

Efficient, Economical and Enclosed: Depth Filtration for Wineries

Overview

Over the past decade, new technologies like crossflow microfiltration have been adopted by large wine cellars and bottling facilities for clarifying filtration. Sheet filters, however, with their high dirt holding capacity, multiple filtration mechanisms and flexibility are still the most widespread form of filtration in many small wineries.

Filter sheets are comprised of a unique matrix of materials including: cellulose, diatomaceous earth and perlite, that provide an excellent combination of adsorption, surface and depth filtration, making them an ideal solution to meet the varied filtration requirements of small wineries. The sheets are available in many different grades to cover applications from rough or particle filtration to colloid removal and micro-organism reduction. Additionally many plate and frame units have the capability to add or remove filter sheets to suit the batch size, the type of wine or the desired flow rate.

On the downside, filter sheets configured in a plate and frame unit are an open system. This potentially exposes the wine to oxygen and the risk of contamination from the outside environment. With multiple sheets assembled in parallel, installation and assembly is labor intensive. Additionally, with sealing dependent on the operator and equipment maintenance, edge leakage is common and results in product loss and unsanitary conditions.

The Challenge

In recent years, wineries are under more competitive pressure to improve quality and reduce costs while satisfying more stringent safety and regulatory requirements. The wineries are challenged with selecting filtration techniques that are easy to use and require less labor, while providing similar filtration characteristics and flexibility as sheet filters. The filtration technology should alleviate the typical weaknesses associated with the open design of traditional assemblies, including oxygen pick up, contamination risk and drip losses. Finally, documentation or certification of the filtration equipment is critical to ensure that wineries comply with their local regulations and HACCP programs.



The Solution

To overcome the obstacles of classical sheets filters, Pall developed SUPRADisc™ II modules, enabling wineries to achieve economical and reliable use of depth filter sheets. SUPRADisc II modules are constructed using the same depth media but in a modular format that fits into an enclosed housing for sanitary operation.

The unique performance of the SUPRADisc II modules is due to its double separator design which provides both upstream and downstream support for the filter media. The media is individually sealed and separated in between polypropylene plates, which results in optimal flow through the available surface area and a mechanically robust module (see figures 1-2). Flow is possible in either the

Figure 1: Module cutaway

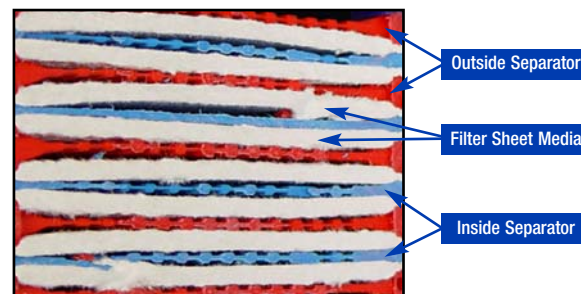
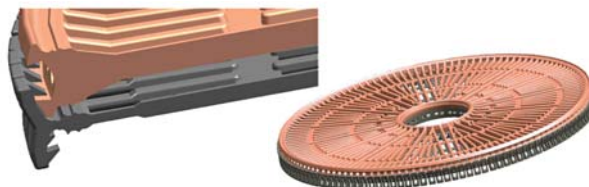


Figure 2: Separators





forward or reverse direction. Backflushing can improve regeneration and increase service life, and the design minimizes the risk of media buckling or tearing if the modules are subjected to reverse pressure or pressure shocks which may occur when the filters are positioned directly upstream of the bottling line. Additionally with the separators acting as a cage, the media is not exposed, which facilitates module handling and filter change-outs.

The enclosed design of the SUPRADisc II technology provides many benefits. In addition to reducing the wine quality risks from an open design, the closed assembly eliminates drip losses, resulting in more recovered wine. Also, when a batch is a complete, the operator can use nitrogen gas to push out most of the wine remaining in the system to further increase yield. This additional recovered wine has a significant impact on the economic justification. For example, a small winery (~30,000 Liters/year) in the United States purchased a new SUPRADisc II assembly. They reduced their annual product losses by 95% from 905 L (240 gal) to 45 L (12 gal), representing a savings of \$11,500 per year.

When combined with a 50% reduction in labor costs, the housing payback was a short 8 months.

The enclosed design also enables module storage and reuse. For short breaks (e.g. up to 3 days) the modules can be stored in a dilute citric acid solution, or for longer breaks (e.g. 4- 6 weeks) modules can be stored in an SO₂ solution. Storage capability was the driving force for a German winery to invest in SUPRADisc II to replace their existing plate and frame filter press. With the open sheet system and risk from contamination, the winery would change their sheets every day. Now with the new enclosed assembly, the same modules are re-used for 15 days, significantly reducing expenditure for filter media and labor costs. See Table 1 for an explanation of the cost savings.

SUPRADisc II modules differ from other classic lenticular modules. With traditional modules, typically two round filter layers are joined with a plastic drainage disc in between to form a filter cell. The filter cell border is sealed by injection molding around the edge and filter cells are then assembled in a stack to form the module (see Figure 3).

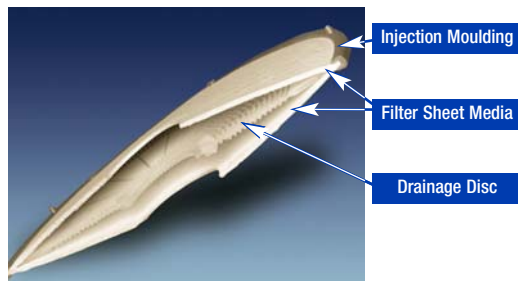
Table 1

Depth Filter Sheet used to protect final membrane filter	Membrane Protection Seitz EK1 400x400
Number of sheets	51
Filter area [m ²]	7.65
Filter change-outs per week	5
Sheet consumption during 15 working days	765
Price per sheet	1 €
Total cost for filter material within 15 working days	918 €
Labor for each change-out (hr)	0.5
Labor for change-outs in 15 working days (hr)	12.5
Total cost for labor change-outs in 15 working days (20 Euro/hr)	250 €
New concept: SUPRADisc II used to protect membrane filter	Membrane Protection SUPRADisc II EK 1 12" module
Number of filter elements	4
Filter area [m ²]	7.65
Filter change-outs within 15 working days	1
Filter consumption during 15 working days	4
Price per filter element	134 €
Total cost for filter material within 15 working days	536 €
Total filter material cost savings	-382 €
Labor for each change-out (hr)	0.25
Labor for change-outs in 15 working days (hr)	0.25
Total cost for labor change-outs in 15 working days (20 Euro/hr)	5 €
Total labor cost savings	-245 €
Total savings (filter material + labor costs) in 15 working days	-627 €
Annual savings (filter material + labor costs, 220 working days)	-9,196 €

Comparative figures must be validated on an individual application specific basis. Variation will occur based on individual conditions

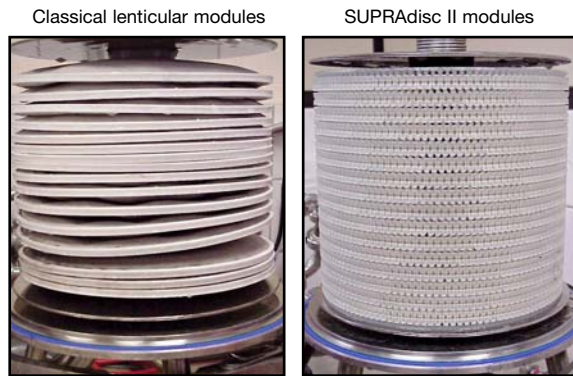


Figure 3: Design of a typical lenticular cell module



In this design, since support is only in the forward flow direction, backwashing is not possible. Manufacturers therefore often recommend a downstream non-return valve to prevent damage from reverse flow or pressure. Additionally these modules are prone to cell deformations or binding during filtration, hot water sanitization or steaming. The separators are designed to prevent this in SUPRADisc II modules (see Figure 4).

Figure 4: After 21 steam cycles



About Pall Corporation

Pall Corporation is the largest and most diverse filtration, separation, and purification company in the world. Pall serves the food and beverage industries with advanced membrane filtration technology and systems engineered for reliability and cost-effectiveness. Easy to install and simple to use, our systems satisfy a wide range of filtration requirements.

Our Total Fluid ManagementSM (TFM) approach offers customers solutions to address the needs of an entire process, encompassing filtration products, services, systems and training.



The Benefits

With SUPRADisc II, wineries can achieve cost effective and quality enhancing filtration for applications from clarification to microorganism reduction. When using these modules to replace traditional sheet filters, wineries can realize the following benefits:

- Increased process security and product quality due to the enclosed system
- Increased product yield (95% less product loss) by eliminating drip losses
- Backwashable for long service life
- Reduced filter spend and labor costs due to regeneration and storage capability
- Vacuum and pressure shock resistant
- Easy handling due to robust design



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