

Microbrewery Positions Itself for Growth with SUPRADisc™ II Sheet-Based Modules

Overview

Microbreweries, traditionally defined as breweries producing limited amounts of beer, are in a state of rapid evolution and growth. Now more reflective of a philosophy that values brewing innovation and quality, experimentation, and customer loyalty, microbrewing is growing rapidly worldwide.

From often small, local beginnings, microbreweries are responding to increased market preference and demands, which often requires updated brewing techniques, production and distribution expansion, and new investments.

Filtration is a key operation in a modern brewing process, which focuses on delivering a visually appealing, high quality and shelf-stable product. Cost-effective filtration solutions, which maintain product authenticity and high quality, and are flexible and adaptable for smaller producers while enabling room for rapid expansion, are a good fit for this rapidly evolving industry.

The Challenge

A microbrewery producing 1500-2000 hL per year had not used filtration in the past, but needed to respond to consumer demand for a more visually clear, particle- and yeast-free premium craft beer. Beer from the fermentation step typically went to a maturation tank, where sedimentation took place over the course of 4-6 weeks. From there it went directly to the bright beer tank and carbonation, prior to bottling.

The microbrewery's requirement was for an economically reasonable primary clarification

installation that provided high quality beer to the bright beer tank.

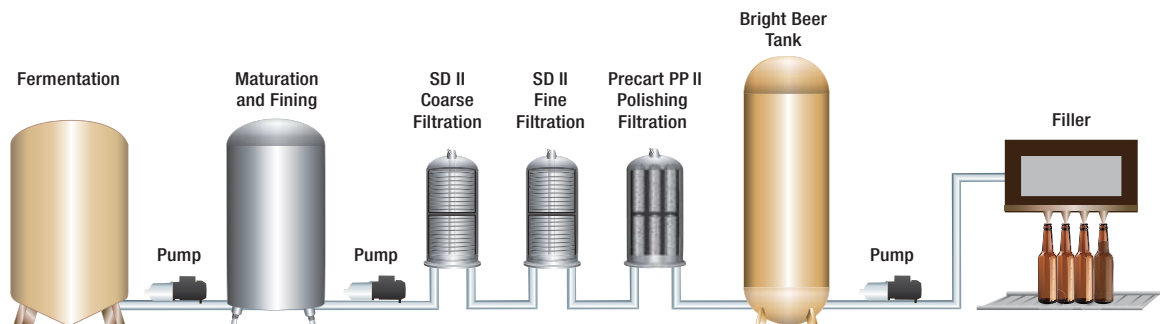
The Solution

After considering various technologies, including a diatomaceous earth (DE) system, a filter press, and a small ceramic crossflow system, the customer decided on a Pall SUPRADisc II (SD II) sheet-based module solution for the task.

The result was a two-step SD II module installation after the maturation tank, to handle 10 hL/hour. With 16 inch diameter modules stacked in two-high Pall lenticular housings, the first step consists of a coarser sheet grade (SD II 700), followed by the second step with a finer sheet grade (SD II 200). A final polishing step was added prior to the bright beer tank, with the use of Pall Precart PP II 1 micron pleated backflushable cartridges.

Pall SD II modules are available in both 287 mm/12 inch (1.8 m²/19.4 ft² filtration area) and 410 mm/16 inch (5 m²/53.8 ft² filtration area) diameter. They employ the same well-known filter sheet media already proven over many years in the brewing industry. They capitalize on the excellent removal performance of the filter sheets, while overcoming the marked disadvantages of filter presses. Modules are installed in enclosed housings and thus provide a hygienic solution with no drip losses, the ability to pressurize the beer with carbon dioxide out of the housings for higher yields, no exposure to air or other environmental contaminants, and no mold growth on sheet filter edges as is the case with traditional filter presses.

Figure 1: The filtration installation at this small microbrewery is a cost-effective solution, which produces a consistently high quality beer with a desired shelf-life of six months.





The SD II module sizing and service life is directly affected by beer filterability, which is influenced by the suspended solids load and the nature of the contaminants in the beer. Beer filterability is related to the length of sedimentation time in the maturation tank. Demand peaks in the summer shorten the available sedimentation time, thus reducing the filterability of the beer.

There are two significant aspects of SD II design which enable best possible service life and an economical solution, in spite of lower beer filterability.

- SD II 410 mm/16 inch diameter modules offer the highest filtration area among lenticulars in the industry, namely 5 m²/53.8 ft², exceeding the closest commercially available ones by 28%.
- The ability to regenerate and reuse the modules is the other aspect which positively impacts service life.

Figure 2: SUPRADisc II modules are robust, cleanable, in-place steamable, and backflushable, satisfying rigorous production requirements in breweries.



The extremely robust design of the SD II modules makes it possible to regenerate them by multiple forward and reverse flushing steps. With the use of special backflush devices, they can initially be backflushed with cool water at maximum 0.5 bar (7.3 psid) differential pressure. This releases the surface load of hop particulates and residues, yeast and other particles. The initial rinse is continued until the rinse water is free of foam. This is followed by forward flushing with warm water, typically at 60 °C (140 °F), to solubilize any contaminants but avoid denaturation of trace proteins, which could cause premature module plugging. Flushing effect can be monitored by methods such as determining color or turbidity of the flushing water, or measuring the conductivity. Subsequent sanitization with hot water or steam, and cooling completes the procedure¹.

By regenerating the modules after every 1-2 batches, which range in size from 10-40 hL, the brewery is able to prolong their service life and achieve high throughputs. Throughputs achieved with the SD II modules after 6 weeks of sedimentation range from 145 hL per module on the coarse (SD II 700) grade to 225-250 hL per module on the fine (SD II 200) grade. When running less than 4 weeks of sedimentation in the summer, throughputs are reduced by about 20% on the coarse grade and 10-16% on the fine grade. The filterability of the beer determines how often the modules are cleaned and regenerated.

Another feature which has proven to be economical for this microbrewery is the ability to reuse the modules for different types of beer. In between uses, the modules can be stored for up to 4-6 weeks. After cleaning and regeneration, they are steam sterilized or hot water sanitized, cooled, and stored under carbon dioxide positive pressure in their housings, until they are needed again. Prior to next use, they are sanitized once more.

Figure 3: Pall's WSFZ lenticular housing provides flexibility in production. By installing internal center posts of different lengths, filtration can be run at 25, 50, 75 and 100% of capacity.

¹Please contact Pall for proper backflushing, cleaning, and sanitization protocols suitable for your application, including options where hot water or steam is not available.



The Design Makes the Difference

SUPRADisc II modules differ significantly from typical lenticular modules. Commonly available lenticular modules are designed according to a traditional stacked disc concept, in which the filter sheets are exposed and unprotected from reverse flow or back pressure shocks (Figure 4a).

On the other hand, the unique performance and robustness of SUPRADisc II modules is due to its patented double separator design, which provides upstream and downstream support for the filter media. The media is individually sealed and separated between polypropylene flow distribution plates, which results in optimal flow and higher throughput through the available surface area, and a mechanically robust module in both forward and reverse flow operation (Figures 4b and 4c).

Figure 4b: SD II module cutaway view

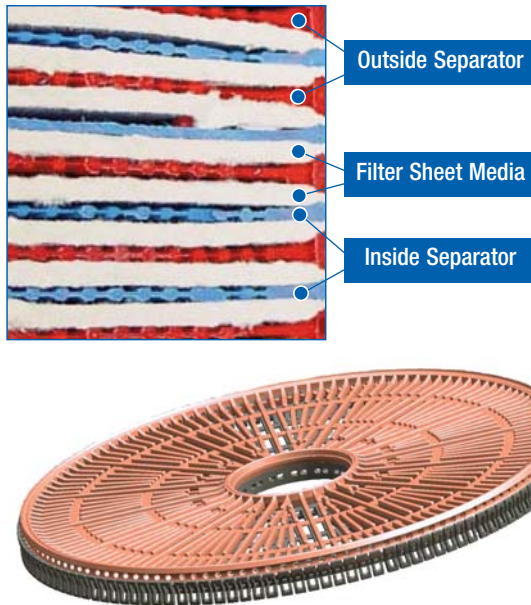


Figure 4a: Traditional lenticular module cutaway view

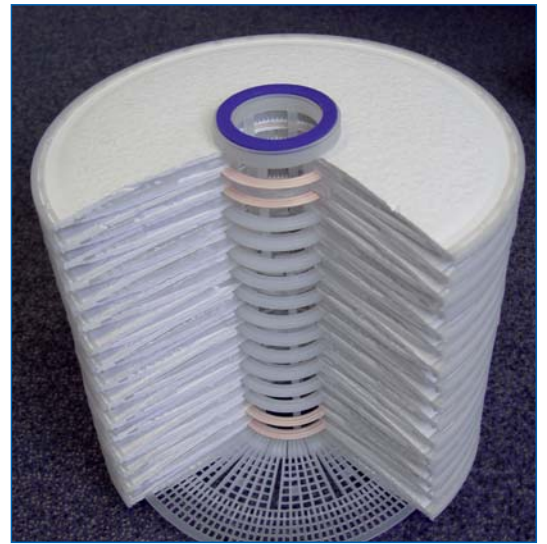


Figure 4c: New patented separator design

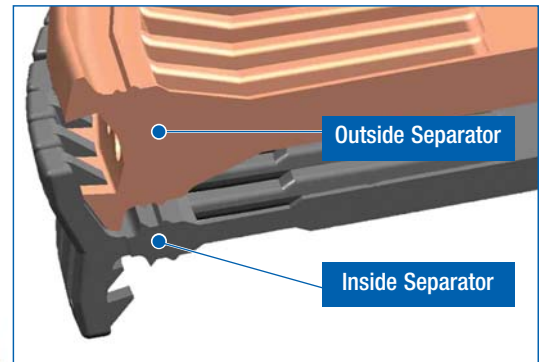
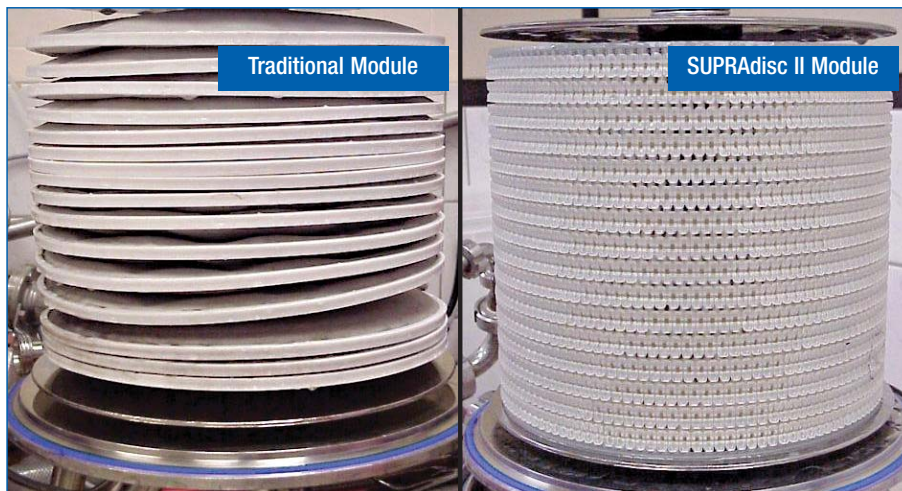


Figure 5: After 21 steam cycles, deformation is evident on traditional lenticular modules (*left*). SUPRADisc II modules maintain their shape, keeping the individual filter cells separate from each other, unobstructed and fully available for filtration (*right*).





The Benefits

The benefits realized by SUPRAdisc II technology in this application include:

- Attractive capital investment cost: 50-65% of CAPEX compared to the competing technologies
- High yields and product protection, due to enclosed system
- Long service life and reduced filter spend, due to regeneration and storage capability of the modules
- Simple installation, quick filter change-out, and ease of handling both pre- and post-filtration
- Flexibility to use filter modules for different batches of beer, in discontinuous production
- Economical use of space due to very compact footprint

At this microbrewery, which produces a wide selection of lagers, darks, ales, stouts, seasonal and other craft beers, it would have required a minimum of four years before they would have paid off the capital investment for the competing technologies.

This case study has been replicated in other microbreweries of similar scale and with comparable economic drivers.

About Pall Corporation

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