

## Tech Talk - Filters Part 1 of 3

On the surface, the subject of filters may not seem like an exciting topic. However there are an amazing number of filter types and applications, and having a basic understanding of where and why different types of filters are used could be helpful.

Filters generally fall into two broad categories; those designed to remove particulates, and those designed to remove gaseous contaminants.

Particulate filters are rated on their ability (efficiency) to remove particles of a known size from an air stream. The two most common rating scales are ASHRAE 52.1 Dust Spot Efficiency and the DOP efficiency rating (MIL-STD-282). Most filter manufacture's quote ASHRAE 52.1 efficiencies. The "dust" particulates removed by these filters are actually a combination of dry particulates including smoke, mold spores, pollen, soot, insect parts, dirt (including man-made products such as concrete, brick, etc.), skin and hair.

The most common filters are "fibrous media filters" (including those cheap furnace filters you use at home – great for removing rocks and birds from the air stream). Dry media filters trap particulates in multiple layers of spun fiberglass, open cell foams, synthetic or natural textiles or even animal hair. Another common media is the expanded metal screen filter. Spraying a fine film coating of oil on its surface

See Tech Talk page-2

## Snohomish County Administration Building



Photo provided through MA Mortenson, by Soundview Photography

PSF recently started work on the Snohomish County Administration Building project in Everett. Although it doesn't look like much yet, the new building will be the new home to many of the people who help run Snohomish County. In addition to the new building, the existing facilities are also being upgraded and remodeled.

The Administration building is part of the Snohomish County Re-development Initiative project, which includes the new jail, parking garage and the administration building. Project completion and turnover is scheduled for early 2005. The new jail was topped out a few weeks ago. We intend to stay out of the facility once it's completed!

Currently, the new administration building core is clearly visible, with the floors and skin soon to follow.

**General Contractor:** MA Mortenson  
**Prime Mechanical:** WA Botting  
**HVAC:** PSF Mechanical  
**PSF Team:**

Project Manager  
Amy Roberts



Field Foreman  
Randy Nau



### In This Issue:

Tech Talk - Filters .....	1,2
Snohomish County Administration Building .....	1
VMC - The Evolution of a Building .....	3,4
Four's Company .....	3
Summer Projects .....	4

## Tech Talk - Filters Part 1 of 3 -Cont..d-

often enhances the metal mesh filter's efficiency. When coated, this type of filter is technically referred to as a "Viscous Impingement" filter.

"Viscous Impingement" filters are basically standard dry fibrous media filters with a fine coating of oil added. The oil enhances the dust trapping ability of the filter. Incidentally, for those of you with high performance intake systems on your hot rod, motorcycle, snowmobile, etc. (such as the K&N systems), these are typically of the "Viscous Impingement" variety.

Increasing filter efficiency without taking up large surface areas is achieved by adding pleats (folds) to the filter surface, with higher efficiency filters gaining depth rather than width or height. For example, a "standard" low-efficiency flat filter at 24" x 24" x 1" deep may be upgraded to a 25% "medium efficiency" pleated filter of the same dimensions. Greater filter life and/or lower pressure drop may be obtained by increasing filter depth to 2" (or even 4"). As filter efficiency rating increases, media construction changes and surface area (via pleat depth) also is increased.

With "very high-efficiency" filters it becomes necessary to add special frames and seals to prevent unfiltered air from bypassing the filter. In the case of filters used to remove hazardous particulates (such as a radioisotope exhaust hood), airtight bagging systems are used to contain

the dirty filter upon removal (referred to as a "bag-in, bag-out" filter station). These "very high-efficiency" filters are often referred to as HEPA (High Efficiency Particulate Air) filters or ULPA (Ultra Low Penetration Air) filters.

There are also filters that use electrical charges to remove particulates from the air stream. These fall into two broad categories, electret (or electrostatic) and electronic. Electronic air filters use a property called "electrostatic precipitation" to collect particulates, and are particularly (pun intended) efficient at removing pollen, smoke and dust. The air stream is passed over a positively charged wire grid, then a grounded series of plates. As the particulates are passed over the wire grid they receive a positive charge. As we all remember from our school days, opposite charges attract, so as the air passes over the grounded plates the particulates are stuck to the plates by the charge. Eventually the plates become loaded (reducing efficiency) and must be washed. These filters may be used indefinitely, as long as they are washed frequently. Electronic air cleaners are capable of producing ozone gas. Under the right (wrong?) conditions, this gas production can lead to degradation of rubber, paper and other products. In addition, the gas is considered toxic, and can cause symptoms such as scratchy or sore throats (ozone irritates the mucous membranes in the throat and lungs). A clear indication of excessive ozone is a "bleach" smell, more noticeable in humid or rainy conditions.

Electrostatic filters have been around for years, and are often viewed with a bit of suspicion. After all, how can a filter with no power source use electrical charges to collect dust? Electrostatic filters are manufactured with electrostatically charged materials; typically resin wool, electret and an electrostatically sprayed polymer. The efficiency of these type filters is due to

the normal collection characteristics of a media filter (as with a standard filter) and the added benefit of the strong electrostatic fields in the filter media. Initial loading is enhanced. However, as the filter loads up the electrostatic effect is reduced.

Next issue, we'll take a look at filters used for removing gaseous contaminants from the air stream.

### Fun filter story:

Several years ago, a local prominent architectural firm had a small air quality problem. Every morning, the employees would arrive to desks and work surfaces covered with a very fine film of "soot". Surely the culprit must be a local smoke stack or exhaust outlet? Upon investigation, it was quickly discovered that the building's HVAC system design made no provisions for filtering outside air. Clearly the source of the "soot" was from the unfiltered air. Quickly, modifications were made to add filters, the duct systems were professionally cleaned and the building restored to "clean as a whistle" condition.

A sample of the offending "soot" collected from the duct cleaning process was retained (actually a whole garbage bag full), to be analyzed by a local laboratory. The result of the investigation?

### Contents:

- \* Cement dust – assumed from local construction projects (airborne).
- \* Fiberglass (green, blue & yellow – how pretty!) – assumed from liner, filters & equipment cabinet housings.
- \* Feldspar, calcite and quartz (common natural minerals).
- \* Fibers including synthetics (carpet?), hair and insect parts (that always impresses people).
- \* Soot (just enough to give everything a nice black color).

The coups de grace?

Tire rubber (so where do you think it goes? After all, you don't see big piles of rubber along the freeways do you?)!



## VMC - The Evolution of a Building

From the outside, the VMC Consulting Corporation building looks like a static building, unchanging. On the inside, it is a different story. The building is constantly changing to meet the demands of its tenant.

The building started out as a standard office building, built for the Quadrant Corporation at their Willows Corporate Center in Redmond, Washington. When

Water Source Heat Pumps have been added, a new fan powered VAV terminal has been added, and upgrades to the existing system are taking place. Perhaps the most interesting part of the upgrade is the optimization of the control system to minimize energy use.

Previously the water source heat pumps had been connected directly to the outside



VMC, a software testing and consulting company, took over the building (circa 2000), PSF was hired to install a water source heat pump system (with a fluid cooler to provide the water) to serve the computer labs vital to VMC. Along with the heat pumps, a Dedicated Outside Air Only system was provided to deliver ventilation air to the labs, eliminating the need for each lab to have openings to the outside.

Through the years, VMC has made some minor changes to the building HVAC system to accommodate the changing needs of its business, but has now found itself having growing pains and needing a major upgrade. VMC, along with building owner Zetron Properties and consultant Chamberlain Mechanical tasked PSF and Foushee Construction to provide improvements to the building.

The improvements include adding new Software Testing Labs, a conference room, and general facility improvements. New

air unit, receiving a constant volume of outside air. That forced the Outside Air unit to process a constant volume of outside air regardless of need. The Testing Labs have a highly variable occupancy rate, sometimes sitting vacant, sometimes crowded with up to thirty people. Modern building codes require that the ventilation rate meet the requirements of maximum occupancy at all times, unless the outside air system has controls to adjust the ventilation rate automatically, known as Demand Control Ventilation.

Processing outside air makes up a large part of the Air Conditioning load on a building. If the outside air load can be reduced, it translates directly to energy savings. With that in mind, PSF is upgrading the Outside Air Only system to a Demand Control Ventilation System. To accomplish that, the Outside Air Only System is being outfitted with a Variable Frequency Drive (VFD), which allows the

See VMC page-4

## Four's Company

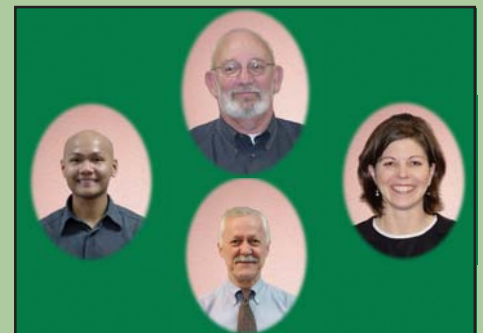
PSF recently added a dose of horsepower to our staff.

**Ron Marson** came to PSF just a few months ago. Ron began his mechanical career in 1967 as a draftsman. Over the past 37 years Ron has participated in a great variety of projects, including the Key (Gateway) Tower 60 story high-rise and the King County Aquatics Center in Federal Way. Ron traveled a long and interesting route since those early days. He brings a high level of experience and developed maturity that nicely augments our engineering group, sales and marketing efforts.

Coinciding with Ron's addition, **Ricky Guevarra** started at PSF as a CAD technician. Ricky brings a fresh dose of enthusiasm and talent to our CAD team. Ricky holds an Associate of Applied Sciences certificate in CADD from ITT Technical Institute and has three years experience.

**Amy Roberts** joined PSF as a skilled Project Manager. Her most recent projects prior to coming to PSF were the Tulalip Casino and NSR Gatehouse & Gardens projects. Amy's primary focus has been on the management of construction projects. She holds a BS in Industrial and Management Engineering from Montana State University.

Just recently **Joe Dorman** joined PSF as a senior level Project Engineer. Joe has over twenty-five years experience in the mechanical engineering field, specializing in HVAC, plumbing, fire protection and energy management systems for industrial and commercial projects.



Clockwise from Top: Ron Marson, Amy Roberts, Joe Dorman, and Ricky Guevarra

## Summer Projects

The following are projects that PSF will be working on this year:

### ***Snohomish County Admin. Bldg.***

- Scope: Plan/Spec Office Bldg.
- GC: MA Mortenson
- PSF PM: Amy Roberts

### ***ICOS Lab Modifications***

- Scope: New Laboratory Expansion
- Architect: SABArchitects
- GC: BN Builders
- PSF PM: John King

### ***Boeing Frederickson T-12 Tank Expansion***

- Scope: Modify T-12 Tank Line
- GC: BMWC
- PSF PM: Walt Clear

### ***Xcyte Bothell***

- Scope: New Laboratory Construction
- GC: Lease Crutcher Lewis
- Architect: NBBJ Group
- PSF PM: Amy Roberts

## VMC - The Evolution of a Building -Cont..d-

unit to vary the air volume it processes. To accommodate the varying airflow, each Water Source Heat Pump is fitted with a VAV terminal on the outside air only supply duct. The VAV terminals vary the amount of outside air supplied to the heat pumps in response to Carbon Dioxide sensors located in their respective spaces. The more people in the space, the higher the Carbon Dioxide will read, and the VAV terminal will open to deliver more outside air. Control is accomplished through the existing Trane Energy Management Control System (EMCS), which was installed during the original construction. It pays to remember that modern building EMCS systems can do a lot more than just turn lights on and off.

This project requires some adaptation, on the part of the construction crew also. VMC needs to be able to continue working during construction. Their clients demand

secrecy, so the labs in use are off limits to the construction crews. This requires careful coordination between the VMC facilities crew and the construction teams, making labs available for construction without delaying the VMC delivery schedule. It will be a delicate balance, requiring construction crews to work in the evenings and early mornings to complete the work. It is a modern project with modern challenges.

Like to get on our mailing list? Send your name and address or email address to: [sales@psfmech.com](mailto:sales@psfmech.com)

Or, simply write:

*PSF Mechanical, Inc.  
9322 14th Avenue South  
Seattle, WA, 98108*

For more information about our company, visit our web site at [www.psfmech.com](http://www.psfmech.com)



**PSF Mechanical, Inc.**  
9322 14th Avenue S.  
Seattle, WA 98108

