Automatic Filtration System Designs

3 basic types of automatic filtration systems, strengths and limitations of each

By: Chris Pasquali, CEO Factory Direct Pipeline Products, Inc.

Automatic filtration systems are designed to reduce manual labor associated with cleaning and replacing strainer screens and disposable filter media. They employ one of 3 methods to purge retained particulate from the piping system without the need for personal intervention: ① Flushing, ② Backwashing and ③ Mechanically Cleaning.

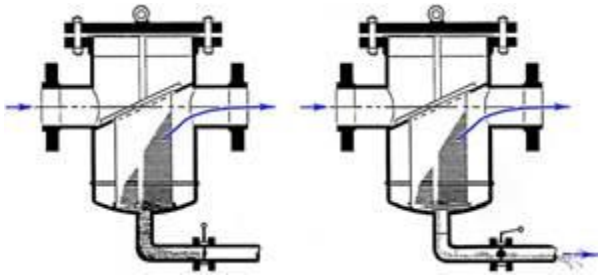
Automated filtration systems can be used to maintain a consistent flow rate and pressure for a given process. In some cases, implementing automation reduces personal exposure to hazardous liquids, although it is also advantageous if the particulate removed is valuable or to be used in another process.

Flushing, as Mr. Barnard said "a picture is worth a thousand words", so yeah, this is pretty much how a flushing strainer works. Actually, the first type of flushing strainer was the "Y" strainer patented in 1913; in addition to the inlet and outlet connections, Y strainers have a connection (drain port) under the internal screen. When the drain port below is opened, the differential pressure of the system vs. atmospheric (for example) results in high velocity flow through the drain port, "flushing" retained particulate entrapped within the screen. Refer to our article about Y strainer designs for illustrations. (https://fdpp.com/articles/Y-Strainer-Design.htm)

The reason this works for Y strainers and not standard simplex strainers is because a Y strainer element is opened at its bottom, allowing for material to be purged through its drain port.

Y strainers have some limitations with regards to how well their screens seal and thus how fine of a particle they can retain. In addition, their straining ratio is typically 1:1, so they are designed for system protection and not continuous separation of particles.

Simplex basket style strainers provide a much higher screen open area (straining ratio) and they are made by modifying the internal basket so that it does not have a bottom and to enable it to seal against the bottom of the strainer chamber, right above the chamber drain port. Attach a valve to the drain port and when it is opened the material within the strainer screen will flush-out down the drain. As with Y strainers, you can install a manual or actuated ball valve to initiate flushing. Actuated ball valves can be set to cycle based upon sensed differential pressure, timer or manual override.



This type of automatic filtration system has limitations:

A. If the retained material is gelatinous, soft, stringy or otherwise imbedded within the strainer mesh, it will likely resist flushing, thus eventually some manual cleaning might be required.
B. Simplex strainers are limited to approximately 50-micron retention, thus not suitable for finer filtration levels

Flushing strainers are manufactured from modified carbon steel or 316SS castings or custom fabricated to accommodate higher open area filtration ratios.

If you are on a budget, have a high flow rate water application and are mostly requiring separation of hard particles >50 microns in size, a flushing strainer is a cost-effective design worth considering.

Backwashing refers to the reversal of flow through the filter element, thus not only flushing out the particulate within the element chamber but also embedded within the mesh of the element itself.

This type of filtration system can be subdivided into two distinct styles based upon the fineness of particle retention required: backwashing strainers and backwashing filters. "Strainers" infer a coarser level of retention (74 - 6350 microns) and "filters" (1 – 1650 microns). Both the strainer and filter designs operate on a similar principle, the drain port is opened and the difference between system and drain port pressure results in sweeping retained material through the drain. The key design feature compared to flushing style strainers is that the purged flow passes through the element, helping to dislodge particles which may be imbedded within the filter media.

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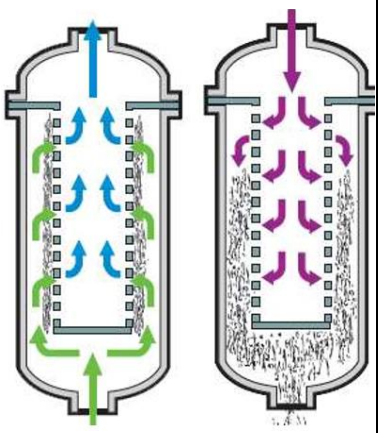
Backwashing Strainers have an internal structure which rotates within the dirty side of the element, one end is shaped as a suction nozzle and the other is connected to the drain. When the drain valve is opened the suction nozzle sweeps across the ID of the element and some of the filtered process liquid is "sucked through" the element and into the suction nozzle. The suction nozzle is positioned very close to the surface of the element and its shape and rotation helps break-up larger contaminates such as twigs which might be entrapped in the strainer element. Their design and operation are described in detail online at https://automaticstrainers.com/back-flushing-strainers/back-washing-strainers.html. Their filter elements are typically fabricated from perforated stainless steel or slotted wedgewire.

Backwashing Filters offer a finer level of particle retention, the media used for backwashing filters are commonly SS mesh (2-1650 microns), slotted wedgewire (25-1600 microns) and fabric mesh (1-230 microns).



This style also temporarily reverses the flow through the element however relies on a diverting valve installed on the inlet port to enable periodic diversion to drain. These are illustrated and explained in detail online at https://automaticstrainers.com/tbf/tubular-back-washing-filters.html.

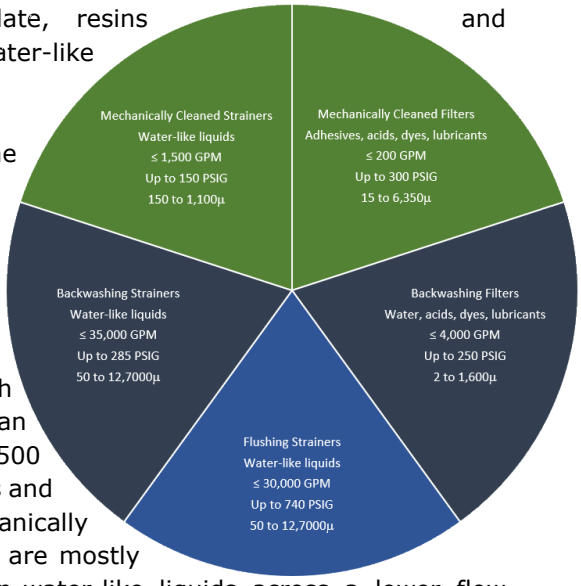
Although the retention levels of both backwashing filtration systems overlap, the backwash strainers are almost exclusively used for water systems due to the volume of liquid used during the 5-minute backwashing cycle and they are also typically applied to high flow rate applications (up to 35,000 GPM) whereas backwashing filter systems are limited to <4,000 GPM.

Whereas backwashing strainers are not designed for viscous liquids, backwashing filter system can be utilized for viscosities up to 50,000 CPS.

Mechanically cleaned systems fall under two sub categories, "strainer" and "filter".

Both styles utilize a similar physical "scraping" method to clean retained particles from the internal element. A cleaning disc consisting of (4) spring loaded quadrants apply consistent pressure against the element even as the abrasive resistant disc material wears. The disc is cycled at a user set rate, such that it frequently pushes retained particulate downwards and into a purge chamber. The frequent sweeping across the element contributes to a consistent system differential pressure. Purging of the particulate slurry within the purge chamber occurs when the attached drain valve is briefly actuated; this very brief actuation, lasting a fraction of a second, is sufficient to purge the material to a drainage header, waste bin or wherever it needs to go.

The strainer versions have a particle retention range of 150 to 1100 microns and are designed for water-like liquids. The filter versions have a retention range of 15 to 6350 microns and due to the way their cleaning discs are actuated, they are suitable for a variety of non-lubricating and viscous liquids, ranging from adhesives, syrup, chocolate, resins and certainly water-like liquids.



Thus, the mechanically cleaned strainers are designed for water and water-like liquids with sizes that can handle up to 1500 GPM flow rates and the mechanically cleaned filters are mostly applied to non-water-like liquids across a lower flow range, in the neighborhood of 5 to 200 GPM.