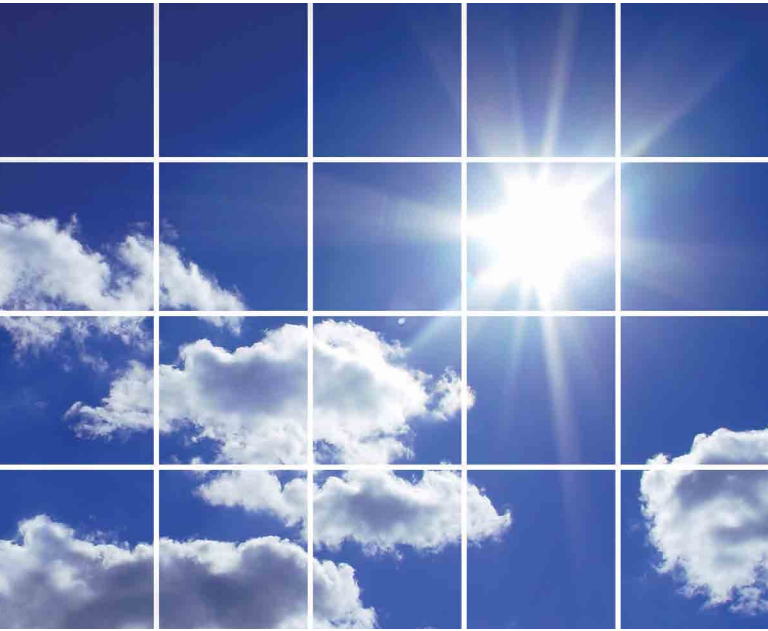
Koch Filter Corporation
Filtration Products Crafted with Pride

The Updated Air Filter Standard
ANSI/ASHRAE 52.2-2007



Koch Filter Corporation...Durable. Reliable. Versatile.

Bulletin No. K-ASH52.2-09

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In recent years, the air filter industry has changed important portions of its long-standing test method, ***ASHRAE Standard 52.1***. Now, the ***ASHRAE Standard 52.2***, is the only ASHRAE standard used to evaluate filtration product performance.

**ANSI/ASHRAE Standard 52.1 was discontinued as of January 2009, ANSI/ASHRAE Standard 52.1 ranges are presented here for reference only*

Please contact us if you have specific questions about air filter options for your applications.

www.kochfilter.com

Who is ASHRAE?

The American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE), founded in 1894, is an international organization of 51,000 members. ASHRAE fulfills its mission of advancing heating, ventilation, air conditioning and refrigeration to serve humanity and promote a sustainable world through research, standards writing, publishing and continuing education.

The latest ASHRAE Standard, in the works since 1987, is titled *ASHRAE Standard 52.2-2007: Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size* and is commonly known as **ASHRAE Standard 52.2.** Accredited by the American National Standards Institute (ANSI), it is intended to assist end-users and specifiers in their selection of appropriate air filtration products by defining anticipated performance throughout the useful life of a filter. (For more information visit: www.ashrae.org)

How Data Is Obtained

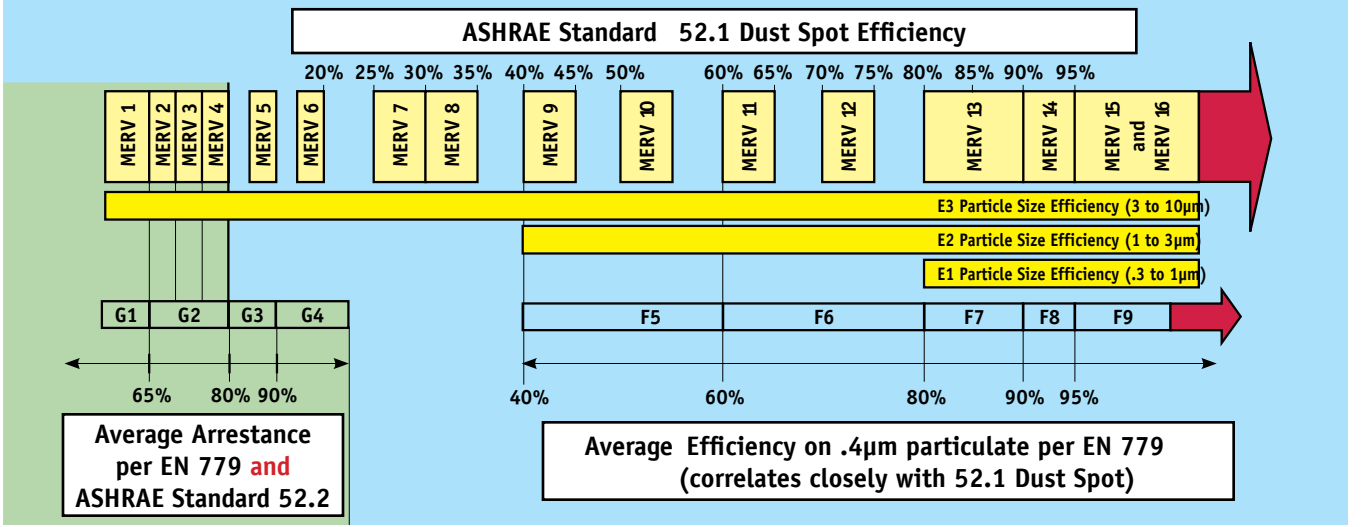
An air filter's performance is determined by measuring the particle counts upstream and downstream of the air-cleaning device being tested.

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.

A laboratory aerosol generator, which operates much like a paint sprayer, is used to create a challenge aerosol of known particle size in the

Test Standard Comparison Chart

The chart below is useful in understanding the relationship between ASHRAE Test Standard 52.1-1999, ASHRAE Test Standard 52.2-2007, E1, E2, E3 and European Test Standard EN 779.



Source: Mr. Robert Burkhead, President of Blue Heaven Technologies, Louisville, Kentucky.

air stream. This will generate particles covering the 12 required particle size ranges for the test (See ANSI/ASHRAE 52.2 Particle Size Ranges Chart).

ANSI/ASHRAE 52.2 PARTICLE SIZE RANGES		
Range	**Size**	**Group**
1	0.30 to 0.40	E1
2	0.40 to 0.55	
3	0.55 to 0.70	
4	0.70 to 1.00	
5	1.00 to 1.30	E2
6	1.30 to 1.60	
7	1.60 to 2.20	
8	2.20 to 3.00	
9	3.00 to 4.00	E3
10	4.00 to 5.50	
11	5.50 to 7.00	
12	7.00 to 10.00	

The challenge aerosol is injected into the test duct and particle counts are taken for each of the size data points.

The filter's performance, on each of the twelve particle sizes, during the six test cycles (a total of 72 measurements) is determined. For each measurement, the filtration efficiency is stated as a ratio of the downstream-to-upstream particle count. 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.

The twelve size ranges are placed in three larger groups according to the following schedule: ranges 1-4 (or E1, which is 0.3 to 1.0 µm), ranges 5-8 (or E2, which is 1.0 to 3.0 µm), and ranges 9-12 (or E3, which is 3.0 to 10.0 µm). 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.

ASHRAE 52.2 CLASSIFICATION PARAMETERS

MERV Performance Rating	Particle size efficiency			Average Arrestance (Addendum B)	ASHRAE 52.1 Reference*	Typical Applications	Koch Filter Product
	Range 1 (.3 to 1 µm)	Range 2 (1 to 3 µm)	Range 3 (3 to 10 µm)		Average Dust Spot Efficiency		
1	–	–	E3<20%	Aavg<65%	Eavg<20%	Residential/ Minimum Light/ Commercial Minimum/ Equipment Protection	FG Pads, FG C&I Disposables
2	–	–	E3<20%	65≤Aavg<70%	Eavg<20%		FG Pads, FG C&I Disposables
3	–	–	E3<20%	70≤Aavg<75%	Eavg<20%		FG & Poly pads, Poly C&I Disposables
4	–	–	E3<20%	75%≤Aavg	Eavg<20%		FG & Poly pads, Poly C&I Disposables
5	–	–	20≤E3<35%	–	Eavg<20%	Industrial Workplaces Commercial Better/Residential Paint Booth/ Finishing	FG & Poly pads, Poly C&I Disposables
6	–	–	35≤E3<50%	–	20≤Eavg≤25%		Maxi-Grid
7	–	–	50≤E3<70%	–	25≤Eavg≤30%		Maxi-Grid
8	–	–	70≤E3	–	30≤Eavg≤35%		Multi-Pleat XL8, Multi-Pleat Elite, SprayStop Universal Cube HE
9	–	E2<50%	75%≤E3	–	40≤Eavg≤45%	Superior/ Residential Better/Industrial Workplaces Better/ Commercial Buildings	Duo-Pack 40
10	–	50≤E2<65%	80%≤E3	–	50≤Eavg≤55%		Multi-Cell, Multi-Sak, Multi-Flo
11	–	65≤E2<80%	85%≤E3	–	60≤Eavg≤65%		Multi-Cell, Multi-Sak, Multi-Flo, Multi Pleat XL11, MicroMAX, DuraMAX 2v, DuraMAX 4v
12	–	80≤E2	90%≤E3	–	70≤Eavg≤75%		Maxi-Cell, Multi-Sak, MicroMAX, DuraMAX 2v, DuraMAX 4v
13	E1<75%	90%≤E2	90%≤E3	–	80≤Eavg≤90%	Smoke Removal General Surgery Hospitals & Health Care Superior/ Commercial Buildings	Multi-Cell, Multi-Sak, Multi-Flo, Multi Pleat Green 13, MicroMAX, DuraMAX 2v, DuraMAX 4v
14	75≤E1<85%	90%≤E2	90%≤E3	–	90≤Eavg≤95%		Maxi-Cell, Multi-Sak, MicroMAX, DuraMAX 2v, DuraMAX 4v
15	85≤E1<95%	90%≤E2	90%≤E3	–	Eavg>95%		DuraMAX GT-98, BioMAX GT, MicroMAX, DuraMAX 2v, DuraMAX 4v, SprayStop E-Pak 950
16	95%≤E1	95%≤E2	95%≤E3	–			BioMAX GT, BioMAX 95, DuraMAX 2v, DuraMAX 4v

* ASHRAE does not have a test procedure for HEPA testing and has thus dropped the MERV 17 - 20 classifications. ANSI/ASHRAE 52.1 ranges are provided for reference only. The ANSI/ASHRAE 52.1 Standard was discontinued as of January 2009.

What has changed?

ASHRAE Standard 52.1 was used as the industry standard for several decades. A main component of Standard 52.1 was the Average Dust Spot Efficiency Tests. The new standard, however, evaluates air filter efficiency as a function of particle size. The new test method determines the ability of an air filter to remove dust by specific particle sizes ranging from 0.3 micrometers (µm) to 10 micrometers (µm). This advancement led to the creation of a Minimum Efficiency Reporting Value (MERV) to determine the performance of each filter tested. MERV is a central feature of ASHRAE Standard 52.2.

One important characteristic of ASHRAE Standard 52.2 is the required calculation of dust holding capacity and arrestance, explained in Addendum B. A key element of 52.2 is particle size efficiency, which has the most significant value when determining filter performance. While the MERV performance is published for all Koch Filter Corporation's Filters, our technical specialists are available to provide assistance to customers in understanding the latest standards.

MERV Performance

The Minimum Efficiency Reporting Value, or MERV, is a guideline to inform consumers how efficient a filter will be when installed. **MERV 1-4** air filters are typically disposable panel filters or pads and are used primarily to protect equipment from particles no smaller than 10 micrometers. **MERV 5-8** air filters are a better choice and more commonly found in both residential and commercial applications. They are capable of effectively collecting particles as small as 3 micrometers. **MERV 9-12** air filters are used in commercial and industrial settings, or in residential, where higher levels of dust control is required. These filters are capable of collecting particles in the 1 to 3 micrometer range. It is important to change these filters when recommended due to the negative impact they will have on air flow when they become dirty. **MERV 13-16** are high efficient air filters and can collect particles as small as .3 micrometers. These filters are typically used in hospitals or manufacturing facilities where higher levels of cleanliness are required.

Standard Test Airflow Rates

The Minimum Efficiency Reporting Value (MERV) must be stated with the air velocity at which the filter was tested. For example, if the filter was tested with an air velocity of 492 FPM and was found to be MERV 8, the filter's Minimum Efficiency Reporting Value would be MERV 8 @ 492 FPM. ASHRAE Standard 52.2 tests are to be conducted at one of seven airflow rates:

118 FPM (0.60 m/s)
246 FPM (1.25 m/s)
295 FPM (1.50 m/s)
374 FPM (1.90 m/s)
492 FPM (2.50 m/s)
630 FPM (3.20 m/s)
748 FPM (3.80 m/s)

ADDENDUM B - AVERAGE ARRESTANCE AND DUST HOLDING CAPACITY (DHC)

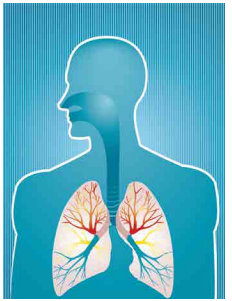
Arrestance and DHC values will be reported on all filters tested per 52.2 testing procedures. While these values will be reported they are not part of the mandatory reporting for MERV unless the values are in MERV's 1 through 4.

Appendix J Conditioning

ASHRAE Standard 52.2-2007 also introduces a standard that insures air filter purchasers and users are aware of the filter's performance in specific applications. Appendix J added in 2008 is an optional test which replaces the non-mandatory filter-conditioning step of 30 grams of dust loading with a potassium-chloride (KCL) conditioning method which is intended to closely mimic the aerosol-particle size distribution normally seen when filters are operated under "real-life" conditions. This test provides an additional value, MERV A, which can be used to quantify a filter's performance (Options: MERV and a MERV "A" required value).

In a few cases, the efficiency of a filter decreases after conditioning, some sufficient enough to decrease the MERV performance by several numbers. Although these measures are useful tools in selecting air filters, it is suggested that customers look at MERV numbers in terms of (+) or (-) 1. Be sure to purchase a better filter, rather than a better test result.

Important Considerations



MERV 11-16 air filters are used to protect individuals from harmful airborne contaminants that may affect health, productivity and life span. When considering proper air filter selection it is important to keep in mind the environmental and health trends currently shaping air filter selection criteria:

- According to the Centers for Disease Control and Prevention (CDC), increases in air pollution have been linked to decreases in lung function and increases in heart attacks (www.cdc.gov/nceh/airpollution). The Environmental Protection Agency's (EPA) Air Quality Index (pm 2.5) states that high levels of air pollution directly affect people with asthma and other types of lung or heart disease, as well as vulnerable populations, such as elderly individuals and children (www.epa.gov).

- In "State of the Air," the American Lung Association noted that small particle pollution presents a serious health risk because the airborne pollutants can enter deep into the lungs and bloodstream (www.stateoftheair.org). Individuals exposed to small particle pollution are at risk for health problems, while long-term exposure is linked to increased rates of respiratory and cardiovascular disease, increased hospitalization rates and death.

- According to the American Lung Association, 1 in 5 Americans live in areas where pollution levels are unhealthy year-round, defined as chronic exposure.

- A long-term study commissioned by the American Cancer Society and published in the Journal of the American Medical Association (Vol. 287 No. 9 1132-1141) confirmed that for an increase of 10 micrograms per cubic volume in fine particulate air pollution (pm 2.5), the following increases also occur:
  - 4% in mortality rates,
  - 6% in cardiopulmonary death and
  - 8% in lung cancer deaths.

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