

AiroDoctor

Definitions and References

Harmful Particles

HEPA is a type of pleated mechanical air filter. It is an acronym for "high efficiency particulate air [filter]" (as officially defined by the U.S. Dept. of Energy). This type of air filter can theoretically remove at least 99.97% of dust, pollen, mold, bacteria, and any airborne particles with a size of 0.3 microns (μm). The diameter specification of 0.3 microns responds to the worst case; the most penetrating particle size (MPPS). Particles that are larger or smaller are trapped with even higher efficiency. Using the worst-case particle size results in the worst-case efficiency rating (i.e. 99.97% or better for all particle sizes).

Source : <https://www.epa.gov/indoor-air-quality-iaq/what-hepa-filter-1>

ASHRAE Standard 52.2				ASHRAE Standard 52.1	Application Guidelines		
MERV	Particle Size Removal Efficiency, Percent in Particle Size Range, μm			Dust-Spot Efficiency Percent	Particle Size and Typical Controlled Contaminant	Typical Applications	Typical Air Filter/Cleaner Type
	0.3 to 1	1 to 3	3 to 10				
20	≥ 99.999	in 0.1 – 0.2 μm particle size		—	< 0.3 μm Virus (unattached) Carbon dust Sea salt All combustion smoke	Electronics manufacturing Pharmaceutical manufacturing Carcinogenic materials	HEPA/ULPA Filters*
19	≥ 99.999	in 0.3 μm particle size		—			
18	≥ 99.99			—			
17	≥ 99.97			—			
16	> 95	> 95	> 95	—	0.3-1 μm All bacteria Droplet nuclei (sneeze) Cooking oil Most smoke Insecticide dust Most face powder Most paint pigments	Superior commercial buildings Hospital inpatient care General surgery	Bag Filters – Nonsupported (flexible) microfibre fiberglass or synthetic media, 12 to 36 inches deep. Box Filters – Rigid style cartridge, 6 to 12 inches deep.
15	85-95	> 90	> 90	> 95			
14	75-85	> 90	> 90	90-95			
13	< 75	> 90	> 90	80-90			
12	—	> 80	> 90	70-75	1-3 μm Legionella Humidifier dust Lead dust Milled flour Auto emission particles Nebulizer drops	Superior residential buildings Better commercial buildings Hospital laboratories	Pleated filters – Extended surface with cotton or polyester media or both, 1 to 6 inches thick. Box Filters – Rigid style cartridge, 6 to 12 inches deep.
11	—	65-80	> 85	60-65			
10	—	50-65	> 85	50-55			
9	—	< 50	> 85	40-45			
8	—	—	> 70	30-35	3-10 μm Mold Spores Dust mite body parts and droppings Cat and dog dander Hair spray Fabric protector Dusting aids Pudding mix Powdered milk	Better residential Commercial buildings Industrial workplaces	Pleated filters – Extended surface with cotton or polyester media or both, 1 to 6 inches thick. Cartridge filters – Viscous cube or pocket filters Throwaway – Synthetic media panel filters
7	—	—	50-70	25-30			
6**	—	—	35-50	< 20			
5	—	—	20-35	< 20			
4	—	—	< 20	< 20	> 10 μm Pollen Dust mites Cockroach body parts and droppings Spanish moss Sanding dust Spray paint dust Textile fibers Carpet fibers	Minimum filtration Residential window air conditioners	Throwaway – Fiberglass or synthetic media panel, 1 inch thick. Washable – Aluminum mesh, foam rubber panel Electrostatic – Self-charging (passive) woven polycarbonate panel
3	—	—	< 20	< 20			
2	—	—	< 20	< 20			
1	—	—	< 20	< 20			

This table is adapted from ANSI/ASHRAE Standard 52.2-2007.¹⁵

*The last four MERV values of 17 to 20 are not part of the official standard test, but have been added by ASHRAE for comparison purposes. Ultra Low Penetration Air filters (ULPA) have a minimum efficiency of 99.999 percent in removing 0.3 μm particles, based on the IEST test method. MERVs between 17 and 19 are rated for 0.3 μm particles, whereas a MERV of 20 is rated for 0.1 to 0.2 μm particles.

** For residential applications, the ANSI/ASHRAE Standard 62.2-2007¹⁶ requires a filter with a designated minimum efficiency of MERV 6 or better.

Table above Identifies Minimum Efficiency Reporting Values (MERV) with relation to HEPA filters, particle sizes, and contaminants. AiroDoctor's HEPA filter (H13) is capable of removing pollutants up to 0.3 μm and

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therefore has the ability to protect users against fungal spores, pollutants, substances, bacteria and viruses listed above. AiroDoctor's Photocatalytic Filter destroys $<0.3\mu\text{m}$.

VOCs, Toughest Odors, Harmful/Toxic Gases

"Volatile organic compounds (VOC)" means any compound of carbon, excluding carbon monoxide, carbon dioxide, carbonic acid, metallic carbides or carbonates, and ammonium carbonate, which participates in atmospheric photochemical reactions.

Source : <https://www.epa.gov/air-emissions-inventories/what-definition-voc>

Volatile Organic Compounds (VOCs) are a large group of chemicals that are found in many products we use to build and maintain our homes. Once these chemicals are in our homes, they are released or "off-gas" into the indoor air we breathe. They may or may not be able to be smelled, and smelling is not a good indicator of health risk.

Common examples of VOCs that may be present in our daily lives are benzene, ethylene glycol, formaldehyde, methylene chloride, tetrachloroethylene, toluene, xylene, and 1,3-butadiene.

<https://www.health.state.mn.us/communities/environment/air/toxins/voc.htm>

The EPA has a list of [189 hazardous](#) air pollutants that can be detrimental to indoor air quality and individual health. The [CDC further defines it as](#), "Breathing in particle pollution can be harmful to your health. Coarse (bigger) particles, called PM10, can irritate your eyes, nose, and throat. Dust from roads, farms, dry riverbeds, construction sites, and mines are types of PM10. Fine (smaller) particles, called PM2.5, are more dangerous because they can get into the deep parts of your lungs — or even into your blood."

Studies such as, "Activated Carbon Adsorption for Treatment of VOC Emissions, presented at the 13th Annual EnviroExpo, Boston Massachusetts—May 2001 by Austin Shepherd, P.E., C.I.H" state that, "In the industrial area, the most common applications of activated carbon are for process off-gases, tank vent emissions, work area air purification, and odor control, either within the plant or related to plant exhausts." (<https://www.carbtrol.com/images/white-papers/voc.pdf>, page 1).

AiroDoctor's combination of its Activated Carbon Filter and HEPA filter (H13) is capable of removing pollutants from $>PM_{2.5}$ to $0.3\mu\text{m}$ and therefore has the ability to protect users against VOCs and air pollutants deemed hazardous by the EPA listed. AiroDoctor's Photocatalytic Filter destroys $<0.3\mu\text{m}$. AiroDoctor was also specifically tested and showed success in the removal of Formaldehyde (HCHO), Ammonia (NH₃), Ethylene Oxide (C₂H₄O), Acetic Acid (CH₃COOH), and Toluene (C₇H₈).

Harmful Residues and Byproducts

KETI (Korea Electronics Technology Institute) tested AiroDoctor for any emissions or byproducts and found no significant traces of Ozone or any additional Byproducts.