

Bag Filtration in HVAC Applications

Next to the threat of fire, severe corrosion and fouling of HVAC piping systems, and their related equipment, presents the most potential for loss to any private, industrial, or commercial property. It is common to find systemwide corrosion rates of 5 mils per year (MPY) and occasionally as high as 20 MPY, whereas corrosion rates of 1-2 MPY were typical only two decades ago.

A number of factors have contributed to the increase in corrosion rates over the past 20 years, including the use of inferior grade imported steel piping. However, none have adversely affected piping systems like the 1980s ban on chromate corrosion inhibitors. That ban removed the most effective chemical protection available for piping systems. Although available water treatment chemicals can be very effective when used properly, they tend to be more dependent on the relative cleanliness of the entire piping system.

It may be obvious that severe corrosion can cause leaks and catastrophic problems in a building's piping system, but also causes a high level of debris in the pipe such as high head pressures, loss of flow, increased energy consumption, and frequent servicing of system equipment. Until recently, however, corrosion monitoring was not a high priority for building owners and plant operators.

Traditional Filter Solutions

In HVAC piping systems, filtration keeps the cooling water free from debris and the pipes clean. Traditionally, filters were used on open cooling loops to remove the debris picked up during the cooling water's passage through an open cooling tower. This debris mainly consists of airborne dirt, dust, and organic matter and is effectively removed by automatic sand filtration.

For years, sand filters and other types of automatic backwashing filters have generally provided low maintenance to HVAC systems. Usually, sand media doesn't have to be changed more than once a year and when systems are set up for automatic backwash they will not require an operator's daily maintenance.

Why Bag Filters Offer Much More

In recent years, bag filters have seen greater use in HVAC piping systems due to their



One #2 DURAGAF filter bag with collection of iron oxide "chip scale"

simple effectiveness and their significantly lower cost in comparison with alternative automatic backwashing systems like sand filters. One reason is that sand filtration cannot easily remove particles that have a higher specific gravity than the sand media itself. The typical iron oxide chip scale and corrosion debris that causes the biggest problem in today's HVAC piping systems cannot be backwashed out of sand filters.

The result, sand media loads up with large amounts of iron oxide debris and quickly needs replacement.

Why Eaton Bag Filters are the Best Choice

Eaton bag filter systems offer a superior alternative to sand filtration in HVAC applications because of the following advantages:

- The increased available surface area effectively removes large amounts of corrosion debris while handling much higher flow rates than sand filters.
- A wide selection of different micron ratings provides for progressively finer filtration.
- Bag filters have a much smaller footprint—they take up a fraction of the space that sand filters use. This can be a critical point in a crowded equipment room of a large commercial property.
- Bags filters do not require electricity to operate.
- Bag filters do not require backwash water, resulting in low operating cost. In certain areas of the country, of course, the cost of water is not the main issue—it is the simple availability of that precious resource. A sand filter can use up thousands of gallons of water per day on backwash alone, whereas a bag filter doesn't waste a drop.
- Bag filters have a much lower installed cost than sand filters.

Eaton Offers a Variety of Bag Filter Solutions

Eaton bag filters are available in a number of designs and configurations to solve HVAC filtration problems. Eaton standard vessels are 150 psi rated and available in single bag and duplex models as well as multi-bag versions in 3 to 24 bag configurations. Because buildings more than 30 stories require high-pressure vessels, Eaton also offers 300 psi rated filters and can even design custom bag filters for up to 700 psi.

Eaton has the best designed single and multi-bag systems currently on the market. The unique low-profile design utilizes a special tangential outlet that keep the height of the vessel down—making for easy and safe change outs. Spring-assisted hinge makes it safer and easier than ever before to change a filter bag, and the quick closure models can open or close in under 20 seconds.

Placement of Filter

In HVAC applications filters typically do not handle the full flow of the system, but connect in a side stream configuration where they act like a "kidney loop," filtering 5 to 10% of the total system flow rate.

Depending on the total volume of cooling water in the system, this equates to a full system turnover rate of 5 to 20 times in a 24-hour period. Initially, because the solids loading in the system may be quite high, it is a good idea to start by installing filter bags with 100 or 200 micron ratings and gradually reduce the micron rating until the visible clarity of the water improves. Pipe scale and other debris tend to collect in the lowest part of the HVAC return piping system, which is where Eaton recommends installing the filter. This ensures collection of the greatest percentage of dirt and debris.

Because extending the time between filter bag change-outs saves money in filter costs and labor, Eaton's DURAGAF™ Extended Life filter bags are



Filter Package with Pump and Control Panel

Bag Filtration Vs. Sand Filtration

	Bag Filter	Sand Filter
Equipment	One eight-bag Eaton filter vessel rated at 960 gpm	Seven 36" units rated 140 gpm each
Purchase Price	Approximately \$15,000	Approximately \$7500 x 7= \$52,500
Installation Cost	Approximately \$8,000	Approximately \$100,000
Electric	None	230 volt/3 phase
Backwash	None	900 - 2700 gpm for 5 min.
Drain required	No	Yes
Filtration area	36 sq. ft.	50 sq. ft.
Footprint	8 sq. ft.	24 sq. ft. x 7= 168 sq. ft.
Micron size	Can be varied as needed	Fixed
Removal of Iron particles	Excellent	Difficult since iron particles do not backwash easily
Cost of maintenance	\$8.00 per bag. Easily disposed	Media replacement \$2000 per vessel. Major maintenance project.
Media loss into system	Will not happen.	Can occur, resulting in fouled heat exchangers.
Incubator of bacteria	No.	Yes, incubation is major problem
Automatic operation	Duplexing available with actuation and valving but normally not needed	Standard

a very good choice. Their increased dirt holding capacity means the bags can last as much as 5 times longer and cost less to use. They are available in 1 through 100 micron ratings.

Eaton also recommends the optional LOFNETIC™ Magnetic Insert accessory for increasing the dirt collecting capacity of filters in HVAC systems.

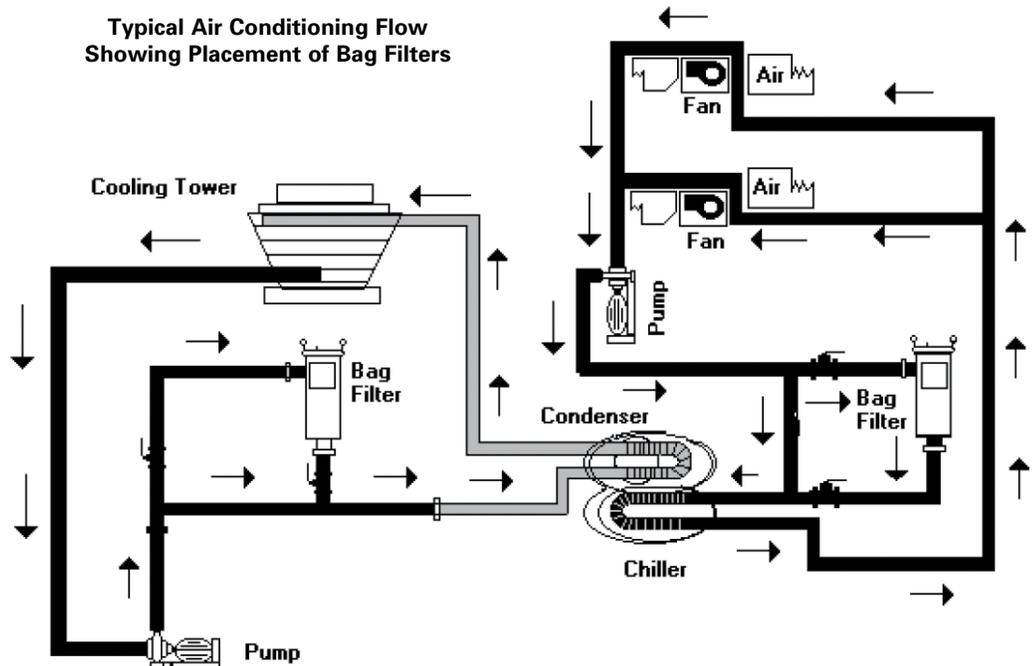


LOFNETIC Magnetic Inserts

Magnetic inserts can increase the dirt holding capacity of bag filters dramatically because iron oxide particles make up most of the debris in HVAC piping systems. LOFNETIC inserts use 9300 gauss rare earth magnets, which are the most powerful non-electric magnets available for industrial use. Rare earth magnets have a 20-year or more life expectancy.

Bag filters in HVAC applications are extremely versatile. Initially using a basket strainer without bags is an option. They also may be used as bypass or "pot feeders" for adding water treatment chemicals, even when bags are in use. While sand filters generally have problems with excessive media fouling during chemical cleaning operations, bag filters work very effectively when used with cleaners or dispersants.

Typical Air Conditioning Flow Showing Placement of Bag Filters



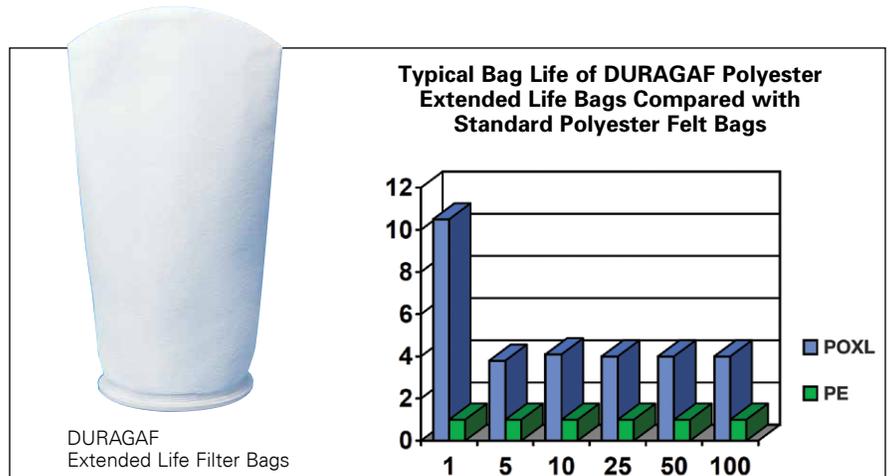
Debris removed from one Eaton filter using magnetic inserts and DURAGAF bags



Duplex cart system on new building start-up, Times Square, NY



Eight bag Quick Closure vessel cooling loop, Penn Plaza, NY



DURAGAF Extended Life Filter Bags

Application Report: Bag Filtration in HVAC Applications



Lofclear
Oil removal
and gels



Hayflow
Up to 5 times the
life of standard
bags



Duragaf
Up to 3 times the
life of standard
bags



Unibag
Efficiency with
an economical
advantage

The FLOWLINE II™ is perfect for operations not requiring continuous flow. Its unique one-piece body design is rated for 150 psi. It is available in several configurations.



MCS-1500 is perfect for high-capacity straining. Magnetically coupled actuation allows for quick and easy access for maintenance, reduces potential leaks, and requires few moving parts.



Model 2596 Automatic Self-Cleaning Cast Pipeline Strainers provide continuous flow, simplified maintenance, and worry-free operation



PROLINE 100™
Series SE with
8 bag capacity



Eaton 300 psi rated duplex filter cart system

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