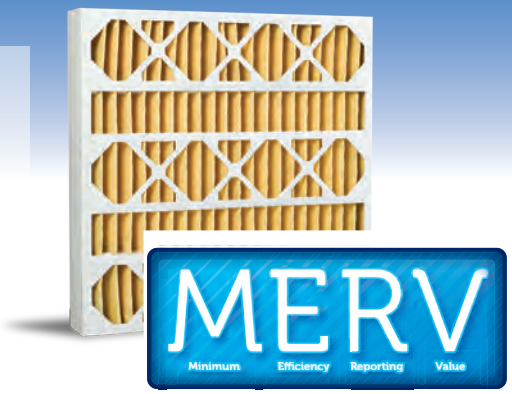
An Inside Look at ASHRAE 52.2

An ASHRAE 52.2 test report provides a wealth of useful information beyond a simple MERV rating. We'll review various sections of a sample report and provide insight on what to look for when conducting a filter evaluation.



1 Test Report-ASHRAE Test Standard 52.2-2007

Report #: **2693**

Test Requested By:	**Kimberly-Clark**
Test Date:	**06/18/2012**
Manufacturer:	**Kimberly-Clark**
Filter ID:	**INTREPID Filtration Media**
Model Number:	**N/A**
2 Dimensions:	**24" x 24" x 2"**
3 Number of Pleats:	**28-Plts**
Filter Description:	**White synthetic pleat filter**
How Filter Obtained:	**Provided by Manufacturer**

Part 1 – Test Report

1 First, note that this is a full test report according to the ASHRAE 52.2 Test Standard. Do not confuse results obtained through the Standard test with those obtained through an Initial test. Be sure to request full test data.

2 Make sure that the dimensions of the filters you are evaluating are the same. The filter tested here is a typical size for commercial and institutional HVAC systems, while residential/retail filters are typically 1-inch thick.

3 Check the number of pleats on each filter as this will affect the pressure drop. A higher pleat count typically translates into a lower pressure drop as there is more media through which air must flow, creating less overall air resistance. A lower pressure drop means the HVAC system motor does not need to work as hard, which helps to reduce system energy expenditures.

Test Results

4	Test Air Flow Rate(CFM)/Velocity (FPM)	**1968 cfm / 492 fpm**
	Initial Resistance (in. WG)	**0.217"**
	Final Resistance (in. WG)	**1.500"**
	Minimum Efficiency Rating Value **(MERV)**	**MERV 11 @ 1968 cfm**
5	Minimum Average Efficiency 0.3 to 1.0 Microns **(E1)**	**30.3**
	Minimum Average Efficiency 1.0 to 3.0 Microns **(E2)**	**69.6**
	Minimum Average Efficiency 3.0 to 10 Microns **(E3)**	**86.7**
6	Dust Fed to Final Resistance (grams)	**146.7 grams**
	Dust Holding Capacity (grams)	**131.3 grams**
	Arrestance:	**89.5%**

Part 2 – Test Results

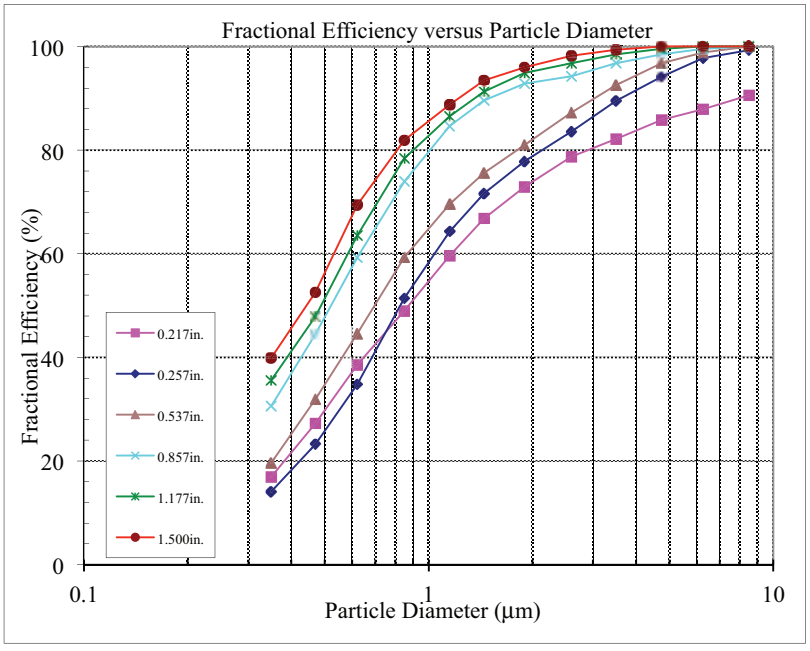
4 Initial Resistance is another term for Pressure Drop. This data point indicates the lowest airflow resistance of a new, out-of-the-box filter. This is a particularly low airflow resistance for a MERV 11 filter, indicating that less energy will likely be needed to run the filter and that the filter may last longer than a filter with a higher airflow resistance, depending on conditions.

5 Note the E1, E2 and E3 efficiency ratings. These are the numbers used to calculate the overall MERV, but each individual number is significant as well. E1 size particles are the easily respirable particles that can cause health problems, so they are of special concern. Interestingly, ASHRAE 52.2 does not require MERV 11 filters to be tested for E1 efficiencies, and many of those that are tested have much lower efficiencies (in the 7-10 percent range).

6 Dust holding capacity is often mistaken for an indication of the useful life of the filter. Per ASHRAE, this is not the case. One should instead use final pressure drop as an indication of when to change filters. In most cases, filters should be changed out just before reaching 1-inch W.G. pressure drop.

A	B	C	D	E		G	
ΔP ("H_2O)	0.217in.	0.257in.	0.537in.	0.857in.	1.177in.	1.500in.	*CME
Size Range (µm)	Fractional Efficiency (%)						
0.3-0.4	16.9	14.1	19.6	30.6	35.6	39.9	14.1
0.4-0.55	27.3	23.2	31.9	44.5	47.9	52.6	23.2
0.55-0.7	38.6	34.8	44.6	59.3	63.5	69.4	34.8
0.7-1.0	49.0	51.4	59.3	73.9	78.4	81.9	49.0
1.0-1.3	59.7	64.3	69.6	84.7	86.6	88.8	59.7
1.3-1.6	66.8	71.7	75.6	89.6	91.3	93.5	66.8
1.6-2.2	72.9	77.9	81.0	92.9	94.9	96.0	72.9
2.2-3.0	78.8	83.6	87.3	94.3	96.8	98.2	78.8
3.0-4.0	82.2	89.5	92.6	96.8	98.5	99.4	82.2
4.0-5.5	85.9	94.2	96.8	98.5	99.6	100.0	85.9
5.5-7.0	87.9	97.8	98.9	99.6	100.0	100.0	87.9
7.0-10.0	90.6	99.3	100.0	100.0	100.0	100.0	90.6

***Composite Minimum Efficiency**



Part 3 – Composite Minimum Efficiency

7 In the 52.2 test procedure, particle counts are taken over the range of particle sizes six times, beginning with a clean filter and then after the addition of standard synthetic ASHRAE dust loadings for five additional measurement cycles. This table indicates the efficiency of the filter as test dust of varying size particles are introduced to the test air.

8 Note that in Column A, the first four particle size ranges represent E1 particles, the second four represent E2 particles and the third four represent E3 particles. The lowest values over the six test cycles are then used to determine the Composite Minimum Efficiency Curve. Using the lowest measured efficiency avoids the misinterpretation of averaging and provides a "worst case" experience over the entire test.

9 Averaging the Composite Minimum Efficiency for each of these groups will calculate the average Particle Size Efficiency (PSE), and the resulting three percentages (E1, E2, E3) are then used to determine the MERV.

10 The data in this table is also reflected in the graph at left.

Part 4 – Airflow Rate and Velocity

11 Not all HVAC systems have the same airflow rate and velocity. That's why the test is conducted at different rates, with 492 FPM being the default standard for a commercial 24x24x2-inch filter.

12 Performance at the default standard 492 FPM velocity is further illustrated by the bottom-left graph which shows what the pressure drop would be with different flow rates.

13 Finally, the bottom-right graph reflects the Dust Fed column of the previous table and shows what happens each time additional dust is fed into the test.

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Flow Rate (CFM)	Velocity FPM	dP (mm H2O)	Pressure drop ("H2O)	% of Rated Airflow	Dust fed	Pressure drop
0	0	0.00	0.000	0%	0.00	0.217
492	123	0.80	0.031	25%	8.20	0.257
984	246	2.10	0.083	50%	85.30	0.537
1476	369	3.50	0.138	75%	119.90	0.857
1968	492	5.50	0.217	100%	134.90	1.177
2460	615	8.40	0.331	125%	148.00	1.500

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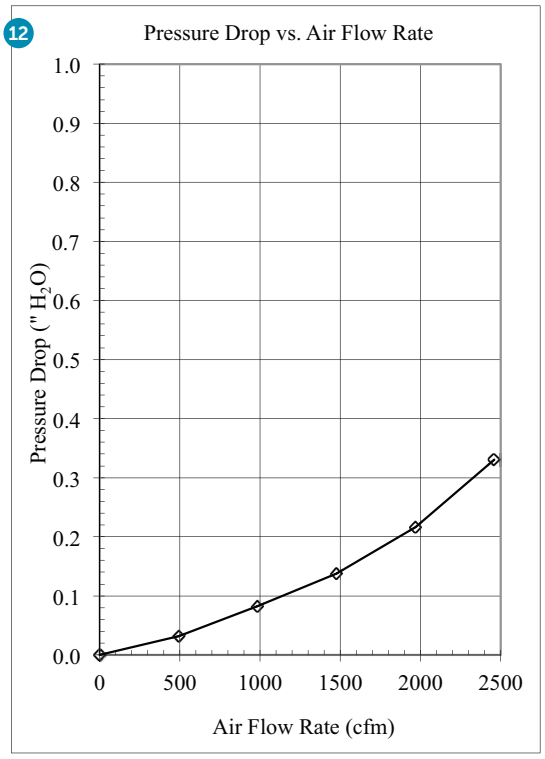

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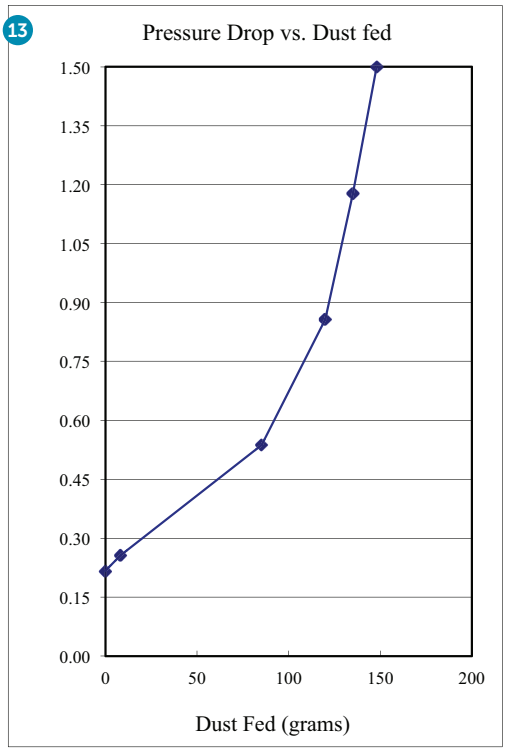

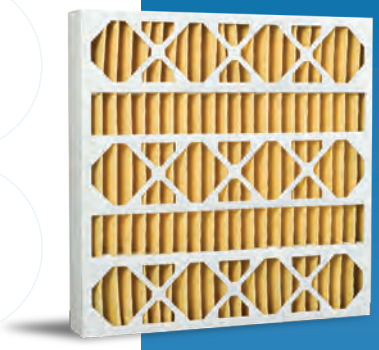

Bottom Line for Facility Managers and HVAC Professionals:

Even at the same MERV, not all filters will perform equally, especially when it comes to removing submicron particles. High E1 and E2 efficiencies are critical for providing for good IAQ and helping building occupants avoid illness related to poor IAQ. Understanding that the estimated total cost to the U.S. economy from poor IAQ can be as high as $160 billion a year, taking action to improve IAQ in your facility may improve your business results. Unfortunately, many pleated filters today have very low E1 and E2 efficiencies. Request and review the full ASHRAE 52.2 test report to conduct a more thorough filter selection review.

Bottom Line for Filter Distributors and Filter Manufacturers:

Filters made with media that provides a good balance of mechanical and electret efficiency will almost always outperform a filter with media that relies solely on mechanical-only media efficiency. The mechanical efficiency provides for sustained filtration efficiency, and the electret charge increases initial efficiency and is particularly useful in increasing capture efficiency for E1 submicron particles.