Electrostatic or Electronic: Know the Facts

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HVAC system air filter upgrades are one way contractors can simultaneously increase customer residential indoor air quality (IAQ) and generate more business.

The central air-conditioning/heating unit is the perfect appliance for providing better IAQ, which few consumers realize. Instead, many consumers buy an electric-powered room air cleaner, which is as logical as using a window air-conditioner in a central air conditioned home. If a consumer is reluctant to purchase an air purifier, contractors can educate consumers and suggest other cost-effective methods to improve IAQ. Any comprehensive approach must include ventilation and purification.

Given the importance of a central air conditioning/heating system in residential IAQ improvement, it is surprising that many systems are equipped with low-quality filters. These filters typically have a Minimum Efficiency Reporting Value, or MERV, rating of 1-4, and capture less than 20 percent of the contaminates in the 3-to-10 micron range. Furthermore, these filters do not remove smaller particles, such as contaminants in smoke and pollen. Consequently, these particles either stick to the wet evaporator tubes and fins or are expelled to the indoor air where they aggravate allergies and/or asthma.

To improve IAQ, contractors should recommend customers use a filter with a higher (MERV) rating, which traps more particles via a tighter weave (such as a pleated filter). While this is normally the best solution, there is a limit to how high of a MERV rating you should recommend based on the system you are making the recommendation for. The most basic consideration you need to make when

recommending a higher MERV filter is if the system blower can tolerate the increased static head on the overall air circulation system. Determining whether the existing system and blower can handle the additional air pressure drop of the improved filtration involves considering the total air pressure drop of the indoor coil, air distribution ductwork (both supply and return), registers and filter. If available, a hand-held anemometer can measure the effect the filter has on the return airflow. If you detect a drop in airflow fan speed may be increased to improve airflow at the cost of increased noise and power consumption. In general (without considering the effect of latent cooling), a reduction in airflow results in a proportional increase in the temperature difference required across the coils.

If the more effective filter causes an increased air pressure drop, the airflow over the evaporator coil will be reduced. This is because the fan must work harder to overcome the increased static air pressure drop. Since the blower power draw is nearly constant, the higher the static air pressure drop, the less air is moved. With less airflow over the evaporator coil, the conditioned air must be cooled more to provide the same cooling capacity.

Sensible cooling = (mass flow rate of air) x (heat capacity) x (air temperature drop across the coils).

To cool the conditioned air to a colder temperature, the evaporator temperature must be decreased. Generally, a system loses 10-percent efficiency for every 10-degree Fahrenheit decrease in evaporator temperature. Therefore, if you

recommend an excessively powerful filter that increases IAQ but causes air pressure to drop it will decrease the A/C system efficiency.

Although each system has specific configurations and requirements, replacing a MERV 1-4 rated filter with a MERV 6 rated filter should not impose significant problems. Similarly, not much difference exists between an excessively dirty evaporator, which results from the poor performance of its MERV 1-4 filter, and the increased airflow resistance of a MERV 6 filter. However, a move to the even tighter weave of a MERV 12 filter may result in significant efficiency reduction or evaporator icing due to the decreased airflow. To improve filtration by using a filter with a higher than MERV 6 rating while avoiding unacceptable air pressure drop requires an alternative approach such as electrostatic and electronic filtration.

Electrostatic Methods

Electrostatic technology provides a means of trapping more particles with minimal airflow pressure drop by creating friction as the conditioned air flows through a filter. This friction creates static electricity which builds up on the surface of the filter. The electrically-charged filter then attracts the particles via electro-forces as well as by mechanical filtration, removing them from the recirculated airstream.

Electrostatic filters that are drop-in replacements for conventional fiber media filters cost approximately $20. Typically, these filters are not 100-percent electrostatic because they are only partially composed of electrostatic fibers. Normally, the filter manufacturers don't disclose the filter's quantity of electrostatic fibers, but they do provide the MERV rating. Filters that contain more electrostatic fibers perform more

effectively. These electrostatic filters can be reusable or disposable (such as the 3M Filtrete 300 disposable filter).

The other electrostatic approach is to create an electrostatic filter by coating a conventional disposable or reusable filter with an electrostatic coating such as PuraClean® Filter Spray, a product originally developed for NASA to keep spacecraft ventilation systems clean. Independent testing has shown that electrostatic filter sprays provide a 200 to 1,200-percent filtration efficiency improvement for particles of 3- and 7-microns in size, respectively.

PuraClean also uses a tackifier, which makes an ordinary filter sticky enough to hold captured particles to the filter and prevent its release into the airstream. Several other filter sprays are available (such as Filter Plus™ and Filter Charger) that function solely as tackifiers.

Electronic Methods

The electronic filter uses the same principle of electrically charging particles that pass through a filter. However, while the electrostatic method relies on a charge created by static electricity (electrostatic), the electronic method uses a high-voltage electric charge created by an electronic high-voltage "transformer" that draws power from an external source. Electronic filters use a high voltage electrode arrangement to charge the particles that are then attracted to a grounded surface, also referred to as a ground plane, collection plate, or ground electrode. This strategy provides effective filtering, but if the collection device is not maintained periodically, it becomes coated with a layer of particles, decreasing electrical conductivity and filtering effectiveness.

Uncollected charged particles that pass through the HVAC system accumulate on register grills, walls, and ceilings.

The charging of the particles by a high voltage electrode can also produce minimal amounts of ozone. At these small levels it should not increase system corrosion or lead to increased allergen levels or asthma, however, contractors should inform customers about the possible effects of ozone in case a problem does occur and teach the maintenance of electronic filter systems to their owners. For example, the Honeywell F300 Electronic Air Cleaner should only add 0.005 PPM ozone to the steady state indoor air level.

Marketing Electrostatic Filters

The investment may be the deciding factor for consumers. Equipment and installation costs of more than $750 for add-on electronic filters typically makes them marketable only to the upper-middle or high-end market. In contrast, reusable or disposable filters containing some electrostatic fibers provide a more affordable option for the middle- and low-end markets. These filters normally average $20 or more per filter.

A bottle of electrostatic spray and tackifier capable of treating up to 12 filters has a wholesale price of approximately $10 and can easily be marked up to $25 or $35 retail. Given that one bottle will treat filters for up to one year; it is a good add-on to preseason tune ups.

A great marketing tool for demonstrating the effectiveness of a filter spray is to treat one-half of a filter and enable the customer to see the difference after two or

three weeks of operation. The treated section will have visibly attracted more dust than the untreated section.

Whatever method of advanced filter technology is used, contractors who educate consumers and select appropriate air filters can increase IAQ without compromising system efficiency and can incorporate another revenue generating IAQ element to their services.

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SIDEBAR: **What are MERV Ratings?**

- The only true measure of a filter's effectiveness is the Minimum Efficiency Reporting Value (MERV). Most filters are labeled with a MERV rating number, which indicates its ability to trap particles ranging in size from 3.0 microns to 10.0 microns. MERV is an industry standard rating used to compare filters made by different companies.

Residential filters commonly have MERV ratings of 1-12. The higher the MERV rating, the more efficient the filter is and the more particles it can trap.

- A MERV rating of 6 means the filter is 35% to 50% minimum efficient at capturing the measured particles.
- A MERV rating of 8 means the filter is 70% to 85% minimum efficient at capturing the measured particles.
- A MERV rating of 11 means the filter is 85% to 95% minimum efficient at capturing the measured particles.

  Note: Information taken from the free online manual, *Indoor Air Quality and Mold Remediation Service Techniques—A Desktop Reference and Training Guide for IAQ and Mold Remediation* by Robert P. Scaringe, is available at www.qwik.com

Bio: *Robert Scaringe, president of Mainstream Engineering (www.mainstream-engr.com), Rockledge, Fla., has been involved in the development of advanced vapor-compression heat pump systems for more than 33 years. He currently has more than 70 HVAC-related patents and more than a hundred technical publications. Mainstream's HVAC service products division www.qwik.com includes products such as foaming coil cleaners, mold test kits, condensate line dispensers/tablets, a lineset flush, an acid eliminator, and an electrostatic filter spray.*