

THE ROLE OF AIR FILTERS IN PROTECTING BUILDING ENVIRONMENTS FROM AIRBORNE CHEMICAL, BIOLOGICAL OR RADIOLOGICAL (CBR) ATTACKS

Assess Current Level of Filtration

The first step is to determine the current level of filtration installed in the building. Review all air distribution systems and make a detailed listing of the types and efficiencies of all filters. Include prefilters and final filters.

Assess the Effect of Increasing Filter Efficiency on the HVAC System

Increasing filter efficiency is one of the few measures that can be taken immediately to reduce the consequences of exterior or interior release of CBR agents.

In general, increased filter efficiency will enhance the indoor environmental quality of air in the building. However, the increase in protection from CBR attacks will occur only if the filtration efficiency applies to the particle size and physical state of the contaminant. Note that particulate air filters are effective at removing biological and radiological particles, but are not effective on removing gases and vapors typical of chemical attacks. Removal of these contaminants requires gas phase adsorbers, such as activated carbon or other sorbent type medias. Of course, the contaminants must be airborne and carried by the air stream circulating throughout the building in order to be captured.

Recent guidelines published by ASHRAE for providing building health and safety under extraordinary incidents suggests that filters with the highest MERV Ratings that are physically feasible and economically justified be used. However, increasing filter efficiency should be done cautiously with a clear understanding of the protective limitations provided by the upgrade and the effect on the HVAC system.

Upgrading filtration is not as simple as merely replacing a lower efficiency filter with a higher one. Typically, higher efficiency filters operate at higher resistance often resulting in reduced air flow and higher energy costs. The magnitude of the reduction is dependent on the design and capacity of the HVAC system. If the air flow reduction is substantial, it may result in inadequate ventilation, reduction in heating and cooling capacity, and potentially frozen coils. Before making a change to higher efficiency filters, consult with a knowledgeable HVAC contractor or mechanical engineer to assess how the change would affect the operation your building's system.

To minimize pressure loss, select filters with the lowest resistance that provides the desired level of efficiency. If feasible, consider installing a filter bank with a larger face area to reduce velocity. Of course, this entails a retrofit situation.

Assess the Integrity of the Framing System

The integrity of the filter framing system has a major impact on the installed filtration efficiency. Reducing the leakage of unfiltered air around the filters, caused by poor seal between the filter and frame, may be as important as increasing filter efficiency. Check the condition of the gaskets on the frames and plenum doors. Consider applying caulking between frames to prevent leakage.

Benefits of Increased Filter Efficiency

In the context of this discussion, higher efficiency filtration is a contributing factor to provide increased protection from CBR attacks. In addition, indoor air quality is improved providing a more comfortable, healthy environment for occupants.

Another function of higher efficiency filters is to keep coils cleaner which maintains proper heat transfer efficiency for optimum energy use. Keeping coils clean also maintains coil resistance at design levels. Clogged coils increase resistance, which is another factor contributing to higher energy consumption. Dirt accumulation on coils also leads to growth of mold and bacteria.

Resistance is a Key Factor in Selecting Filter Efficiency Upgrades

Earlier the statement was made that higher efficiency filters operate at higher resistance. Generally, this is true, but not in all cases. Due to the media selection and configuration of the filter construction, some filters offer lower resistance than others at the same or even higher efficiency.

For example, high efficiency V-bank mini-pleat filters operate at lower resistance than supported pleat type rigid filters. Also, bag filters operate at lower resistance than most rigid filters. This can be seen in the table below.

Why HEPA Filters are Not a Practical Solution

As a general rule, existing systems cannot be upgraded to HEPA filters without a complete retrofit of the air handling system. HEPA filters operate at resistance levels substantially above the design level of air handling systems originally installed with ASHRAE grade filters. Secondly, the sealing capacity of ASHRAE grade filtration systems is not sufficient for HEPA installations. The leakage around the filters more than offsets the benefits of HEPA filtration.

The only way to convert to HEPA filtration is to install a complete new air handling system with sufficient fan horsepower to overcome the resistance and provide a high integrity seal.

(Refer to Airguard Technical Data Sheet, "*HEPA Filters in Commercial Buildings*," for more information.)

Conclusion

Generally, to maximize protection of building occupants against CBR attacks, the highest level of filtration should be implemented that is compatible with the operating parameters of the existing HVAC system, primarily air flow and resistance. There are many options to consider with their associated advantages, disadvantages and costs. Consult your Airguard representative for a thorough evaluation and recommendations.

References:

NIOSH Publication, "*Guidance for Protecting Building Environments from Airborne Chemical, Biological, or Radiological Attacks*"

Department of Health and Human Services, DHHS (NIOSH) Publication No. 2002-139

ASHRAE Report of Presidential Ad Hoc Committee for Building Health and Safety Under Extraordinary Incidents on "*Risk Management Guidance for Health, Safety and Environmental Security Under Extraordinary Incidents*"

**Filter Efficiency and Resistance
Comparison Guide**

Filter Type	Filter Efficiency		Resistance (In. W.G.) @500 FPM
	Dust Spot Efficiency (52.1)	MERV Rating (52.2)	
Pleated Panel Filters			
Type DP (14.3 pleats per foot)	25%	6	.30"
Type DP Max (10 pleats per foot)	25%	6	.32"
Type DP8 (14.3 pleats per foot)	30%	8	.30"
PowerGuard (14.3 pleats per foot)	35%	11	.38"
Ring Panel Filters			
Polyester Ring Panel	<20%	5	.50"
Self-Supported Pocket Filters			
Cube Filters	30%	6	.20"
Two Pocket Filters	35%	7	.26"
Extended Surface Pocket Filters			
90-95% 8 pockets, 29"	90%	14	.45"
90-95% 10 pockets, 22"	90%	14	.52"
Extended Surface Rigid Filters			
90-95% V-Bank Mini-Pleat Style	90%	14	.36"
90-95% Corrugated Separator Style	90%	14	.65"
90-95% Supported Pleat Style	90%	14	.70"
HEPA Style Filters			
95% DOP	95% on .3 microns	NA	.95"
99.97% DOP (High Capacity)	99.97% on .3 microns	NA	1.40"