

## AIR FILTERS

### Introduction

An air filter is an important part of a heating and cooling system. A clean filter intercepts particles such as dust and fibers that build up on the blower fan and the heating and cooling coils. Such particle buildup reduces performance, restricts airflow through the system, and shortens operating life. Secondly, high-quality filters can improve a home's indoor air quality.

### Green Building Benefits

The only reason to have mechanical heating and cooling equipment in a home is to improve occupant comfort and health. Poorly operating equipment will not provide these benefits. Equipment that fails prematurely due to poor filtration clutters our landfills unnecessarily. Equipment replacement is extremely costly for the homeowner, so the longer it can be delayed, the better. Good filters that improve air quality and can reduce respiratory ailments and allergy problems are easily installed by the homeowner and available for a modest price.

### Choosing a Filter

**What do you want to filter out?** Is your family in reasonably good health or do you have family members with special health problems, such as allergies and asthma? Do you have pets that shed a lot of dander and hair? Is your house very "leaky," i.e., does it have high air-infiltration? Is it subject to high winds that bring in a lot of dust?

**Filter efficiency:** The more you want to filter out, the higher the filter efficiency needs to be. Beware of efficiency claims on filters, however. Unless the type of test or rating is referenced (i.e., dust spot efficiency or a MERV rating), such claims are meaningless.

"Dust spot" efficiency is a useful test, which measures a filter's ability to capture particles between 0.3 and 6 microns. Unfortunately, this test is seldom listed on a filter, but the filter-type information given subsequently on this document can serve as a basis of comparison.

More commonly found is the "MERV" rating (Minimum Efficiency Reporting Value). It tells you the filter's ability to capture particles between 3.0

and 10.0 microns, on a scale of 1 to 20. The higher the number, the smaller the particles the filter will capture. Particles of this size make up only about 1% of particles in the air, but note that efficiency changes over time with filter use.

**Can the filter be easily added to your present system?** Is there enough space for it? Will it allow proper airflow through the system? Most types of filters reduce airflow (the better the filter, the more likely this is), so *the filter must be matched to the system*. A mechanical contractor can tell you which filter type will work. If you have an incorrect match, comfort will be compromised and the equipment may suffer damage.

**How much maintenance are you willing to do?** Do you often forget to change the filter? Some types of filters last much longer than others. Some filters are 4 to 6-inches thick and require less frequent replacement than 1-inch filters. Are you willing to do a regular cleaning job? Some require frequent maintenance.

**How much can you spend?** Prices vary, but cheaper filters require more frequent replacement so consider long-term costs (including replacement costs for poorly protected equipment). Electronic and High Efficiency Particulate Air (HEPA) filters cost more but also do more.

### Filter Types

- **Flat Panel filters (1" thick)**
  - Dust spot efficiency less than 5%; MERV of <1; filters particles over 10.0 micron (e.g., hair, lint, some pollen, dust mites)
  - Provide very little protection to AC equipment, and virtually none for air quality
  - Disposable. Change monthly. Cost \$1-\$3
  - Not recommended
- **Pleated-media or extended surface filters (1"-6" thick)**
  - Dust spot efficiency 20%-75%; MERV of 8-12; filters particles 3.0-10.0 micron (e.g. mold spores)
  - Deep pleated-media filters (4" or more) require more space
  - Change every 3-6 months, depending on thickness and household conditions. Costs \$4-\$15 (for 1")
  - Highly recommended
  - Pleated media filters can also be electrostatic

- **Electrostatic filters (1” thick)**
  - Dust spot efficiency 10%-15%; MERV of 1-2; filters particles over 10 micron (see above)
  - Reusable. Clean once per month; may lose much effectiveness after only a week. Costs \$15-\$40
  - The electrostatic charge plays almost no role in particle-capture
  - Not recommended
- **Electronic air cleaners**
  - Dust spot efficiency 90%; filters particles .30-1.0 (e.g., bacteria, tobacco smoke, most particles)
  - Require electricity to create the charge and must be custom-built to fit in return air duct
  - Need frequent maintenance to clean plates
  - Expensive (\$150-\$300)
  - Caution--may produce small amounts of ozone, which is irritating to some people (an activated carbon filter installed downstream can remove it)
- **HEPA filters**
  - Dust spot efficiency 98%; filters particles < 0.30 (e.g. viruses, all combustion smoke)
  - Must be custom-built to fit in return air duct. Requires special high pressure blowers and ducts; used for “clean rooms,” not typically used in homes. Replace filter as needed. Expensive (\$200-\$500)

## Installation

Installation is usually very easy if the filter location is accessible. Consider accessibility when new equipment is installed.

## Operation and Maintenance

It is imperative that filters be clean, regardless of type. A dirty filter may actually be a more effective filter than a clean one, but only at the cost of proper

## Disclaimer

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airflow. Restricted airflow reduces comfort, increases energy consumption, and damages equipment by overworking the fan and shortening operating life.

## General Air Filtration

Filters are at best a second line of defense in improving indoor air quality. Outside air is almost always healthier than indoor air and should be introduced into a home in a controlled manner (typically into the return air of the system) to dilute pollutants indoors. This air can be filtered and pre-conditioned if necessary.

Far more valuable is the reduction of indoor pollutants at their source. Wall-to-wall carpeting, which collects dust, dust mites and moisture, can be replaced with hard-surface flooring. Such flooring (e.g., ceramic tile, wood, real linoleum, cork) is less absorbent and can be kept clean more easily. Particleboard and interior plywood in furniture and cabinets should be avoided, if possible, due to their high levels of unhealthy formaldehyde adhesives. Paints that are low in volatile organic compounds (VOCs) are safer. Look for quantities below 100 grams per liter. Choose cleaning products and insecticides with safety in mind. Avoid chlorine bleach and antibacterial products. They are rarely necessary.

Indoor relative humidity should also be kept below 60% to prevent dust mite and mold growth, two of our most serious indoor pollutants. High humidity also causes unhealthy chemicals in fabrics, paints and other materials to volatilize into the air, which may increase health problems. Humidity should be reduced by use of exhaust fans vented to the outside in kitchens and tub and shower areas. Moisture can also be reduced by locating laundry areas outside of the living space or by the use of horizontal-axis washing machines, which have gasketed doors. Note that lifestyle and personal habits play an important role in humidity levels as well