Choosing a Furnace Filter

by Bruce Sullivan

Dust, hair, and insect feces are just a few of the particles that swirl through the air inside most homes. The small size of these particles allows them to slip past the body's protective cilia and mucous, and to penetrate deeply into the lungs. The health problems they cause range from minor irritation to severe allergies.

You can remove these particles by installing a filter in the forced-air heating system. But if you think a standard furnace filter is up to this job, think again. Any particle that's small enough to inhale will easily pass through a standard filter. To have any success at removing such particles, you'll have to look at better, and more expensive, filters.

Types of Particle Filters

There are five basic filter types. Some fit into a typical heating system, while others require a modification of the ductwork.

Standard furnace filters are the 1/2-inch-thick, 50-cent items you can find at any hardware store. They consist of a loose pad of coarse glass fibers, lightly coated with an adhesive. They only screen out large particles, and have virtually no effect on the smaller ones that cause allergies. They fit into a built-in rack in the furnace cabinet and should be replaced every few months during the heating season.

Passive electrostatic precipitators are made from polypropylene fibers that pick up a static charge as air passes over them (see Figure 1). The static charge helps the fibers to hold fine particles. Passive filters fit into the filter rack of most residential air handlers. They can be washed and reused.

Pleated filters look like an accordion (Figure 2). They use a fine mesh of glass fibers to catch small particles that would pass through a standard furnace filter. Pleated filters are 1 to 4 inches thick. The smaller ones can be used in place of a standard furnace filter, while the larger ones require duct modifications.

PERMATRON

Figure 1. *Passive electrostatic precipitators use static electricity to attract dust particles to the filter fabric. The filter pictured here drops the particles into an accumulator chamber that must be periodically cleaned.*

High-efficiency particulate air filters, or HEPAs, have hundreds of square feet of a fiberglass fabric folded into a couple of square feet of space. They can remove very small particles, including some viruses. Because they're several inches thick, they require duct modifications. A HEPA can cost several hundred dollars, including installation, and must be changed every two to three years. It also creates high resistance to air flow, so you may have to beef up the furnace fan. As a result, HEPAs only make sense where the homeowners have extreme environmental sensitivities.

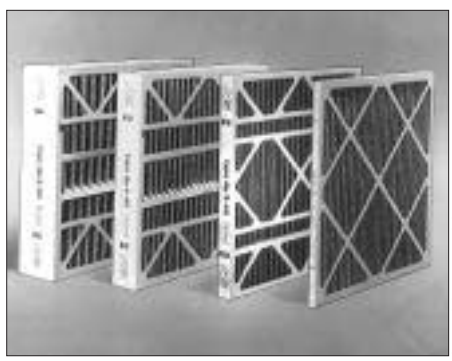

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Figure 2. *Pleated filters have a finer mesh and more surface area than standard furnace filters. They're designed as a direct replacement for standard filters.*

HONEYWELL

Figure 3. *An electronic air cleaner mounts on the return side of the air handler. Dust particles passing through the unit are energized by a set of electrically charged plates and wires, then captured by a set of oppositely charged collector plates.*

Electronic air cleaners, or EACs, are mounted on the return side of the air handler (Figure 3). A set of electrically charged plates or wires in the unit give a charge to the particles passing over them. A set of oppositely charged collector plates then capture these charged particles. EACs generate a small amount of ozone, to which some people may be sensitive. Some units include a carbon filter that helps to alleviate this problem.

Rating Filters

Filter effectiveness is measured with three standard tests. The results of these tests usually aren't printed on the filter package, but can be found in the manufacturer's literature.

Thermal DOP efficiency is sometimes called "absolute" filtration. (DOP is the chemical that's used in the test.) It's really only applicable to HEPA filters.

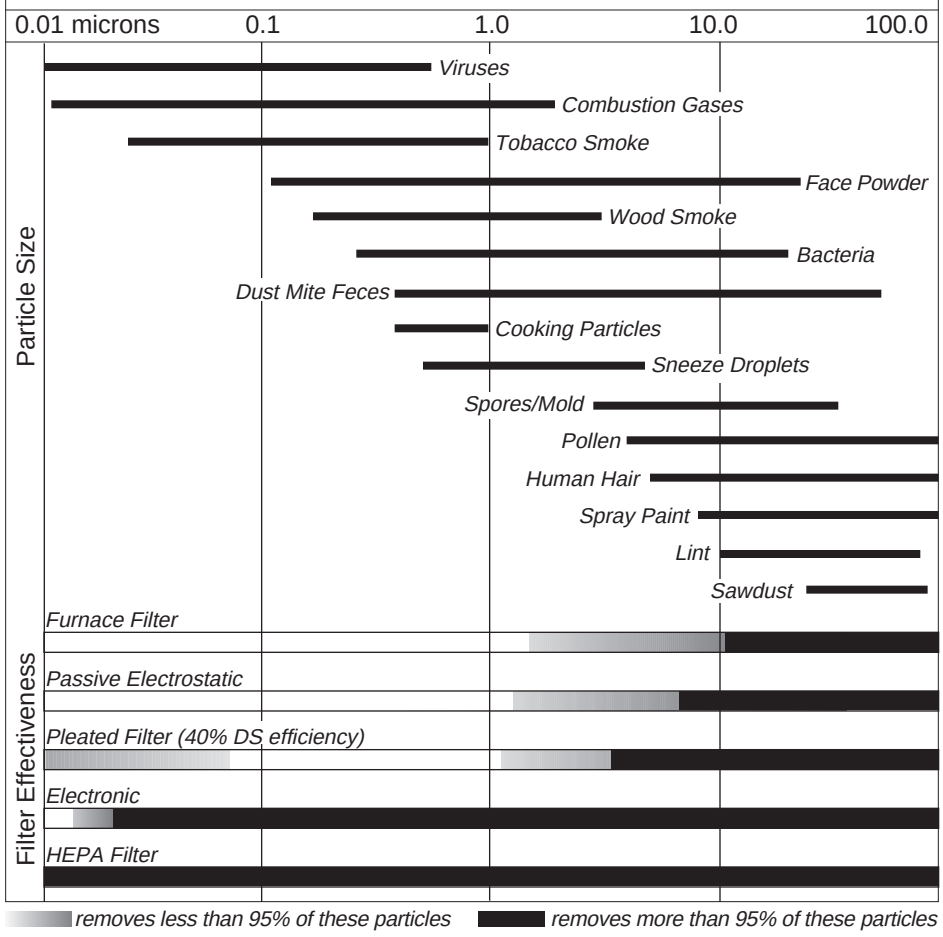
Arrestance is useful only for low-efficiency panel filters; it measures a

Table 1. Filter Cost and Efficiency

	Arrestance	Dust Spot Efficiency	Unit Cost	Installation[1] Cost
Furnace	75%	<10%	$1 – $2	$0
Passive Electrostatic	75% – 95%	<20%	$40	$0
Pleated	90% – 99%	20% – 55%	$10	$0 – $300[2]
HEPA	N/A	95% (DOP)[3]	$130	$350
Electronic	N/A	90% – 95%	$450	$300

[1] "Installation Cost" refers to the cost of any ductwork modifications.
[2] Only large pleated filters require ductwork modifications.
[3] "DOP" is a special test used only for HEPA filters.

Table 2. Filter Effectiveness by Particle Size



Note: *The table shows the specific particles that are removed by each filter type. The particles are measured in microns, or millionths of a meter. (As a point of reference, a human hair can be as thick as 100 microns in diameter.)*

filter's ability to remove large, heavy particles. If you want to know how a filter handles small, breathable particles, arrestance doesn't mean much. Unfortunately, some manufacturers quote filter "efficiency" or even "ASHRAE efficiency," when they really mean arrestance.

Dust spot efficiency is the best all-around measure of how well a filter removes fine particles. It lets you make accurate comparisons, for instance, between pleated filters and electronic air cleaners. The filter industry divides filters into three groups by dust spot efficiency. Low-efficiency filters remove less than 30% of all dust particles (the typical furnace filter has a dust spot efficiency below 10%). Medium-efficiency filters remove 30% to 50% of particles, and high-efficiency filters remove 50% to 95%. (HEPA filters have an efficiency above 95%.)

Table 1 (page 78) lists the effectiveness of different filter types, while Table 2 illustrates how well each filter handles specific pollutants. Note that HEPA filters and electronic air cleaners are the only ones that perform well across the entire range of particle sizes.

The Filter Decision

A good filter choice for most people is a pleated filter with a dust spot efficiency around 20%. You can get it for about $10 at many home improvement retailers. The next step up is a medium-efficiency pleated filter. It won't cost more than the consumer grade and won't require duct modifications, but you will have to buy it from a heating contractor or air filter supplier.

A better choice for allergy sufferers is an electronic air cleaner. It's effective against a wide range of particle sizes and offers little resistance to air flow. With proper cleaning, it's 90% to 95% efficient. It will also filter out combustion gases from appliances such as a wood stove or gas range. Costs for an EAC range from $600 to $800.

Honeywell offers a solution for the indecisive. The model F25 pleated filter is a 25% efficient filter that can be upgraded to a Honeywell F50E electronic air cleaner (it fits into the same furnace slot). If you want an EAC but can't afford it yet, the F25 could be a good choice. ■

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For More Information

For a list of furnace filter manufacturers, send a SASE to JLC, Filters, RR#2, Box 146, Richmond, VT 05477.