



3M Science.
Applied to Life.™

3M Separation and Purification Sciences Division

That's the spirit.

Keep the good times flowing with innovative
filtration solutions for distilleries from 3M.

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Lift your spirits with filtration you can rely on.

From the purest single malt whisky to a perfectly curated brandy, many spirits are aged for decades and some can be worth in excess of thousands of dollars per bottle. As the value of a spirit is often much more than any other beverage per ounce, reducing waste and loss can vastly improve economics within the distilling process.

The answer to reducing loss can be found in moving away from traditional filter presses to fully enclosed depth filters, as well as by utilizing high solid loading filter cartridges with excellent throughput performance and low hold up. In fact, with the correct filtration choices, not only can waste be reduced, but the service life of filters can be dramatically increased—lowering the total cost of production.

Consumer perceptions of quality also often demand a spirit free of haze and particulate, but how do distillers ensure that the clarity and longevity of their pride and joy withstands the time taken to create?

By properly analyzing the clarification and final filtration processes, distillers can polish the spirit and reduce visible haze. There are also options to drive costs down by filtering spirits before tanker loading, delivering a cleaner spirit to the bottling hall.

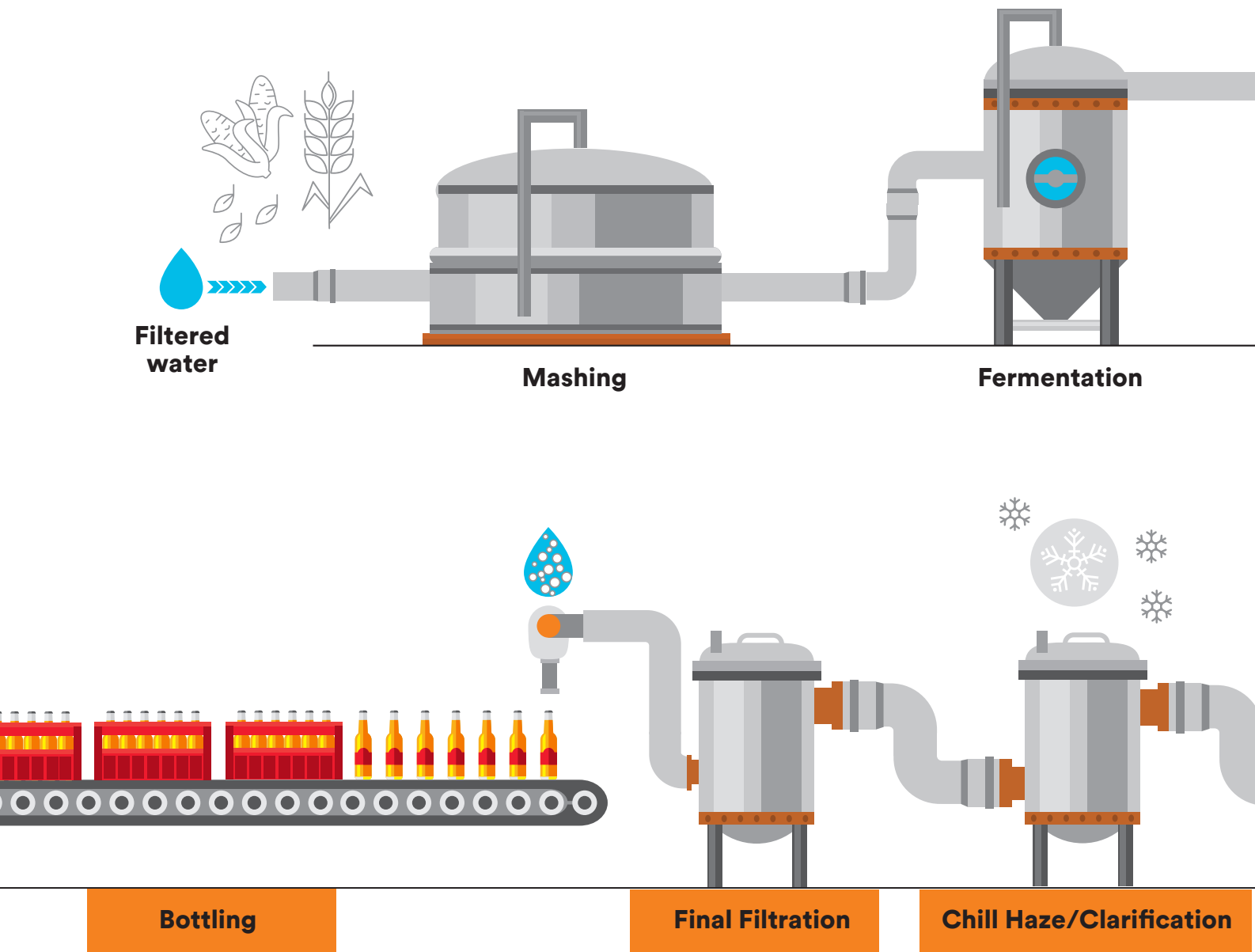
Distilleries around the world use 3M for:

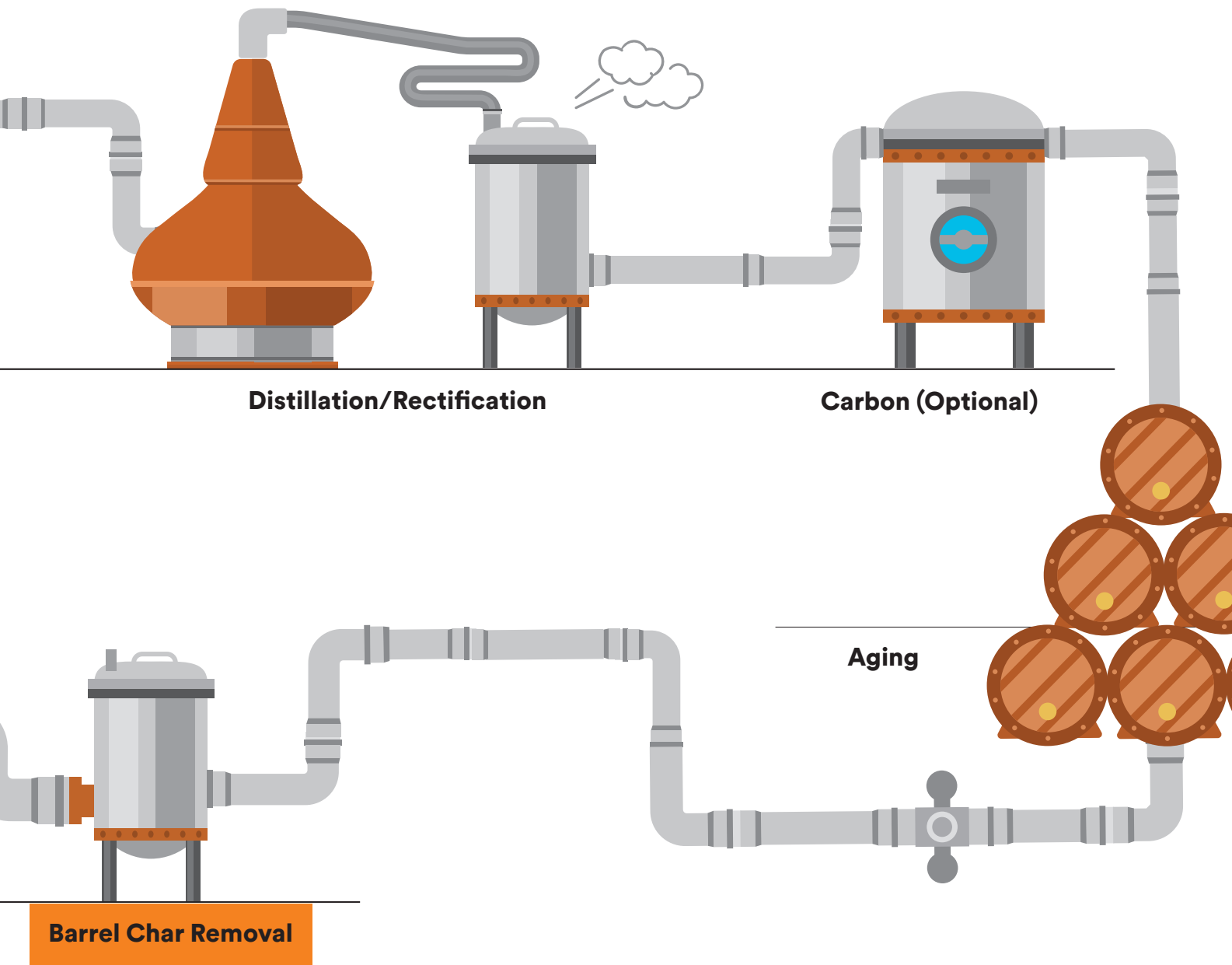
- ▶ **Performance** | Efficient and effective solutions to meet distillers' needs.
- ▶ **Convenience** | Easy-to-use and easy-to-maintain systems.
- ▶ **Quality** | Reliable, consistent results to help maximize production and minimize waste.



Process Map

Here's an example of where filtration can enhance your distilling process.





Barrel Char Removal

Page 6 (High Flow/DF/Bags)

Chill Haze/Clarification

Pages 10–11 (High Flow/3M™ Zeta Plus™ H or MH)

Final Filtration

Pages 12–13 (3M™ Betafine™ XL)



Barrel Char/ Particulate Reduction

Contaminants can detract from the appearance, taste and perceived value of the finished product. Many spirits, most commonly with whisky, are matured in a barrel which is charred on the inside. This helps maturation as the carbon created from the ash acts as a filter for the harsher elements of the spirit, while creating important flavour compounds such as vanillin, tannins and spices.

However, charring and the maturation stage in general can lead to visible particulates in the spirit, so it is vital to include char removal/particulate reduction in your process to ensure a cleaner spirit.



3M™ High Flow Series Filters

For distillers with higher volume and solids loading requirements or space restrictions, we suggest using a High Flow filter cartridge, details of which can be found on page 9.



3M™ DF Series Filters

An advanced alternative to standard bag filters. 3M™ DF Series Filters incorporates both a filter element and support basket that provide 100% downstream support of the DF media.

- ▶ 60% more filter surface area providing up to 3-5 times more service life and 2-3 times more contaminant holding capacity compared to most commonly used standard bag filters
- ▶ Support basket helps to eliminate the potential for filter rupture and downstream contamination
- ▶ 3M™ DF Series Filters elements can be used in existing bag housings with specially designed baskets
- ▶ Graded porosity structure to help increase holding capacity
- ▶ Inside-outside flow configuration results in capturing particles within the filter element, reducing mess upon changeout

3M™ NB Series Bags

For some applications, liquid bags represent the best filtration option.

- ▶ Inside-outside flow configuration
- ▶ Unique sealing welded collar for easy removal
- ▶ High-performance media (polypropylene)



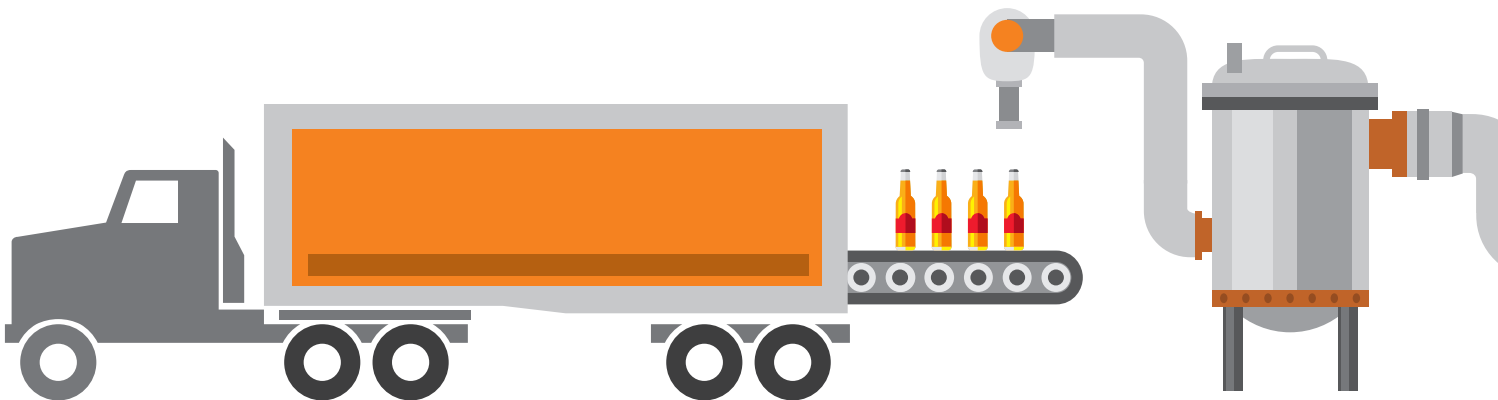
3M™ High Flow Filter System

High flow capability; compact design. The 3M™ High Flow Filter System is a result of 3M's extensive filtration experience applied to delivering high flow filter technology in a compact design.

Barrel char removal and pre-tanker loading

3M recommends that barrel char removal should be administered before the tanker loading stage. This way, cost savings can be gained by using 3M™ High Flow Filter Systems before the tanker loading stage at disgorgement. By doing this, a cleaner spirit is transported to the bottling hall where more expensive clarifying filters and final filters are less likely to blind prematurely. This can increase the service life/throughput and consumables cost, reducing the likelihood of production interruptions and downtime.

See the process below.



3M™ High Flow Filter System benefits:

High flow capability

- ▶ Flow rates up to 1893 L/min (500 GPM) per absolute rated 152.4 cm (60") length filter cartridge
- ▶ Available in 25.4 cm (10"), 101.6 cm (40") and 152.4 cm (60") cartridge lengths

Compact design

- ▶ Smaller housings diameter for a given flow rate compared to conventional filters

Easy to use

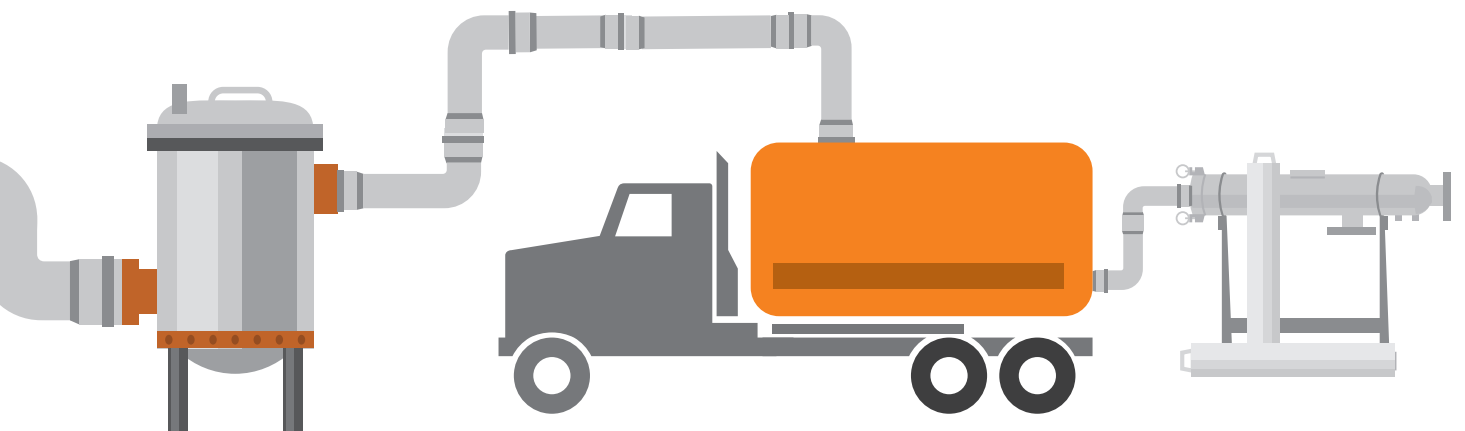
- ▶ 'Twist-to-Lock' design facilitates faster filter change-outs
- ▶ No special tools or hardware required for filter change-outs

Economical

- ▶ Can be gravity fed by installing vertically; this lowers pump power requirements and carbon footprint/energy costs
- ▶ Requires fewer cartridges than conventional 6.35 cm (2.5") outer diameter cartridge systems for a given flow rate
- ▶ Fewer cartridges reduce waste. Filter change-outs are quicker, easier and help save on labour and disposal costs
- ▶ High filter loading capacity enables a long service life

Applications:

- ▶ Barrel char removal
- ▶ Sanitation water
- ▶ Chill haze and clarification
- ▶ Bottling



Chill Haze/Clarification

Tanker Loading

3M™ High Flow Filter System



Chill Haze / Clarification

The same barrels that impart a great taste to whisky, brandy and rum can also be responsible for a hazy appearance. Our lenticular-style depth filter cartridges provide turbidity reduction—by removing suspended long-chain fatty acids that can give spirits a hazy appearance at lower temperatures; while helping to eliminate spirit leakage, reducing alcohol fume emission.

Solutions for limited/ premium runs

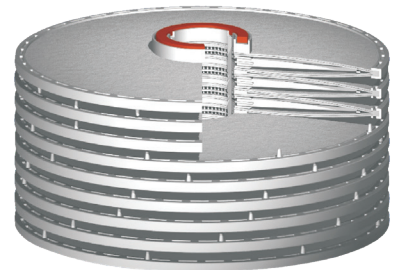
For where runs are limited or encompass a premium spirit, reducing waste and hold-up has a direct impact on your bottom line. To minimize loss, we recommend the following process. Begin with the 3M™ High Flow Filter System to remove heavy charring and/ or particulate matter, while also reducing holdup. Followed by 3M™ Zeta Plus™ Series Filters, removing haze and the need for a cumbersome filter press. Lastly, we recommend running the spirit through 3M™ Betafine™ XL Series Filters, that utilize our Advanced Pleat Technology. This innovative staggered pleat design increases the useable surface area of the filter, while helping to ensure the longevity and clarity of the spirit for years to come.

3M™ Zeta Plus™ H Series Filters

3M™ Zeta Plus™ H Series Filters are charge modified depth filters, constructed with high tensile strength media.

The H Series media formulation is optimized to withstand repetitive hot water sanitation cycles.

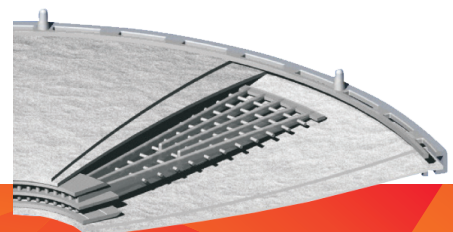
Zeta Plus H Filters are available in 20.3 cm (8"), 30.5 cm (12") and 40.6 cm (16") diameter cartridges, to easily accommodate flow rates at small, medium and large distilleries.



3M™ Zeta Plus™ ‘Dual-Zone’ MH Series Filters

3M™ Zeta Plus™ Dual-Zone MH Series Filters are an advanced dual zone depth filter designed to provide optimal prefiltration where clarity is imperative.

The construction consists of two distinct layers, or “zones” of durable H Series filter media, with the upstream zone more open than the downstream zone. This enhances the contaminant holding capacity by trapping larger particles and hazes in the upstream layer and the smaller ones in the downstream layer.



The Benefits of the 3M™ Zeta Plus™ Series Filters

Filter Press	3M™ Zeta Plus™ Series Filters
<p>Leakage and spirit loss</p> <ul style="list-style-type: none"> ▶ Can be as high as 1-2% of volume filtered 	<p>Zero leakage</p> <ul style="list-style-type: none"> ▶ No loss of valuable spirits to leakage
<p>Labour</p> <ul style="list-style-type: none"> ▶ It can take 2 to 4 hours to change a small filter press ▶ When a filter press is repacked, it is not operating, reducing productivity 	<p>Greatly reduced labour</p> <ul style="list-style-type: none"> ▶ 3M Zeta Plus series filters can be changed in 15 minutes
<p>Filter change-outs</p> <ul style="list-style-type: none"> ▶ Filter sheets are changed on a time basis, not when filtration capacity has been achieved ▶ Risk of throwing away a percentage of unused filters 	<p>Fewer change-outs</p> <ul style="list-style-type: none"> ▶ Since cartridges are used completely, fewer filter change-outs are needed per year
<p>Capital costs</p> <ul style="list-style-type: none"> ▶ Filter presses are large, expensive pieces of equipment 	<p>Decreased capital costs</p> <ul style="list-style-type: none"> ▶ 3M Zeta Plus series filter housings are typically 25-50% the capital cost of a stainless-steel filter press
<p>Maintenance</p> <ul style="list-style-type: none"> ▶ Presses typically have dozens of O-rings and gaskets to maintain ▶ Plates are heavy and cumbersome to remove and the surfaces must be cleaned regularly 	<p>Low maintenance</p> <ul style="list-style-type: none"> ▶ 3M Zeta Plus housing systems have only 3 O-rings to maintain ▶ Easy to clean, easy to maintain
<p>Disposal</p> <ul style="list-style-type: none"> ▶ Filter sheets are discarded on a timed basis, additional disposal costs could be incurred as a result 	<p>Reduced disposal</p> <ul style="list-style-type: none"> ▶ Fewer change-outs a year results in less filters to dispose, reducing disposal costs
<p>Floor space</p> <ul style="list-style-type: none"> ▶ A 60 cm² (9.3 in²) press requires up to 9.3 m² (100 ft²) of floor space 	<p>Floor space</p> <ul style="list-style-type: none"> ▶ Very small footprint ▶ Helps provide space for other operations
<p>Energy</p> <ul style="list-style-type: none"> ▶ Filter presses have a great deal of steel to heat ▶ A filter press typically takes 30-90 minutes to reach sanitation temperature ▶ Filter presses have many dead legs which are hard to clean properly 	<p>Low energy consumption</p> <ul style="list-style-type: none"> ▶ The compact design allows the housing to reach sanitation temperature in approximately 15 minutes ▶ Reduced energy/water operation time





Final Filtration

Your finely distilled spirit is a product of history, tradition and pride. Often with years being dedicated to the aging process. Therefore, before being bottled, spirits must run through a final filtration process. This stage ensures that the clarity and longevity of the spirit succeeds the time taken to create, be it months, years or decades after bottling. The bottles must also be rinsed with particle-free water prior to filling to avoid contamination.

3M™ Betafine™ XL Series Filters

The 3M™ Betafine™ XL Series Filter is an all-polypropylene filter constructed with our innovative Advanced Pleat Technology (APT). This staggered pleat convention allows for greater contaminant loading between pleats at the inside diameter, while the reduced length pleats take advantage of existing open space closer to the cartridges' outer diameter, creating an innovative flow pattern in the process.

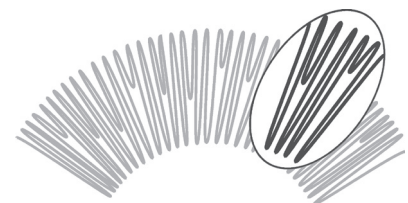
The result is a fully used surface area that enhances the dirt holding capacity and service life, while reducing flow restrictions and long-term costs.

3M™ Betafine™ XL Series Filter benefits:

- ▶ Greater service life compared to conventional pleated filters
- ▶ Greater utilized surface area compared to a conventional depth filter
- ▶ Faster flow rates per filter compared to a conventional depth filter
- ▶ Absolute rated
- ▶ Retrofit capabilities



Conventional pleating



Advanced Pleat Technology

Application Engineering

The cornerstone of 3M's philosophy is service to customers, not only in product quality and prompt delivery, but also in validation, application support and in the sharing of scientific information.

By using 3M products, distilleries have access to 3M Application Engineering support, a global team of market-focused scientists and engineers who excel in supporting collaborative efforts between customers and 3M.

Our Application Engineers can work with your distillery from start to finish to suggest the most effective and economical filters to achieve the clearest results.

Application Engineers routinely provide end-users with:

- ▶ Validation and regulatory support
- ▶ Extractable and compatibility analysis
- ▶ Filter system optimization studies
- ▶ Product training



A man wearing a green long-sleeved shirt, dark pants, and a grey baseball cap is seen from behind, working with wooden barrels in a distillery. The barrels are stacked on metal racks and have various handwritten labels such as "Rye 75", "20.9 proof", "64.54 opp", "70/255", "119.4 proof", "28.5485018", "Bourbon", "NBT", "7/21/15", "#51", "100/514", "120.9 proof", "66.19", "100/494", "120.3 proof", "62.34 opp", "97/498", "120.3 proof", "63.45 opp", "121.3 proof", "29.23 opp", "BT", "12/9/15", "#201", and "DSF-11-2017". The scene is dimly lit, with light coming from the side, highlighting the textures of the wood and the man's clothing.

3M™ Filter Housings and Systems

3M offers an extensive range of filter housings designed to handle even the most critical applications found in distilleries.

Process flow rates from 3.8 to 3785.4 L/min (1 to 1000 GPM)

3M filter housings can meet virtually any process flow requirements found in distilleries.

From the lab to pilot plant to full production, 3M filter housings are available to grow with the needs of the distillery.

User-friendly designs

3M filter housings are specifically designed with the end user in mind, to make installing and removing filter cartridges quick and easy. Fast-action swing bolts, quick release clamps and convenient cartridge hold-down devices allow for rapid filter change-outs, low labour requirements and reduced downtime.

Product Selection and Use:

Many factors beyond 3M's control and uniquely within user's knowledge and control can affect the use and performance of a 3M product in a particular application. As a result, customer is solely responsible for evaluating the product and determining whether it is appropriate and suitable for customer's application, including conducting a workplace hazard assessment and reviewing all applicable regulations and standards (e.g., OSHA, ANSI, etc.). Failure to properly evaluate, select, and use a 3M product and appropriate safety products, or to meet all applicable safety regulations, may result in injury, sickness, death, and/or harm to property.

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