INDOOR AIR QUALITY

Filters are at the core of creating healthy spaces

One of the many lessons we learned from the COVID-19 pandemic is the importance of indoor air quality (IAQ), particularly in large communal spaces such as office towers, shopping malls, schools and healthcare facilities. Air filters are an irreplicable part of a functioning HVAC system. A properly sized, installed and maintained filtration system is at the heart of any IAQ plan.

DUAL BENEFITS

The primary concern with IAQ is for the people who occupy the space. Particulate matter, ranging in size from 0.3microns to 1.0 microns that can have long-term health impacts if ingested through the air we breathe.

"Filters capture harmful airborne bacteria, mold, VOCs, off-gassing from new materials on new buildings and other pollutants," says Will Elaridi, Business Development Representative – HVAC Division for Mitsubishi Electric Canada.

A proper filtration system also protects the interior space and all the equipment within it. Airborne contaminants can stain fabrics and ceilings (think of the black soot you often see around a diffuser vent), while dust accumulation dims lighting and requires custodial staff to put in longer hours.

Dust accumulation on coils, fans and motors can shorten the life of HVAC systems, computers, servers and other sensitive electronics.

The cleaner the indoor air, the more efficiently an HVAC system will operate, and it will require less ongoing maintenance.

FILTER FACTS

Inside a filter's reinforced cardboard frame are the fibers that catch the particulate matter.

The fibers are made from a variety of materials including polypropylene and other plastics, fiberglass and activated carbon. "The filter media is a bunch of randomized, intertwined fibers with the intent of attracting as many particles to these fibers as possible," says Elaridi.

Filters are rated on the MERV (Minimum Efficiency Reporting Value) rating, ranging from 1 to 20, with 1 the lowest and 20 the highest.

THE PHYSICS OF FILTRATION

There are four different ways filters capture airborne particles: inertial impaction, interception, diffusion and electrostatic attraction.

- ***Inertial impaction***
  Larger particles tend to have inertia – their weight causes them to travel in a more-or-less straight path as the ventilation system pushes or pulls them through the filter. They collide with the filter fibers as they pass through.
- ***Interception***
  Interception captures medium-sized particles. While they lack sufficient amount of inertia, particles of this size eventually affix to the filter media as they pass through the filter.
- ***Diffusion***
  Small particles move in a random path. "The particles are so small they barely have any inertia," says Elaridi. Eventually these particles collide with the filter fiber. This phenomenon is referred to as the Brownian Motion of small particles.
- ***Electrostatic attraction***
  With electrostatic attraction, the filter media is negatively or positively charged, causing an imbalance of electric charges between media and the particle. This electrostatic force pulls the particles and they eventually stick to the media.

INSTALLATION AND MAINTENANCE

Air will always follow the path of least resistance. That's why it's essential that the filters used are properly sized, sealed and installed within the frame so that there are no gaps for the air to flow through, bypassing the filter.

Filters are designed to face in one direction. Look for an arrow on the filter indicating air-flow direction. Set up calendar reminders to change the filters or install a filter alarm that goes off when a clogged filter causes a drop in pressure.

If you want to increase the amount of particulate matter your system captures, you can't just install a filter with a higher MERV rating. This could result in a pressure drop that forces the motor to overwork. Before upgrading filters, refer to the system's manual or contact the manufacturer. When designing a new system, the manufacturer can help you optimize the specs. Note that if you're using higher rated MERV filters, you may also need to increase the frequency of filter changes.

Finally, be aware of local environmental conditions. Forested areas might have a pollen overload in the spring or excess soot if there are forest fires nearby. Open fields could lead to higher rates of airborne particulate matter during arid periods. Factor in local conditions when planning a filter change schedule.

Canadian building code energy recovery and minimum fresh air standards actually exceed those in the U.S. "Unfortunately, there are still a lot of projects out there that go by bare minimum code standards. There's always room for improving indoor air quality," says Elaridi.