



What should I know about ASHRAE Efficiency?

Understanding MERV or the Minimum Efficiency Reporting Value

How the ASHRAE 52.2 Helps You Select an Air Filter

For 30 years tests for air filters were done according to ASHRAE 52.1. This test provided an efficiency rating such as a 30%, 65%, 90%, etc.. This system is relatively easy to understand. However, it has some major deficiencies in that it does not provide a very good guide for selecting filters for particular contaminants. In order to do that effectively you need to know two things – one, the particle size of the contaminant you are trying to remove and two, the level of efficiency of the filter on that particle size. Thus the ASHRAE 52.2 test was developed to provide this particle size efficiency data.

Obtaining the Data

An air filter's performance is determined by measuring the particle counts upstream and downstream of the filter being tested. Particle counts are taken over the range of particles six times. One begins with a clean filter and then uses that same filter 5 additional times.

The particle generator creates particles of a known size in the air stream. The objective is to create particles of sufficient numbers to obtain meaningful counts in all of the measured particle ranges which are the following:

ASHRAE 52.2 Particle Size Ranges

Range	Size (in microns)	Group
1	0.30 to 0.40	E1
2	0.40 to 0.55	E1
3	0.55 to 0.70	E1
4	0.70 to 1.00	E1
5	1.00 to 1.30	E2
6	1.30 to 1.60	E2
7	1.60 to 2.20	E2
8	2.20 to 3.00	E2
9	3.00 to 4.00	E3
10	4.00 to 5.50	E3
11	5.50 to 7.00	E3
12	7.00 to 10.00	E3

The efficiency of the filter is then measured on each of the 12 particle size ranges for each of the 6 cycles. Efficiency is measured as the percentage of particles captured by the filter. The lowest of the 6 readings is then taken to determine the Composite Minimum Efficiency Curve.



The twelve size ranges are then placed in three larger groups (E1, E2, E3) and the percentages in each group are averaged. This average is called the Particle Size Efficiency and these are used to determine the Minimum Efficiency Reporting Value (MERV).

MERV Parameters

MERV Value	Group 1 Av. Eff. % (0.30 to 1.00)	Group 2 Av. Eff. % (1.00 to 3.00)	Group 3 Av. Eff. % (3.00 to 10.00)
1	n/a	n/a	E3<20
2	n/a	n/a	E3<20
3	n/a	n/a	E3<20
4	n/a	n/a	E3<20
5	n/a	n/a	20<35
6	n/a	n/a	35<50
7	n/a	n/a	50<70
8	n/a	n/a	70
9	n/a	E2<50	85
10	n/a	50<65	85
11	n/a	65<80	85
12	n/a	80	90
13	E1<75	90	90
14	75<85	90	90
15	85<95	90	90
16	95	95	95

When using the above table you move up each Group until you arrive at a true statement. This will correspond with a MERV number. The lowest MERV of the three groups is the MERV rating for the filter.

Another important consideration is the speed of the airflow during the test. There are seven approved speeds:

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| 1. | 118 Feet Per Minute (FPM) | 0.60 meters/second (m/s) |
| 2. | 246 FPM | 1.25 m/s |
| 3. | 295 FPM | 1.50 m/s |
| 4. | 374 FPM | 1.90 m/s |
| 5. | 492 FPM | 2.50 m/s |
| 6. | 630 FPM | 3.20 m/s |
| 7. | 748 FPM | 3.80 m/s |

The Minimum Efficiency Reporting Value (MERV) must be stated with the speed of the airflow at which the filter was tested.



One of the challenges of having both an ASHRAE 52.1 test and an ASHRAE 52.2 test is trying to make some comparisons between the two. The table below may help in this regard:

MERV Rating	Efficiency	Particle Size	Applications	Filter Type
1-4	<20%	>10 microns	Residential Light Commercial Equipment Fiberglass Poly Panel	Permanent Metal Foam
5-8	<20 to 35%	3 to 10 um	Commercial Industrial Better Res. Paint Booth	Pleated Filters Tackified
9-12	40 to 75%	1 to 3 um	Res. – Best Commercial Telecommunications Industrial	Best Pleated Rigid Box Rigid cell Bag
13-16	80 to 95%	0.3 to 1 um	Smoke Removal General Surgery Hospitals Health Care Superior Comm.	Rigid Cell Bags V-Cell Mini-pleat

These comparisons are not meant to be definitive. They are guidelines only.

As a practical matter, let's see how we can use the MERV rating. One example would be mold spores. What filter would we recommend if we were concerned with pulling out a high percentage of mold? Mold varies in size from about 4 microns to 40 microns. The greatest number of mold spores are less than 10 microns in diameter. If we look at our chart a MERV 8 filter will pull out at least an average of 70% of the particles down to 3 microns. Not a bad recommendation. However, for just a little more money pleated filters are available in a MERV 11. The MERV 11 would give you an average of at least 85% mold removal. For all those but the most mold sensitive this should be adequate.

Note: This article is based on information provided by the National Air Filtration Association (NAFA). For more information on NAFA and the programs offered by this excellent organization please visit their website at www.nafahq.org.