

Filtration Solutions for Distilled Spirits

All in Good Spirit



A large range of products and chemicals are treated with Carlson filters



Lenticular filters and Carbon filters

Objective

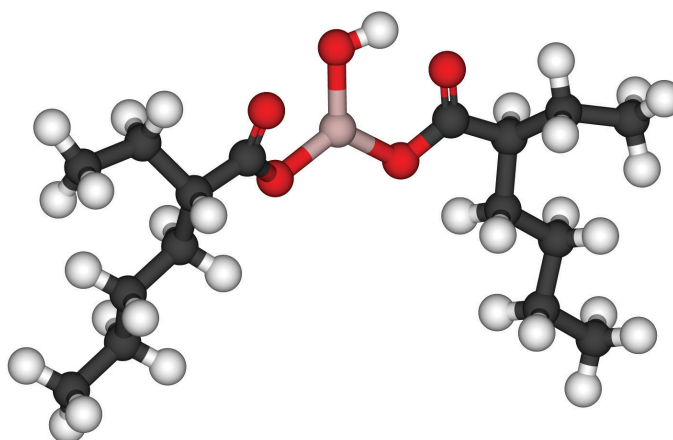
Distillers have high objectives with regard to the quality of spirit produced and removal of haze. As such, filtration prior to bottling is vital to ensure long shelf life, stability and minimal turbidity. To this end the removal of hazes and the precursors to haze formation is particularly important.

Two typical hazes found in spirits are chill haze and floc or crystal formation.

Chill Haze - a chill haze can develop when the spirit is held under cold storage conditions, or with the addition of ice. To ensure the stability of the spirit, the product normally goes through the process of chill filtration. Chill filtration is the removal of various chain lengths of fatty esters (C12-C18 saturated and unsaturated fatty acids). The technique of chill filtration uses low temperature to achieve maximum haze formation and subsequently filtration to achieve maximum haze removal.

Chill haze esters found in spirits can consist of the following types and are measured using gas chromatography;

Ethyl Hexanoate	Ethyl Hexadecanoate
Ethyl Octanoate	Ethyl-9-Hexadecanoate (C16:1)
Ethyl Decanoate	Ethyl Octadecanoate
2-Phenethyl Acetate	Ethyl Oleate (C18:1)
Ethyl Dodecanoate	Ethyl Linoleate (C18:2)
2-Phenethyl Ethanol	Ethyl Linoleate (C18:3)
Ethyl Tetradecanoate	



Spirits



Consequently, the steps used in the filtration of spirits require careful control and correct choice of filter equipment and media.

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any of the chill haze esters are associated with the flavour and character of the spirit.

Generally, long chain fatty esters are connected with chill haze, whilst short chain fatty esters have more affinity with flavour of the spirit.

The lower the chill filtration temperature, the more stable the spirit, however there is greater potential to affect flavour.



The lower the chill temperature, the greater the haze formation and consequent potential for its removal through chill filtration. However, the filters may blind more quickly.



There are generally 3 levels of chill filtration:

+3 to +7°C

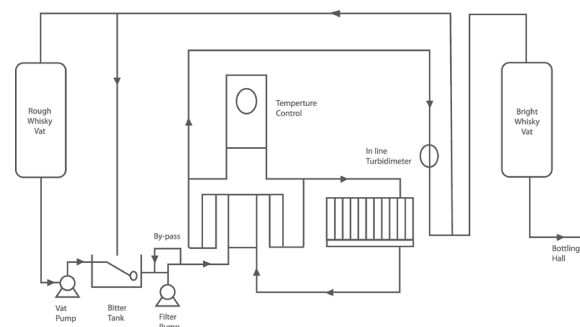
Known as 'attenuation'. At this temperature there is minimal effect on flavour. However chill haze stability is not normally very good for higher malt whiskies and haze can appear under certain conditions.

-5 to +2°C

This is the most common chill filtration temperature range and is termed 'chill filtration'. The product will be very stable with a possible slight effect on flavour.

-5 to -10°C

This temperature range will offer maximum protection from chill haze, however there could also be a significant effect on flavour.



Spirit Production



Floc/Crystal Formation

The most common form of floc/crystal formation found in spirits is Calcium Oxalate. These can show as flat plates or a white powdery deposit in the bottle, known as 'puff balls'. These can be the formation of various complexes of beta sitosterol and its glucoside with tannins.

Calcium released from filtration media can cause crystal formation in spirits, so it is desirable that these metal concentrations be kept low. This is not normally an issue in non-aged or blended spirits, however they can occur with aged spirits which may contain significant quantities of Calcium before filtration.



Typical Spirit Production Process-

PREPARATION



Depending upon the spirit being produced, the various raw materials which can be used (eg: barley, malted barley, grain, corn, rye, juniper, aruba) are ground and cooked.

MASHING



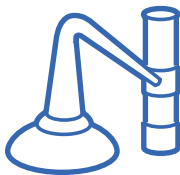
The cooked raw materials are added to warm water which converts to a liquid known as mash.

FERMENTATION



The mash is added to a fermentation tank, usually with yeast, which converts the sugar to alcohol. After a few days a percentage of the liquid is alcohol.

DISTILLATION



The fermented liquid is heated until the alcohol turns to vapour and the water remains. The alcohol is collected into a separate container and the process is repeated as many times as necessary to produce the required distilled spirit.

AGING



Water is added to the distilled spirit, which is then aged in wooden barrels (usually charred oak barrels) and aged for a number of years to develop a specific flavour and character.



Filtration



FILTRATION - Hard particulates, such as production by-products like barrel char, need to be removed before the spirit can be polished and then bottled.

Barrel char is typically removed using a series of bag and/or cartridge filters.

Typically, 40 micron polypropylene pleated filter cartridges, followed by a 10 micron, will adequately remove sufficient size and quantity of barrel char, prior to the polishing filtration.

Depth filter sheets have been used for decades in spirit filtration including first stage coarse filtration followed by specific polishing. Due to the nature of the depth filter sheet they still remain one of the most economic and cost effective forms of filtration.

Specifically in the polishing role, the filter sheet achieves its performance by virtue of its depth structure. The structure offers up a tortuous route for the spirit to pass through. This, combined with built-in selective filter aid powders, ensures particulate is retained within the sheet. The sheet itself has a high voidage giving high dirt holding capacity and long filtration life.

Carlson Filtration '**XS**' speciality filter media used for processing spirits has the following qualities:

- Selective long chain fatty ester adsorption/removal
- Minimal short chain fatty ester adsorption/removal
- Low extractables (especially Calcium, Magnesium and Iron)
- Low drip loss
- Minimal colour removal
- Available in a range of particulate retentions - 0.4 microns to 25 microns

Carlson Filtration '**XS**' speciality filter media can be used in filter presses or modular format.



Our range of filter presses is specifically designed for demanding spirit applications and environments. Supplied in a range of sizes (20x20cm, 40x40cm, 60x60cm, 80x80cm, 120x120cm) to suit a particular batch size or flowrate. Our filter presses are available with stainless steel 316 contact parts, from laboratory scale, to pilot plant, to small scale, to full scale production capacities, with ATEX certification, incorporating pneumatic, self-regulating closures and even no-gasket plate options to reduce product losses.

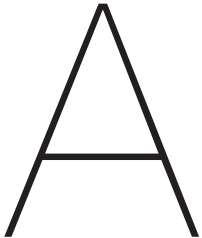
The filter presses can also incorporate multi-stage filtrations, i.e. coarse to polishing in one pass.

- Various sizes, 6cm and 10cm diameter laboratory filter
- Pilot plant 20x20cm filter
- Full production scale- 40x40cm, 60x60cm, 80x80cm and 120x120cm
- Stainless steel 316L contact parts
- Plastic or stainless steel plates
- Plate & frame option
- ATEX certification
- Pneumatic, self-regulating closure
- Multi stage filtration in the same filter
- Filter plate with no gasket option

Lenticular Filtration



XS media



Another option to the filter press (possibly used in conjunction with it) and one whose use is growing world-wide in the spirits industry is the lenticular module. Incorporating exactly the same speciality 'XS' media as in the filter press but designed into a module for mounting in a completely sealed simple housing.

Carlson's range of modules are available in an array of sizes and types to suit the batch size and flowrate required.

- 12" and 16" diameter modules, ability to multi stack
- DOE (double open ended) and DOR (double 'o' ring) format
- Protective scrim, used as a pre-filter or to allow back-flushing
- Downstream filter paper, for added filtration
- Heavy duty support feet between cells, to stop movement
- Extra space design, for high solids (barrel char) removal
- Small module design for single cask filtration
- Small footprint
- Skid mounted systems, to run in series or parallel and for increased filtration area
- Multi stage systems
- Lifting device for safe removal and quick replacement of spent modules



Specifically at the point of bottling, the distiller is looking to protect the product against all particulate contaminants entering the bottle. Extreme stability and low extraction is required at this stage. Carlson's range of absolute-rated pleated cartridges guarantee an efficient particle retention that is both predictable and reproducible. They ensure the highest degree of integrity during the final critical stage of filtration. The technical characteristics of these products allow an increase in flow rate leading to a significant increase in service life.

Some example filtration options are shown below-

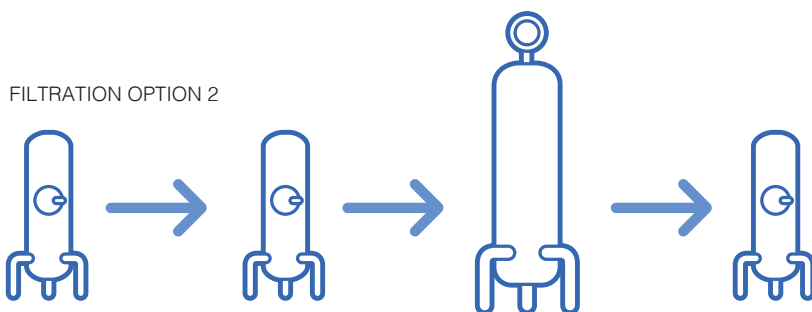
FILTRATION OPTION 1



Option 1 - 40 micron pleated cartridge filter followed by a 2-stage sheet filter and final 10 micron absolute pleated cartridge filter and then bottling.

Example - P2-400F-100S → XS5 / XS350K flat sheets → P2-100F-100S

FILTRATION OPTION 2

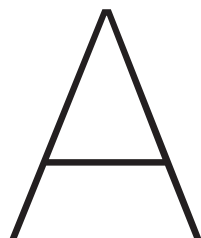


Option 2 - 40 micron pleated cartridge filter followed by a 10 micron pleated cartridge filter, then a lenticular module filter and final 10 micron absolute pleated cartridge filter and then bottling.

Example - P2-400F-100S → P2-100F-100S → XS350K module → P2-100F-100S



Carbon Treatment



Activated carbon powder has long been used for the removal of organic impurities, such as colour, taste and odour, in niche applications, such as blended white spirits, like tequila and white rum.

Loose carbon powder has many operational related issues:

- Dirt
- Fire risk!!
- Health issues
- Long processing time
- Operator error
- Needs secondary filtration

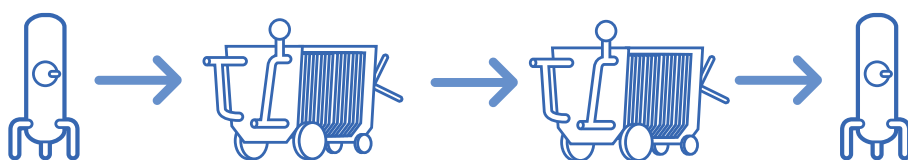
Carlson offer a range of seven types of activated carbon impregnated depth filter media for use in either a filter press or modular housing.

Carlson's activated carbon sheet and module range offers the distiller the following benefits:

- No loose powders - lower fire risk and cleaner
- Clean product - minimal release of carbon into product
- Quicker process time
- No need for secondary filtration
- Seven different grades of carbon media
- Varying quantities of activated carbon added, to adjust the relative adsorption capability

Some example filtration options are shown below-

FILTRATION OPTION 1



Option 1 - 40 micron pleated cartridge filter followed by activated carbon sheets and then polishing sheets and 1 micron absolute pleated filter cartridges and bottling.

Example- P2-400F-100S → PROC3ACN → XS350K sheets → P2-010F-100S

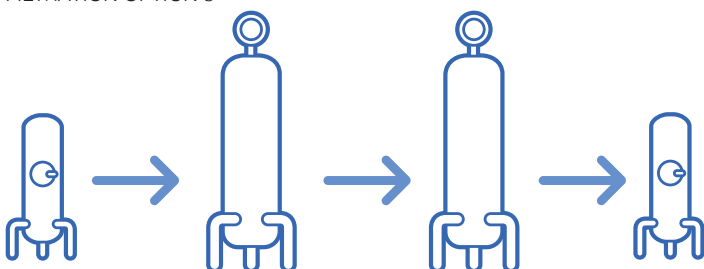
FILTRATION OPTION 2



Option 2 - 40 micron pleated cartridge filter followed by activated carbon sheets and then polishing sheets in the same filter and 1 micron absolute pleated filter cartridges and bottling.

Example- P2-400F-100S → PROC3ACN / XS350K sheets → P2-010F-100S

FILTRATION OPTION 3



Option 3 - 40 micron pleated cartridge filter followed by activated carbon module and then polishing module and 1 micron absolute pleated filter cartridges and bottling.

Example - P2-400F-100S → PROC3ACN module → XS350K module → P2-010F-100S

CORRECT FILTRATION CHOICE - to enable the distiller to make the correct choice of filtration equipment and media, Carlson can offer a full range of laboratory scale filtration options to make the decision easier.

Through extensive laboratory trials, the correct filter type, level of filtration, flowrate and potential lifetime of the filter can be determined.

Trials can be either carried out at the customer's site, or under controlled conditions within the research and development facility at Carlson Filtration.

For details on any of the products Carlson Filtration can offer to the distilled spirits industry, please contact your sales consultant.

Filtration Solutions for Distilled Spirits

All in Good Spirit

FILTER SHEETS

To eliminate the specific factors associated with the filtration of spirits, Carlson Filtration has developed a range of filtration media specifically for these purposes which are available in all customary sizes. Special formats to suit a variety of filter presses are available upon request. Further information on the "XS" range of sheets can be obtained either from your Carlson representative or the company website.

Lenticular modules

The lenticular module concept offers a compact, self contained, liquid filtration solution utilising proven filter media technology.

The lenticular module concept can incorporate the full range of Carlson Filtration filter media.

Carlson Carlent lenticular filters are essentially composed of Carlson depth filter media, supported on a polypropylene skeleton and supplied in modular format normally comprising of 16 cells of either 12" (300mm) or 16" (400mm) diameter. They offer all the advantages of traditional filter sheet filtration but in a totally enclosed, sterile environment, thus eliminating product losses and external contamination.

They are designed to fit industry standard housings incorporating 1,2,3 or 4 modules. These can be supplied either as stand alone or complete turn key skid mounted units.

For further information on this product and the associated housings please see our Carlent brochure.

Complementary Filtration

Cartridges, Bags and Housings.

Carlson can also offer a comprehensive range of cartridges from wound, pleated and thermal bonded through to PES membranes as well as bags in felt, nylon monofilament, polypropylene and polyester. They are available for either new application or to retrofit to current installations.

A full range of housings are also available to compliment this range

Filtration Equipment and Spares

New filter equipment

Carlson offers a comprehensive range of new filtration equipment, incorporating a full range of filter presses and plate and frame filters. The range includes plate and frame and sheet filters from 20x20cm to 120x120cm. Manual models and fully automatic closing systems are available.

Reconditioned filter equipment

Carlson also offers reconditioned sheet and plate and frame filter presses. We have developed a wide ranging network of contacts in the filter press community as well as amongst dealers in used factory equipment. On arrival at Carlson's factory all filters are rebuilt to exacting standards to meet customers filtration requirements and to achieve an "as good as new" quality.

Filter spares

Another important element of Carlson's support service is to supply spare parts for their filter range. These are categorised into:

- Consumable spares which include eyelet seals in a host of materials including Nitrile, Silicon, Natural Rubber, EPDM, Butyl and Viton.
- Servicing spares including pump spares, sight glasses, valve diaphragms and pressure gauges etc. Service kits for hydraulic filter press closing systems are also available.

Dealer stamp

purity through quality™ since 1923



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