Kimberly-Clark PROFESSIONAL*

Panels to Pleats

A Guide to Upgrading Your Filtration System

Panel filters were originally developed in the 1930s, and were primarily designed to protect HVAC system equipment rather than building occupants. However, technology from the 1930s is no longer adequate for today's needs. By replacing your current panel filters with high-quality pleated filters, you can not only protect your HVAC system equipment, you can also improve indoor air quality (IAQ), reduce system operating costs and make your building a healthier and more productive place to work.

ASHRAE HVAC Standards

The American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc. (ASHRAE) has developed two HVAC filter test standards that quantify the efficiency of filters. The ASHRAE 52.1-1992 standard measures:

- Pressure drop – How much airflow the filter restricts.
- Arrestance – The amount of synthetic dust a filter is able to capture.
- Dust spot efficiency – A measure of the ability of the filter to remove atmospheric dust from the test air.
- Dust holding capacity – The amount of dust a filter can hold until a specified pressure drop is reached.

The newer ASHRAE 52.2-1999 standard measures the fractional particle size efficiency of an HVAC filter. This indicates the filter's ability to remove airborne particles of differing sizes between 0.3 and 10 microns in diameter. A MERV, or minimum efficiency reporting value, is assigned to the filter based on laboratory testing. The lower the MERV, the less efficient the filter is at particle removal. As MERV increases, the filter is called on to remove progressively smaller particles. Filters with performance below MERV 5, like most panel filters, are rated under ASHRAE 52.1-1992 and have a particle size removal efficiency of <20 percent for particles 3 microns and above.

The Problem: Old Technology

There are more than 4.6 million commercial buildings in the United States today. And while some of these facilities were built or upgraded in recent years with the latest in technology and systems for occupant comfort and convenience, others are still using pre-WWII filter technology in their HVAC systems.

The result? Poor indoor air quality (IAQ) – a condition affecting about 30 percent of occupied commercial buildings, and one that costs the U.S. economy as much as $168 billion per year in lost productivity, absenteeism and health care. Moreover, HVAC systems can be more costly to operate from an energy standpoint because the older type of air filters used in them allow system components to become dirty, which causes them to run inefficiently.

The Culprit: Panel Filters

Back in the 1930s, panel filters (often called "throw-away filters") were invented for use in forced air heating and cooling systems in large commercial office buildings. Constructed of a simple cardboard frame, a thick bat of spunglass filtration media and

an open metal backing to support the media, panel filters today are made in much the same way they were made 75 years ago. Their simple construction and low filtration efficiency makes them among the lowest priced filters in use today.

Panel filters were originally developed primarily to protect HVAC system equipment, rather than building occupants. Their goal was to prevent "fouling" of HVAC systems. Fouling occurs when particle deposits build up on fans and heating and cooling coils. This problem greatly reduces air flow through the HVAC system and prevents heat transfer in the coils, all of which can add up to a significant increase in energy costs for building owners.
For years, it was believed that panel filters provided adequate filtration to keep HVAC systems running cleanly and efficiently. However, a recent study found that panel filters do not provide adequate protection to HVAC equipment. In fact, it found that even filters with a minimum efficiency reporting value (MERV) of 5 to 6 - a higher MERV than typical panel filters - provide "insufficient cleanliness improvement."

Perhaps more disturbing to building occupants are the IAQ shortcomings of panel filters. Most panel filters have efficiency values less than 20 percent for particles in the 3 to 10 micron range. That means that more than 80 percent of these large particles and virtually all of the smaller (0.3 to 3 microns) particles in the air pass through the filter without being captured. Pollen, mold spores, pet dander and dust are just some of the particles passing through panel filters that may trigger allergic reactions in building occupants, resulting in poor IAQ for the building overall.

The Solution: Pleated Filters

One of the easiest ways for commercial buildings to both improve their IAQ and reduce costs to operate HVAC systems is to upgrade from panel filters to high efficiency pleated filters.

While panel filters typically yield performance only in the MERV

1 to 4 range (calculated based on their arrestance value from the ASHRAE 52.1-1992 standard), higher-quality pleated filters are available with performance up to MERV 12 (as tested according to the ASHRAE 52.2-1999 standard). See section on ASHRAE HVAC Standards for more information.

Upgrading to a higher MERV filter makes a significant difference in IAQ: pleated filters with filtration efficiency at or above MERV 8 (the minimum required for efficient equipment operation) can remove 70 percent of large (3 to 10 microns) particles and allergens from the air stream. Moving up to a MERV 11 filter further increases efficiency to more than 85 percent for large particles. At MERV 12, fully 80 percent of the very small (1 to 3 microns) particles and more than 90 percent of large particles are captured and removed from the air stream.

Filtration Efficiency Comparison

	MERV	Filter Type	Efficiency @ 1-3 Microns	Efficiency @ 3-10 Microns
	1-4	Panel Filters	n/a	<20%
Minimum Recommended Performance ▶	8	Pleated Filters	n/a	>70%
	11	Pleated Filters	>65%	>85%
	12	Pleated Filters	>80%	>90%

Lower Operating Costs

In addition to improving IAQ, upgrading from panel filters to pleated filters provides cost-saving advantages – but you must look beyond the low purchase price of panel filters. First, there is the cost of routine HVAC system maintenance. As mentioned previously, MERV 1 to 4 panel filters do not adequately protect HVAC equipment from fouling. This leads to expensive and time-consuming fan and coil cleaning, which is usually scheduled for after office hours when buildings are vacant, potentially incurring overtime charges.

Next, there is the cost of operating the HVAC equipment. Energy accounts for 80 percent of the overall cost to operate an HVAC system. Because panel filters allow HVAC system components to become dirty, operating efficiency decreases and energy costs to operate the inefficient system can increase. The small amount of money saved by purchasing a low priced panel filter can be substantially offset by even a slight reduction in the operating efficiency of the system.

How can high efficiency pleated filters deliver cost - saving benefits? New synthetic filtration media used in pleated filters today significantly increases filtration efficiency with lower air flow resistance than older generation media. The higher efficiency of these pleated filters can keep systems cleaner which reduces costs - all while improving IAQ for building occupants.

Improved IAQ

Of course, the best reason for switching from panel filters to pleated filters is to improve IAQ. According to the Environmental Protection Agency (EPA), indoor air is often two to five times (and occasionally 100 times) more polluted than outdoor air. The problem of poor IAQ is so prevalent that nearly half of U.S. office workers polled in a national survey selected IAQ as one of the key things they would like to improve in the office where they work.

More than just a nuisance, however, poor IAQ is also bad for business. Numerous studies place average productivity losses due to poor IAQ between three and seven percent, with individual productivity losses as high as 33 percent. Improving the indoor environment, on the other hand, can lead to as much as a 20 percent improvement in worker productivity, for gains of $20-60 billion per year nationwide.

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