

# **TECHNICAL BRIEF**

## **“SPIDER” ASSEMBLY FOR ZETA PLUS™ FILTER SCALE-UP**

***Novel filter assembly design allows simultaneous testing of up to eight different Zeta Plus filter grades to select the most optimal filter grade for the customer's application.***

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## INTRODUCTION

Four disposable filter configurations are currently available for Zeta Plus filter scale-up study: BC25, BC1000, BC2000, and BCE03. BC1000 and BC2000 are designed for standard Zeta Plus filter testing, and BCE03 for Zeta Plus EXT Series testing. Each configuration's effective filtration area (EFA), average throughput and estimated hold-up volume are summarized in Table 1. Another configuration, 47 mm discs, is recommended for standard Zeta Plus filter testing but not for Zeta Plus EXT Series testing. The 47 mm filter discs have to be tested in a reusable metal housing, thus are not completely disposable.

**Table 1. Characteristics of Zeta Plus Scale-up Devices**

	Units	Zeta Plus BC25 capsule	Zeta Plus BC1000 capsule	Zeta Plus BC2000 capsule	Zeta Plus BCE03 capsule
EFA	cm <sup>2</sup>	25	650	1300	1000
Throughput	liter	1	26	52	40
Hold-up volume	ml	8-11	2100	1500	1800

Assuming average throughput is 400L per m<sup>2</sup> of Zeta Plus media

For certain applications, it is useful to have an intermediate scale up device with an EFA between 25 cm<sup>2</sup> and 650 cm<sup>2</sup>. In this article we introduce a "Spider" assembly design that is capable of accomplishing the following purposes utilizing BC25 capsule filters:

- Provide up to 200 cm<sup>2</sup> of the effective filtration area to process from 1L to 8L of liquids
- Simultaneously test up to 8 different Zeta Plus grades to select the best performing filter media

### "SPIDER" ASSEMBLY DESIGN

A complete "Spider" assembly consists of two sanitary 5-way flow diverters, eight 90° elbows and 18 clamps and gaskets as demonstrated in Figure 2B. Figure 1 shows a longer and a shorter version of the ½" sanitary 5-way flow diverters which are the key components of a "Spider" assembly. Both flow diverters have the same height but different arm length. The function of the flow diverter is to evenly distribute the incoming fluid to four connected devices. Each BC25 capsule is connected to one arm of a sanitary 5-way flow diverter through a 90° elbow and clamps. The longer version of the 5-way flow diverter is designed to be used with the 90 mm disc holders, and the shorter version of the flow diverter with the 47 mm disc holders.

**Figure 1. Half inch sanitary 5-way flow diverters.**



Figure 2 shows two “Spider” configurations that allow 4 identical BC25 capsules to be connected in parallel. In those tests that involve only a single stage of Zeta Plus filtration as shown in Figure 2A, one 5-way flow diverter is used to increase the filtration surface area. A second flow diverter is not required. If additional filtration stages are needed as shown in Figure 2B, a second 5-way flow diverter is required after the Zeta Plus filter to direct the effluent to the subsequent stages of filtration. If all BC25 capsules are the same grade of Zeta Plus media, constant pressure filtration (CPF) or constant flow filtration (CFF) can be performed in these two configurations. To maximize total capacity, two “Spider” assemblies can be run in parallel. With two “Spider” assemblies, a total of 200 cm<sup>2</sup> EFA from 8 BC25 capsules can be achieved.

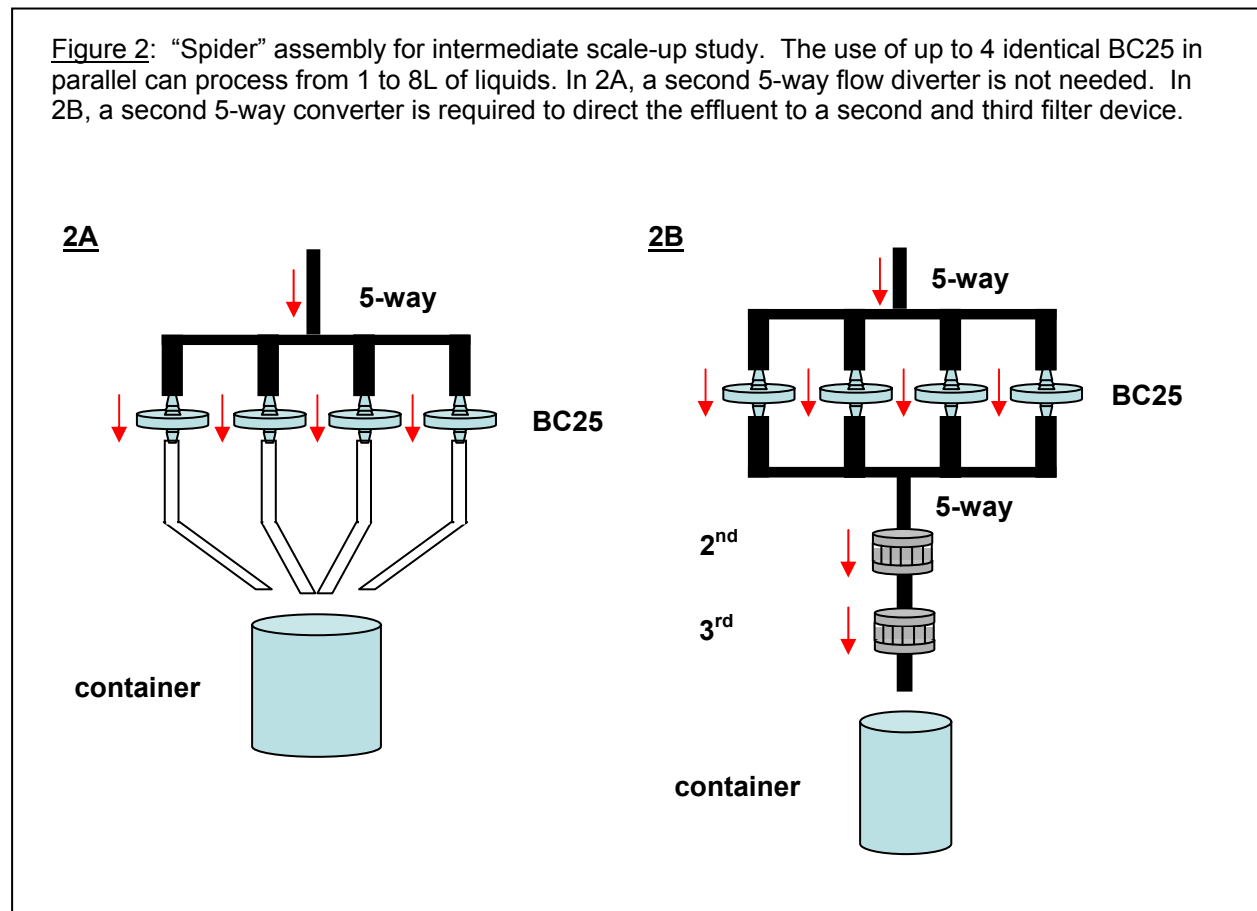
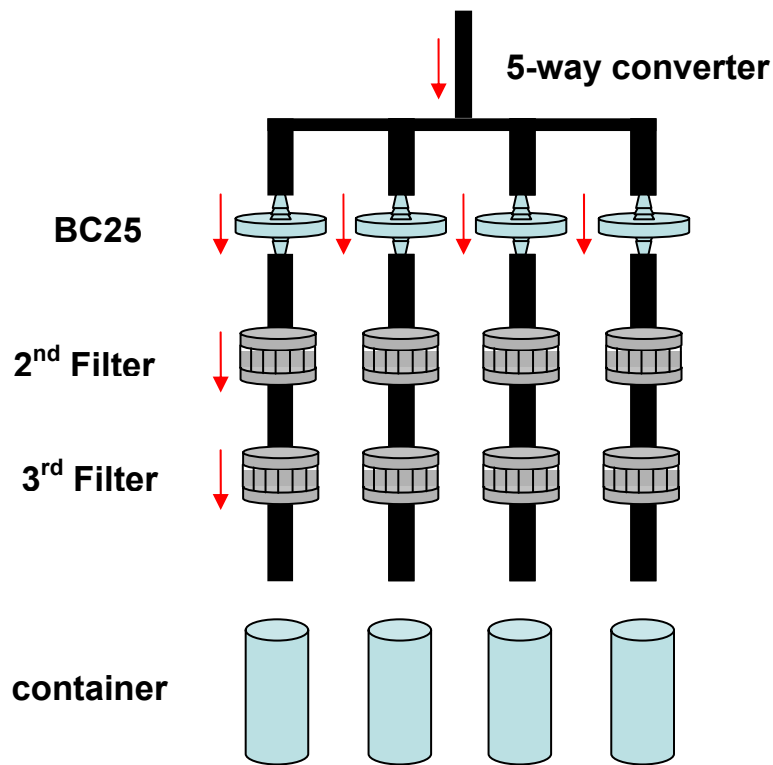


Figure 3 shows another “Spider” assembly configuration that allows simultaneous testing of up to 4 different Zeta Plus grades using a single assembly. Only one 5-way flow diverter is needed in this configuration. The flow diverter is used to evenly distribute the flow to the 4 BC25 capsules. Each BC25 capsule can be connected to one or more downstream filter devices such as a second BC25 capsule or 47 mm housing. The subsequent filter devices can contain Zeta Plus media or various membrane media. Since each filter train is different, only constant pressure filtration (CPF) testing should be run. Each filter train is monitored individually. A filter train can be shut down and separated from the system as soon as it is plugged. Two “Spider” assemblies can be connected to the same pressure reservoir with a tee and elbows, and up to 8 different filter media trials can be run simultaneously.

Figure 3: “Spider” assembly for simultaneous filter media testing. Each BC25 can be connected to a second and third filter device in series equipped with Zeta Plus filter or various membrane filter media.



## SUCCESS STORIES

This “Spider” assembly was designed by Harald Schillinger, SASS Specialist in 3M Austria. The system has been tested in several European customers’ facilities with great success. In one application, the use of the “Spider” assembly design allowed the completion of two filtration trials within a day. In the first trial, a total of 7 different Zeta Plus EXT grades were screened simultaneously within 3 hours. Two “Spider” assemblies were employed with 4 BC25 capsules in one assembly and 3 BC25 capsules in another. Only one sanitary 5-way flow diverter was used for each assembly. The effluent from each BC25 capsule was collected directly in an individual container. Constant pressure filtration was performed and the two best performing filter media were selected based on throughput and filtration efficiency (turbidity). Figure 4A shows a test in which 9 BC25 capsules are tested instead of 7. In the subsequent filtration test, the two selected CUNO depth filters were connected to individual CUNO membrane filters in series, and were tested against competitive products. Figure 4B demonstrates a similar test in which each of the 4 BC25 capsules was connected to two 47 mm disc holders in series. This “Spider” assembly system impressed our customer so much that they had decided to purchase one complete system for their own use.

**Figure 4.** Pictures of the “Spider” assemblies in field tests. In 4A, nine BC25 capsules were tested using two assemblies. In 4B, each of the four BC25 capsules was connected to two 47mm disc holders in series.

**4A**



**4B**



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