Not All HEPA Filtration Systems Are Created Equal: 5 Tips for Selecting the Right Filter

If you're planning a new cleanroom or maintaining an existing one, your choice of filters can be critical to product quality, production yields and regulatory compliances.

The key to achieving contamination control, whether in the hospital operating room or the semiconductor assembly area, is the air filtration system, which is ultimately dependent on the reliable performance of HEPA (and in some cases ULPA) filters. This includes cleanrooms and mini clean filtration "environments" such as biosafety cabinets, clean benches and fume hoods.

While most HEPA filters may look the same, they vary widely in quality and high-purity performance. These filters also vary in design, pressure resistance, frame construction, sealant and temperature capabilities.

Although cleanroom filtration systems are certified to meet initial contamination containment capabilities and regulatory requirements, the *effective* lifespan of filters may be limited, requiring premature replacement to avoid costly air quality problems – that is, if the user is aware of the problem. Examples of limiting factors include filter design shortcomings, marginal quality of filter material, incomplete or inappropriate filter testing, and insufficient heat resistance in high-temperature applications.

"Inadequate filtration in cleanrooms or clean spaces can result in lower production yields and unsatisfactory conditions," says Wayne Copeland, president of CEPA Operations, Inc. (Ontario, CA) a cleanroom certification service and HEPA filter specialist. "It can also mean failure reports, downtime and frequent replacement or maintenance – all of which can get very expensive."

Given the pivotal impact HEPA filters have on cleanrooms and other clean

environments, here are five points that experts say you should consider before replacing your filters or specifying a new cleanroom system:

Test according to application

Prior to purchasing any HEPA filters, Copeland advises his customers to confirm that all HEPA (or ULPA) filters are tested individually, because batch testing is unacceptable.

"We have a strict policy of individually testing every customer's filter according to the application and specification requirements," says Richard Braman, president and co-founder of HEPA Corp (Anaheim, CA), one of the leading manufacturers of HEPA and ULPA filters. "We also certify the test results and performance characteristics of the filters on an individual basis."

In addition to standard flow and pressure testing, some industries require leak testing. However, the standard oil-based aerosol DOP (dioctyl phthalate) leak testing is not permitted in some sectors, such as optics and semiconductors. For those ultra-sensitive applications Braman says his firm uses PSL (polystyrene latex spheres) for leak testing.

Use deep pleats to save energy

The lower a filter's resistance to air flow, the less air handler force is required to push the required amount of air through a filter. Hence, the less energy expended to move the required air via electric fan. Copeland says the best way to lower resistance is with deep-pleated HEPA filters, which are designed to give more surface area and thus dramatically improve filter efficiency.

"We have used HEPA Corp's deep-pleated filter packs that more than doubled the filter media size, and the energy savings were very substantial," says Copeland. "The original filter installation had a resistance in the .6"-.7" Water Column (in inches) range. By installing the deep-pleated filters we reduced the pressure to the .3" W.C. range, which allowed the customer to slow their air handlers by 50 percent and also shut down a cooling tower. While the initial investment was higher than standard filters, the savings in electric power consumption may have saved that amount within the first year. Plus, they won't have to change the filters for years to come, which will save substantial labor and material cost savings."

On the "green" side of the picture, because deep-pleated HEPA filters promise a substantially longer lifespan, that means improved sustainability and fewer products that end up in landfills.

Roomside systems are easiest

Copeland points out the difficulty of changing cleanroom filters is often overlooked by cleanroom designers and engineers. However, when replacement service is required, the cost includes much more than just the filters.

"When it is time to change the HEPA filters, the true cost includes downtime, labor and cleanup," Copeland says. "And those costs can really add up."

Copeland adds that when you change out most individual terminal type filters, which can be time-consuming because they are commonly a difficult replacement, you can tie up a cleanroom for an extended period of time. This will be very expensive in terms of production downtime. It also is a dirty operation, causing contaminants to enter the clean space, and that will require time and labor to clean properly.

To solve this situation Copeland recommends a "roomside replaceable" filtration system, such as HEPA Corp's Perma-Hood® filter system or Q3-4000® Gridless® ceiling filter system. Through the use of an innovative, patented latching system, filters and lights are suspended in a "gridless" double channel system. The ceiling is constructed and installed completely from the roomside. Filters are self-aligning; there is no need to lift the filters up into the plenum before putting in place, nor time-consuming squaring of a T-bar grid.

He says that with these gridless and modular systems he can change filters from 5-10 times faster than individual panels. “Plus, with a roomside replaceable you have a housing that stays permanently installed,” explains Copeland. “So now you simply flip a couple of levers to change the filter out, so you have a much faster change with far fewer contaminants to deal with.”

Copeland adds that well-designed roomside filtration systems can improve the laminar flow of air in a cleanroom, making it easier to provide cleanest “first” air to desired areas within the room.

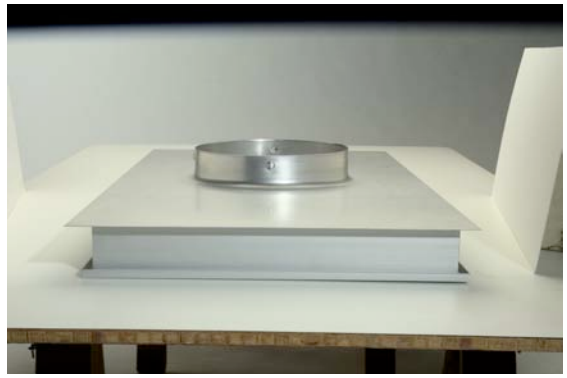
Sourcing custom and odd sizes

For one reason or another, some cleanrooms and many mini clean environments (biosafety cabinets, clean benches and fume hoods) require custom, odd-size HEPA filters.

Many distributors don’t stock odd-size filters simply because there are so many shapes and sizes, and orders may be difficult to predict. Some manufacturers evidently find odd sizes difficult to deal with, so they wait for like-size orders to accumulate before making the filters, which can cause extensive delays in turnaround time.

“Custom or odd sizes are a fact of life that we have to deal with,” says Copeland. “Our company avoids the backlog that results from filter manufacturers who simply add these special size orders together until they have what they consider a sufficient number to run. In combination with required testing, those orders can take months to fill.”

Copeland says one reason his firm sources from HEPA Corporation is that it is the only HEPA filter manufacturer he knows who will make filters to custom specifications and test them as part of the normal production flow. This means that custom shapes and sizes will be tailor-made and delivered in weeks rather than months.



Spec’ing high-temperature filters

In the case of high-temperature applications, HEPA filters need to have special materials for the frames and seals, allowing them to handle temperatures of up to 750 degrees (F), and are available with a choice of frames and seals.

Applications that are performed in high-temperature environments require corresponding high-temperature ASHRAE, HEPA, or ULPA filters. However, it is essential to specify high-temperature filters according to appropriate filter media, frame and sealant capabilities. For example, while filters are readily available in various temperature ranges up to 750 degrees (F), the sealant method will determine the range, with urethane sealing appropriate for temperatures up to 230 degrees (F), and glass pack required for the highest temperature range.

Some consideration must be given to filter binders, also. Since the acrylic binder used in temperature ranges above 500 degrees (F) will burn off and produce smoke, products should not be introduced to the high-temperature environment until the smoke is exhausted.

Nevertheless, the variables governing the correct choice of high-temperature filters suggest that users confirm their choices. “Whenever in doubt about any filter specification, it’s a good idea to talk to a filter manufacturer,” Braman advises.

For more info, contact HEPA Corporation, 3071 East Coronado Street, Anaheim, CA 92806; Phone: (714) 630-5700; Fax: (714) 630-2894; Email: filters@HEPA.com; Visit the web site: www.HEPA.com