# Recommended Priming Recipes for Impact® 2 V2 and Impact 8G 5 nm

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## INTRODUCTION

Due to the costliness of photoresist used in the semiconductor industry, ingenuity is necessary to minimize waste during the process. Filter priming, an activity generally conducted when installing a new filter into a dispense line, is one step in the process that generates an enormous volume of photoresist waste. The ability to provide a priming recipe that requires a small quantity of photoresist would benefit manufacturers in terms of cost saving. Though Entegris' latest technology has provided a 3 nm pore-size filter to the industry, 5 nm filters still remain prevailed and active. This application note recommends the priming recipes which are able to prime Impact® 2 V2 5 nm and Impact 8G 5 nm with chemical consumption less than 1 L and time consumption less than 2 hours. The priming sequences include various types of priming cycles which can be operated by new firmware of IntelliGen® Mini (Mini) and the IntelliGen AFS (AFS) dispense system. However, some tracks may not have the capability to match new firmware and operate new features of the priming cycles. Priming recipes recommended in this application note give a comparative priming performance so that end-users can select the recipe which is able to be operated by their track.

## 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 used in the testing. The chemical used was PGMEA and an Impact 2 V2 5 nm UPE filter was chosen to establish the baseline particle counts. After a low baseline was achieved, testing was conducted with filters and priming recipes of interest. Both existing and newly developed priming recipes were tested on Impact 2 V2 and Impact 8G 5 nm UPE filters. The recipes which were able to prime both filter types with the consumption of chemical less than 1 L and time consumption less than 2 hours were considered.

## PUMP RECIPE AND PRIMING METHOD USED IN THE TESTING

Values of parameters used in continuous dispense mode after priming is completed are shown in Figures 1 and 2.

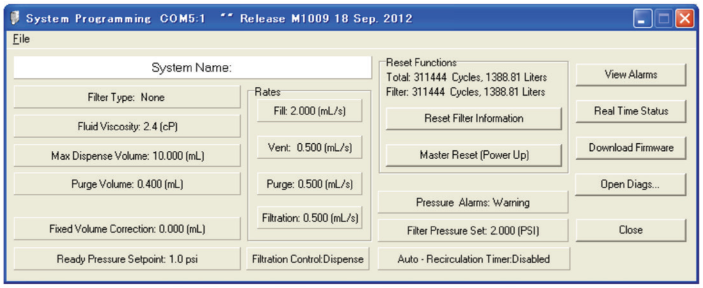


*Figure 1. System page of IntelliGen MMI.*

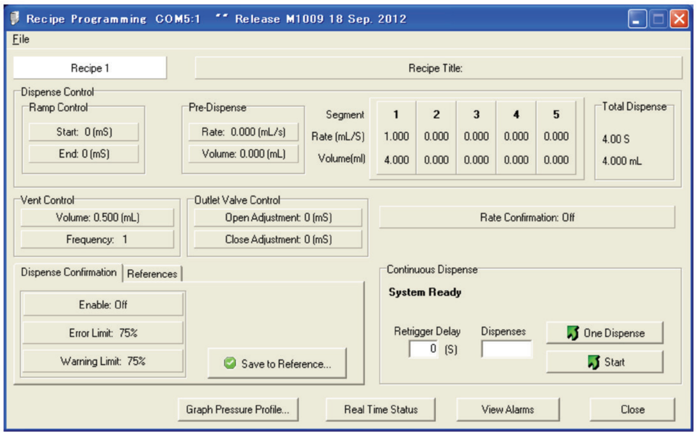


*Figure 2. Recipe page of IntelliGen MMI.*

Priming recipes tested on each filter type are summarized in Table 1.

Table 1. Priming recipes tested on each filter type

| FILTER TYPE | PRIMING RECIPE |
|---|---|
| **Impact 2 V2 5 nm UPE** | POR FR = 0.5 mL/sec |
| | POR FR = 3.0 mL/sec |
| | Soak 5 psi 10 min |
| | Soak 25 psi 10 min |
| | Backflush 5 psi 10 min |
| | Backflush 25 psi 10 min |
| | Double Vent |
| **Impact 8G 5 nm UPE** | POR FR = 0.5 mL/sec |
| | POR FR = 3.0 mL/sec |
| | Soak 5 psi 10 min |
| | Soak 25 psi 10 min |
| | Backflush 5 psi 10 min |
| | Backflush 25 psi 10 min |
| | Double vent |
| | New recipe (4 recipes) |

*Notes: "FR" refers to filtration rate used during priming.*
*"5 psi" and "25 psi" refer to pressure applied to liquid in soak and backflush cycle.*
*"10 min" refers to pressurizing time set in soak and backflush cycle.*

Chemical and time consumption to prime filter were measured and results are shown in the next section.

## OVERALL TEST RESULTS

Total chemical and time consumption of each recipe to completely prime each filter type is summarized in Table 2.

Table 2. Chemical and time consumption of each recipe for each filter type

| FILTER TYPE | PRIMING RECIPE | TOTAL CHEMICAL CONSUMPTION | TOTAL TIME CONSUMPTION |
|---|---|---|---|
| **Impact 2 V2 5 nm UPE** | POR FR = 0.5 mL/sec | 711.0 mL | 1.98 hours |
| | POR FR = 3.0 mL/sec | 3947.0 mL | 8.14 hours |
| | Soak 5 psi 10 min | 3433.0 mL | 6.86 hours |
| | Soak 25 psi 10 min | 5493.0 mL | 11.15 hours |
| | Backflush 5 psi 10 min | 2153.0 mL | 4.19 hours |
| | Backflush 5 psi 10 min | 2889.0 mL | 5.72 hours |
| | Double vent | 833.5 mL | 1.70 hours |
| **Impact 8G 5 nm UPE** | POR FR = 0.5 mL/sec | 919.0 mL | 2.41 hours |
| | POR FR = 3.0 mL/sec | 2219.0 mL | 4.54 hours |
| | Soak 5 psi 10 min | 4017.0 mL | 8.07 hours |
| | Soak 25 psi 10 min | 609.0 mL | 0.97 hours |
| | Backflush 5 psi 10 min | 1113.0 mL | 2.02 hours |
| | Backflush 25 psi 10 min | 2041.0 mL | 3.96 hours |
| | Double vent | 753.5 mL | 1.52 hours |
| | New method 1 | 3041.5 mL | 6.43 hours |
| | New method 2 | 1459.0 mL | 2.99 hours |
| | New method 3 | 589.5 mL | 1.19 hours |
| | New method 4 | 1869.5 mL | 3.86 hours |

## PRIMING RECIPES RECOMMENDED FOR IMPACT 2 V2 5 nm AND IMPACT 8G 5 nm

Recipes which are able to prime filter within 2 hours and consume chemical less than 1 L are summarized in Table 3 and detailed sequences of each recipe are shown in Figures 3 through 6.

Table 3. Chemical and time consumption of each recipe for each filter type

| FILTER TYPE | RECOMMENDED RECIPES |
|---|---|
| **Impact 2 V2 5 nm** | POR 0.5 mL/sec 6 psi |
| | Double vent |
| **Impact 8G 5 nm** | Soak 25 psi 10 min |
| | Double vent |
| | New method 3 |

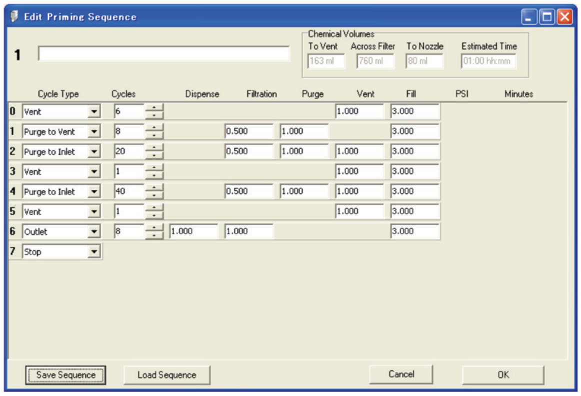


*Figure 3. POR 0.5 mL/sec 6 psi recipe.*

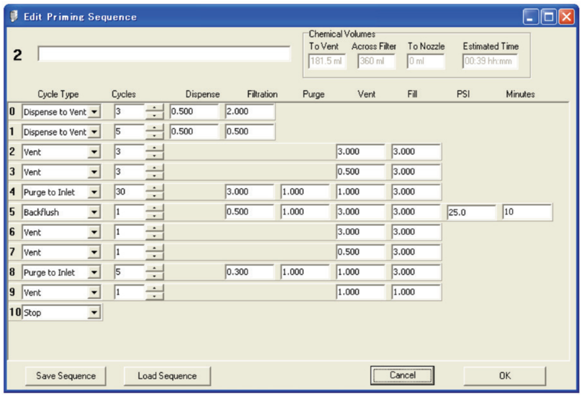


*Figure 4. Double vent recipe.*

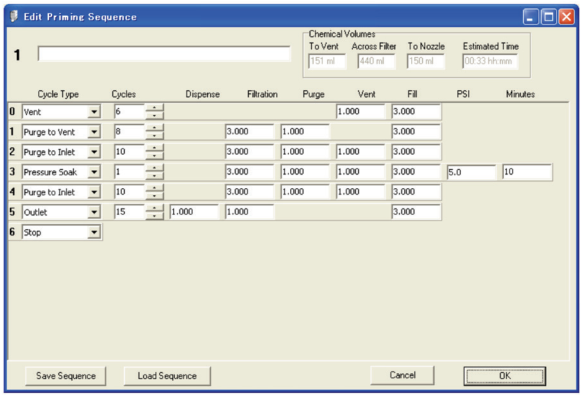


*Figure 5. Soak 25 psi 10 min recipe.*

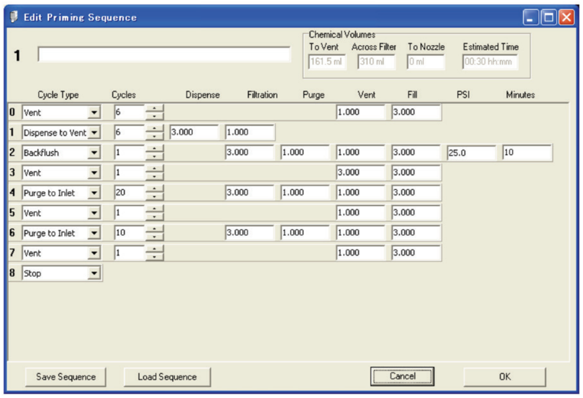


*Figure 6. New method 3.*

## KEY TAKEAWAYS FOR EACH RECIPE

Filter priming is a process to displace air occupying filter's gaps and membrane's pores with liquid. How to quickly fill up those gaps and pores without generating microbubbles is the problem to be solved to gain a high priming performance. Order of priming cycle in priming sequence and values of parameters used in each cycle are the key factors that affect the priming performance and need to be optimized to match membrane material and sort of liquid. In this testing, the membrane material is UPE with pore size of 5 nm and the liquid is PGMEA. End-users should keep in mind that priming recipes recommended in this application note are optimal for only this combination. However, these recipes might also be able to apply for other combinations of filter type and liquid especially in the case that they have similar properties. The summary below points out the reasons that make recommended recipes are able to give a good priming performance.

### 1. POR 0.5 mL/sec 6 psi Recipe

POR is the method in which pressurization is not included in the priming sequence. When the filter is primed with a low-viscosity liquid such as PGMEA, the condition of low filtration rate is able to give a better priming than the condition of high filtration rate because it has a lower degree of turbulence. This recipe gives a high priming performance in both Impact 2 V2 5 nm and Impact 8G 5 nm filters (see results in Table 2).

### 2. Double Vent Recipe

Double vent is the recipe in which vent is continuously conducted twice; the first one with a high vent rate and the second one with a low vent rate. With this approach, bulk air can be removed in the first step and the membrane can be effectively wet in the second step.

### 3. Soak 25 psi 10 min Recipe

This recipe gives good results for only Impact 8G 5 nm. In general, high level of pressurization should not be done on the liquid that has a high degree of solubility of air because degassing will occur later on once that liquid experiences pressure drop. However, due to the structure of Impact 8G, the soak cycle is able to dissolve a large amount of air into the liquid, which leads to the best priming performance.

### 4. New Method 3 Recipe

This recipe was newly developed for Impact 8G 5 nm. Pressurization from the filter downstream by a backflush cycle in the early stage of the priming sequence is the point of this recipe. Filling small membrane's pores occupied by air with liquid cannot be quickly completed if pressurization is not employed because pressure generated by air in the pores acts against the flow of liquid. Backflush facilitates this difficulty, which leads to less consumption of time and chemical to wet the membrane.

## CONCLUSION

In a competitive semiconductor industry, wise manufacturers should make every effort to gain a position in the market. Being able to reduce time and cost in process start-up is one strategy that is worth consideration. Entegris' IntelliGen Mini and IntelliGen AFS provide the ability to operate filter priming, the process that generates time and chemical waste, with various types of priming cycles. This advantage enables the Impact 2 V2 5 nm UPE and Impact 8G 5 nm UPE filters to be primed with various priming recipes, yet the priming performance is on the same level. From the recipes recommended in this application note, the end user can select the one that matches the communication system installed in their track. With this flexibility, end users are able to use Entegris' products without any additional troublesome work.

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