Application Note

Technical Application Publication

Standardization of wine for tanker loading / off-loading

Summary

The export/import of wine throughout the world has increased in recent years through an increased consumption in regions which do not have their own commercial wineries. To achieve cost-effective transportation of wine, it is generally bottled or packaged in the country of consumption. However, the wine must be protected from degradation during transportation or storage in a bottling facility, so there is a requirement to remove spoilage organisms and haze forming colloids. This process is called "standardization" or "pre-stabilization".

There are a number of technologies used to perform effective standardization of wine, however, cartridge filtration offers an increased level of protection to the wine and returns significant process advantages and cost savings over other methods. Parker domnick hunter has worked with wine producers, importers and contract packaging companies around the world to develop the PREPOR NG range of cartridge filters designed to excel in wine standardization applications.

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Key Filtration Requirements:

Wine standardization with PREPOR NG cartridges returns the following process performance advantages:

- Consistent performance – validated retention against wine spoilage organisms.
- Long service life - easily cleaned and regenerated for repeated use.
- Increased wine protection – a closed system for minimal wine loss and oxidation.
- Improved process efficiency – greater protection to downstream membrane filters.

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The requirements to export / import wine

Major wine producing regions of the world are generally confined to regions which are in temperate zones and lie between 30° and 50° degrees latitude. However, wine is increasingly being consumed in regions outside of these boundaries, which is leading to a higher demand for importing / exporting wines.

As an example the UK ranks as the 6th largest consumer of wine, however with the exception of a handful of vineyards on the south coast, the UK is a country devoid of commercial wineries and instead relies upon importing wine from the world's major producing countries (see tables 1 and 2 below).

		(000s of cases)
1	China	630,507
2	USA	329,267
3	France	312,643
4	Italy	306,140
5	Germany	286,726
6	UK	147,176
7	Russia	112,936
8	Argentina	112,885
9	Spain	103,685
10	Japan	99,511

Table 1. Wine consumption per country[1]

		Volume (000s of cases)
1	Australian	25,495
2	Italian	19,529
3	French	19,100
4	USA	16,055
5	Spanish	12,170
6	Chilean	11,709
7	South African	9,564
8	German	4,800
9	New Zealand	4,787
10	Argentinian	2,100

Table 2. UK wine imports by country of origin[1]

Currently, the most cost-effective method of transporting wine between countries is in bulk via road tanker, with bottling/packaging carried out in the countries of consumption. Wines that are transported in bulk from the winery to a packaging facility generally fall into three categories of ownership:

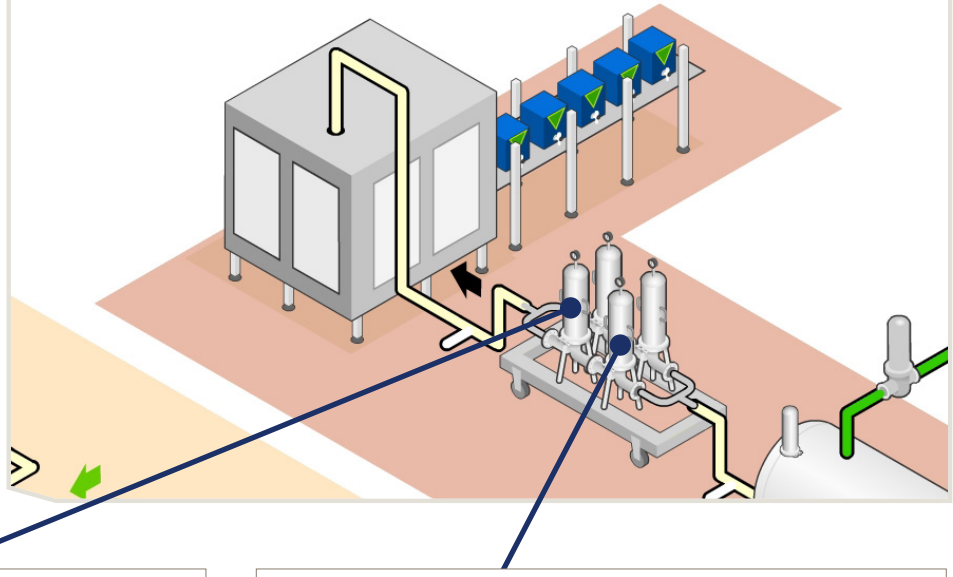
1. Wines produced by wineries that are owned by the packaging organization, or are part of a common parent group.
2. Wines purchased by the packaging company for resale under their own label.
3. Wines that are packaged under contract for their owners.

The transportation of wine between countries represents significant problems for both the wine brand owner and the packaging facility alike. The ultimate goal for all parties is to package wine that maintains its essential characteristics and remains stable once packaged. For the wine owner, the transportation conditions and packaging techniques used can influence the character of the wine, which can directly influence the success of the wine on the market. For the wine bottler, the condition of the wine received can directly influence the efficiency and profitability of the packaging facility.

Wine treatment requirements for tanker loading / unloading

For packaged wine to be successfully placed on the market within the country of import it must be microbiologically stable, visually clear and particulate free. The widely accepted method of achieving microbial stability without affecting the wine's essential characteristics is to filter the wine using membrane filtration immediately before the wine moves into the packaging machine. The membrane filters should be validated to remove wine spoilage organisms without affecting the wine's essential characteristics, where typically 0.65µm membranes are used for red wines, and 0.45µm membranes are used for white wines. Figure 1 below represents a typical system for the final filtration of wine.

Figure 1.
Schematic diagram of a typical filtration system prior to wine bottling / packaging



Final membrane filter requirements:

- Validated microbial retention
- Integrity testable
- Easily cleaned
- High flowing

Note: Typically red wine is low in sugars and high in tannins and exhibits increased natural microbial stability. White wine can be considered at higher risk of contamination. Final filters should demonstrate retention to the following yeast and bacterial species:
Saccharomyces, Brettanomyces, Acetobacter, Oenococcus.

Prefilter requirements:

- Particulate removal 1µm – 0.5µm
- Microbial reduction
- Easily cleaned
- High flowing

Note: Prefilters should offer adequate protection to final membrane filters and should demonstrate retention to fine particulate. In some cases, microbial validation also applies.

In order to operate efficiently, the bottling filters are required to run for many batches of wine and without stoppages through premature filter blockage. To help achieve long filter life and prevent system stoppages for filter change-out, the wine must be treated to give a certain quality prior to entering this filtration system. This process is termed "standardization" or "pre-stabilization".

The standardization / pre-stabilization process addresses the wine's microbial stabilization, clarity and potential for blocking subsequent final filters prior to packaging.

When preparing the wine for export, the winery will adopt a method of standardization, to achieve stability during transport, protect essential characteristics and reduce the levels of SO_2 required.

However, these standardization treatment methods vary between country, region, winery and wine type, leading to variable qualities of wine being received by the packaging facility. In response to this, the packaging facility should make a quick assessment of the incoming wine to understand its filter blocking potential (Filterability Index testing) and then perform its own standardization process when off-loading the wine from the road tanker, prior to storage.

Historically, standardization was carried out by powder filtration or using sheet filters, but as the demand for wine export / import has grown and more focus has been applied to this process, other technologies have become available which have offered significant improvements. Table 3 summarizes the performance aspects of these techniques against the requirements of the wine standardization process.

Note:
Filterability index (FI) testing is a practical technique designed to give a rapid assessment of a wine's filter blocking potential. Typically, this involves passing the wine under investigation through a 0.45µm filter disc under a constant feed pressure of 2barg and measuring how long it takes to filter 200ml and 400ml. The difference between the two times indicates the FI result and the blockage potential, with a low value (<20) indicating low blocking potential and high value (>20) indicating likely blocking potential.

$FI = T_2 - (2 \times T_1)$
Where:
T_1 = Time taken to filter 200ml
T_2 = Time taken to filter 400ml

Please contact **tsg@parker.com** for more guidance and information

Performance of each standardization technology against the target conditions, 1 star = bad, 3 star = good.						
Performance aspect	**Target condition**	**Powder (DE) filter**	**Sheet filters**	**Lenticular / stacked disc**	**Cross-flow filtration**	**Cartridge filtration**
Microbial reduction	Able to reduce risk of microbial spoilage during storage. Typically requires yeast removal / bacterial reduction.	★	★	★★	★★	★★★
Particulate removal	Removal of haze colloids to achieve visual clarity.	★★★	★★★	★★★	★★★	★★★
Flexibility to suit different wines	Adaptable to suit different types of wine.	★	★	★★	★	★★★
Regeneration / Sanitization	Easily cleaned and sanitized.	★	★	★★	★★	★★★
Wine losses	Minimal wine losses.	★	★	★★	★★	★★★
02 pick up	Minimal 02 pick up.	★	★	★★	★★	★★★
Capital cost	Low.	★	★★	★★★	★	★★★
Operational cost	Low	★★	★★★	★★★	★★	★★★

Table 3.
Summary of tanker loading / off-loading technologies and performance

Cartridge filtration for wine stabilization during tanker off-loading

The use of cartridge filtration represents an attractive option for wine standardization for tanker loading off-loading, as process benefits can be accessed on a number of levels.

Consistent retention

The filter cartridges used are typically available in a range of absolute retention ratings and should have been validated by the filter manufacturer to give specific retention against spoilage organisms under different operating flow rates or feed pressures. This in turn leads to very well defined retention characteristics. As a result, the filtration can be easily tailored to suit the type of wine being filtered, allowing flexibility to optimize the process against the specific requirements of the winery or bottling / packaging facility.

Long service life

Operational costs are minimal and are dictated by the frequency of filter change-outs due to blockage, which will be influenced by the level of contamination within the wine. However, cartridge filters if properly designed can be easily cleaned to aid regeneration and repeated use, so extended operational lifetimes can be easily achieved. Effective cleaning is a significant drawback experienced with the operation using the sheet / lenticular format of filter. Due to the construction of sheets / lenticulars, the filter media is very difficult to regenerate through cleaning and often leads to damage rather than effective regeneration.

Increased wine protection

Cartridge filtration is termed a "normal flow filtration" or "dead end" process, where all of the fluid passes through a filter barrier which is designed to capture specific contaminants. As this is a closed system, the wine is protected against external contamination or oxidation and the system can be purged through (e.g. with nitrogen) to eliminate wine loss.

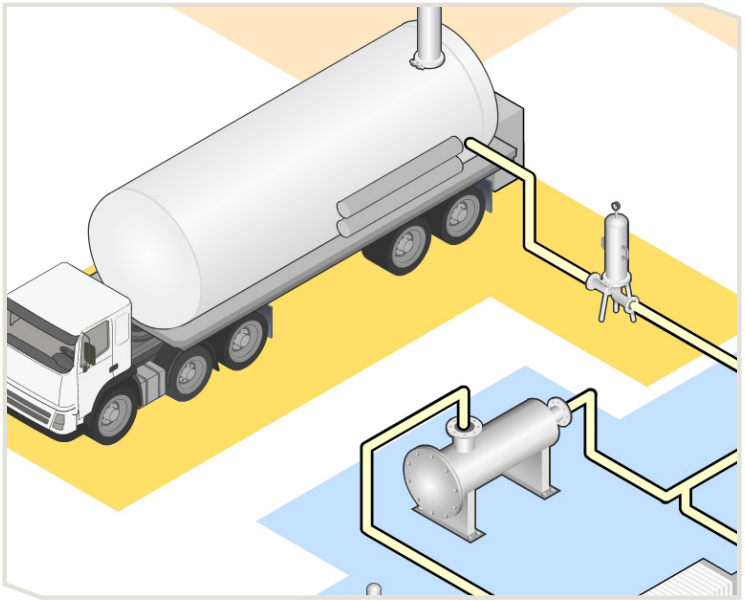
Improved process efficiency

By standardizing the quality of wine on delivery, the wine bottling / packaging facility can access further cost savings in the form of extended operational lifetime of the final filters used prior to bottling.

Capital costs are dictated by the complexity of the system including the degree of automation required. For a simple manually operated filtration skid, capital costs are kept low and are attractive to bottling / packaging facilities with multiple loading / off-loading locations within the facility. Full automation can be included or added to the system later to help optimize the process further, and improve filter lifetime through standardized CIP regimes.

For wine tanker loading / off-loading, Parker domnick hunter recommends the use of the PREPOR NG range of cartridge filters. These new filters utilise a graded density polypropylene filter media which has been developed and optimized with wine producers and packagers worldwide to achieve optimum operation in wine standardization applications.

The filter media utilized in PREPOR NG filters is capable of retaining spoilage micro-organisms and fine haze forming colloidal material, whilst being capable of regeneration through chemical cleaning and backwashing operations. As a result, PREPOR NG filters are capable of reducing the FI value of wines to deliver the correct quality of filtered wine for tanker loading / off-loading whilst being capable of repeated use under the variable loading conditions expected in this application.



Key filter requirements:

- Removal of spoilage and yeast bacterial reduction
- Removal of haze colloids
- Stable construction for frequent cleaning
- High flowing

High depth products

Relatively low effective filtration area but high depth

PREPOR NG
Combines both features

High effective filtration area

High depth

Optimized construction

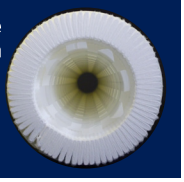


Figure 2.
Summary of tanker loading / off-loading requirements

Conclusion

The standardization of wine is a required process to facilitate its transportation between producing and consuming locations. There are many approaches to the wine standardization process, however, the requirements of the process are consistent; to protect the essential characteristics of the wine during storage and to standardize it prior to final filtration.

Cartridge filtration with Parker domnick hunter's range of PREPOR NG filters represents an economical and flexible approach to the processes of wine standardization for tanker loading / off-loading and delivers on all the key criteria required to perform optimally in this application.

Use of PREPOR NG cartridge filters for tanker off-loading applications will return significant processing cost savings for wine bottlers / packagers in the forms of:

- Greater levels of protection against spoilage micro-organisms.
- Comparatively lower process costs than other technologies.
- Reduced wine losses and oxidation.
- Reduced membrane filter usage used on bottling / packaging lines.

References:
1. UK Wine and Spirit Market Overview 2012
2. Clean in Place Support Guide – Parker domnick hunter

For more information, please visit Parker domnick hunter's website at www.parker.com/dhpfoodandbeverage

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Ed. 2010-09-29

AN_W_35_07/14 Rev1A

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