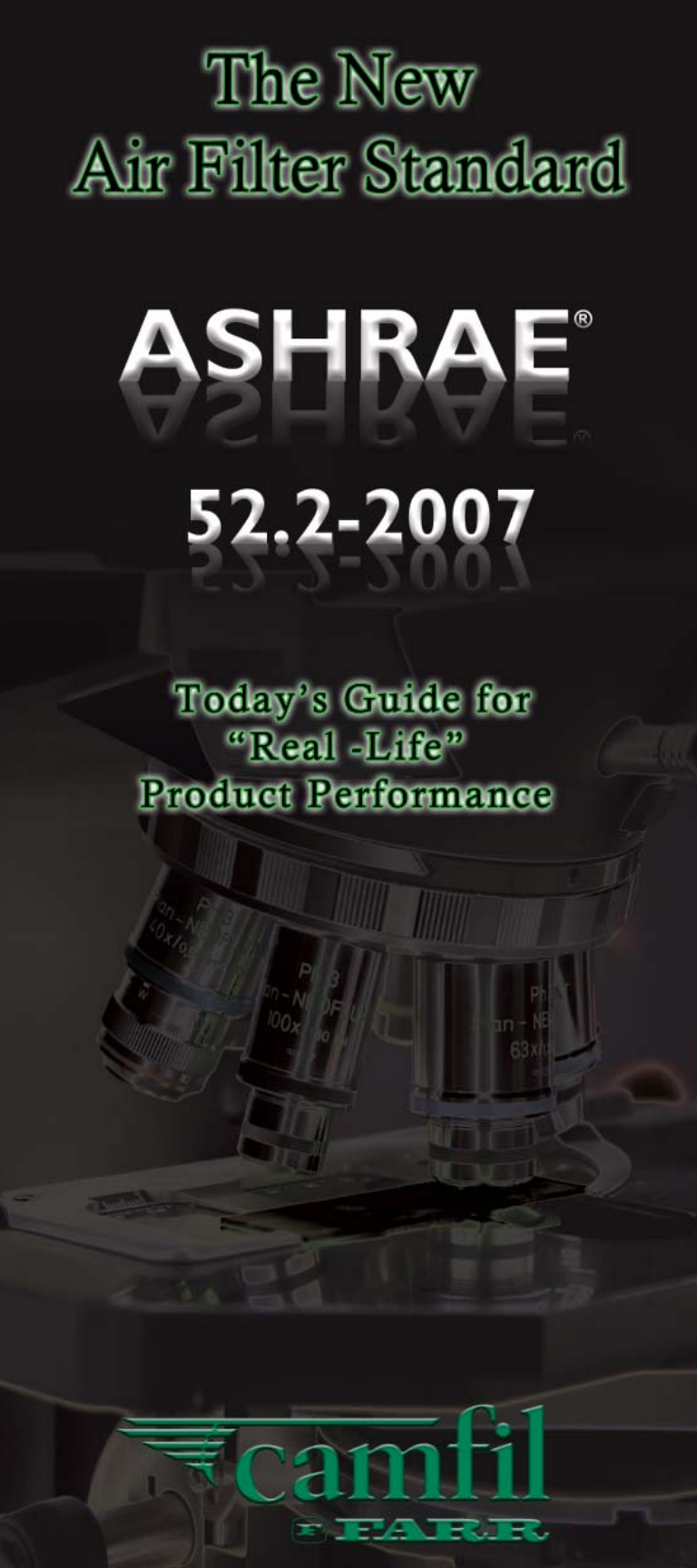
The New Air Filter Standard

ASHRAE®

52.2-2007

Today's Guide for "Real -Life" Product Performance



camfil FARR

ASHRAE (American Society of Heating, Refrigerating, and Air-Conditioning Engineers) was founded in 1894 and is currently an international organization of 50,000 persons. The mission of ASHRAE is to advance the arts and sciences of heating, ventilating, air-conditioning and refrigerating to serve humanity and promote sustainability.

As a service to their membership, ASHRAE develops standards for both its members and others professionally concerned with the design and maintenance of indoor environments. They publish standards that fit under one of the following three headings:

1. Method of Measurement or Test
2. Standard Design
3. Standard Practice.

ASHRAE has published a standard for testing air filters since 1968. *ASHRAE Standard 52.2-2007 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size* has been universally accepted and used to evaluate product alternatives. It is a consensus standard, accredited by the American National Standards Institute (ANSI) developed and published to define minimum values or acceptable performance.

The standard is also one that is under a program of continuous maintenance. The Committee meets at least twice a year to discuss and propose changes that would be beneficial to users of the standard. Virtually every manufacturer is represented on the committee.

Major Encompassing Changes in 2008

In January 2008, the ASHRAE Standards Committee charged with reviewing and improving the ASHRAE 52.2-2007 test standard for air filters and air cleaners voted to initiate two changes to the current testing and reporting method.

Addendum B was created to require mandatory calculation of dust holding capacity and arrestance into the 52.2 standard. Previously they were incorporated into an alternate standard, ASHRAE 52.1-1992, that included a value called dust spot efficiency. Since particle size efficiency, an integral part of Standard 52.2 is recognized as having the most significant value when determining performance of a filter, the incorporation of dust holding capacity and arrestance into 52.2 allows ASHRAE to obsolete the older standard. Arrestance and dust holding capacity will be considered for air filters, however, only Arrestance will be used to determine the MERV for the filters less than 20% (MERV 1 thru 4).

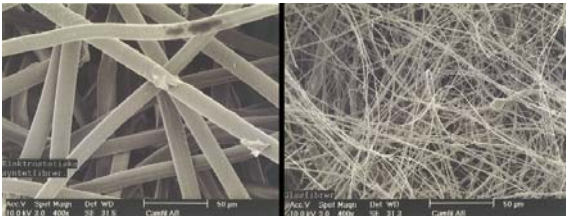
Appendix J was developed to incorporate a non-mandatory filter-conditioning step to replace the 30 grams loading of ASHRAE dust that was defined in ASHRAE 52.2-1999 as the conditioning step. The revised standard will challenge the filter using a KCl (potassium chloride) conditioning method that closely mimics the aerosol size particle distribution that air filters will commonly experience when operated in "real-life" conditions. This will provide air filter users and specifiers an additional value so they can further ensure the filter's performance for the intended application.

The Appendix was developed because filter users and committee members recognized that the method in the original version of 52.2 might not have reflected actual filter performance when placed in an air handling system. In fact, the 1999 version stated, *"Some fibrous media air filters have electrostatic charges that may either be natural or imposed upon the media during manufacturing. Such filter may demonstrate high efficiency when clean and drop in efficiency during their actual use cycle. The initial conditioning step of the dust-loading procedure described in this standard may affect the efficiency of the filter but not as much as would be observed in actual service. Therefore, the minimum efficiency during test may be higher than that achieved during actual use."*

The optional KCl conditioning step is the outcome of multiple research projects and industry input. Two of the more significant papers published on this subject include *ASHRAE Research Project 1190; Develop a New Loading Dust and Dust Loading Procedures for the ASHRAE filter Test Standards 52.1 and 52.2* and *ASHRAE Research Project 1189; Investigations of Mechanisms and Operating Environments that Impact the Filtration Efficiency of Charged Air Filtration Media.*

These studies have shown that coarse fiber media (charged synthetic media), unlike fine fiber media (fiberglass media), perform differently in real-life applications. Coarse fiber media depends on an electrostatic charge to achieve the published filter efficiency. As atmospheric air passes through the filter with 99% of the particulate less than 1.0 microns in size, this very fine particulate will dissipate the charge and the filter quickly loses efficiency. This performance drop will be evident to users and specifiers if the procedure in Appendix J is used.

Filters that use fine fiber media operate on mechanical principles of particle removal, including impingement and diffusion. They do not lose efficiency over time and typically, their rated MERV will be the MERV obtained when testing using the optional method in Appendix J. The user or specifier may take comfort that the published efficiency of the filter will be consistent throughout the life of the filter.



The magnified image on the left is MERV 13 synthetic coarse fiber media. The image on the right is MERV 13 fine glass fiber media. Economical to produce, coarse fiber media is dependent upon an electrostatic charge to obtain a MERV 13 rating. The charge disappears as the fiber loads with dirt. The fine fiber media uses mechanical principles of particle capture ensuring that the filter will maintain its efficiency over time.

This discharge test method is required and has been accepted practice in Europe since 2002 and is part of their standard Eurovent 779.

The new standard is approved and will be formally published and implemented by fall 2008.

Importance of Changes

Addendum B will combine particle size versus efficiency, arrestance and dust holding capacity into one filter-testing standard. The critical values of MERV, 1 thru 16, will be the only criterion for matching a filter's efficiency to an application.

The Appendix J conditioning step will allow manufacturers to show both test procedure results on reports and product literature. Users can access this information, or have filters tested at independent test laboratories, to judge air filter selection and specification for optimum air quality and equipment protection.

ASHRAE Research Project 1189 showed that using the KCl conditioning step closely replicated real-life filter performance. Thus in the revised standard, if a filter shows a different MERV value between the standard test and the optional Appendix J test it is safe to assume the Appendix J rating will be closest to the actual efficiency performance value the filter will deliver in real-life application.

Recent independent air quality research studies have shown that fine airborne particles are a true detriment to health. Selection of air filters based upon the offending particle size is becoming critical to protect the health of building occupants. Appendix J provides the only true value of what filter efficiency will be provided in real-life scenarios.

Air filters provide protection from airborne contaminants created from sources beyond our control, including emissions from international sources such as developing countries. These unseen particles have been shown to increase mortality rates in many academic studies.

Performing the Optional Test: When and Where?

The Appendix J conditioning procedure is a separate test from Section 10.7.1.2 item B in the body of the standard. It is important to note that the same filter cannot be used for both tests. Two filters of the same construction must be provided to the laboratory.

Section 10.7.1.2 item B will provide a value defined as MERV. The data value obtained from the Appendix J test procedure after the KCl conditioning step is defined as MERV-A. Thus, the standard test may produce a MERV 14 rating while the conditioning step test may show a MERV-A 11-A for the same type filter.

This means that the filter will perform at a MERV 11 efficiency in the HVAC system versus the higher rated efficiency stated on literature or in the standard ASHRAE test.

The tests are performed in a test duct with a cross-dimensional area of 610mm x 610 mm (24” x 24”), incorporating a HEPA filter bank, transition, aerosol injection tube, mixing orifice, perforated diffusion plate, upstream sampling probe and main flow measurement nozzle per design and installation requirements in section 4.2 of the standard. The conditioning aerosol is generated using one or more Laskin generators operated at air pressures from 20-60 psig. The conditioning aerosol is injected between the inlet filter bank and upstream mixing orifice.

The ASHRAE 52.2-2007 tests can be submitted and performed at several independent testing laboratories and select advanced air filter manufacturing company test facilities.

Advanced filter manufacturers will provide data on literature for both MERV and MERV-A values. This additional step in testing will provide users and specifiers with filter performance values where they can ensure that they are truly selecting the proper filter to protect their building occupants or processes.

Evaluating Air Filter Products

MERV 1-4 filters are used primarily to protect equipment. In this case, MERV, dust holding capacity and arrestance should be a part of the user/specifiers criteria. Generally the higher the MERV value, the better the product performance is. MERV 6-16 rated air filters are used to protect people 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 that two trends are dramatically changing filter selection from just a few years ago. They are:

- In spite of regulations to reduce pollution, small particle emissions as a by-product of combustion of fossil fuels continues to increase at alarming rates as the number of vehicles (automobiles, trucks, construction and mining equipment) in operation has increased (20% over the last 10 years). In addition, a 2006 study by scientists at Harvard University determined that 30% of the pollution in the U.S. is “imported” as a result of smog and smoke from Mexico, dusts from Africa and particulates from China as airflow patterns carry pollution from newly industrialized countries to within our borders, and;
- Numerous medical studies are providing documented cases where very small particles (less than 2.5 microns in size) present significant health risks. Very small particles, much less than 1-micron in size, can find their way deep into the lungs and create damage. Even particles in the 1-micron size range can actually penetrate into the bloodstream. Prior thought was that larger airborne particles were the only risk to health and were primarily an upper respiratory threat.

Recent Facts to Consider

- Twenty-six percent of the U.S. population lives in areas with levels of pollution shown to increase the risk of death from heart attack, strokes and asthma. 1 in 5 Americans live in areas where pollution levels are unhealthy year-round, defined as chronic exposure (American Lung Association, Lung Disease data 2006).
- Nosocomial, or hospital infections that patients contract after entering a health care facility for other treatment, are the fourth largest killer in the United States, causing as many deaths as AIDS, breast cancer and auto accidents combined. One out of every twenty hospital patients gets an infection. That is two million Americans annually, and an estimated 103,000 of them die. Another 1.9 million people require lengthy hospitalization, rehabilitation or unemployment from infections contracted while in hospitals. Hospital infections add $28 billion to $30 billion to the nation's health costs each year. (Federal Center for Disease Control, 2007, and the Chicago Tribune).

The transient nature of medical facilities makes them an incubator for the transfer of airborne bacteria and viruses. Even with high efficiency filtration in place hospital visitors often incur infections either as patients or visitors. By contrast, infants with undeveloped immune systems are placed in incubators with superior air quality through direct air filtration. Medical environments will benefit from the new filter evaluation step as it is critical that their filters maintain efficiency throughout their life in the system.

- A study of 59,000 women in 36 cities over a 6-year period found women living in the most polluted cities (particles smaller than 2.5 microns) had a 150% increased risk of death from heart attack and stroke (New England Journal of Medicine, Long-Term Exposure to Air Pollution and Incidence of Cardiovascular Events in Women, Feb 2007).
- A study involving 500,000 people in 100 U.S. cities over a 16-year period found that lung cancer deaths went up by 8% for every 10 micrograms of fine particles (particles smaller than 2.5 microns) per cubic meter of air, heart disease deaths went up by 6%, and all deaths increased by 4% (Journal of the American Medical Association- Vol. 287, No. 9: 1132-1141).
- In 2007, $2.3 trillion was spent on health care equating to $7,600 per person. By 2016, the figure is projected to jump to $4.1 trillion, according to a government report published in Health Affairs. Researchers

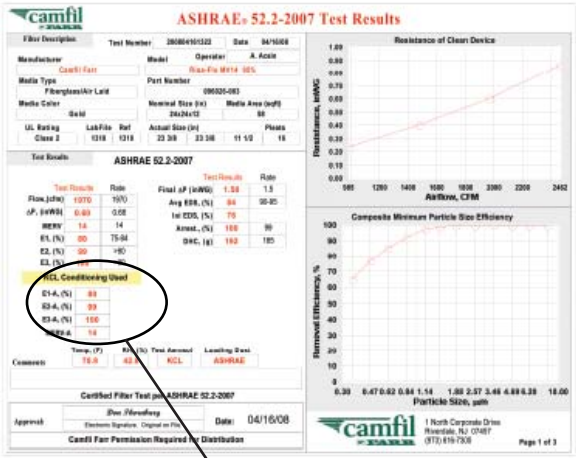
included the deputy director of the National Health Statistics Group, which is part of the Office of the Actuary in the Centers for Medicare and Medicaid Services.

What to Look for When Evaluating Air Filters

- Look for both the MERV and the MERV-A values as you are comparing filters to confirm you are getting a filter that will provide its rated efficiency during its entire time in use. This data should be visible and printed on the product literature. The manufacturer should be able to provide test reports from their laboratory verifying Appendix J conditioning step testing capabilities. When considering a typical air sample, the most common particle by size is around 0.4 micron. For the protection of building occupants, choose a filter that has a high efficiency at this particle size. For commercial buildings, select MERV 13 and MERV-A 13-A and for medical facilities, select MERV 14 and MERV-A 14-A.
- Choose air filters that use a fine fiber media that is not dependent upon an electrostatic charge. These filters maintain their efficiency over time as opposed to filters that use coarse fibers that are dependent upon an electrostatic charge, which dissipates and loses efficiency over time.
- Evaluate the filter construction and configuration (shape of the media pack, stability of the pleats, pleat separation, etc.) to confirm the entire media area is being used effectively. In general, a filter with more media area will offer the longest life and use less energy over the life of the filter.
- Ask the filter manufacturer for actual filter pressure drop performance over time, not just initial pressure drop. Filter pressure drop rise is not linear and superior performing filters offer a longer loading curve. This translates to improved airflow and energy savings over the life of the filter.

Advanced filter manufacturers can provide on-site testing to ensure that you are receiving the filter efficiency that you are specifying for your application and to protect the occupants of your building. Reputable filter manufacturers should guarantee that a MERV 13 filter is a MERV 13 filter throughout its life in your system.

- Always consider the total cost of ownership. Evaluation should include product cost, filter life, energy cost over the life of the filter, labor to install and remove filters, and disposal expense.
- Seek an air filter manufacturer that can provide a life cycle costing analysis, perform field tests to verify the real performance of products. They should also provide case studies detailing similar applications or other information that support your projected results for air quality and operating costs for the offered products.



Camfil Farr product test reports show MERV per Standard 52.2-2007 and discharged MERV per ASHRAE 52.2-2007 Standard. If the numbers are the same value then users may be confident that the filter will maintain its efficiency throughout its life in their system.

Information that Supports the Changes

Numerous field studies were performed to provide the committee with irrefutable data that a conditioning step must be considered to provide the public accurate information for them to use when evaluating filters from various filter producers. Upon request Camfil Farr can supply actual field testing data, from numerous locations around the country, that demonstrate the loss of efficiency of coarse fiber products in a relatively short period of time. In the same tests, performed side-by-side, under the exact same conditions, the fine fiber products maintained their efficiency. These tests raise concerns over the effect of the passed-through of contaminants can have on building occupants and the building itself when considered over time.

The Change Effect on LEED® Criteria

The minimum efficiency to obtain LEED credit for occupied buildings is MERV 13. Currently LEED recognizes MERV and has not yet incorporated MERV-A. As the new standard is presented to the United States Green Building Council, it is anticipated that they will consider both values. Improved environmental air quality is a foundation of the LEED concept and a filter that loses efficiency defeats that principle.

Where Can I Obtain a Copy of the New Standard?

Standard 52.2-2007 may be obtained from the ASHRAE Bookstore at WWW.ASHRAE.ORG. To order by telephone or mail contact ASHRAE at (800) 527-4723, 1791 Tullie Circle, NE, Atlanta GA 30329-2398. Available in electronic (PDF) or print format for $39.00. The revised document will be available in the fall of 2008.

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