

## **Don't Delay Air Filter Maintenance** **Today's small savings add up to bigger costs.**

By Lon Edelman

When looking to reduce maintenance expenses, customers may try to save money by reducing the frequency of air-filter changes, or by downgrading to a lower-priced filter. However, the small amount of money saved by reducing air-filter purchases or by purchasing lower-priced (and lower-efficiency) panel filters instead of higher-efficiency pleated filters pales in comparison to the energy and operating costs that can be saved by maintaining a robust air-filtration maintenance and upgrade program.

### **Air Filtration Costs: Myths and Facts**

**Myth:** Delaying filter change-outs will help customers save money.

**Fact:** While purchasing fewer filters may reduce initial expenses for customers, delaying filter change-outs causes the filter to run more days at peak airflow resistance and energy usage. It doesn't take long for peak usage cost to offset any savings in the filter price, as seen in Figure 1.

It comes down to physics; the energy used to operate filters is directly proportional to the airflow resistance of the filters (see Figure 2). The more resistance (due to clogged filters that aren't changed as frequently as needed), the more energy is needed to push air through the filter. Resistance typically increases as filters remove more contaminants from the air. This filtration is essential for air quality and protection of HVAC equipment, but it comes at a high cost when filter change-outs are delayed (see Figure 3).

**Myth:** There is little economic incentive for customers to upgrade their building's air-filtration system.

**Fact:** Some commercial and institutional buildings in North America still use pre-WWII technology in their air filtration system — panel filters. For years, it was believed that panel filters provided adequate filtration to keep HVAC systems running efficiently. However, a recent study found that panel filters do not provide adequate protection to HVAC equipment, allowing particle deposits to build on fans and coils, a problem known as "fouling." Fouling greatly reduces airflow through the HVAC system and prevents heat transfer in the coils, all of which can increase energy costs.

### **Reducing HVAC Costs**

Filters will support good IAQ and perform as specified only when they are maintained correctly. It is therefore important that your customers establish the appropriate filter change-out frequency.

Pay close attention to filter installation during change-outs. The goal is to avoid bypass air (air that does not go through the filter), which occurs when filter media is not properly sealed in the filter frame, when filters are not properly installed and gasketed in filter racks, or when air handler doors and ducts are not properly sealed. Bypass air can contaminate housings, coils, fans, and ducts and can increase system operating costs. Fouled heat exchangers have diminished heat transfer performance and increased pressure drop, increasing energy use and decreasing heating and cooling performance. Bypass air can also decrease a filter's performance and negatively affect IAQ.

Bypass air tends to have a larger effect on high-performance filters. A 1mm gap causes a MERV 15 filter to perform as a MERV 14 filter, while a 10mm gap causes a MERV 15 filter to perform as a MERV 8 filter.

One way to help your customers lessen the frequency of and purchase costs related to filter change-outs is to recommend a high-capacity pleated filter, which typically has an extended filter life along with a low resistance to airflow.

Pleated filters offer advantages over "throw-away" panel filters. First, while panel filters typically yield performance only in the MERV 1 to 4 range, higher-quality pleated filters are available with performance up to MERV 13, allowing improved efficiency in capturing both large and small particles. Second, upgrading from panel filters to pleated filters provides cost-savings advantages thanks to decreased routine maintenance and energy costs. 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 lower-priced panel filter can be substantially offset by even a slight reduction in the operating efficiency of the system.

One of the easiest ways to realize HVAC-related energy costs savings is to switch to a filter with a lower resistance to airflow. When filters have a lower resistance to airflow, the HVAC system motor needs to overcome less resistance to deliver the required air flow, thus reducing the motor's energy consumption.

For example, a 0.05" water gauge (WG) reduction in a filter's initial pressure drop (also known as airflow resistance) can reduce energy costs by up to 3.5 percent or about USD\$7 per filter, while a 0.20" WG reduction in a filter's initial pressure drop can reduce energy costs by up to 10 percent or about USD\$28 per filter. While an energy cost savings of USD\$28 per year may not sound like a lot, keep in mind that those cost savings are *per filter*, not for an entire HVAC system. For a large office building or industrial facility with 50 filters, a savings of \$28 per filter translates to a total savings of \$1,400 a year.

**Conclusion**

Because energy costs are the largest component of an air filter's total lifecycle cost, it is imperative for customers to look beyond the line item purchase price of filters when seeking to reduce their overall costs and instead look at the initial and sustained pressure drops of different filters.

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Figure 1.

<b>Total Cost Comparison</b> <i>Routine Versus Delayed Maintenance Schedule for Filter Change Outs</i>				
	<b>Regular Scheduled Maintenance</b>	<b>Delayed Maintenance</b>	<b>Impact</b>	
<b>Initial Investment - Filter Cost</b> <i>assumes \$6 per filter; 100 filters in system</i>	\$2,400	\$1,800	\$600	<i>savings</i>
<b>Energy Consumption (kWhr)</b> <i>assumes average <math>\Delta P</math> is 0.64" wg</i>	227,660	259,600	31,940	<i>Additional kWh</i>
<b>Energy Cost of System</b> <i>at \$0.07/kWhr</i>	\$15,936	\$18,172	\$2,236	<i>Additional cost</i>
<b>Total Cost</b>	\$18,336	\$19,972	\$1,636	<i>Total addl. cost</i>
<b>CO<sub>2</sub> emissions (pounds)</b> <i>at 1.354 pounds/kWh US EIA/DOE determined value</i>	308,000	351,000	43,000	<i>Additional CO<sub>2</sub></i>

 Calculate your savings

Energy Consumption =

$$\frac{Q \times \Delta P \times t}{n \times 1000}$$

Where:

Energy Consumption in kilowatt hours (kWh)

Q = airflow in cubic meters/second (m<sup>3</sup>/s)

$\Delta P$  = the average pressure drop across the filter in Pascals (Pa)

T = the time the fan is in operation in hours (hrs)

n = the product of the fan, motor and drive efficiency in %

Figure 2.

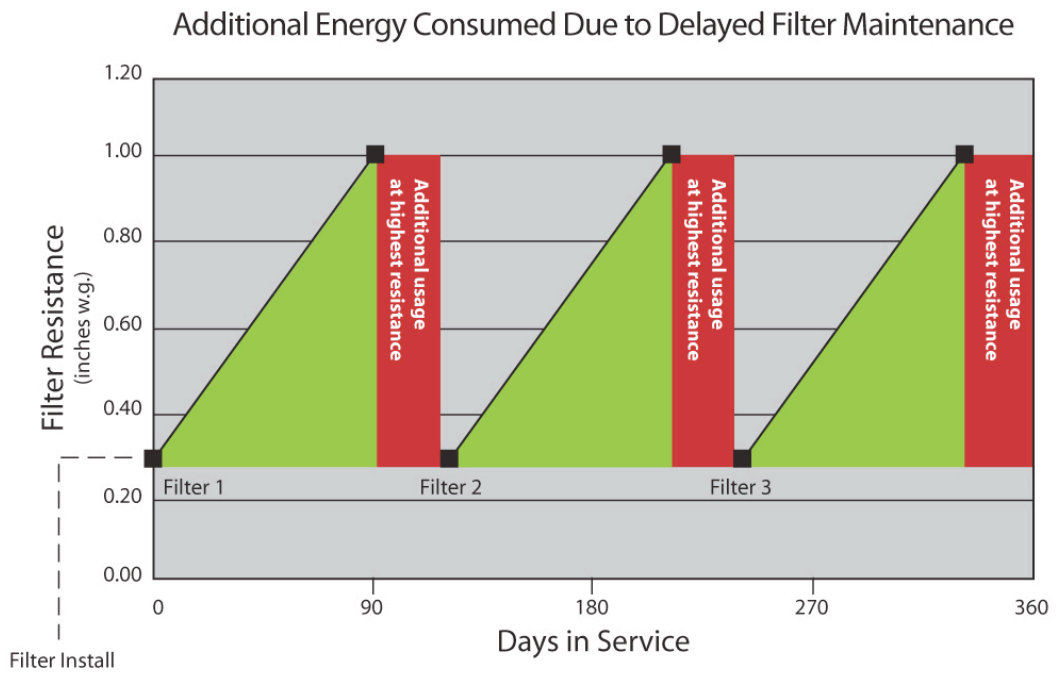


Figure 3.