



# TECHNICAL PUBLICATION

## THE VALUE OF CORRECT SIZING - BEVERAGE

TP0032



### The Value of Correct Filter Sizing

#### Introduction

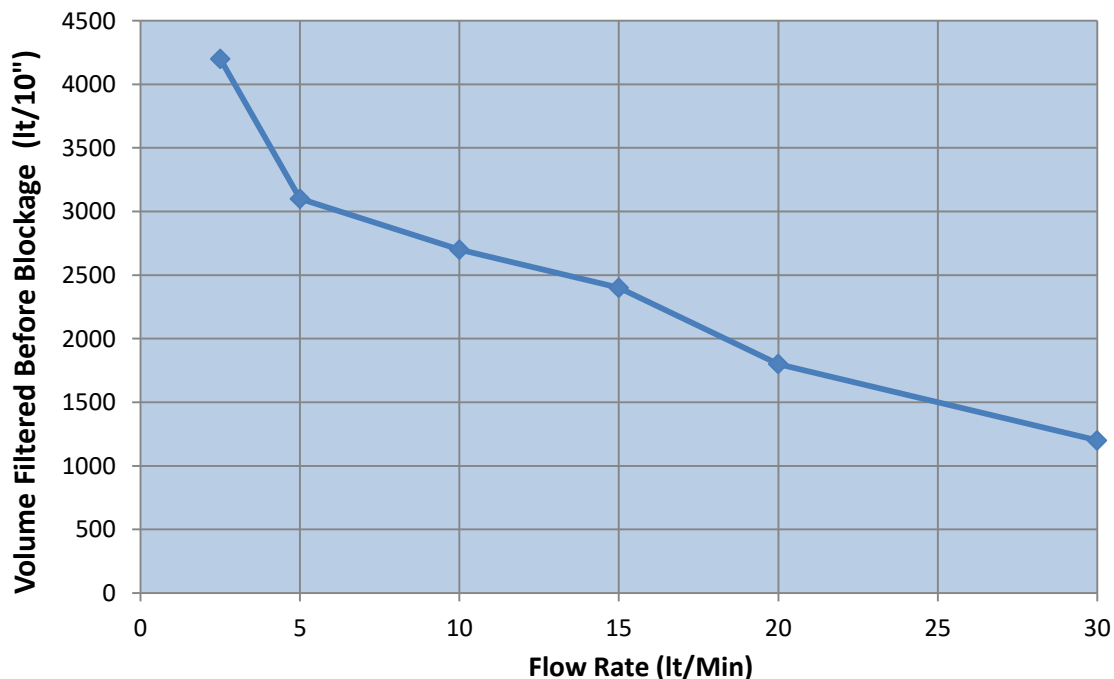
Sizing filters correctly is important to ensure filtration (and process operating) costs are minimised. Under-sizing systems will result in high initial pressure drops, short life and ultimately a disappointed customer.

The approach to filter sizing will differ depending upon whether the application involves long-term use of the filter or whether the filter is used short-term only – for batch processing for example. Failure to consider these differences will result in poorly specified systems and higher than expected (operational) costs.

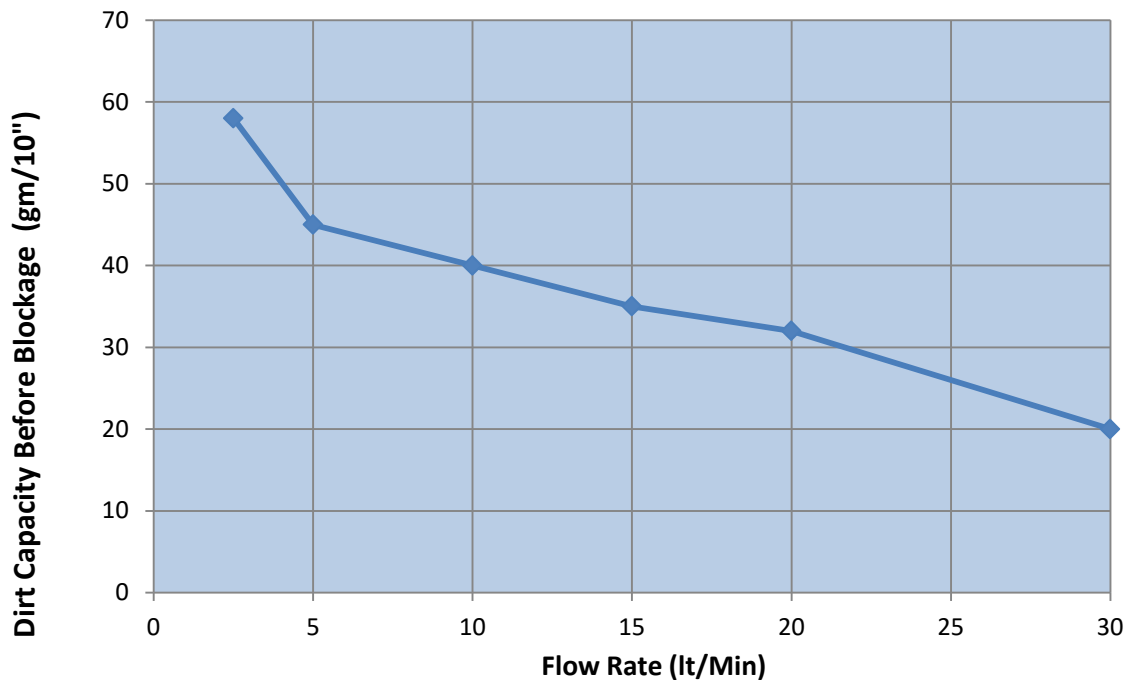
In applications where filters are used in long-term continuous processes it is essential to ensure the filters are not undersized. If the system is undersized to reduce capital costs, this will result in a high flux rate (unit flow rate per filter area) which will cause the filter to block prematurely and reduce throughputs. This will affect process efficiency thereafter as the filters will need changing more frequently. In addition overall filtration costs will increase, as large numbers of filter cartridges will be used. Maintenance time, increased process downtime and product losses are also consequential negatives of a poorly sized filter.

**Figures 1 and 2** demonstrate the negative effect on filter life that high flow rates can produce.

**Figure 1. Effect of Increasing Flow Rate On Volume Throughput Capacity**



**Figure 2. Effect of Increasing Flow Rate On Dirt Holding Capacity**



It is generally recognised that for a given flow rate, under-sizing the filter by a factor of 2 (i.e. a filter is selected that is half the size of what it should be) will decrease the life of the filter by a factor of 3 - 4. We can see from the example below that reducing the size of a filter system to cut installation costs will ultimately result in higher than expected running costs.

Size of Filter	Cost per Unit	Lifetime Before Change-out	Annual Operational Costs
20" Length	£100	1 month	£1200
40" Length	£200	3 months	£800

### Sizing Guidelines

Filtration systems can be sized on a number of factors including clean pressure drop, dirt loading, space limitations etc, but flux rate (flow rate) is the most commonly used criteria. Amazon Filters provides general guidelines on sizing filter systems based on flux rate, that takes into account the differences in types of filter design and removal ratings (see Figure 3).

It should be noted that this basic guidance cannot take into account specific (project by project) process attributes that require particular consideration, such as:

- Viscosity and/or temperature of liquid being filtered
- The level of contaminant challenging the filter
- Nature of contaminant e.g. solid or deformable material and/or organic/oil contamination

### Beer and Brewed Products

- Beer covers a wide range of products so these guidelines are for keg and bottled beers. Many beers are pasteurised to sterilise them, but if they do not do that, then we call it **cold stabilisation** when using our PES membrane
- Typically they will be looking for a 12 month shelf life and therefore a zero yeast count, however this does not apply to all breweries, many German beers will have a minimum yeast count, could be >10
- Trap filters will be seen first, 'green' beer will be sent for DE (Diatomaceous Earth - Powder) or sheet filtering and in many instances PVPP (Stabilisation)
- High flows will affect the beer and therefore influence the filters performance, generally fouling quicker than expected. A low flow will always result in the optimum performance.
- A smooth flow is also essential. High velocity, pulsating or, fluctuating pressures can and do affect filtration – potential release of fragile spoilage material or stripping of colloidal material
- Beers contain proteins and polysaccharides and therefore can appear 'sticky' – both of these materials can make filtration a challenge. Also yeasts and acid bacteria (lactic and acetic) will have an affect
- Check the various stages of pre-filtration (pre-stabilisation of bright beers – already clarified by powder or sheet filters), when filtering, we are generally presented with a "fined" and "clarified" product. **SupaPleat Plus**, and **SupaPore 16PPG/FPW** are a good choice where we are looking for bioburden reduction, or processing to the final packaging area
- Sterilisation of the bright beer prior to packaging should see the use of **SupaPore 16VPW** or **16VPWS** or where we have heavier beers, the double layer premium **16VPWA**

**Figure 3. Sizing Guidelines for a Range of Amazon Filters Cartridges for specified Beverage application:**

Filter Service	Filter Type – Pleated or Depth	Max. Recommended Flux (lt/hr/per filter length)
Beer	Depth – <b>SupaSpun II</b>	100-250lt/hr/10"
	Pleated – <b>SupaPore PPG/XPG</b>	400-600lt/hr/10"
	Pleated - <b>SupaPore FPW Series</b>	300-600lt/hr/10"
	Pleated – <b>SupaPore VP Series</b>	200-400lt/hr/10"

### Wine or Fermented Products

- As you can imagine, a wider range of fluids you can ever imagine but they all have a basic end point, shelf life (and taste!)
- White Wine – The easier of the two, a relatively straight forward product where pre-filtration is key. The membrane is the last line of defence before packaging and should be the most straight forward to filter, if this blocks then we haven't got the pre-filtration right
- Red Wine – Tends to have higher sugar tannin levels making them more resistant to spoilage (white wines tend to be less resistant)
- Pre-filter grades can in many instances, act as final filters depending on the clients' expectations regards shelf life and flavour. They may be looking for simple bioburden reduction rather than complete elimination
- Final Membrane selection can be from any of the **SupaPore 16VPW** range with a focus on **16VPWS**. Micro-organism or spoilage material will determine the pore size but generally 0.45µm with some on 0.65µm. Flow rates do not need to be that conservative **IF** we pre-filter correctly
- **SupaSpun 04PP003** and **04PP001** or **SupaPore 16FPW** (grade matched to membrane) are ideal pre filters but the individual client will have their preference on this
- Red Wine – can be more challenging but in some instances may not require final membrane filtration, SupaSpun 04PP and SupaPore 16PPG or 16FPW will suffice, however where membranes are required 0.8-0.45µm is common

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Filter Service	Filter Type – Pleated or Depth	Max. Recommended Flux (lt/hr/per filter length)
Wine	Depth – SupaSpun II	100-250lt/hr/10"
	Pleated – SupaPore PPG/XPG	400-600lt/hr/10"
	Pleated - SupaPore FPW Series	400-700lt/hr/10"
	Pleated – SupaPore VP Series	500-900lt/hr/10"

### Mineral Waters

- An easier fluid than the Beer and Wine discussed above, but careful understanding of the source of the water and any prior processing will help. Generally all products will be suitable but your combination will still be important for the optimum life.
- Mineral waters generally need to be filtered (when permitted) to 0.2µm so that the product is stable for consumer protection and shelf life
- Ideally any membrane will work – so what are their expectations?
- **SupaPore 16VPWS** is the ideal product. A strong and robust membrane with the ability to withstand multi sanitisation regimes
- SupaPore **16XPG** or **16PPG** is the ideal pre-filter but the train of filtration often seen will be variable (**SupaPore 16FPW's** are **not** common)

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Filter Service	Filter Type – Pleated or Depth	Max. Recommended Flux (lt/hr/per filter length)
Mineral Water	Depth – <b>SupaSpun II</b>	200-500lt/hr/10"
	Pleated – <b>SupaPore PPG/XPG</b>	600-1200lt/hr/10"
	Pleated – <b>SupaPore VP Series</b>	500-1200lt/hr/10"