



# Delaying filter maintenance: How much is it costing you?

Changing the filters in heating and cooling systems is fundamental in the maintenance arena. And while changing filters has always been part of the maintenance schedule, it is commonly believed that the longer you can put off replacing filters, the more cost savings there are to the company. The following facts and information may be a motivator in regularly changing your HVAC air filter, as recommended by the manufacturer. Bottom line: Changing filters can save the company money, reduce energy usage, and reduce emissions. Here are the facts.

**Fact:** *It costs more in energy to push air through a filter than it actually does to buy the filter.*

An air filter that hasn't been changed in awhile triggers your heating and cooling system to run more days at peak energy usage. The more regularly you change your filter, the better savings the company will see in its energy bill. (See figure 3.)

Typical Life-Cycle Costs of Filter System  
18% filter price and installation  
81% energy consumption  
1% filter disposal

Looking at these figures, one can see that filter price and installation represent only 1/5 of total filtration costs, even though the thought of delaying the purchase of air filters seems attractive because the savings appear to be immediate and tangible.

So, what is the best opportunity for saving money? Energy use is easily the largest operating cost involved in filtration. If you use less energy, you save more money. By regularly changing the filters, the company may actually notice a savings in the monthly bill.

**Fact:** *The energy your HVAC uses is directly related to the filter.*

This is a lesson in physics. Now before you start yawning, I promise it is an easy physics lesson. The more clogged your filter is, the more energy it takes to push air through. Thus, energy used is directly proportional to the airflow resistance of your filters.

The purpose of the air filter in a HVAC system is to remove contaminants from the air. This filtration is essential for air quality and protection of HVAC equipment. But as the filter continues to collect contaminants over time, it becomes clogged and unable to do its job efficiently. The clogged filter then starts to cost your system in increased energy usage.

Energy Consumption =

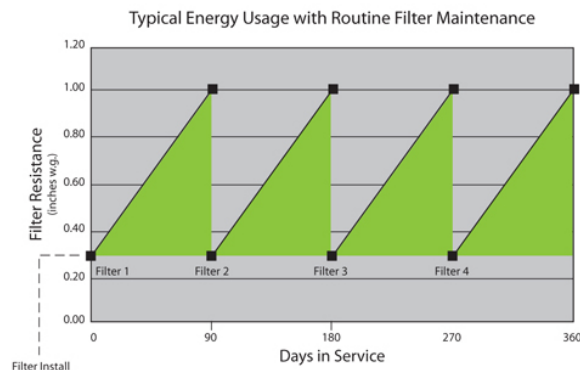
$$\frac{Q \times \Delta P \times t}{n \times 1000}$$

where:

Energy Consumption in kilowatt hours (kWh)  
Q = airflow in cubic meters/second (m<sup>3</sup>/s)  
ΔP = 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 %

Figures 1 and 2 show typical loading curve schematics of routine maintenance (four cycles) versus delayed maintenance (three cycles).

Figure 1



In Figure 2, the red area shows the additional period of highest energy consumption.

Figure 2

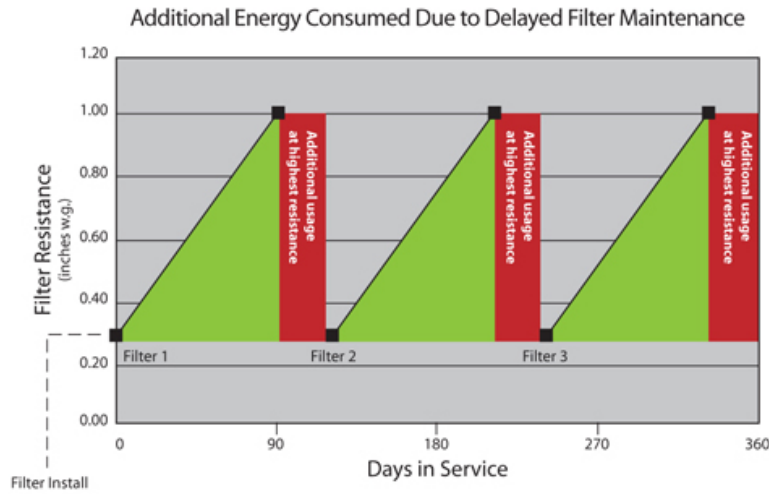


Figure 3 gives a summary of the total cost of delaying filter maintenance versus routine filter maintenance. Because the filters are operating at their highest airflow resistance, the cost of energy is higher.

Figure 3

Total Cost Comparison			
Routine Versus Delayed Maintenance Schedule for Filter Change Outs			
	Regular Scheduled Maintenance	Delayed Maintenance	Impact
<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<sup>2</sup> 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

In addition to saving energy, the cost of environmental impact is also one to consider

**Fact:** When filter maintenance is delayed, it not only increases energy production but also increases CO<sub>2</sub> emissions.

The extra energy consumed by clogged filters drives up energy production and greenhouse gas emissions. According to a study by the U.S. Environmental Information Administration, 1.354 pounds of CO<sub>2</sub> are released into the atmosphere for every 1 kWh of electricity produced.

In summary, by delaying filter maintenance, you may be costing your company money and damaging our environment. It just makes sense to routinely change air filters.