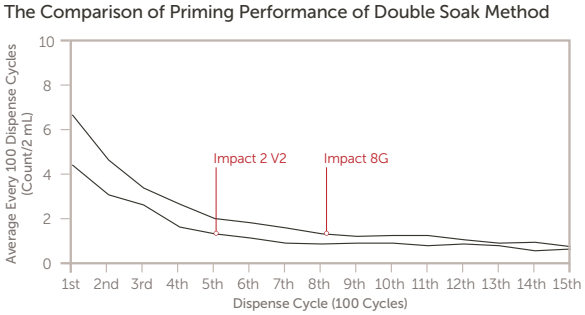

Figure 6. Priming performance of double soak method.

As previously mentioned, the differences in the structure of liquid flow path are a contributing factor. Through these experiments it was determined that changes to the priming recipe could positively affect Impact 8G performance.

The strategy for developing priming method is described in the following section.

STRATEGY FOR DEVELOPING PRIMING RECIPE

When priming a new filter, two main conditions must be considered:

1. Where is air trapped and how can it be removed quickly?
2. After the bulk air is displaced by a liquid, how can the smallest membrane pores be wet without generating microbubbles?

By the application of mathematics in the perspective of fluid mechanics, the above two questions were answered and a more effective priming method was developed.

NEW PRIMING METHOD AND EXPLANATION

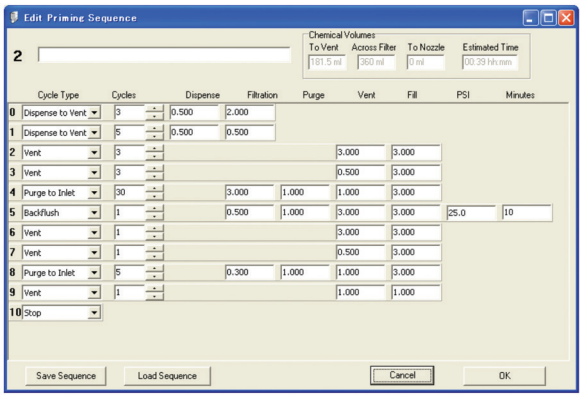

Figure 7. New priming method optimized for Impact 8G.

There are five important points which are the key factors for a better priming performance in the new method:

1. "Dispense to Vent" is conducted at the first step of priming sequence in order to reduce the pressure drop in "Purge to Inlet" cycle.
2. "Vent" is conducted twice: the first one with high vent rate to displace a bulk of air by liquid and the second one with low vent rate to increase the contact time of liquid and membrane.
3. "Purge to Inlet" is also conducted twice: the first one with high filtration rate at the early stage of priming sequence to fill up membrane's pores and the second one with low filtration rate at the late stage of priming sequence to prevent the generation of microbubbles.
4. "Backflush" with maximum vent rate (3.0 mL/s) was use to pressurize the membrane from the downstream.
5. After Backflush, "Vent" is again conducted twice with the same reason explained in item 2.

PRIMING EFFICIENCY OF THE NEW PRIMING METHOD

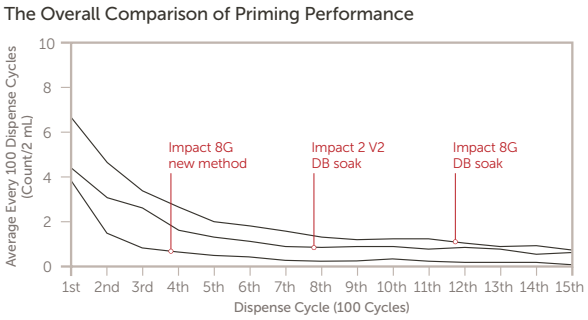

Figure 8. The comparison of priming performance of the best known double soak and the new method.

Figure 8 shows that the decline in particle counts of Impact 8G primed with the new method is the fastest among three conditions in the testing. That is the new priming method has been developed in the correct direction to match the structure of liquid flow path in Impact 8G.

Besides the decline of particle counts, there are two other factors that need to be brought in to account for the determination of priming efficiency:

1. How long does that priming method take?
2. How much chemical is consumed?

The information for the above two items are automatically calculated by MMI software (see Figures 5 and 7).

The summarization of the information mentioned above are shown in Table 1.

Table 1. Summarization of the information obtained from MMI software

Priming method	Priming time	Chemical consumed
Double soak	0.59 hour	310.5 mL
New method	0.39 hour	181.5 mL

CONCLUSION

The Impact 8G was designed to be a filter which can improve bubble clearance time. Nevertheless, it cannot give a good performance without a suitable priming method. With a solid understanding of flow path structure, the new priming method has been developed. This new method has the ability to decrease priming time, decrease the amount of chemical consumed and the most important, increase priming performance. Moreover, these benefits can be realized without any change in both pump hardware and software.

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