

# Choosing the Best Filtration Method for Your Liquid Processing Application

*[Clockwise from top left]* Hundreds of filter cartridge options available from Eaton Filtration. New Flowline II™ makes it easy to changeout filter bags. Accuflux™ filter for maximum surface area in self-cleaning systems. New Unibag™ utilizes welded construction and recycled materials.

**S**electing filtration equipment is the combined result of many considerations. In addition to removing undesirable material from a liquid stream, the filtration method selected must also satisfy other requirements. Installed costs must be weighed against operating costs. Waste disposal costs must be considered. Is continuous flow a requirement of the application, or can the filtration equipment be operated intermittently? Is worker exposure to the process liquid during filter cleaning or replacement a problem? These and other factors must be weighed when choosing the right filtration method for a particular application.

The products being removed from a liquid process stream are as widely variable as the types of filters designed to remove them. Products being removed in potable water treatment applications are often molecular in size. However, many other filtration applications are concerned with the



Graded density bag filters provide high dirt holding capacity for less frequent changeouts.

removal of specified trace solids from a liquid process stream. Surface-type filters using fibrous cartridges or mesh screen made of woven wire or fabric are often used in these applications. This article will focus on the removal of these trace solids, rather than the entire scope of liquid filtration.

## Filtration Methods

There are three basic filter types to consider when specifying a liquid processing filter; bag filters, cartridge filters, and clean-in-place (CIP) filters. Each one has advantages and disadvantages when compared with the others, and the different types are appropriate for different applications.

CIP filters are typically most appropriate for applications where flow rate are high, filter media replacement costs are high, or exposure of the process liquid to workers or the environment is undesirable. They can be used to remove suspended solids of approximately one micron and larger for all types of liquid process streams. Bags and cartridge



The QMC cartridge is one of dozens of filters available from Eaton Filtration. It features 12.5 ft<sup>2</sup> of surface area and can trap particles as small as 0.1 microns



Eaton Flowline II™ Single bag filter housing

filters can both remove suspended solids for applications with lower flow rates, where exposure to the process liquid is not a problem, and where lower volumes of solids must be removed. Bag and cartridge filters are roughly equivalent in price, while CIP systems tend to cost more initially. However, users should consider the total operating costs of a filtration system, not merely the initial purchase

price. Media replacement and disposal costs, labor costs, and downtime should all be included when evaluating filtrations systems.

Bag filters may be the most appropriate choice in some situations. For small batch applications, the cost of a large CIP system is not justified. In this type of application, bag replacement would be so infrequent that disposal costs are not a significant factor in deciding which type of filter system to select. Bag filters also generate less solid waste than cartridge filters, so they may be appropriate in situations where users want to minimize the waste volume (especially when it is hazardous waste).

High Flow MCS uses magnetically coupled, self-cleaning actuation.



Also, in situations where a cartridge filter user wants to convert to a CIP system but cannot for whatever reason, bag filters may provide a compromise solution. Bag filters generate 10-15 times less solid waste than cartridges, and they require less labor for media changeout. Plus, some bag filters can be cleaned and reused, lowering waste and disposal costs even further. Bag filters can also be used in conjunction with CIP filter systems when processors want to recycle the waste liquid containing the solid contaminants. Installing a bag filter in the waste line removes contaminant from this fluid and allows it to be recycled back into the process.



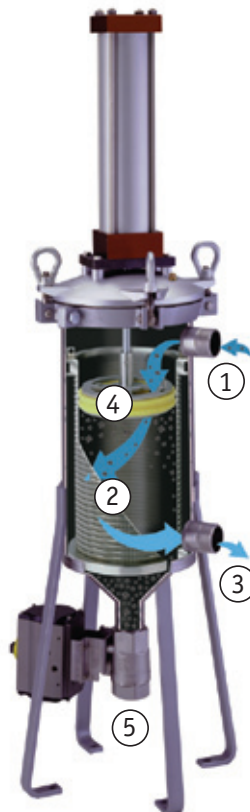
Eaton Maxiline™ vessels holds up to eight filter bags.

Multi-bag and multi-filter units can accommodate higher flow applications. Multi-bag units provide longer run times between bag changeouts, while some multi-filter units provide continuous operation by sequentially taking individual filters off-line for backwash cleaning while the other filters continue operating.

## Factors to Consider

- When selecting a filter for a particular application, the following criteria should be considered:
- How large is the process volume? What is the flow rate?
- Is it a continuous or batch process?
- What are the material characteristics of the solids being removed? (How large are the particles? Is the material hazardous? Can the material being removed be recycled back into the process stream at another point?)
- What are the waste disposal costs? How often do bags or cartridges need to be replaced? Can the waste volume be reduced or eliminated by switching to a different filtration method?
- What are the labor and downtime costs for filter or cartridge replacement? Can downtime be minimized by switching to a different filtration method?

Disposal costs for used bags and cartridges are generally about half of the purchase price. And with hazardous liquids, disposal cost can easily exceed the purchase price. When comparing a bag or cartridge filtration system with a self-cleaning system having permanent, fixed media, these disposal costs should be included in the comparison.



In a typical mechanically cleaned filter unit, incoming fluids (1) are channeled from the interior cylinder through a wire screen (2) to the outer cylinder and out the discharge port. (3) A cleaning disc (4) travels inside the cylinder to periodically clear the filter screen. Particles are collected at the bottom of the housing where they can be discharged (5).

## Advantages of Upgrading/Adding More Filtration

Many processors consider upgrading existing filtration systems or adding new filtration systems an unnecessary expense. This is understandable, since the solids in process fluids only occasionally cause catastrophic failures. However, the hidden costs created by contaminants are significant, while the cost to filter and remove them is modest and can be recovered quickly. Here are some examples of situations where significant benefits can be achieved.

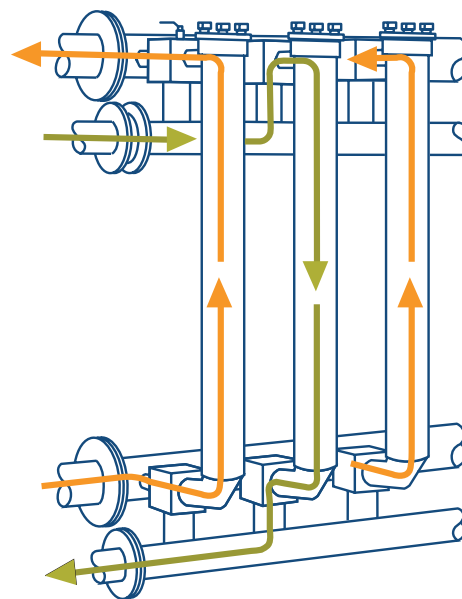
- In paper making and other process applications, many processors are incorporating pre-filters upstream of expensive membrane filtration systems. The pre-filter, typically either a bag or CIP filter, removes suspended solids that could prematurely foul or damage the membrane system.
- Adding a filtration system before a liquid passes through spray nozzles offers several benefits. Filtration prevents solid particles from reaching the nozzles, preventing unnecessary wear on the nozzles. Removing solid particles also prevents passage of debris through the nozzles and into the process or on the products. Spray patterns and process quality are improved and defects are reduced.
- A knife manufacturer was able to use well water instead of city water to cool their molding machines by adding a stainless steel CIP filter. In order to make the switch, the well water had to be filtered to a level as clean as or cleaner than the city water. The CIP system met the company's water cleaning requirements and allowed them to save \$25,000 annually in city water costs.



Eaton Maxiline bag filter vessels are designed for flow rates up to 4400 gallons per minute—excellent for pre-filtration protection of downstream equipment and process integrity.

- In plastic molding and extrusion operations, cooling water readily picks up small plastic particles, lime scale, and airborne particulates, especially if the cooling water is kept in a central sump. Removing suspended solids from this cooling water results in decreased maintenance,

downtime, equipment wear, and utility costs. Consequently, cycle times and production rates remain high while rejects are minimized.



Multiplex backwashing systems provide continuous operation while require almost no maintenance. During backwash, (green arrows) a single tube is taken off-line from the process flow (orange arrows) via a three-way valve. Once an element is clean, it is returned to service and the next element may be cleaned. The remaining elements in the filter remain operational throughout this cycle. Backwashing can use an external fluid source (shown) or the normal process stream.

- A virgin plastics manufacturer was using a cartridge filter system to remove unreacted organic perester from the final product. This will result in two costly problems: (1) cartridges had to be replaced and disposed of daily, and (2) unreacted and costly perester was being thrown out with the cartridges. The company switched to a self-cleaning filter and solved both problems. When the filter screen becomes plugged with perester, the media is backwashed with water. The cleaning water and unreacted particles are fed back into the process stream, and there are no cartridge disposal costs.

Careful consideration when choosing a liquid filtration system will offer numerous potential benefits. A wise filter selection can minimize process downtime, reduce or eliminate waste disposal costs, limit worker exposure to the process liquid, reduce maintenance time and expense, and improve product quality. Therefore, it is important to review all the available filtration options and identify potential areas where adding or upgrading filtration can provide cost savings. ■

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