

# Application Note

## Technical Application Publication

### Successful powder trap filtration of beer

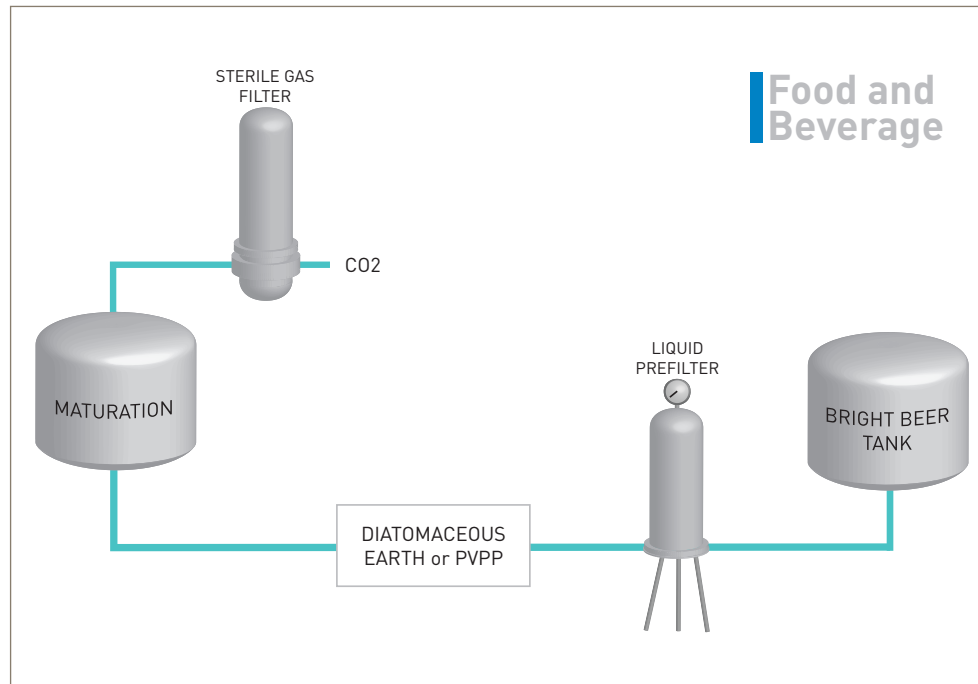


## Introduction

Trap filtration - the removal of fine particulate released from upstream treatment processes such as deionization, carbon polishing and powder filtration - is a major application area for microfiltration cartridge filters.

Trap filtration in beer processing is typified by the filtration of the beer immediately before bright storage, where it is applied to remove fine powder released by previous diatomaceous earth or polyvinylpolypyrrolidone filtration and adsorption stages.

**Parker domnick hunter can work with you to improve the quality of your beer by capturing any solid particulate which has been left behind by the initial separation stage following fermentation.**



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'How long will the filters last?' is a question commonly asked. Unfortunately there is no straightforward answer. The life-time of the filters in terms of total throughput is dependent on many factors such as:

- The type of powder
- The efficiency of the powder stage
- Beer style and specification
- Filter selection
- Operational procedures

Parker domnick hunter offers a selection of filters that are suitable for trap filtration. Two options in the beverage range of filter cartridges from Parker domnick hunter have been designed especially with beer trap filtration applications in mind - PEPLYN HD and PEPLYN HA. Working closely with the brewer to understand their requirements and to agree operational procedures, will enable selection of the filter type and grade to deliver consistent filtrate quality and provide economical life.



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# Common powders

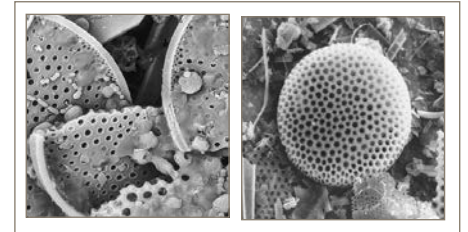
## Clarification and physical stabilization of beer

The most common powders that are encountered in beer filtration are diatomaceous earth (also known as kieselguhr, diatomite and DE), and polyvinylpyrrolidone (PVPP). DE is naturally occurring. It is classed as a sedimentary rock and is found in deposits where prehistoric tropical seas provided a habitat for diatoms. These microscopic, single-celled organisms are related to algae and have the ability to extract silica from the water to produce a skeletal structure. Masses of dead diatoms have provided deposits, which are extracted, refined and graded. Although DE is

classified as a hazardous substance, and requires special handling and disposal, it remains a popular filtration medium for clarification and physical stabilization of beer. This is due to its proven ability to economically clarify large volumes, its high porosity and rigid structure giving it the ability to handle high levels of particulate.

PVPP is a synthetic polymer and is used to reduce polyphenol (tannin) content by adsorption. This reduces the likelihood of the protein-tannin (P-T) interactions that form first chill, then permanent, hazes.

PVPP is insoluble and is available in single and reusable form. Polyvinylpyrrolidone (PVP) is a non-polymerized, soluble version. The particle size distribution of the powders vary considerably and consequently influence the choice of trap filter.



Photomicrographs of various forms of diatom  
(Courtesy of World Mineral Inc.)

# Powder filters

## Making the right choice

Powder filters are many and varied but come in three basic forms – horizontal or vertical leaf, candle and sheet or pad. Horizontal or vertical leaf and candle filters work on the same principle.

The powder is mixed in water and is circulated through the filter, which has a fine support screen that the powder builds up onto. This is termed the precoat layer. When using DE, a second coating of finer powder is then added. Once the precoat has been prepared, the beer is brought on-stream and further powder, the body feed, is dosed into the beer as it is passed through the filter. The body feed increases the cake depth and the life-time of the

filter run by preventing surface blinding of the powder. After filtration has taken place, the powder is either discharged or cleaned for reuse. Polyphenols removed from the beer can then in turn be removed from PVPP using a hot caustic clean, enabling it to be reused.

Sheet or pad filters are used in a filter press and are either cellulose washable support sheets, that serve the same purpose as the support screen in leaf and candle filters, or are a combination of cellulose fibres impregnated with a binder and with the selected powder.

Powder filters, whether using DE, PVPP or any other powder, by their nature will shed some of the particulate into the filtrate. In extreme cases, total bed collapse or sheet tears can occur which result in mass unloading of the powder and contamination of downstream lines, equipment and vessels. Properly designed, trap filters will remove this gradual weeping of particulate and block immediately if there is any catastrophic collapse of the powder bed or support materials.

# Absolute filtration

## Guaranteed efficiency

Absolute retention is defined by most filter manufacturers as the ability of the filter to remove 99.98% of particles above a specified size. This is equivalent to a  $\beta$  ratio of 5000 at the specified particle size (where  $\beta$  ratio is the ratio of number of particles upstream to number of particles downstream).

Unfortunately, the test conditions under which filters are rated may differ between

filter suppliers. Parameters such as flow rate, viscosity, pressure drop, particle sizing method, particle size distribution and particle characteristics also influence the final figure that can be quoted. Few, if any, filter manufacturers would specify their products' absolute ratings based on retention of DE or PVPP. The main reason for this is the wide variety of DE and PVPP products that exist, and there is no standard size distribution for the powders.

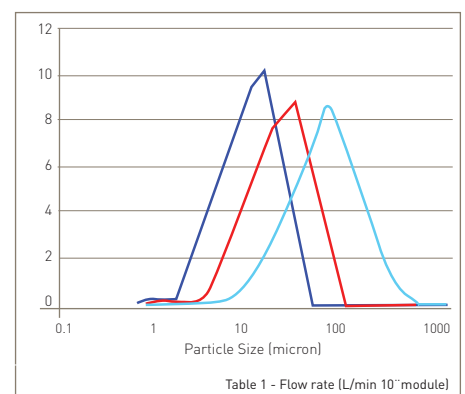


Table 1 - Flow rate (L/min 10" module)

Mircron Rating	5-20	>20
Beer / Wine (L/min 10" Mod)	10-15	15-20
Water (L/min 10" Mod)*	25-30	30-35

\* Subject to 90L/min 30" cartridge maximum

# Trap filter selection

## The correct choice for your process

Trap filter selection is not as easy as quoting a particular cartridge filter rating for the application. The basis of selection has to be on the ability of the trap filter to provide the desired specification of filtrate. However a balance must be struck between achieving this target whilst ensuring economical life-time of the trap filters. In general, experience does provide us with guidelines that enable a logical first choice. Usually Parker domnick hunter trap filters for DE removal fall within the range 5-15 microns absolute, while PVPP trap filters will normally range from 10 to 25 microns. The most economical choice will usually be the more open (least retentive) filter that still produces satisfactory filtrate specification.

Small-scale testing, using disposable capsules, is an excellent first stage benchmarking exercise to home in on the grade of trap filter to be used.

However, the full-scale process can never be exactly replicated. For that reason, close monitoring of the filtrate during full-scale use is a necessity, and is the only way to provide the necessary history to enable optimisation and further improvement in performance to be

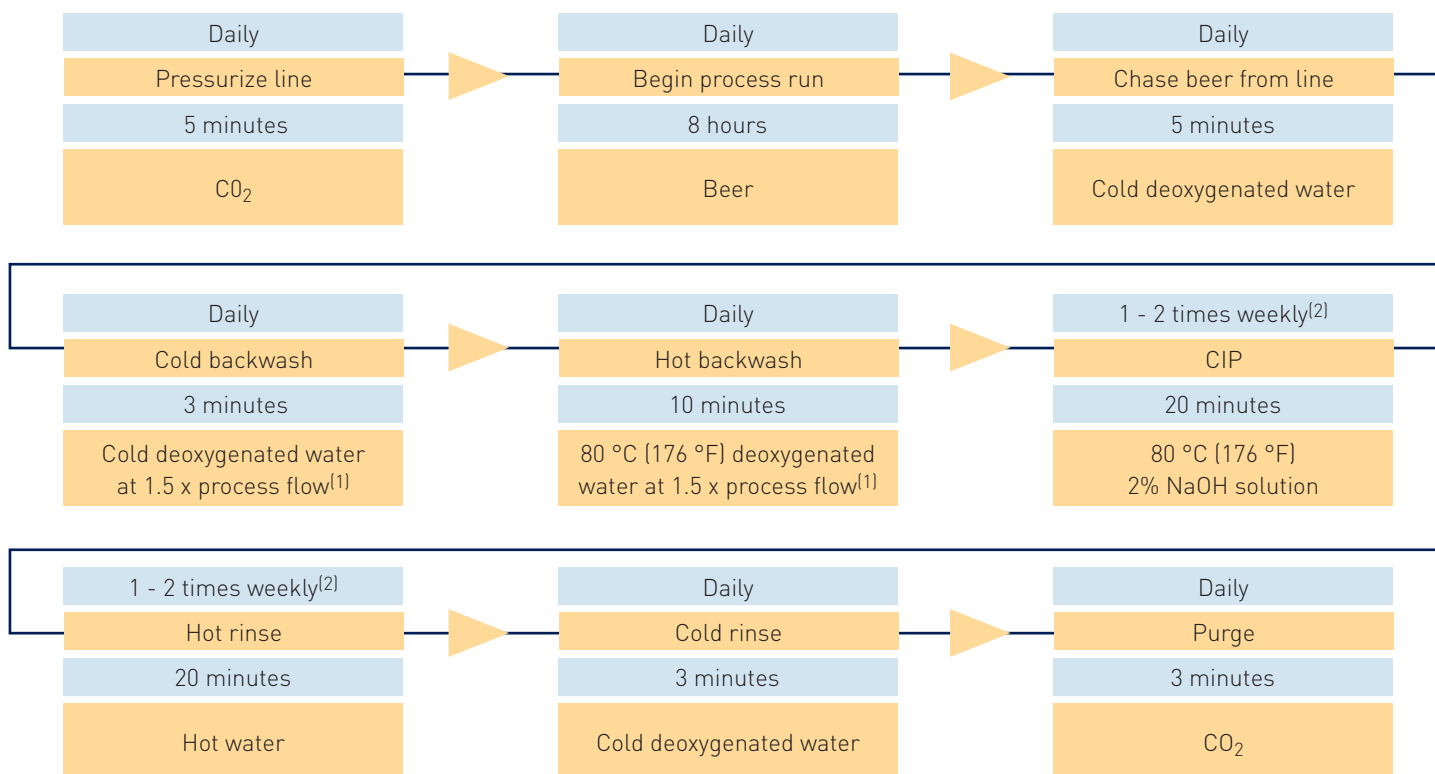
made. Higher flows per cartridge, in order to reduce system size, may be acceptable, and choice is a balance between size and change-out period and potential changes to cleaning procedures and frequency that this may entail. Thought should be given to the potential for degassing in beer if higher differential pressure or low counter pressures are used. Water and CIP solution that is used for cleaning the filters should be filtered to an absolute retention rating.

Rating (µm)	5 - 20	>20
Beer / Wine (L / min 10" module)	10 - 15	15 - 20
Water (L / min 10" module) <small>Subject to 90 L / min per 30" cartridge maximum</small>	25 - 30	30 - 35

Table 1 -Flow rate (L / min per 10" (250 mm) module) for Parker domnick hunter trap filters

# Typical PEPLYN HA trap filter operation

## Maximizing potential



Notes:

(1) Differential pressure during backwash must be monitored and kept within specific limits

(2) or if differential pressure exceeds 1.5 times clean value.

Figure 2

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# Operating procedures

## The correct choice for your process

The following should be considered when planning the operating procedure:

### Cartridge selection

PEPLYN HD is designed for forward flow applications where backwash is not possible. It will benefit from regular (daily) backwash, but PEPLYN HA has been specifically designed to improve the efficiency of backwash and should always be the first choice.

### Beer recovery

System should be designed to keep beer hold-up to a minimum.

### Pre-Pressurization

Under-pressurization may result in de-gassing, particularly as pressure drop across the filter begins to build up.

### Pressure Drop

The more often the filter is cleaned, the longer will be its life. However, daily cleaning may be impracticable. As a guide, back washing should be carried out when the differential pressure reaches 1.5 times its clean value and caustic cleaning should take place at 1.5 - 2 times clean differential pressure.

The document 'Cleaning Guidelines for Parker domnick hunter Cartridge Filters in Beverage Applications' is available from the Process Filtration Technical Support Group, [dh.tsg@parker.com](mailto:dh.tsg@parker.com). This provides general guidelines that are intended for incorporation into Standard Operating Procedures. Recommendations should be considered flexible, and continuous monitoring should be carried out to improve the process as on-going experience is gained.

### Technical Support Group

The Process Filtration Technical Support Group exists to provide help and advice on filter selection, planning operational procedures and providing advice for QA and HACCP programmes where Parker domnick hunter filters are concerned. For more information please contact [tsg@parker.com](mailto:tsg@parker.com), Tel: 0191 4105121



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## Conclusion

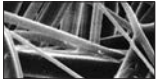
### Brewer halves operating costs

A major international brewer has recently achieved significant cost savings in its operating costs by incorporating PEPLYN HA trap filters after DE powder filtration.

The brewer had already experienced consistent performance of Parker domnick hunter general purpose absolute-rated filters for a number of years. Controlled trials were conducted when PEPLYN HA filters, part of a dedicated range developed for beverage applications were introduced. Working with Parker domnick hunter's technical support team, the combination of the new filter, combined with operator training and optimization of operational procedures, led to an increase in filter life-time from a throughput of 500,000 hL to 1 million hL for a set of eighteen 30 inch filter cartridges.

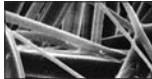
# Products

## Liquid filtration - clarification

**PEPLYN HD** 

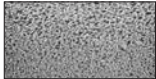
5 - 35 micron absolute Polypropylene

- Graded density and increased depth resulting in high dirt holding capacity
- Ideally suited to high volume, forward flow processes

**PEPLYN HA** 


5 - 100 micron absolute Polypropylene

- Graded density results in high dirt holding capacity
- Optimised pleat configuration maximizes backwash efficiency

**PREPOR GF** 

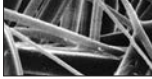
2 - 10 micron absolute Glass microfibre

- High voids volume media provides high dirt holding capacity
- Higher flow than polypropylene media results in low pressure drop even in viscous liquids

**PROPLEAT** 

1 - 75 micron Polypropylene

- Economical general clarification
- Higher area than spun bonded products provides longer life to blockage

**PROSPUN** 

0.5 - 75 micron absolute Polypropylene

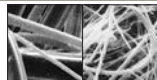
- Economical general clarification
- Excellent first-stage protection of downstream processes

**BAG FILTERS** 

Medium to coarse Various

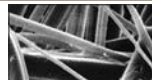
- Economical general clarification in non-critical applications

## Liquid prefiltration - stabilization

**PREPOR GP** 

0.6 - 1.5 micron stabilizing Glass microfibre / polypropylene

- Composite media provides high strength and dirt holding capacity
- High efficiency removal of spoilage organisms and yeasts

**PREPOR PP** 

0.6 - 1.5 micron stabilizing Polypropylene

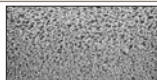
- Maximised chemical and mechanical resistance for repeated regeneration
- Yeast removal and spoilage organism reduction

**CARBOFLOW MX**

Adsorptive colour, odor and taste removal Extruded activated carbon

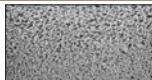
- High capacity, long life
- Extruded media provides particulate reduction as well as adsorption

## Sterile liquid filtration

**BEVPOR PS** 

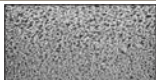
0.2 - 1.2 micron stabilizing Polyethersulphone

- Can be sanitized and regenerated for extended life
- Low adsorption of protein colours and flavours

**BEVPOR PH** 

0.2 - 1.2 micron sterilizing Polyethersulphone

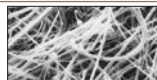
- Integral prefilter layer maximizes service life
- Can be sanitized and regenerated for extended life
- Higher surface area extends service life

**BEVPOR PT** 

0.2 - 0.65 micron sterilizing Polyethersulphone

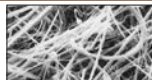
- Prefilter layer means colloids extending service life
- Low adsorption of protein, colours and flavours

## Sterile gas and vent filtration

**HF BIO-X** 

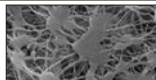
0.1 micron stabilizing PTFE impregnated glass fibre

- 94% voids volume PTFE impregnated glass fibre
- Exceptional flow rates with low pressure drops
- Integrity testable by aerosol challenge

**BIO-X** 

0.01 micron sterilizing Glass microfibre

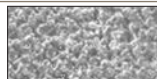
- High temperature operation 200 °C (329 °F)
- Robust construction

**TETPOR AIR** 

0.01 micron sterilizing Polypropylene expanded PTFE

- Assured biosecurity with absolute rated filtration
- High voids volume PTFE membrane
- Unique prefilter layer
- Steam sterilizable to 142 °C (287 °F)

## Steam filters

**SINTERED** 


1.0 - 25 micron 316L stainless steel

- Ideally suited for low flow rate applications
- Available in culinary grade 1 micron
- Low pressure drops

**PLEATED** 

1.0 - 5.0 micron 316L stainless steel

- Re-cleanable metal fibre 316L Stainless Steel
- Exceptionally high flow rates
- Available in culinary grade 1 micron

**HOUSINGS** 

- A full range of stainless steel housings specifically designed for the beverage industry
- Air / gas and liquid applications

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