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Debunking Myths About MERV, Air Filtration

7-9 minutes

Q&A

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Besides the basic need for good indoor air quality (IAQ), many extremely relevant reasons exist in 2020 to discuss air filters, according to Kathleen Owen, Fellow ASHRAE, member of the ASHRAE Epidemic Task Force, and Carolyn (Gemma) Kerr, Ph.D., Life Member ASHRAE.

From common misconceptions to recommended best practices, Owen and Kerr talked with *ASHRAE Journal* about what people need to know about ASHRAE Standard 52.2, *Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size*, and air filters.

Owen and Kerr also appear in the December *ASHRAE Journal*. They wrote the technical article "What You Can and Can't Do With ASHRAE Standard 52.2," which clarifies the misconception that there has ever been a MERV higher than 16 and explores why some filters increase efficiency with time while others decrease.

1. Why is it important to be talking about filters right now?

Along with the basic need for good IAQ for the good of the people breathing the air and any sensitive equipment in the indoor space, there are many reasons that are extremely relevant in 2020.

a. COVID-19

With the understanding that COVID-19-containing particles can stay in the air long enough to move into the breathing space and into HVAC systems, the desire to filter these particles out of the air is strong.

ASHRAE is recommending that MERV 13 filters be used where possible, with MERV-A 13-A or MERV 14 preferred. This is pushing the use of higher efficiency filters in many buildings. For locations that can't upgrade the HVAC filter or increase outdoor air during winter, in-room units are recommended to add cleaning capability. These units should include high MERV or better filters to remove most of these virus-laden particles.

b. Wildfires

With global warming, the wildfires seen on the West Coast are likely to be a continuing major problem. Air filters are needed to clean the air to help people breathe in fewer particles. Filters are also often used to help people with allergies and asthma.

c. Energy Costs, Especially with Global Warming

Using appropriate filters can lower the need for bringing in outdoor air. This lowers the costs for heating, cooling and conditioning outdoor air. The filter used and its pressure drop will be important in determining how much energy savings can be achieved.

2. Why is it important to talk about ASHRAE Standard 52.2 right now?

The reason for our [*ASHRAE Journal*] article is to alert people to capabilities and limitations of the standard, particularly the recent addition of the $PM_{52.2}$ calculation. This addition enables a better understanding of the relationship of MERV to the EPA particulate matter (PM) regulations.

3. What are the most common misconceptions about filters?

a. "Putting the filter in the HVAC is enough."

No, you must run the HVAC system to get the benefit of the filter. This isn't so much a misconception as something people often overlook. If supply air doesn't go through the filter, the filter can't capture particles.

b. "Filters work well when they are simply slid into place."

Not usually. This can be sufficient, but it is important to be sure the filter is sealed into place. If the air goes around the filter (called leakage or bypass) it will not get cleaned.

c. Filters remove everything nasty from the air.

In fact, they only work as well as the MERV specification. The higher the MERV, the more small, damaging particles are removed. In addition, particle filters don't remove volatile organic compounds (VOCs) or ozone.

d. That they will last forever without being replaced (see our answer to Question 5 below.)

e. "HEPA and MERV filters don't catch particles below 0.3 *μ*m."

Filters get more efficient as particles get both bigger and smaller compared to the filter's most penetrating particle size (MPPS),

usually near 0.3 μm. These claims are often made in advertising.

Lately, I have seen this used as a faulty reason for saying that filters don't catch COVID-19 because the virus itself is less than 0.3 μm. In practice, the virus is almost always embedded in particles that are much bigger, with recent reporting indicating much of the COVID-19 virus may occur mostly in particles in the 1 μm to 5 μm size range. So, the filter efficiency below 0.3 μm is completely irrelevant.

4. Are you seeing more people misapplying filters for COVID-19 mitigation? If so, how?

I see people confusing statements about filter performance with statements about the performance of other air cleaning technologies. When a filter is stated to be 99% efficient, that means that 99% of particles in entering air are removed continuously. This is not equivalent to another technology removing 99% of particles in two days. Control technologies need to be compared on the same basis, such as their equivalent uncontaminated air delivery rate.

For example, if a space has a volume of 1,000 ft^3 (28 m^3), and air from the space passes through a 100% efficient filter at a flow rate of 100 cfm (2.8 m^3/min), an amount of air equal to the volume of the space will pass through the filter every 10 minutes, so the clean air change rate is 6 per hour. If the space is well mixed, this would reduce the number of particles initially in the air by 99% in 50 minutes. A 50% efficient filter would require twice as long to achieve the same result. An air cleaner claiming to reduce contamination by 99% in two days would have an equivalent air change rate of about 0.1.

The point is that a filter can be effective quite quickly, over a period from a few minutes to a few hours, if it is at least moderately efficient and there is enough airflow through it.

Another way I see filtration being misapplied is in air cleaners that combine HEPA filters with other technologies that remove or inactivate infectious aerosols. A well-sealed HEPA filter is more than 99.9% efficient for all sizes of particles. Adding other technologies in series with it can't add more than a very tiny amount of additional performance to the air cleaner.

So, there is little point to adding these for particle removal. Virus-laden particles are still particles, so this applies to COVID-19, too.

5. What are your recommended best practices regarding filter replacements?

If you are trying to replace your filter with a higher MERV filter, be sure it will fit and seal in your system. Look for a filter with a similar pressure drop to the filter you have, or make sure your system can accommodate the upgrade. If possible, look for MERV-A 13-A filter if you can get that information. If not, try for a MERV 13 or higher filter.

When replacing potentially virus-contaminated filters, wear rational personal protective equipment (PPE), including gloves and a mask. Bag the filter immediately before disposal. Wash hands afterward.

Order your replacement filters early this year as many are back-ordered due to COVID-19 demand.

Always replace filters according to the manufacturer's recommendation to ensure that they perform as specified.

6. Is there anything else that you think design engineers need to know about this topic?

First, everyone should join SSPC 52.2 and come to meetings.

Going forward, it is likely that some current standards will be updated to include recommendations for pandemic preparedness. Right now, we're envisioning something similar to guidance for earthquakes or hurricanes.

It's too soon to know what will end up being done, but we on the ASHRAE Epidemic Task Force are very aware that we need to use what we have learned this year to prepare for the future. Folks should check in every so often to stay up-to-date.