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What Are MERV Ratings and How Do They Work?

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What is the Minimum Efficiency Reporting Value?

The Minimum Efficiency Reporting Value, also known simply as MERV, measures the performance of air purifiers, specifically large purifiers intended to clean an entire house or building. Large, whole-house purifiers are not evaluated in the same manner used to measure the effectiveness of small, portable air cleaners, which are sometimes given Clean Air Delivery Ratings (CADR) instead.

Whole house and building air purifiers usually receive MERV ratings of between 1 and 16, though the upper limit is sometimes extended to 20. Common residential air purification systems tend to fall within a narrower range. Higher numbers translate to more effective air filtration. According to the online encyclopedia Wikipedia, "The scale is designed to represent the worst case performance of a filter when dealing with particles in the range of 0.3 to 10 micrometers."

MERV Rating Chart

ASHRAE Standard 52.2				ASHRAE Standard 52.1	Application Guidelines		
MERV Rating	Particle Size Removal Efficiency			Dust-Spot Efficiency Percent	Particle Size and Typical Contaminant	Typical Applications	Typical Air Filter Type
	0.3 to 1	0.3 to 1	0.3 to 1				
20	≥ 99.999	in 0.1 - 0.2 μm particle size		-	< 0.3 μm Virus (un attached) 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	in 0.3 μm particle size		-			
17	≥ 99.97	in 0.3 μm particle size		-			
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 - Non supported (flexible) microfine 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 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	Better residential Commercial	Pleated filters - Extended surface with cotton or polyester media or both, 1 to 6 inches thick
7	-	-	50-70	25-30			
6	-	-	35-50	< 20			

5	-	-	20-35	< 20	and droppings Cat and dog dander Hair spray Fabric protector Dusting aids Pudding mix	buildings Industrial workspaces	Cartridge filters - Viscous cube or pocket filters Throwaway - Synthetic media panel filters
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

(Table Data Source - United States Environmental Protection Agency)

Who Uses MERV Ratings?

The MERV rating system was initially created by the American Society of Heating, Refrigerating and Air-Conditioning Engineers (or [ASHRAE](#) for short) in 1987. However, this evaluation system was based on older methods that date back to 1968, when ASHRAE issued "Standard 52," the first formal testing standard for filters. According to an article by engineer Donald Newell, the purpose of the Standard has not changed since its early days, and is designed to determine the following attributes of air filters:

- Particle removal capability
- Resistance to airflow
- Expected operating life

MERV ratings measure only the first quality, however. The MERV rating of an air cleaner is determined according to updated standards set by the [ANSI/ASHRAE Standard 52.2-1999](#).

How is an Air Cleaner's MERV Rating Determined?

Air cleaners are given MERV ratings based on the results of a series of tests. Simply put, the process works as follows:

1. Test particles are introduced into the air of the testing area. These particles fall into one of twelve categories, based on size. The smallest category contains particles ranging from .3 to .4 micrometers (also known as "microns"). The largest includes particles from 7 to 10 micrometers.
2. The air is then passed through the filter being tested. The density of particles in the air is measured before and after the air passes through the filter to determine how effective the filter is at removing pollutants in each size category.

After this is done, the process is repeated five more times, so that there are ultimately six measurements for each of the twelve categories. The MERV number is assigned based on the worst result. Hence the "minimum" in "Minimum Efficiency Reporting Value."

What Does an Air Cleaner's MERV Rating Mean for You?

A helpful chart detailing what MERV ratings mean can be found at http://www.mechreps.com/PDF/Merv_Rating_Chart.pdf. Of particular interest is the column detailing what types of pollutants are filtered out at each level.

Precise technical details will be less important to the average customer than an answer to the question, "What MERV ratings are acceptable for my home?" The United States Environmental Protection Agency provides some information on this matter. "Medium efficiency filters with a MERV of 5 to 13," it states, "are reasonably efficient at removing small to large airborne particles. Filters with a MERV between 7 and 13 are likely to be nearly as effective as true HEPA filters at controlling most airborne indoor particles." Furthermore, the EPA adds that "medium efficiency air filters are generally less expensive than HEPA filters, and allow quieter HVAC fan operation and higher airflow rates than HEPA filters since they have less airflow resistance."

HEPA (High Efficiency Particulate Air) filters are the top-of-the-line air filters. Most homes are not capable of having whole-house HEPA filtration systems installed without extensive modification. Therefore, the EPA's recommendation of filters with a MERV rating from 7 to 13 is something that potential customers should keep in mind.

The National Air Filtration Association gives a roughly similar answer. The highest range it recommends for residential systems is 9-12; higher numbers are said to be suited for hospitals or commercial buildings rather than homes.

Limitations of the MERV Rating System

An air cleaner's MERV rating is based on its ability to filter out undesirable particles from the air. Not all indoor air pollution is particle-based, however. Gasses contribute significantly to pollution as well. The ability of an air purifier to remove particles is not predicative of its ability to remove gasses, so the MERV rating is not helpful in this regard.

Newell's article cautions that air filters given the ASHRAE test "are likely to perform worse than predicted because of various installation conditions." This is known as the "installation effect." Therefore, it is important to remember that MERV ratings are assigned based on a purifier's performance in carefully controlled testing conditions, and not the "real world."

And finally, as stated above, MERV ratings are only relevant to large air cleaners intended to affect whole buildings. Common small portable air cleaners do not have MERV ratings.

Conclusion

The MERV rating system is a helpful way to describe the capabilities of different large air cleaners. It is determined through rigorous testing and is gives the worst-case performance of the filter, so the MERV number is not inflated. No one should forget to consider MERV ratings when shopping for such cleaners. There are, however, other factors to consider as well, so it would be a mistake to think that buying the right air filtration system is a simple matter of picking the unit with the highest MERV.

Sources referred to in this article:

- Mechanical Reps., Inc. "MERV Rating Chart."

http://www.mechreps.com/PDF/Merv_Rating_Chart.pdf

- National Air Filtration Association. "Understanding MERV: NAFA User's Guide for ANSI/ASHRAE Standard 52.2-2007." <http://www.nafahq.org/LibraryFiles/Articles/Article006.htm>
- Newell, Donald A. "Interpreting Filter Performance."
<http://www.emcorservicesnynj.com/news/FilterPerformanceByDN.pdf>
- United States Environmental Protection Agency. "Guide to Air Cleaners in the Home."
<http://www.epa.gov/iaq/pubs/airclean.html>
- Wikipedia. "Minimum Efficiency Reporting Value."
http://en.wikipedia.org/wiki/Minimum_Efficiency_Reporting_Value
- Wilkinson, Ron. MC2 "Market & Competitive Convergence -- Air Filters: New Facilities, New Standard."
http://www.foustco.com/fileCabinet/ProductInstructions/HVACFilters/merv_explanation.pdf

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