

Filtration 101

Filtration is a mechanical or physical operation which is used for the separation of solids from gases (Air) by interposing a medium through which only the air can pass. Oversize solid particles in the air are retained in the filter media, (depending on the pore size and filter thickness).

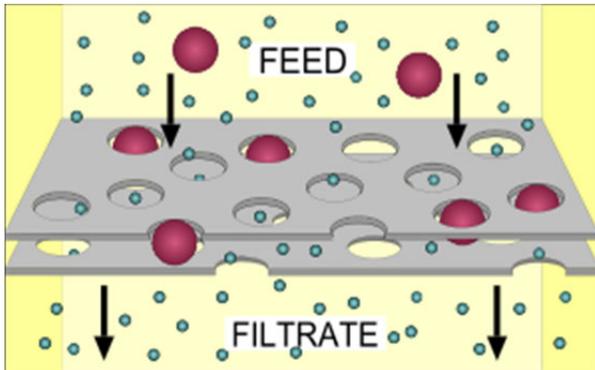
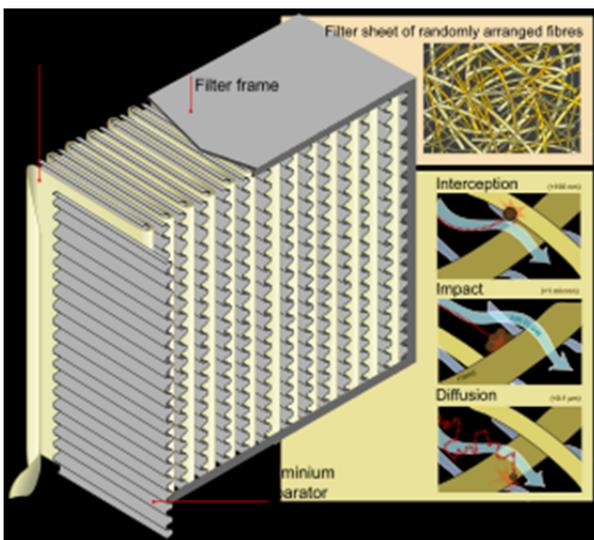


Diagram of simple filtration: oversize particles in the FEED (Dirty Air) cannot pass through the lattice structure of the filter, while air and small particles pass through, becoming FILTRATE.

If you can imagine in time, the more oversized particles that get stuck in the filter the harder it is for air to pass through and even the smaller particles will get caught up in the filter giving you less volume of FILTRATE but cleaner air with less particles.

Note: If it requires 10 lbs of pressure per square inch to keep the FEED flowing through the filter when it is clean, it will take more pressure to maintain that same flow amount after the filter has begun collecting the large particles and clogging up the pores of the filter. How much more pressure will depend on the amount of oversize particles retained by the filter.

Looking back to the diagram, if the darker yellow area around the outside of the filter does not make a good seal with the filter and air is allowed to bypass around the filter, the filtration efficiency is compromised and the quality of FILTRATE is lowered sometimes the same as the FEED. This effect takes place more as the filter becomes clogged with particles creating greater resistance.



This filter to be labeled in the USA as a HEPA filter, must meet HEPA Filtration Standards of filtration. This standard is 99.97% efficient to .3 microns. This in simple terms means it must remove 99.97% of all particles the size of .3 microns or smaller.

Today, a HEPA filter rating is applicable to any highly efficient air filter that can attain the same filter efficiency performance standards as a minimum and is equivalent to the more recent [NIOSH N100](#) rating for respirator filters. The [United States Department of Energy](#) (DOE) has specific requirements for HEPA filters in DOE regulated applications. Products that claim to be "HEPA-type", "HEPA-like", or "99% HEPA" do not satisfy these requirements and may not have been tested in independent laboratories.

Applied to Vacuum Cleaners

Bagged Vacuums

A bagged vacuum cleaner whether an upright or canister, is a vacuum cleaner that its primary filtration is a paper, cloth or synthetic bag located either on the inside or outside of the vacuum cleaner. This bag acts as the first level of filtration catching large particles and allowing the cleaner air with only smaller particles to pass through the pores of the bag.

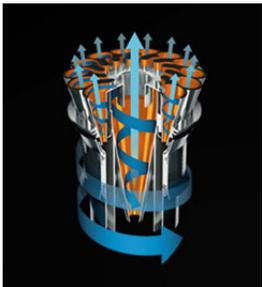
In the past ten years or so most vacuum manufacturers improved their filtration and added an additional (secondary or final) filter to the bagged type vacuum cleaners. This filter is many times called a HEPA (High Efficiency Particle Arrest) filter.

For a HEPA filter in a vacuum cleaner to be effective, the vacuum cleaner must be designed so that all the air drawn into the machine is expelled through the filter, with none of the air leaking past it. This is often referred to as "Sealed HEPA" or sometimes the vaguer "True HEPA." Vacuum cleaners simply labeled HEPA have a HEPA filter, but not all air necessarily passes through it. Finally, vacuum cleaner filters marketed as "HEPA-like" will typically use a filter of a similar construction to HEPA, but without the filtering efficiency causing poor airflow or less than desirable filtration. Because of the extra density of a HEPA filter, HEPA vacuum cleaners require motors with higher airflow and suction combined to provide adequate cleaning power.

Bagless Type

Bagless type vacuum cleaners whether they are canisters or upright vacuum cleaners, usually have a HEPA or HEPA type filter attached to their exhaust too. Unlike the bagged type these bagless machines do not always have a primary filter (Bag) as their first defense of capturing the large particles in the air that is being sucked into the vacuum. Some are designed with pre-filters made of washable foam. Most also use centrifugal force to attempt to separate the particles from the air and then finally force the air through a HEPA or HEPA type filter to expel only cleaned air.

Since most readers are familiar with the Dyson brand of vacuum cleaners it will use one of their units as an example of how bagless vacuums work. Keep in mind all bagless vacuum cleaners do work the same. Dyson uses the term cyclone technology, but it is still simply centrifugal force that separates the large particle from the air.



This type of filtration is the equivalent of a low quality filter or vacuum dust bag. Many manufacturers also include a motor filter after the cyclonic assembly to catch somewhat finer particles prior to the air passing through the motor. Once the air has been cleaned of the large particles it still needs to pass through a HEPA filter to finish cleaning the air before it is expelled from the vacuum. All of these filters and even the centrifugal forces uses energy and restricts airflow just like in bagged type vacuum cleaners.

Note about all information above: Vacuum cleaners in and of themselves do not lose suction, none of them do. Dirt clogging passageways and filters are the cause of loss of suction. As long as the motor is running at normal speed, the suction from the motor is relatively the same in a new motor or a 10 year old one. Electric motors do not get "Tired" like gas powered engines.

What does all this mean to you?

When choosing a vacuum cleaner filtration type and quality is an important part of the process. Allergy sufferers tend to pay closer attention to the filtration quality of the vacuum and less attention to the overall design and efficiency of the unit. If this step is overlooked allergy sufferers might find themselves purchasing a vacuum that has a great filter but does not have the sealed aspect of the HEPA filter or even a machine that does not have enough power to push the air through the filter thus lowering your cleaning effectiveness.

In addition to the previous paragraph many people purchase a less expensive vacuum based on what the outer box says rather than doing research to be sure that vacuum is properly designed with the correct balance of filtration efficiency, cleaning effectiveness and ease of use.

Since the introduction of HEPA filters to the vacuum cleaner industry most manufacturers have been forced to boost the power consumption of the motor in the vacuums to the maximum allowed by UL (United Laboratories) for household appliances in order to accommodate the back pressure caused by HEPA filters. This has caused a great increase of

power consumption in mainstream vacuum cleaners and in doing so has caused more noise, and shorter average life spans, and more heat generated by these electricity hogging vacuums.

Summary:

Vacuum cleaners are a major appliance in your home. They offer great results when they are designed and manufactured correctly. They do require the same amount of thought to purchase as does any other major appliance in your home. Don't sell them short and please do your homework, finally; by all means ask questions when making a purchase.

Below are some key points to look for and ask about when researching the proper vacuum to purchase for your home and needs.

- Filtration; e.g. Allergen, HEPA type, HEPA, and Sealed or True HEPA. Keep in mind the better the filtration the better the vacuum needs to be for it to effectively clean.
- Power Consumption; Amps or amperes are the measurement of power consumption that your machine uses. More is not necessarily better. The best vacuum cleaners give you the controls to adjust the power of your machine thus allowing you to conserve large amounts of energy when used correctly.
- Air Flow; Air flow is the key ingredient to a vacuum cleaner actually cleaning. Air flow can be adversely effected by HEPA filters especially if they are clogged with debris.
- Suction; for the most part suction is not an important part of cleaning. Many people use the term suction instead of the appropriate term airflow while others just maybe don't understand the difference. Here is a simple way of thinking about it. Put you thumb close to the end of a vacuum hose while the vacuum is on. That force you feel pulling your thumb into the hose is actually airflow flying past your thumb at high speeds and high volumes. Once your thumb is inside the hose and a seal is made around the hose the funny feeling that you feel is the blood in your thumb being pulled by the suction. Keep in mind air flow cannot effect your blood because it is inside your finger, but suction can as it extracts every spec of air out of your skin.
- Functionality; put quite simply what works the best for your cleaning needs. RTake time the next time you vacuum your house and make a mental wish list of thigs you wish your vacuum could help you clean. Once done, write them down and use that list while researching you new vacuum.
- Longevity; look lets face it, nobody likes to spend money on something and have to replace it in a year or two just because they didn't pay attention to what they were buying. Buying a cheap piece of junk does only little for you in the short run and ends up costing you a lot of grief and more money down the road. If you had to commute 100 miles each direction every day you would look for a car that was efficient, and lasted for hundreds of thousands of miles wouldn't you? Do the same with your vacuum. You will be surprised what you will find. Simple rule of thumb is if it is made in China the company that is having it made over there is doing it so they can have the cheapest product not because it is the highest quality. European and American made products are always of higher quality. Incidentally when I speak of American I am speaking of all the Americas including Canada, Mexico Central America and even South America
- Warranty; pay attention to it but not too much. I have seen many companies claim they had a 3 to 5 year warranty on vacuums. They really do but if you paid \$69 for the machine how much effort do you think is put into that warranty and customer service? Those items notoriously have to be taken to a service center other than where you purchased it for warranty work to be performed. High end vacuums also have 1 to 7 year warranties but usually will allow you to return your vacuum back to where you purchased it for warranty service work.
- Price; this is simple; buy the best you can COMFORTABLY afford.