

Application Note

Technical Application Publication

Successful powder trap filtration of beer

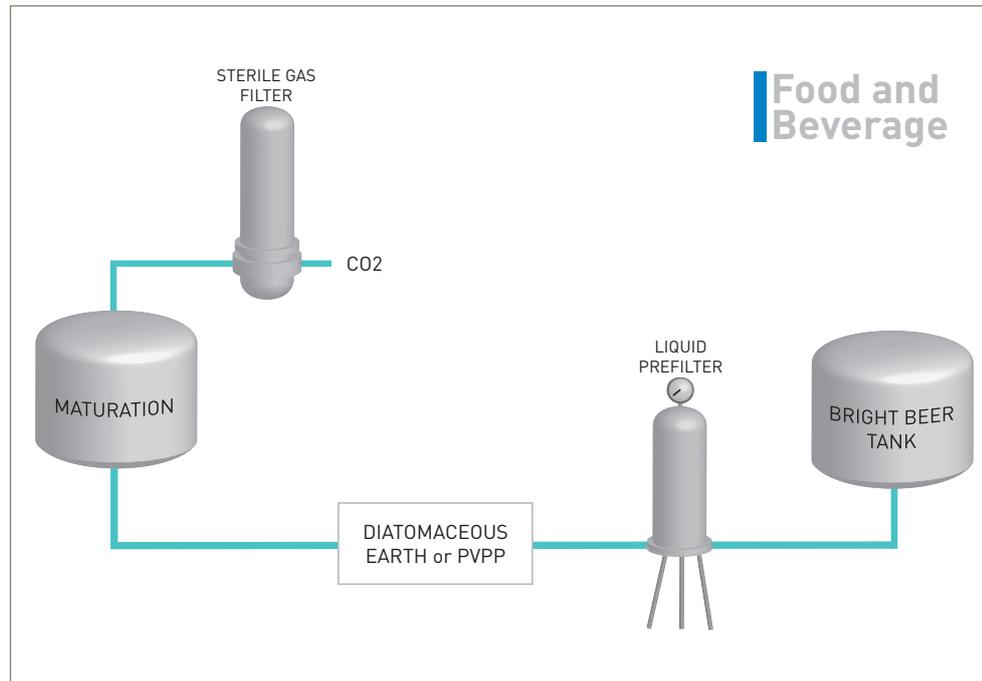


Introduction

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 polyvinylpyrrolidone 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.



Parker-filter.ru

Contact information:

Parker Hannifin Manufacturing Ltd
domnick hunter
Process Filtration - Europe
phone +44 (0)191 4105121
dhprocess@parker.com

Parker Hannifin Corporation
domnick hunter
Process Filtration - North America
phone 877 784 2234
dhpsales.na@parker.com

www.parker.com/processfiltration

'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.



ENGINEERING YOUR SUCCESS.

Common powders

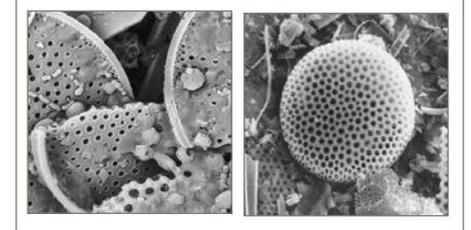
Clarification and physical stabilization of beer

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.

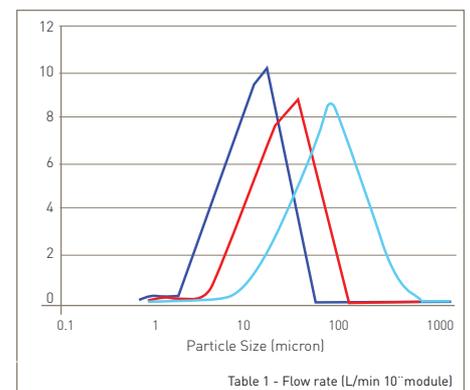
Absolute filtration

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 β ratio of 5000 at the specified particle size (where β 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.



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

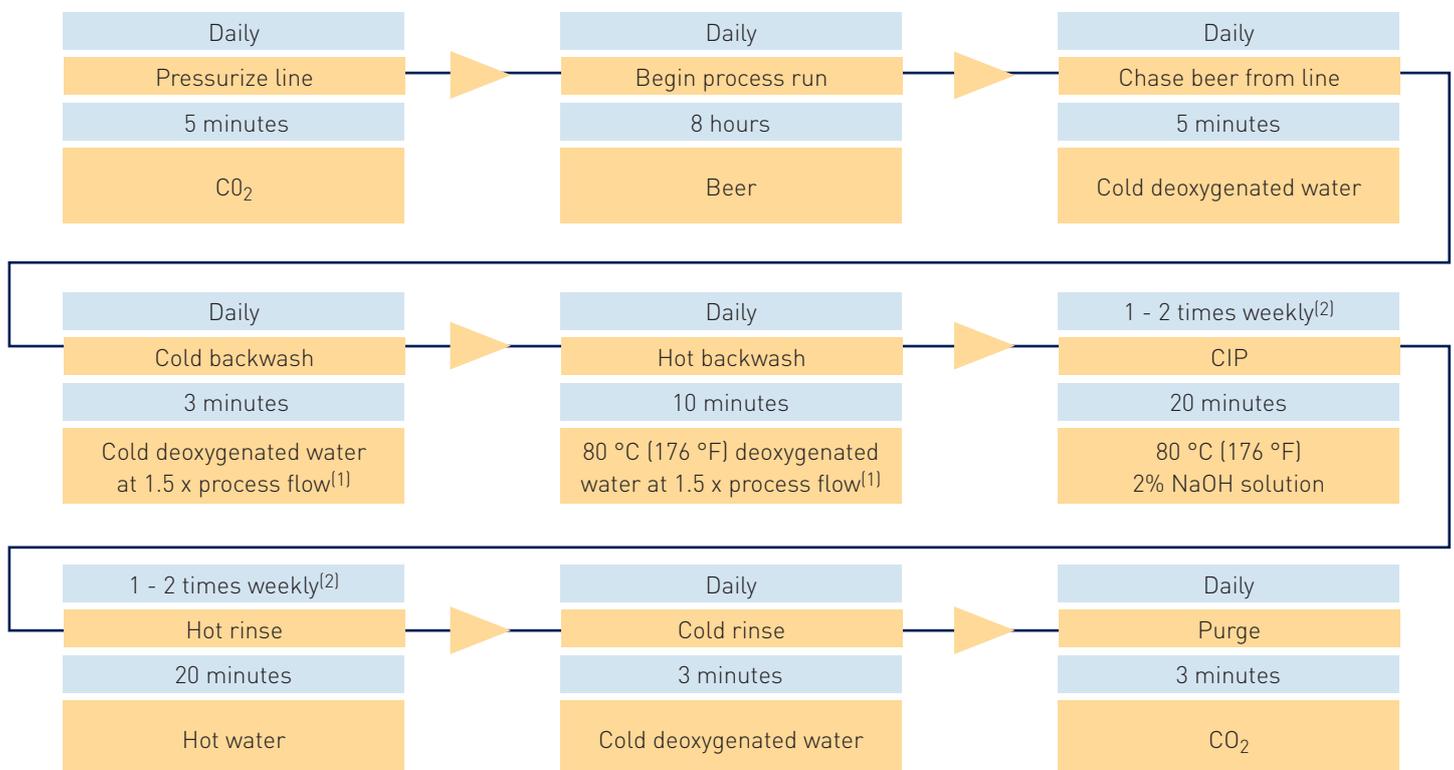
made. Higher flows per cartridge, in order to reduce system size, may be acceptable, and choice is a balance between size and change-out period and potential changes to cleaning procedures and frequency that this may entail. Thought should be given to the potential for degassing in beer if higher differential 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) <i>Subject to 90 L / min per 30" cartridge maximum</i>	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

Parker-filter.ru

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. 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, Tel: 0191 4105121



Parker-filter.ru

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

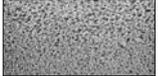
Liquid filtration - clarification

PEPLYN HD 
5 - 35 micron absolute Polypropylene

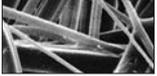
- Graded density and increased depth resulting in high dirt holding capacity
- Ideally suited to high volume, forward flow processes

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

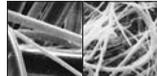
PROSPUN 
0.5 - 75 micron absolute Polypropylene

- 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

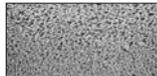
PREPOR PP 
0.6 - 1.5 micron stabilizing Polypropylene

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

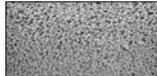
CARBOFLOW MX
Adsorptive colour, odor and taste removal Extruded activated carbon

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

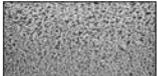
Sterile liquid filtration

BEVPOR PS 
0.2 - 1.2 micron stabilizing Polyethersulphone

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

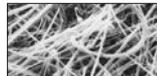
BEVPOR PH 
0.2 - 1.2 micron sterilizing Polyethersulphone

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

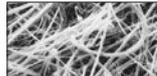
BEVPOR PT 
0.2 - 0.65 micron sterilizing Polyethersulphone

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

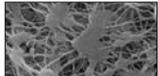
Sterile gas and vent filtration

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

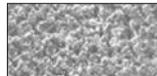
BIO-X 
0.01 micron sterilizing Glass microfibre

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

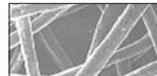
TETPOR AIR 
0.01 micron sterilizing Polypropylene expanded PTFE

- 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

Parker Worldwide

Europe, Middle East, Africa

AE – United Arab Emirates, Dubai
Tel: +971 4 8127100
parker.me@parker.com

AT – Austria, Wiener Neustadt
Tel: +43 (0)2622 23501-0
parker.austria@parker.com

AT – Eastern Europe, Wiener Neustadt
Tel: +43 (0)2622 23501 900
parker.easteurope@parker.com

AZ – Azerbaijan, Baku
Tel: +994 50 2233 458
parker.azerbaijan@parker.com

BE/LU – Belgium, Nivelles
Tel: +32 (0)67 280 900
parker.belgium@parker.com

BY – Belarus, Minsk
Tel: +375 17 209 9399
parker.belarus@parker.com

CH – Switzerland, Etoy
Tel: +41 (0)21 821 87 00
parker.switzerland@parker.com

CZ – Czech Republic, Klecany
Tel: +420 284 083 111
parker.czechrepublic@parker.com

DE – Germany, Kaarst
Tel: +49 (0)2131 4016 0
parker.germany@parker.com

DK – Denmark, Ballerup
Tel: +45 43 56 04 00
parker.denmark@parker.com

ES – Spain, Madrid
Tel: +34 902 330 001
parker.spain@parker.com

FI – Finland, Vantaa
Tel: +358 (0)20 753 2500
parker.finland@parker.com

FR – France, Contamine s/Arve
Tel: +33 (0)4 50 25 80 25
parker.france@parker.com

GR – Greece, Athens
Tel: +30 210 933 6450
parker.greece@parker.com

HU – Hungary, Budapest
Tel: +36 1 220 4155
parker.hungary@parker.com

IE – Ireland, Dublin
Tel: +353 (0)1 466 6370
parker.ireland@parker.com

IT – Italy, Corsico (MI)
Tel: +39 02 45 19 21
parker.italy@parker.com

KZ – Kazakhstan, Almaty
Tel: +7 7272 505 800
parker.easteurope@parker.com

NL – The Netherlands, Oldenzaal
Tel: +31 (0)541 585 000
parker.nl@parker.com

NO – Norway, Asker
Tel: +47 66 75 34 00
parker.norway@parker.com

PL – Poland, Warsaw
Tel: +48 (0)22 573 24 00
parker.poland@parker.com

PT – Portugal, Leca da Palmeira
Tel: +351 22 999 7360
parker.portugal@parker.com

RO – Romania, Bucharest
Tel: +40 21 252 1382
parker.romania@parker.com

RU – Russia, Moscow
Tel: +7 495 645-2156
parker.russia@parker.com

SE – Sweden, Spånga
Tel: +46 (0)8 59 79 50 00
parker.sweden@parker.com

SK – Slovakia, Banská Bystrica
Tel: +421 484 162 252
parker.slovakia@parker.com

SL – Slovenia, Novo Mesto
Tel: +386 7 337 6650
parker.slovenia@parker.com

TR – Turkey, Istanbul
Tel: +90 216 4997081
parker.turkey@parker.com

UA – Ukraine, Kiev
Tel: +380 44 494 2731
parker.ukraine@parker.com

UK – United Kingdom, Warwick
Tel: +44 (0)1926 317 878
parker.uk@parker.com

ZA – South Africa, Kempton Park
Tel: +27 (0)11 961 0700
parker.southafrica@parker.com

North America

CA – Canada, Milton, Ontario
Tel: +1 905 693 3000

US – USA, Cleveland
Tel: +1 216 896 3000

Asia Pacific

AU – Australia, Castle Hill
Tel: +61 (0)2-9634 7777

CN – China, Shanghai
Tel: +86 21 2899 5000

HK – Hong Kong
Tel: +852 2428 8008

IN – India, Mumbai
Tel: +91 22 6513 7081-85

JP – Japan, Tokyo
Tel: +81 (0)3 6408 3901

KR – South Korea, Seoul
Tel: +82 2 559 0400

MY – Malaysia, Shah Alam
Tel: +60 3 7849 0800

NZ – New Zealand, Mt Wellington
Tel: +64 9 574 1744

SG – Singapore
Tel: +65 6887 6300

TH – Thailand, Bangkok
Tel: +662 717 8140

TW – Taiwan, Taipei
Tel: +886 2 2298 8987

South America

AR – Argentina, Buenos Aires
Tel: +54 3327 44 4129

BR – Brazil, Sao Jose dos Campos
Tel: +55 12 4009 3500

CL – Chile, Santiago
Tel: +56 2 623 1216

MX – Mexico, Apodaca
Tel: +52 81 8156 6000

VE – Venezuela, Caracas
Tel: +58 212 238 5422