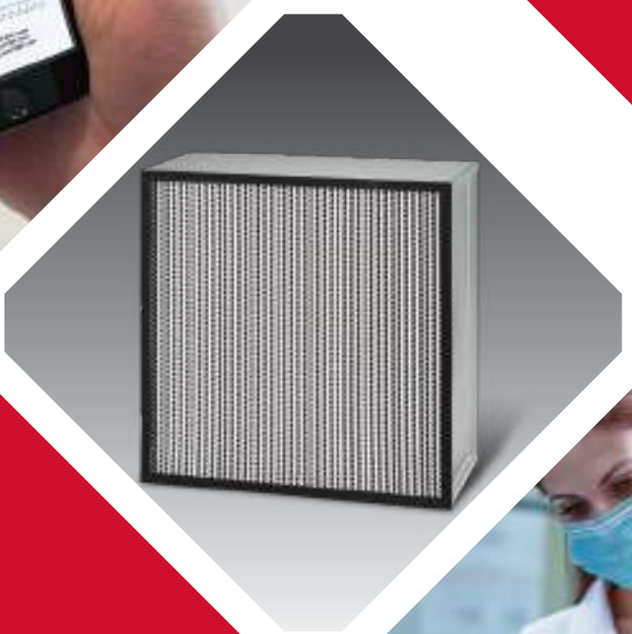
AAF | Flanders®

Bringing clean air to life.®



AIR FILTRATION REFERENCE & PRODUCT GUIDE

January 2020

Our Vision

AAF Flanders understands the vital importance of clean air. That's why we are committed to **cleaning the indoor air around the globe** to improve our quality of life, increase productivity, **protect critical processes and equipment**, and **create products that advance the human condition**.

AAF | Flanders®
Bringing clean air to life.

What's Inside

What's Inside

Introduction

Indoor Air Quality

Bringing clean air to life.®

Air is essential for life, and the quality of that air is critical. At any given moment, the air surrounding us and filling our lungs contains billions of particles too small to be seen, but powerful enough to impact our health, the operation of equipment and instrumentation, and manufacturing processes.

The Environmental Protection Agency (EPA) reports that the air indoors can be up to 100 times more polluted than the air outside. The leading cause of poor indoor air quality is a lack of proper air filtration, according to the American Medical Association. AAF Flanders, the world leader in air filtration solutions, is bringing clean air to life through unmatched expertise and innovation.

34% of American workers feel that poor IAQ had caused them to miss work

Up to **65%** of asthma cases in school-aged children could be prevented with proper IAQ

The Urgent Risk of Poor Air Quality

Indoor air quality (IAQ) has been identified by the EPA as one of the top five most urgent environmental risks to public health. The air we breathe at home, work, and school may contain a variety of contaminants in the form of gases and particles emitted by office machines, cleaning products, construction activities, carpets and furnishings, perfumes, cigarette smoke, water-damaged building materials, microbial growth (fungal, mold, and bacterial), insects, and outdoor pollutants.

An extensive body of scientific evidence demonstrates that short and long-term exposure to fine particle pollution, also known as fine particulate matter (PM), has harmful effects on the cardiovascular system, increasing emergency room visits and hospital admissions for heart attacks and strokes, leading to premature death. The respiratory system has also been shown to experience harmful effects, including asthma attacks.

"We inhale over **3,500 gallons** of air each day.**"**

Those most at risk from particle pollution exposure include people with heart or lung disease, older adults, children, and people with lower socioeconomic status. Research indicates that pregnant women, newborns, and people with certain health conditions, such as obesity and diabetes, may also be more susceptible to PM-related effects.

Poor IAQ and its related health effects are commonly associated with improperly operated and maintained heating, ventilating, and air conditioning (HVAC) systems.

Indoor Air Quality

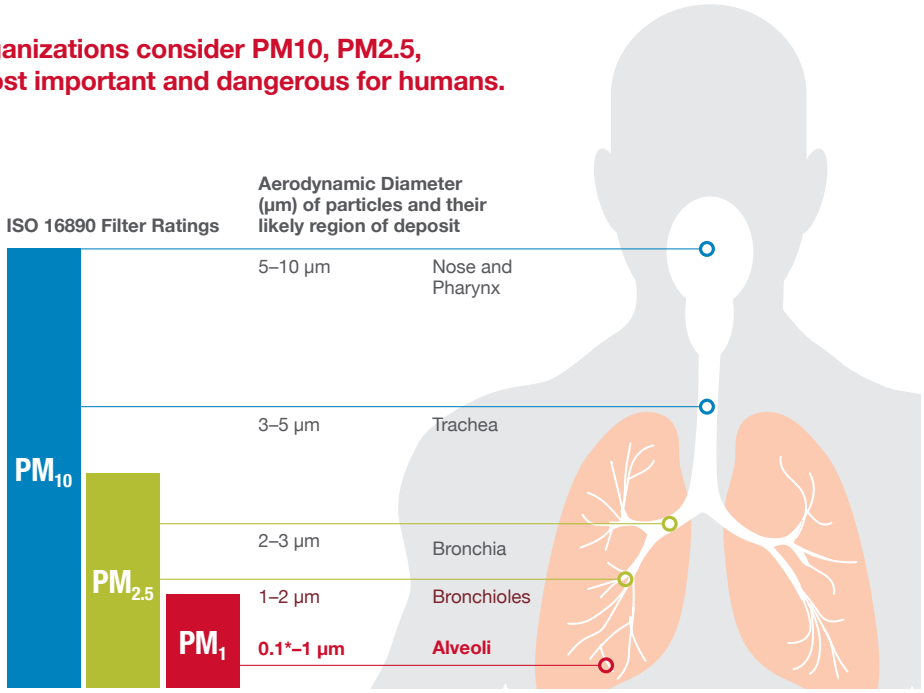
The world's leading health-related organizations consider PM10, PM2.5, and PM1 fine dust fractions as the most important and dangerous for humans.

Particles with an aerodynamic diameter of:

10 micron (ePM10)
deposit in the **nose and pharynx** of the human respiratory system

2.5 micron (ePM2.5)
are small enough to reach the **human lung** and deposit in the bronchia

1 micron (ePM1) or smaller
are small enough to find their way through the cell membranes of the alveoli into the **human blood stream** and cause life-threatening diseases



*Efficiency on particles smaller than 0.3 micron is not defined by ISO 16890.

For every **1000** workers poor IAQ results in **600** sick days per year

The Centers for Disease Control and Prevention (CDC) estimate that the majority of Americans spend approximately **90%** of their time indoors

Improved Air Quality Increases Employee Productivity

What are the benefits of a properly operated and maintained HVAC system? Studies have found that workers in buildings with optimum air quality have reduced symptoms related to exposure to fine particle pollution, resulting in lower rates of absenteeism. Improved IAQ has also been found to result in significant increases in worker productivity. Maximizing the level of filtration employed within the constraints of a building's HVAC system design is an important step in improving air quality, which provides a substantial return on investment.

Meeting the Growing Demand for Better Air Quality

Poor indoor air quality is one of the top complaints made by building tenants, according to a study by the International Facility Management Association. Occupants are demanding better air quality. In response, facility managers are demanding more from their air filtration solutions.

"The U.S. Indoor Air Quality market is expected to grow to **$11.4 billion** by 2019, with the equipment segment predicted to top nearly **$6 billion**."

Driven by increased consumer awareness, growing economies, and technological advancements, the IAQ market continues to grow at an extraordinary rate. Facility managers are faced with the challenges of keeping pace with the rapid changes occurring in this state-of-the art industry, while keeping costs in line and avoiding the risks associated with deferred maintenance. Meeting increased demands for optimal IAQ with limited resources requires a partner with the highest level of expertise and innovation in the field of air filtration solutions.

Indoor Air Quality

The Need for Effective Filter Monitoring

Delivering and maintaining optimal air quality requires effective monitoring and timely replacement of air filters. Unfortunately, decades of advancements in building automation have failed to include filtration monitoring. Facility managers have had to continue to rely on traditional methods of monitoring, which lack accuracy and pose significant risks, including HVAC system failure and work disruptions.

Common methods of monitoring air filtration performance include measuring differential pressure across the filter bank, which fails to consider the potential for small changes in pressure that result in large changes in airflow. Visual inspection of filters also fails to be an effective method of monitoring, due to the fact that fine particles are difficult or even impossible to detect with the eye. With scheduled filter replacements, you run the risk of replacing filters before needed or not replacing them before operating efficiency is significantly impacted, because the replacement schedule fails to account for seasonal changes in the external environment, or for changes in the building's occupancy.

The Risks of Deferred Maintenance

A lack of automated filter monitoring capabilities is not the only challenge facility managers have had to face in operating and maintaining their HVAC systems. The number one concern of facility managers is not having enough time to get the necessary work done. With significant budget and time constraints, they find themselves deferring maintenance and reacting to resulting issues, rather than employing preventive maintenance, which saves costs significantly over the long term.

"Studies have shown that **energy costs are up 81% in facilities with deferred maintenance issues**, and 71% of this increase is related to the HVAC system."

Automated Filter Monitoring Technology Saves Time and Money

Today, facility managers striving to meet building occupants' increased demands for optimal air quality while facing the challenges of time and budget constraints can breathe easier with the availability of automated filter monitoring technology. This latest advancement in building automation eliminates guesswork and provides accurate and immediate information on filtration replacement needs. This proactive approach to filter maintenance reduces energy, material, and labor costs, and prevents HVAC system failures and work disruptions resulting from inaccurate assessments of filter performance and deferred maintenance.

Partnering with AAF Flanders, the world leader in clean air solutions, enables you to navigate rapidly evolving market demands and technological innovations. With our extensive expertise and high performance products, you are equipped to deliver and maintain optimal air quality for healthier and more productive tenants, and more efficient and cost-effective operations.

Sources: U.S. EPA. Indoor Air Quality—The Inside Story: A Guide to Indoor Air Quality; CDC. Healthy Housing Reference Manual: Indoor Air Pollutants and Toxic Materials; Fisk, W.J. (2000). Health and Productivity Gains from Better Indoor Air Environments and Their Relationship with Building Energy Efficiency. Annual Review of Energy and the Environment; Wellesley, Mass., October 31, 2014–BCC Research, "U.S. INDOOR AIR QUALITY MARKET"; Tenant Satisfaction, Sustainability Link Revealed in DTZ Research, DTZ, 2015; Indoor air quality: the latest sampling and analytical methods, second edition, Hess-Kosa; State of the Air 2015, American Lung Association, 2015

50% of a facility's energy costs are attributed to heating, cooling, and moving air.

88% of facility managers say that deferred maintenance is an issue.

Deferred maintenance results in **$5 million** in annual facility operating costs. **36%** of companies surveyed say this number is even higher!

Social Responsibility

At AAF Flanders, we believe that the growth of our company and the conservation of our natural environment are complementary. Guided by the philosophy of taking action with the future of the earth in mind, our mission is to use our core skill sets and products to help you protect your environment, reduce overall risk, and optimize your filter-related spending.

Green Building Design

Air filtration is a major component of green building design, which is both cost-efficient and resource-saving. 78% of Americans agree that corporations have a responsibility to adopt "green" behaviors like clean air.

In addition, green buildings use on average 26% less energy, emit 33% less carbon dioxide, use 30% less indoor water, and send 50%-75% less solid waste to landfills and incinerators. Thinking green is a great way to maintain energy efficiency, minimize costly downtime, and extend the lifespan of your equipment.

Addressing the Issues

While it is often assumed that outdoor air is more polluted than indoor air, the fact is that poor Indoor Air Quality (IAQ) ranks as one of the top five environmental risks to public health. Poor IAQ in buildings can lead to allergic reactions, aggravation of respiratory conditions, asthma attacks, eye irritation, coughing, irritability, and the inability to concentrate. The air inside your building can contain:

- Molds, spores, pollens
- Carbon monoxide, radon, Volatile Organic Compounds (VOCs)
- Bacteria, viruses, and byproducts
- Vehicle engine exhaust, exhaust from industrial plants
- Asbestos, clays, elemental particles, and man-made fibers

Between respiratory illness, allergies, and asthma, along with increased worker comfort, experts estimate that improved indoor air quality would produce an annual U.S. savings of up to $235 billion.

As a member of the U.S. Green Building Council (USGBC), AAF Flanders has joined with leaders from every sector of the building industry to promote buildings that are environmentally responsible, profitable, and healthy places to live and work.

Continuous Improvement

In short, social responsibility comes down to optimizing air quality while choosing products that minimize total life cycle costs, including energy consumption, and the amount of landfill waste by changing filters too frequently. AAF Flanders is committed to continuous improvement by measuring and monitoring our progress towards minimizing our environmental impact, and by identifying further opportunities to prevent pollution, reduce waste, and conserve our natural resources. We pride ourselves on taking a collaborative and consultative approach to help our customers optimize performance and lower their total cost of ownership, while taking the well-being of our planet into consideration at all times.

Nearly **78%** of Americans agree that **corporations** have a responsibility to adopt **"green" behaviors** like clean air

62% of **North American consumers** look for a brand that is committed to **positive environmental impact**

17% of a company's total market capitalization is directly **tied to their reputation**

Sources: Assessing Green Building Performance, GSA Public Buildings Service; Survey, Deferred Maintenance, Facilities.net, 2015; A science based approach to selecting air filters, Pharmaceutical Engineering, 2013; The Costs and Financial Benefits of Green Buildings, Greg Katz; Doing Well by Doing Good, Nielsen, 2014; The 2015 Reputation Dividend Report, Reputation Dividend 2015

AAF Flanders History

AAF Flanders, the world's largest manufacturer of air filtration solutions, operates production, warehousing, and distribution facilities in 22 countries across four continents. We are committed to protecting people, processes, and systems through the development and manufacturing of the highest quality air filters and filtration equipment available today. Our company offers comprehensive, innovative air filtration solutions designed to remove and control airborne particulates and gaseous contaminants in commercial, industrial, cleanroom, and transportation applications.

While AAF Flanders is an international company, our global headquarters remain in Louisville, Kentucky, where AAF was founded in the 1920s. Bill Reed, a skilled engineer and entrepreneur, developed the Reed Air Filter in 1921. This creative filter solution for the automobile industry would establish the foundation for what is now a global leader in air filtration. Today, AAF has joined with Flanders, an innovator in the filter industry with a rich history of their own, and as AAF Flanders we are a proud member of the Daikin Group, which also includes American companies such as Daikin Applied, Goodman, and Amana.

For the past 100 years, our world has increasingly demanded cleaner, more comfortable air. AAF, Flanders, and Daikin – whether separately or as a combined force – introduced most of the air filtration products currently in use. Our collective heritage revolves around innovation, and our complementary strengths uniquely position us today to meet the challenges of tomorrow.

Timeline

1921 Bill Reed founds Reed Air Filter Company and manufactures the first commercial air filter in the U.S., the Reed Air Filter.

1924 Akira Yamada founds Osaka Kinzoku Kogyosho Limited Partnership, the company that would later become Daikin, in Osaka; company begins production of aircraft radiator tubes and other products.

1929 Reed Air Filter Company merges with seven leading air filter manufacturers to form American Air Filter Company Inc.

1935 Daikin succeeds in fluorocarbon synthesis, begins mass production in 1942.

1936 American Air Filter (AAF) introduces the first high-efficiency box-style filter.

1950 AAF introduces fiberglass replacement filters to the residential market.

1950 Flanders Filters founded by A.R. Allan, Jr. to supply filters to the Atomic Energy Commission.

1951 Daikin begins production of packaged air conditioners.

1953 AAF introduces Roll-O-Mat®, the first automatic self-renewable media filter.

1961 AAF introduces DriPak®, the first bag-style filter.

1963 AAF introduces VariCel®, the first modern high-efficiency box-style filter.

1964 AAF introduces the AstroCel® HEPA filter.

1964 Flanders becomes the first filtration company to also make their own HEPA media.

1968 Flanders creates first separator-less HEPA filter.

1969 NASA lunar module uses AAF filters in Apollo 11 mission to moon.

1969 Flanders moves from New York City to Washington, NC.

1969 Flanders develops the first fluid seal for HEPA filters.

1970 AAF establishes Asian and European headquarters.

1972 Daikin Europe N.V. opens in Ostend, Belgium.

1978 AAF introduces first V-Bank HEPA filter.

1978 Flanders makes the first ULPA filter.

1978 Daikin successfully produces Neoflon, Japan's first fluorocarbon polymer.

1982 Daikin develops Japan's first Variable Refrigerant Volume (VRV) system.

(Continued on next page)

AAF *Daikin* *Flanders*

AAF Flanders History

Timeline (cont.)

1984 Daikin becomes first in world to produce cumulative total of 1 million packaged air conditioners.

1986 Flanders creates Blu-Jel®, the first silicone-based HEPA fluid seal.

1989 AAF introduces VariCel® II, the first high-efficiency mini-pleat 4″ deep filter.

1991 Daikin establishes Daikin America, Inc. and MDA Manufacturing, Inc. in U.S. as fluorocarbon polymer production and sales companies; factory begins operation in 1994.

1993 Flanders supplies HEPA filters to the International Space Station.

1993 Daikin launches Air Conditioning Network Service System, industry's first 24-hour online monitoring system for business air conditioners.

1996 Flanders Filters acquires PrecisionAire and expands into the retail market.

1999 AAF begins development of PTFE filters with Daikin Industries.

2000 AAF introduces PerfectPleat®, the first self-supported pleated filter.

2000 Daikin establishes 24-hour, 365-day after sales service system for air conditioning and refrigeration customers.

2002 AAF builds Suzhou and Shenzen plants in China.

2006 Daikin acquires OYL Industries and AAF McQuay (Malaysia), major global air-conditioning manufacturer, to become the world's No.1 air conditioning manufacturer.

2006 AAF becomes member of Daikin Group.

2009 AAF introduces MEGAcel® I, first HEPA filter with ePTFE filtration technology.

2009 Daikin establishes Daikin McQuay Solutions Plaza in New York metropolitan area.

2009 Daikin acquires Nippon Muki Co., Ltd., a major Japanese air filter company.

2012 Daikin acquires American residential use air conditioner company Goodman to solidify position as leader in the global air conditioner market.

2013 AAF introduces MEGApleat® M8 filter.

2014 AAF introduces VariCel® 2+ filter with Impress® Technology.

2014 AAF Suzhou joins with SNM Nippon Muki Suzhou.

2016 AAF merges with Flanders to form AAF Flanders in U.S.

2016 AAF introduces TCO Diagnostic® filtration optimization tool.

2016 AAF opens Clean Air Innovation & Research Center in Jeffersonville, IN.

2016 Daikin acquires Dinair AB, an air filter manufacturer in Sweden.

2017 Daikin Texas Technology Park, Daikin's largest air conditioner manufacturing factory in North America, opens.

2017 Daikin and Osaka University conclude a comprehensive collaborative agreement aiming to create innovation by combining expertise in the HVAC and AI/IoT fields; Daikin launches "Daikin Information and Communications Technology College," a training program to secure AI/IoT experts.

2018 AAF introduces Sensor360®, the first IoT-based filtration monitoring and optimization tool.

2019 AAF introduces VisionAir™ Clean, cleanroom design and configuration tool.

AAF *Daikin* *Flanders*

The Clean Air Difference

Revolutionizing the Future of Air Filtration

Through the integration of two global leaders in air filtration, AAF Flanders is uniquely positioned to revolutionize the future of the air filtration industry in all aspects—design, analysis, optimization, and monitoring.

AAF Flanders prides itself on taking a collaborative and consultative approach to help our customers optimize performance, as well as lower their total cost of ownership. We invest the time to help your business perform better.

AAF Flanders is the leading provider and manufacturer of air filtration solutions that help companies create superior air quality and better manage their HVAC systems. Our outcome is to provide you the highest quality air filtration solutions, while minimizing your overall costs.

We do this by understanding your complete air filtration needs, applications, and goals for total air quality. Our mission is to match our core skill sets and products to help you protect your environment, reduce your risk, and optimize your clean air related spending.

Companies turn to AAF Flanders because they demand:

- Expert, education-based alternatives for improvement
- The best life cycle cost with optimum performance
- Professional and prompt technical support
- Collaboration, consultation, and superior communication
- Rapid response times on drawings, specifications, and proposals
- Exemplary customer service, providing accurate, timely answers
- Consistent and reliable execution of well-designed products with superior performance
- Information sharing and consensus across the entire customer organization

Choosing AAF Flanders ensures:

- In-depth understanding of improving indoor air quality with the lowest Total Cost of Ownership
- Trusted advisors to support and improve overall energy efficiency
- Reduction of risk to process and time spent
- Commitment to continual innovation in air filtration
- Added value that will help companies stand out among their peers as industry leaders

At AAF Flanders, we are committed to helping our customers reduce costs, decrease risk, and save time. We are innovators, always working to develop better solutions and create new possibilities. Our in-depth understanding of improving indoor air quality with the lowest Total Cost of Ownership enables our customers to optimize processes and systems. We have an unparalleled reputation for quality, through consistent, reliable execution of well-designed products and superior performance.

88%

of Facility Managers say that **deferred maintenance is an issue**

55%

of Facility Managers fall into **reactive management**

LOSING 228 hours every year!

49%

of Facility Managers spend **2 to 4 hours per day** dealing with occupant complaints. One of the **top complaints is poor IAQ.**

Of those surveyed, **16%** say they spend **more than four hours per day** doing this.

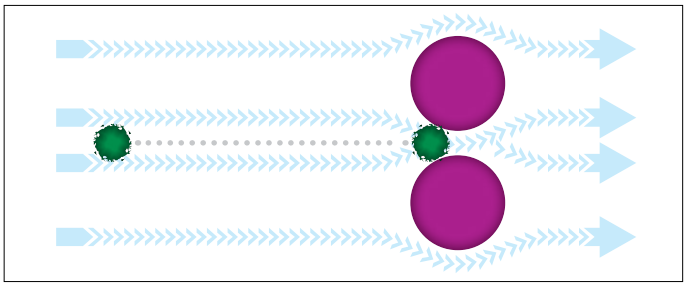
Sources: The 2015 Core Facility Benchmarking Study, iLab Solutions, 2015; How Facility Managers Can Handle Occupant Complaints, Facilities Net, 2014.

Principles of Filtration & TCO

Methods of Filtration

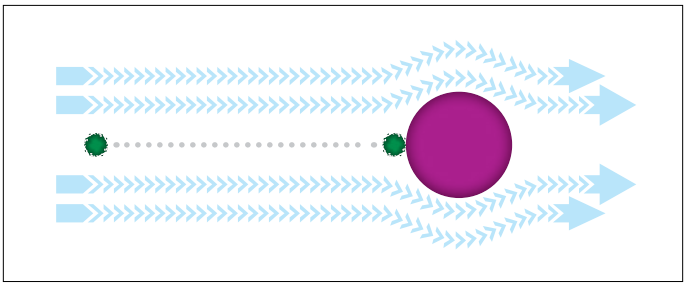
There are several possible methods involved in creating a safe and secure indoor environment. AAF Flanders takes great care in assessing and addressing the individual and specific needs of our customers and choosing the appropriate solution for any IAQ challenge.

Mechanical



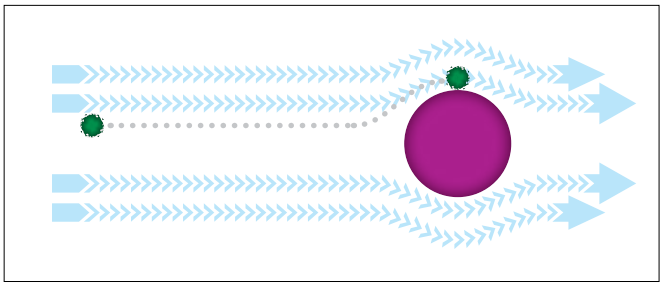
Straining

Straining occurs when a particle is larger than the opening between fibers and cannot pass through. It is a very ineffective method of filtration because the vast majority of particles are far smaller than the spaces between fibers. Straining will remove lint, hair, and other large particles.



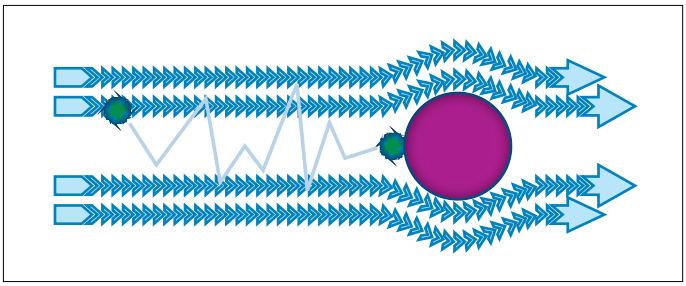
Impingement

As air flows through a filter, it makes repeated changes in direction as it passes around each fiber. Dirt particles, especially larger particles, cannot follow the abrupt changes in direction because of their inertia. As a result, they do not follow the airstream, and they collide with a fiber. Filters using this method are often coated with an adhesive to help retain particles on the fibers.



Interception

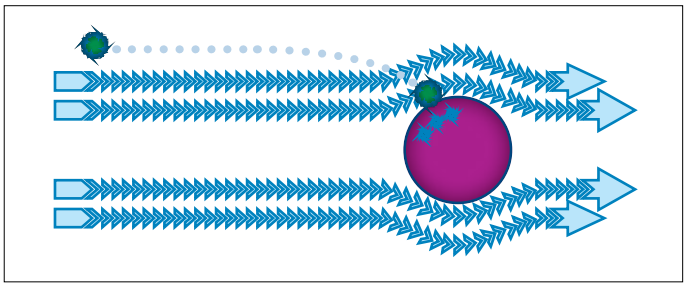
Interception is a special case of Impingement, where a particle follows the airstream, but because of its size in relation to the fiber, it comes in contact with the fiber. Interception is not dependent on the inertia of the particle to bring it into contact with a fiber. The particle is retained by the inherent adhesive forces between the particle and fiber, called “van der Waals” forces.



Diffusion

Diffusion takes place on particles so small that their direction and velocity are influenced by molecular collisions (called “Brownian movement”). They do not follow the airstream, but behave more like gases than particulate. These particles are battered across the direction of flow in a random “helter skelter” fashion. When a particle strikes a fiber, it is retained by the adhesive forces (van der Waals forces) between the particle and fiber.

Electrical



Electrostatic

The electrostatic method of filtration is based on the principle that objects carrying opposite electrical charges are attracted to one another. Dust particles tend to be negatively charged, while some filter media carries a weak positive electrostatic charge. This positive charge may be created during the manufacturing process, imparted by the air handler, or, more commonly, created merely by the friction caused by the flow of air across media fibers.

This positive charge attracts negatively charged small particles to the fiber, helping to increase retention and efficiency against particles small enough to be acted on by these forces. This effect diminishes over time, however. As the fibers become coated with dust, this dust layer has an insulating effect, and the charge is reduced or eliminated.

Particle Efficiency and Resistance

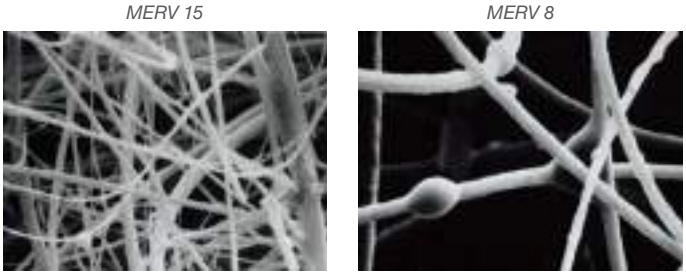
Factors Impacting Filter Choice

When considering which air filter to choose, the answer seems simple – just choose the one that removes the greatest amount of particulate from the airstream! However, in the real world there are far more factors impacting filter choice than merely particle efficiency. Chief among these factors is the impact of the filter on energy costs.

At the heart of the filter is media – the component of the filter where filtration actually happens. Many filter medias look fairly similar to the naked eye. However, look a little closer, and you can see some pretty stark differences.

Most lower-efficiency filter media has relatively larger fibers and primarily filters out large particles via straining or impingement. It also typically has wider openings between fibers that allow air to pass through relatively easily.

Higher-efficiency filter media, by comparison, typically has many smaller, finer fibers and can also filter by straining and impingement. By contrast, though, higher-efficiency media can capture smaller particles via interception and diffusion, too. In order to filter smaller particles effectively, this type of media typically has a dense web of small fibers with smaller openings for air to pass through. Therefore, if you were to have just a flat sheet of media, it would be more difficult for airflow to pass through the higher efficiency media.



MERV 15 vs. MERV 8 media under 2000x magnification

When it's difficult for airflow to pass through media, HVAC systems have to work harder, consuming more energy. Filters are generally designed to reduce this effect and consume as little energy as possible over their lifetime. In some cases, this need for energy efficiency means designing new and better medias (such as AAF Flanders ePTFE and eFRM medias) that reduce resistance.

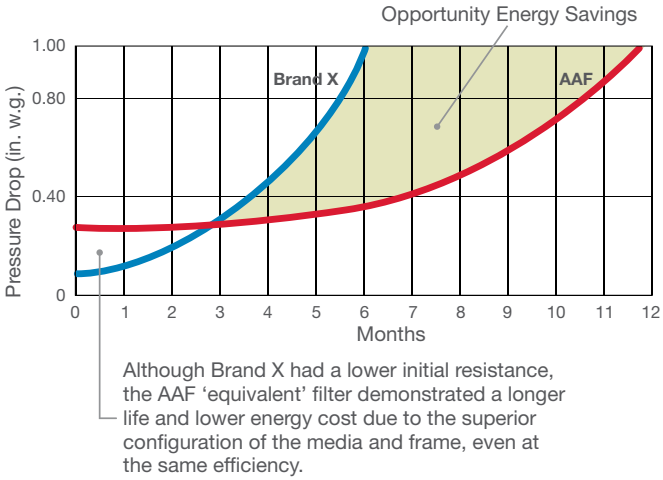
However, in many cases it means configuring the filters in a new way. Most of the major advances in filter design over the years, such as the DriPak®, the VariCel®, the mini-pleat media pack (used in such filters as the AAF Flanders' VariCel® II and VariCel® M-Pak), and the V-Bank filter (such as the VariCel® VXL) were achieved by constructing the filter in a new way, arranging the media in the filter differently so as to reduce resistance to airflow.

In general, these advances extend the surface of the media, essentially adding more surface area for air to come in contact with as it flows through the filter. More media means both more fibers and more spaces between them available for air to flow, so this has two positive effects on energy consumption.

1. More spaces between fibers means air can more easily pass through the filter.
2. More fibers to collect passing dust means that the filter will last longer before becoming clogged and requiring replacement.

Combined, these effects reduce energy consumption over the life of the filter.

In many cases, end customers and even filter manufacturers are focused solely on reducing *initial resistance*, the resistance to airflow when the filter first goes into use. However, in many cases, poorly designed filters do not load dust evenly over their surface, and/or use substandard media that clogs easily. These filters will become loaded with dust more quickly and either will require frequent replacement or, if not replaced, will consume much more energy to draw sufficient air through. While having a lower initial resistance, these filters drastically increase the total cost to operate the filter as compared to better-designed, longer-lasting filters that may have slightly higher initial resistance.



Also note that in many cases filters using synthetic media will have a relatively low initial resistance for their respective MERV ratings. However, these MERV ratings are often achieved by using media that relies in part on an electrostatic charge to filter out small particulates. While such filters may work well for certain applications, note that they could lose efficiency as fibers become loaded with dust. Also, such filters tend to become dust-loaded more quickly than comparable ones that filter particles by mechanical means only.

Factors Impacting Total Cost of Ownership

Total Cost Analysis

The most significant cost normally affecting Total Cost of Filter Ownership is energy. However, other costs, such as the filter cost, installation, disposal, freight, procurement overhead, storage, and filter effectiveness in maintaining clean coils and ductwork to prevent ancillary maintenance costs, should also be considered in any total cost analysis.

For perspective, in a recent filter cost optimization study of a hospital, the annual energy cost was approximately 65% of the total cost of ownership, the filters represented approximately 25%, the other costs were approximately 10%, and the Price of Energy was only $0.067/kWh, while the National Commercial Average was $10.28/kWh.

Because energy is normally the most significant cost, an understanding of the factors that affect energy costs is particularly useful.

The Annual Filter Energy Cost factors can be simply shown in the following equations:

$$\textit{Annual Filter Energy Cost (\$/year)} = \textit{Price of Energy (\$/kWh)} \times \textit{Filtration Energy (kWh/year)}$$

Where Filtration Energy is defined as:

$$\textit{Filtration Energy (kWh)} = \frac{\textit{(System Airflow (CFM)} \times \textit{Average Filter Pressure Drop (in. w.g.)} \times \textit{Cycle Time (yrs)}}{\textit{Fan System Fractional Efficiency (0.00)} \times 8520}$$

Where, equation units are:

kWh	=	kilowatt-hours
CFM	=	cubic feet per minute
in. w.g.	=	inches of water gauge
yrs	=	years
0.00	=	digital fraction, to convert digital fraction to %, then multiply by 100
8520	=	conversion factor

The **Factor Table** below shows the key relationship between the different variables in the above equations:

Approximately **50%** of a building's energy consumption goes to the heating, cooling, and moving of air

Energy costs up to **81% higher** in **facilities** with **deferred maintenance** issues

71% of this increase is **HVAC related**

Source: Department of Energy; 2006 Buildings Energy Data Book

Annual Filter Energy Cost ($/yr)		Cycle Time (yrs)		Price of Energy ($/kWh)		System Airflow (CFM)		Average Filter Pressure Drop (in. w.g.)		Fan System Efficiency (00.0)
Goes Down	with	Same	as	Goes Down	and/as	Goes Down	because	Goes Down	or as	Goes Up
Goes Up	with	Same	as	Goes Up	and/as	Goes Up	because	Goes Up	or as	Goes Down

Factor – Price of Energy ($/kWh)

The Retail Price of Energy can range in base rate from 0.04$/kWh to over 0.25$/kWh in different regions in the U.S. However, additional charges, such as customer charge, distribution, commodity charge, purchase energy adjustment, and state taxes added to the base rate will increase the electricity cost on a $/kWh basis. "Single Issue Ratemaking" surcharges for items like aging infrastructure, conservation, renewable resources, and storm damage, among other items, will also add to the electricity cost on a $/kWh basis. A fair, accurate assessment of the electricity cost is to divide the total bill by the number of kilowatt hours.

US Department of Energy	2013 Total Electric Industry – Average Retail Price (cents/kWh)	
State	Commercial	Industrial
New England	13.97	12.25
Middle Atlantic	13.06	7.27
East North Central	9.58	6.65
West North Central	8.98	6.67
South Atlantic	9.38	6.55
East South Central	9.81	5.98
West South Central	8.11	5.82
Mountain	9.35	6.48
Pacific Contiguous	12.57	8.13
Pacific Noncontiguous	25.49	26.08
U.S. Total	10.28	6.84

Factors Impacting Total Cost of Ownership

Factors – System Airflow (CFM) and Average Filter Pressure Drop (in. w.g.) – Filter Physics

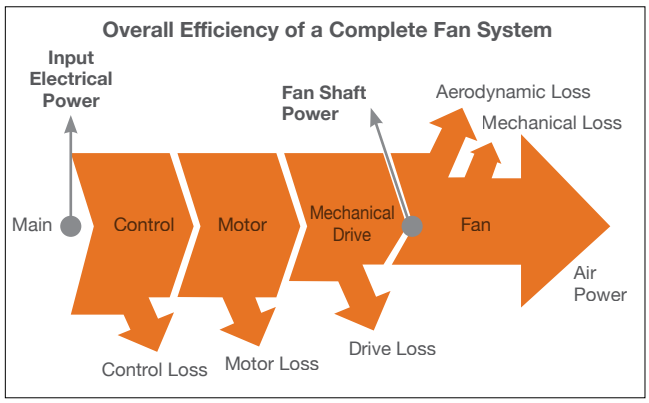
The System Airflow and the Average Filter Pressure Drop are interrelated through Filter Physics. As shown in the Factor Table, as the System Airflow increases, then so does the Filter Pressure Drop, and conversely, as the flow decreases, so does the pressure drop.

The Filter Dust Holding Capacity Test graphic shows the relationship between System Airflow (as velocity) and Filter Pressure Drop, where a filter was tested at 600, 500, 400, and 300 FPM velocities. Filter specifications for life cycle and recommended pressure changeout are normally for 500 FPM velocity. In practice, many filtration units operate at velocities in the 300 to 400 FPM range. At these velocities, the filters likely will not attain the manufacturer's recommended changeout pressure, based on 500 FPM. This could result in the filter being left in the filtration unit for an excessive period of time, likely wasting energy and possibly leading to issues like fungal growth.

Calculations for Annual Filter Energy Cost should compensate for the effect of the system velocity on initial filter pressure drop, recommended pressure drop, average filter pressure drop, and cycle time.

Factor – Fan System Fractional Efficiency

The Fan System Fractional Efficiency is a difficult value to determine because of the many variables in fan system design and operations, as shown in the figure below.

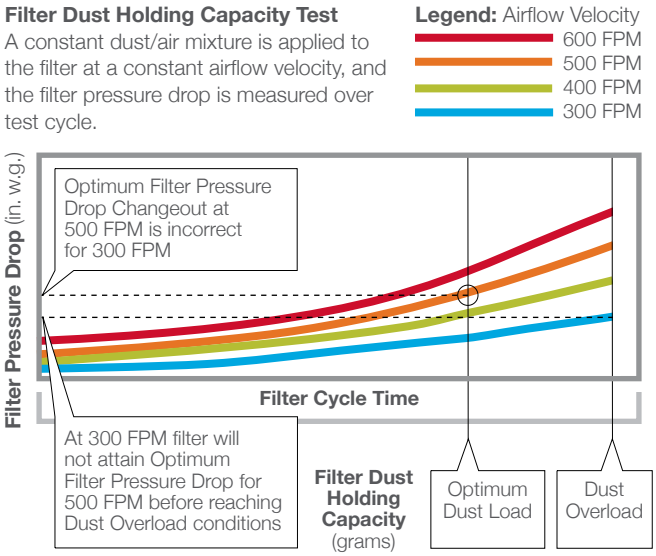


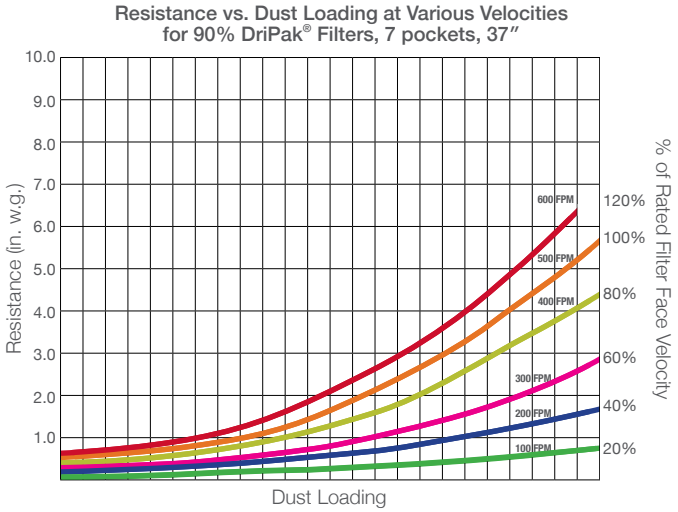
Fan system fractional efficiency values used in total cost of ownership and energy calculations can range from 0.20 to 0.70, dependent upon the type of fan and the actual airflow versus design. Many systems are designed for 500 ft/min velocity, but most operate between 200 and 350 ft/min. These turn-down velocities affect the fan system components as each falls in efficiency, especially the fan itself.

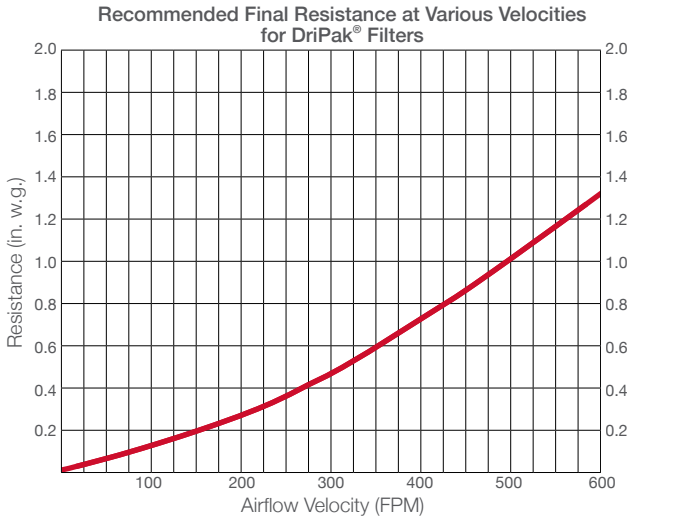
Published studies, as well as AAF Flanders field studies, show that typical fan system efficiencies in the range of 0.40 is appropriate for most energy use calculations.

Filter Dust Holding Capacity Test

A constant dust/air mixture is applied to the filter at a constant airflow velocity, and the filter pressure drop is measured over test cycle.







Factors Impacting Total Cost of Ownership

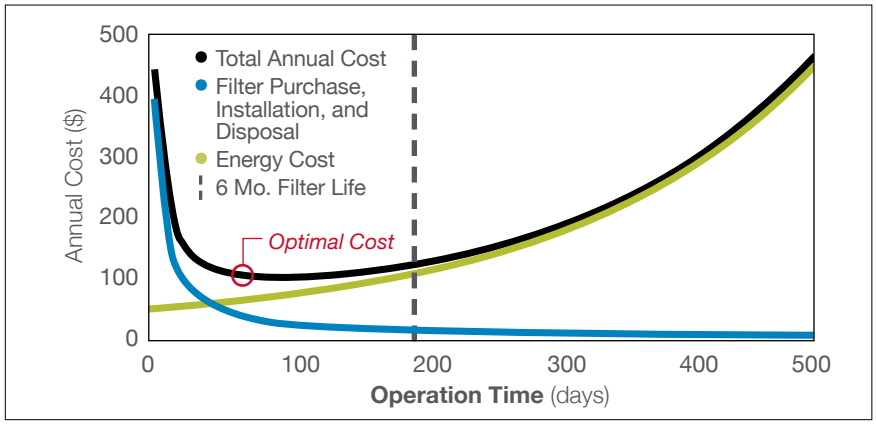
There are methods to directly determine the fan system fractional efficiency that allow for accurate values to be used in the total cost of ownership calculations. **Contact an AAF Flanders specialist for more information.**

Annual Filter Energy Cost ($/yr)		Cycle Time (yrs)		Price of Energy ($/kWh)	Annual Filter Energy Cost ($/yr) based Fan System Efficiency		
Assume	with	Assume	as	Assume	Low Efficiency 0.20	Assume Correct Efficiency 0.40	High Efficiency 0.60
$1,000/yr	with	Same	as	Same	$2,000	$1,000	$1,500

Annual Cost

Total Cost of Ownership (TCO) quantifies the cost of a purchase across the product's entire life cycle. Therefore, it offers a more accurate basis for determining the value – Cost vs. ROI – of an investment in air filters and their installation, rather than just considering the purchase price alone. The overall TCO includes direct and indirect expenses, as well as some intangible ones that can have monetary values assigned to them. When looking to improve your performance in this area, you should employ the expertise of an air filtration specialist who can provide professional guidance and analysis to help you optimize performance and lower your TCO.

Manufacturer's Recommended Changeout Resistance is often misunderstood. When systems were predominantly single speed fans and operated at 500 ft/min, the dust loading of 1.0 in. w.g. was a reasonable changeout recommendation. When VAV systems can modulate and average systems velocities are in the 200–300 ft/min range, the appropriate resistance changeout point is best determined using a total cost of ownership tool to fully account for energy, filter, installation, and disposal costs.



Also note that in many modern Variable Air Volume systems, airflows and pressures vary widely on a day-to-day basis, and average velocities over longer periods of time tend to change with the seasons. These complicating factors add additional complexity to predicting the optimal time to change filters.

Along with planned changeouts and filter recommendations through tools such as TCO Diagnostic®, use of a filter monitoring and optimization tool such as Sensor360® can account for this variability and adjust optimal changeout cycles accordingly, based on ongoing data collection. Such systems can also alert the user when conditions change and filters require changout urgently, as well as if air quality issues are detected.

Research shows that facilities with **poor IAQ** can expect **an overall daily productivity drop of around**

9%

with individual losses up to **33%**

— another factor in **return on investment**

15%–40%

of the lifetime ownership cost of an air handler unit (AHU) is directly attributable to the **air filters selected**

$

Sources: Staples Employee Study 2013; Presenteeism and productivity analysis; General Consulting Associates; Department of Energy; 2006 Buildings Energy Data Book

HVAC

FILTER SELECTION, STANDARDS & TESTING

HVAC

Selecting the Proper Air Filter

Major Selection Factors

The most important element to consider in selecting the proper air filter is to meet the optimum air quality requirements of the facility, at the most favorable Total Cost of Ownership (TCO) possible. For example, healthcare regulations often mandate very specific filter efficiencies.

Other selection factors include:

- Consider the dimension of the tracks or frames that hold the filters within an existing installation; filters that fit the existing system will be available in various types of media and design that will directly affect the filter's pressure drop, dust holding capacity, efficiency, and price
- Utilize a TCO approach to normalize filter costs and energy costs associated with filter performance criteria like pressure drop and dust holding capacity, and note the impact of TCO against desired filter maintenance cycles, such as three, four, six, or twelve months
- Be aware of the opportunity to improve the IAQ of the facility, which has been shown to directly affect worker health and productivity, as well as the attentiveness of students and employees
- Be aware of the opportunity to reduce overall costs by using recently developed products that reduce energy costs
- Be aware of the high cost of deferred maintenance that can lead to unplanned expenses, safety risks, and system downtime
- Understand the role indoor air quality plays in occupant satisfaction, and that poor IAQ is one of the top tenant complaints
- Use a professional, technically capable air filtration specialist for guidance, and start by asking for an audit of the air filtration system

You should expect the following from an Air Filtration Audit:

- Analysis of your current state by a team of industry experts
- Professional guidance and analysis to reduce spend, decrease risk, and save time
- Valuable and detailed benchmark data
- Optimized TCO report that will show you where you could be performing better
- A standardized list of filters by air handler unit (AHU) and application

The Selection

Once the Air Filtration Audit is complete, review alternative recommendations for the filters, any recommendations to optimize your system, and the TCO information on each filter alternative. After consideration of all of these factors, you're ready to make the filter selection. Ask the air filtration specialist to check the installation at regular intervals to determine if the performance is as predicted.

There are

175,268

pages on IAQ

in the U.S. Code of Federal Regulations

Companies Choose AAF Flanders' Expertise Because of Our:

- Technical approach to problem solving
- Air Filtration Audits that provide professional guidance, insight, and analysis for cost savings and risk reduction
- TCO Diagnostic,® an HVAC filtration system analysis program, helps reduce deferred maintenance backlogs and decreases reactive time by analyzing system data, optimizing preventative maintenance schedules, and extending changeout cycles
- Broad range of filters for the optimal selection in each application

Source: Database of state indoor air quality laws, Environmental Law Institute, 2015; Code of Federal Regulations Total Pages and Volumes, Federal Register, 2015

HVAC

Relevance of Fine Particulate Matter

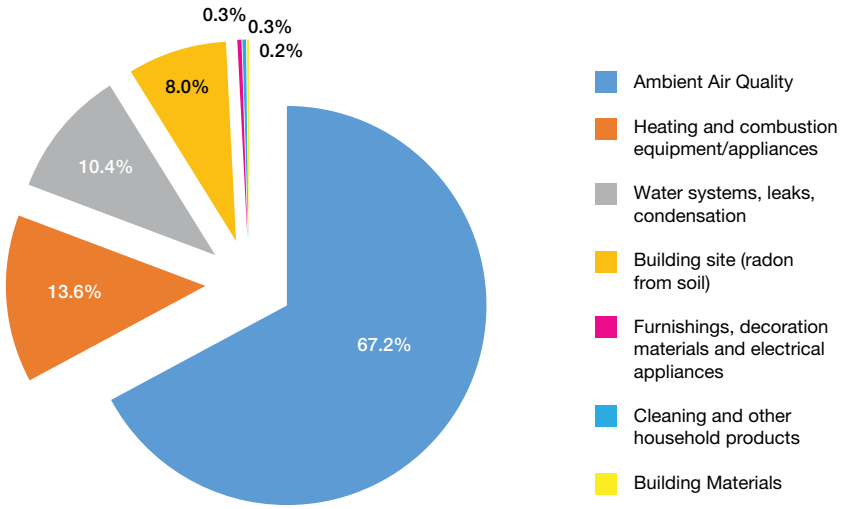
Outdoor air pollution plays a significant role in indoor air exposures. Due to ventilation providing continuous air exchange in buildings, the indoor air exposure to fine PM originates mostly from outdoor air, especially in areas affected by heavy traffic. The second most important source of exposure comes from the indoor combustion of solid fuels for cooking and heating (if present).

The outdoor air fine PM originates mostly from combustion sources, local and distant, in particular where the levels exceed rural background.

What is often not acknowledged is that in strongly polluted areas (e.g. heavy industry zones, city centers with heavy traffic) without air filtration, over 90% of ambient PM levels monitored outdoors, occurs indoors.

Applying correctly selected, efficient air filters in ventilation systems can significantly reduce the impact of PM exposure on the Burden of Disease (BoD).

Bad Ambient Air Quality Most Affects the Burden of Diseases (BoD)



Source: Eurovent 4/23-2017

Determining Recommended Filter Efficiency by Application and Typical Outdoor Air Quality

The table below helps you select air filters that ensure you meet requirements for the air inside your facilities based upon a combination of factors. By cross-referencing **your application** with the **typical quality levels of outdoor air**, you can determine the recommended minimum MERV rating for air filters in your application.

Application		Typical Outdoor Air Quality		
Commercial	**General Ventilation**	**GOOD** PM 2.5 ≤ 10 PM 10 ≤ 20	**MODERATE** PM 2.5 ≤ 15 PM 10 ≤ 30	**UNHEALTHY** PM 2.5 ≥ 15 PM 10 ≥ 30
High Hygenic Demand (pharma, hospitals, electronic industry, supply air in facilities with cleanrooms)	N/A	**MERV 14**	**MERV 15**	**MERV 16**
Medium Hygenic Demand (food and beverage production, etc.)	**Permanently Occupied** (schools, offices, hotels, residences, conference/exhibition halls, theaters)	**MERV 13**	**MERV 14**	**MERV 15**
Basic Hygenic Demand (less critical food and beverage production)	**Temporarily Occupied** (storage, server rooms, copier rooms)	**MERV 11**	**MERV 12**	**MERV 13**
No Hygenic Demand (automotive general production)	**Short-Term Occupancy** (restroom, stairways)	**MERV 8**	**MERV 11**	**MERV 12**
Heavy Industry Production Areas (steel mill, smealting, welding plants)	**Unoccupied** (garbage room, parking garage)	**MERV 7**	**MERV 8**	**MERV 11**

Given the speed at which Outdoor Air Quality can worsen due to wildfires and other unexpected events, we recommend exceeding the above efficiencies when feasible to ensure adequate protections if conditions worsen.

Minimum recommended filtration requirements above refer to final stage of filtration, ensure prefiltration is used as-recommended for the final filter chosen.

Based in part on EUROVENT 4/23/2017 "Selection of EN ISO 16890-rated air filter classes for general filtration applications" 1st Edition, published Jan. 9th, 2019.

Some countries may have national guidelines or industry-specific requirements that vary from the above.

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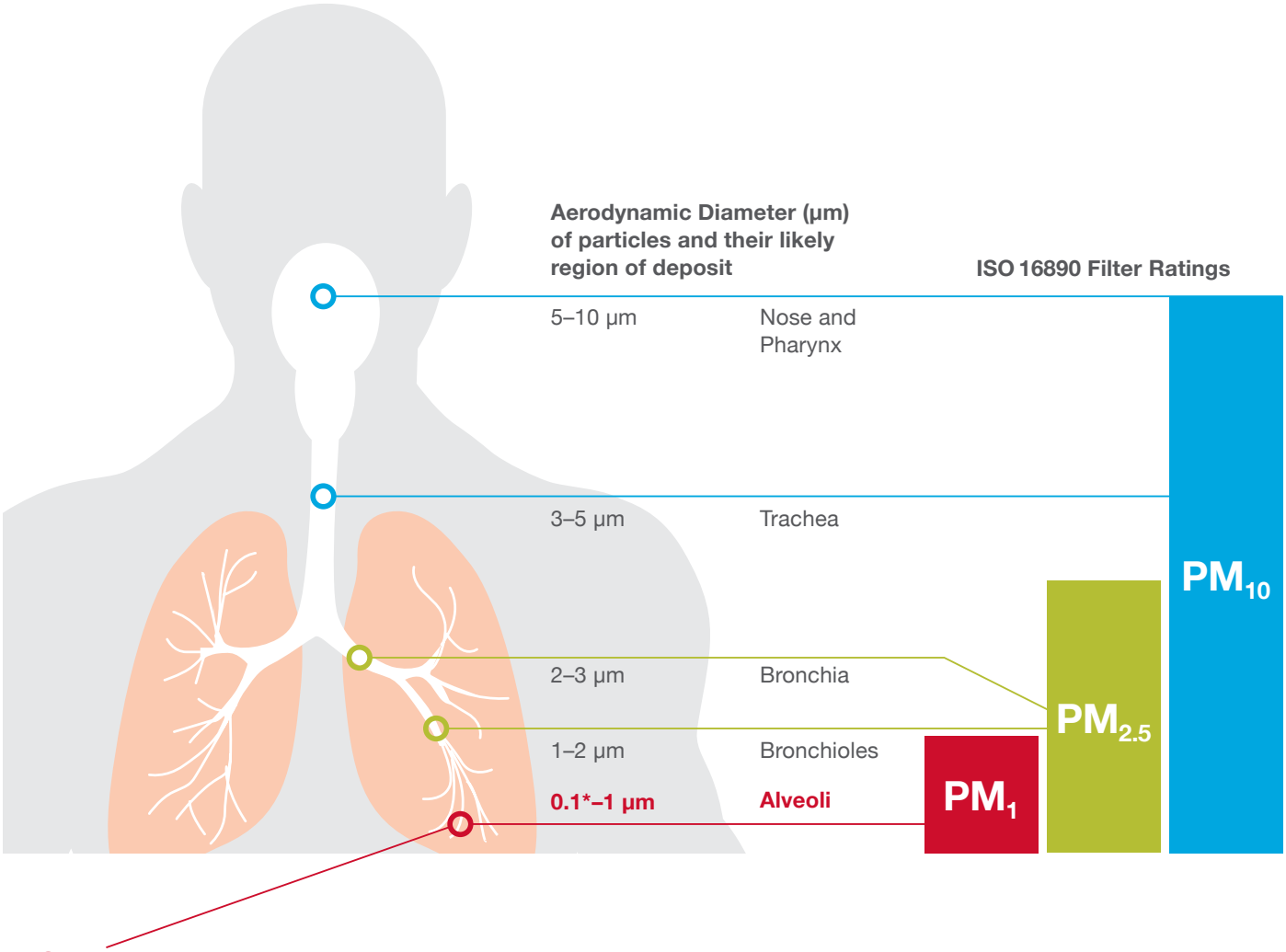
Burden of Diseases (BoD)



Small Particles Have Damaging Effects on Human Health

A variety of studies focus on the negative health impact of small particle pollution.

Conducted research determined an impact of IAQ on the burden of diseases (BoD). The burden of diseases is measured by the means of a so-called disability-adjusted-life-year (DALY). This time-based measure combines years of life lost due to premature mortality and years of life lost due to time lived in states of less than full health and was originally developed in 1990.

The total estimated burden of disease attributable to IAQ in the European Union is approximately 2 million DALYs per year, which means that two million years of healthy life is lost annually. It is worth noticing that, according to latest estimation carried out by French economists, the cost of 1 DALY can amount up to 100.000 EUR. On a global scale, losses resulting from an inadequate IAQ are large.

Source: Eurovent 4/23-2017

Information on small particle pollution is included in the air quality data of most weather apps.

HVAC

ANSI/ASHRAE Standard 52.2

ASHRAE Standard 52.2 was originally released as a standard in 1999. This standard is under continuous maintenance by a Standing Standard Project Committee (SSPC), which has established a documented program for regular publication of addenda or revisions. The most recent publication is ASHRAE Standard 52.2-2017. The title of the standard is:

"Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size"

As the name implies, the standard provides a methodology for determining a filter's efficiency in removing various sizes of particles as the filter becomes loaded. The standard also measures the filter's resistance to airflow when clean. In 2008, the arrestance test and dust holding capacity (DHC) from ASHRAE Standard 52.1 were added to ASHRAE Standard 52.2.

Removal efficiency is calculated by counting the number of particles upstream and downstream of the filter through a range of particle sizes, detailed in the table below. The challenge aerosol is poly-dispersed solid-phase (dry) potassium chloride (KCl) particles generated from an aqueous solution. The removal efficiency is measured when the filter is clean and after each of 5 incremental dust loadings as the filter is loaded to its final resistance. Fractional efficiency curves are developed for the clean filter and after each dust loading. A composite minimum efficiency curve is developed, which reflects the lowest efficiency for each particle size from the 6 curves.

ASHRAE advances the arts and sciences of heating, ventilation, and air conditioning, with more than **53,000 members** from over **132 nations**

Source: ASHRAE www.ashrae.org

Range	Size Range Lower Limit (µm)	Size Range Upper Limit (µm)	Range Geometric Mean Particle Size (µm)
1	0.30	0.40	0.35
2	0.40	0.55	0.47
3	0.55	0.70	0.62
4	0.70	1.00	0.84
5	1.00	1.30	1.14
6	1.30	1.60	1.44
7	1.60	2.20	1.88
8	2.20	3.00	2.57
9	3.00	4.00	3.46
10	4.00	5.50	4.69
11	5.50	7.00	6.20
12	7.00	10.00	8.37

The composite minimum efficiency curve has all of the detailed data to make an appropriate filter selection. For example, if filters are being used to clean the air supplied to a paint booth where particles 4 micron and larger can cause a defect in the painted finish, filters that remove 100% of the particles in range 9 through range 12 when tested can be selected. However, to simplify the selection and specification of air filters, the test standard provides an "overall" reporting value of a 52.2 evaluated air filter expressed as the Minimum Efficiency Reporting Value (MERV).

MERV is a single number on a 16 point scale that is determined by placing the efficiencies of the 12 size ranges from the composite minimum efficiency curve into three larger groups as follows:

E1 = Ranges 1 to 4 (0.3 to 1.0 µm)

E2 = Ranges 5 to 8 (1.0 to 3.0 µm)

E3 = Ranges 9 to 12 (3.0 to 10 µm)

The efficiency for each group is arrived at by averaging the composite minimum efficiencies of the 4 ranges.

Range	Size	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

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ANSI/ASHRAE Standard 52.2

The average particle-size efficiency (PSE) for each group is referenced against the MERV parameters (see table below). Moving up from the bottom of the table, the MERV rating will be in the left hand column of the first row, where that PSE for each group generates a true statement. For example, if the PSE for Range 3 is 81%, and the PSE for Range 2 is 42%, the filter would be MERV 9 (Range 1 efficiency is not taken into consideration for MERV 9).

Minimum Efficiency Reporting Value (MERV) Parameters Table

Standard 52.2 Minimum Efficiency Reporting Value (MERV)	Composite Average Particle Size Efficiency, % in Size Range, µm			Average Arrestance, %
	Range 1 0.30-1.0	Range 2 1.0-3.0	Range 3 3.0-10.0	
1	N/A	N/A	$E_3 < 20$	$A_{avg} < 65$
2	N/A	N/A	$E_3 < 20$	$65 \leq A_{avg}$
3	N/A	N/A	$E_3 < 20$	$70 \leq A_{avg}$
4	N/A	N/A	$E_3 < 20$	$75 \leq A_{avg}$
5	N/A	N/A	$20 \leq E_3$	N/A
6	N/A	N/A	$35 \leq E_3$	N/A
7	N/A	N/A	$50 \leq E_3$	N/A
8	N/A	$20 \leq E_2$	$70 \leq E_3$	N/A
9	N/A	$35 \leq E_2$	$75 \leq E_3$	N/A
10	N/A	$50 \leq E_2$	$80 \leq E_3$	N/A
11	$20 \leq E_1$	$65 \leq E_2$	$85 \leq E_3$	N/A
12	$35 \leq E_1$	$80 \leq E_2$	$90 \leq E_3$	N/A
13	$50 \leq E_1$	$85 \leq E_2$	$90 \leq E_3$	N/A
14	$75 \leq E_1$	$90 \leq E_2$	$95 \leq E_3$	N/A
15	$85 \leq E_1$	$90 \leq E_2$	$95 \leq E_3$	N/A
16	$95 \leq E_1$	$95 \leq E_2$	$95 \leq E_3$	N/A

Filters that have a Range 3 value of less than 20% undergo an Arrestance test to establish the MERV.

The arrestance test is also useful for comparing filters, particularly those that are MERV 10 and less. The removal efficiency tests to establish MERV are conducted with a dry aerosol. Some filters show declining efficiency values in Range 3 as the particle size gets larger. This is because the larger dry KCl particles do not adhere as well to dry clean media. A filter's ability to stop and retain the large KCl particles does not necessarily translate into a greater ability to capture dirt. There are MERV 9 and 10 filters that have lower arrestance values (capture less dirt) than MERV 8 filters. It is a good idea to compare the arrestance values and dust holding capacity (DHC) of filters MERV 10 and below to ensure you are getting good filtration value.

Appendix J

There have been many studies globally that have demonstrated a loss in efficiency in some filters as they are exposed to sub-micron particles, due to the dissipation of electrostatic charge from the media. Appendix J was added to ASHRAE Standard 52.2 in 2008 as a non-ANSI approved, optional conditioning step to provide a method of identification of the drop in efficiency. The reported value per Appendix J is referred to as MERV 'A'. Filters tested per Standard 52.2 with the Appendix J option have both a MERV and a MERV 'A.'

A motion at the ASHRAE meetings in New York City in 2014 to make appendix J a mandatory part of the standard was subsequently voted down. For the time being, it remains an optional appendix. Note that the ISO 16890 standard now in use in Europe has a conditioning step as a mandatory part of the test methodology.

HVAC

How to Read an ASHRAE 52.2 Test Report

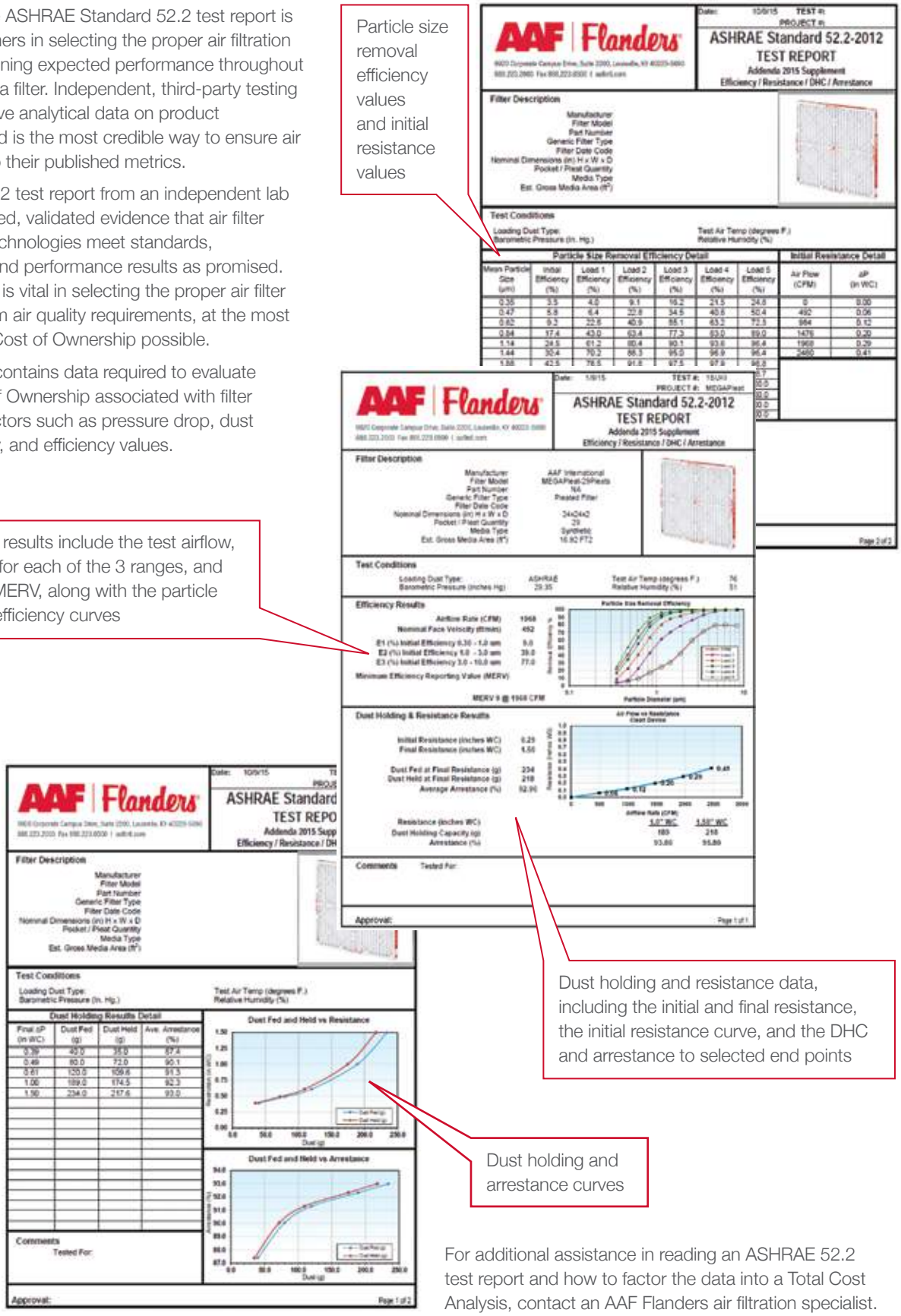
The intent of the ASHRAE Standard 52.2 test report is to assist customers in selecting the proper air filtration products by defining expected performance throughout the useful life of a filter. Independent, third-party testing provides objective analytical data on product performance and is the most credible way to ensure air filters perform to their published metrics.

An ASHRAE 52.2 test report from an independent lab provides unbiased, validated evidence that air filter products and technologies meet standards, specifications, and performance results as promised. This information is vital in selecting the proper air filter to meet optimum air quality requirements, at the most favorable Total Cost of Ownership possible.

The test report contains data required to evaluate the Total Cost of Ownership associated with filter performance factors such as pressure drop, dust holding capacity, and efficiency values.

Particle size removal efficiency values and initial resistance values

The efficiency results include the test airflow, the efficiency for each of the 3 ranges, and the resulting MERV, along with the particle size removal efficiency curves



Dust holding and resistance data, including the initial and final resistance, the initial resistance curve, and the DHC and arrestance to selected end points

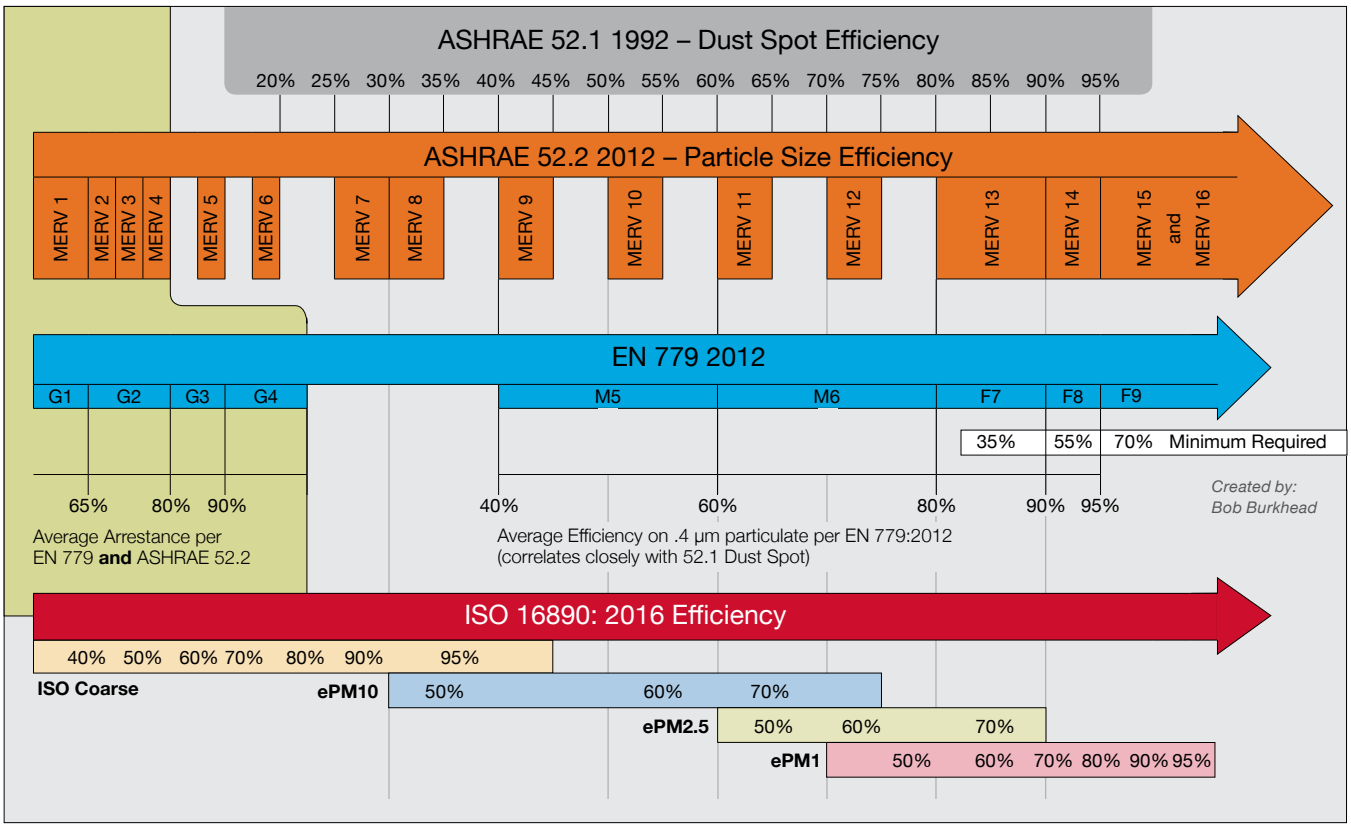
Dust holding and arrestance curves

For additional assistance in reading an ASHRAE 52.2 test report and how to factor the data into a Total Cost Analysis, contact an AAF Flanders air filtration specialist.

HVAC

HVAC Filter Designations

Test Standard Correlations



The test standard correlations above are approximations based on results obtained on a sampling of products. Actual results on products may differ somewhat from these correlations, and a product tested to one standard that needs to meet the requirements of another standard should be tested in accordance with the specified standard.

Comparison of EN 779 and EN ISO 16890 Rated Filter Classes

The direct conversion of EN 779 and EN ISO 16890 classes is not possible. To facilitate an indicative comparison, particularly for the purpose of replacing existing filters, the Eurovent Association has developed a table matching both EN 779 and EN ISO 16890 classes tested for the same filters.

The comparison shows the actual overlapping of EN 779 and EN ISO 16890 classes and was developed based on real test data of 91 filters provided by Eurovent Certita Certification.

ASHRAE 52.2	EN 779 2012	EN ISO 16890 – Range of Actual Measured Average Efficiencies		
Filter Class		ePM_1	$ePM_{2.5}$	ePM_{10}
MERV 10	M5	5% – 35%	10% – 45%	40% – 70%
MERV 11	M6	10% – 40%	20% – 50%	60% – 80%
MERV 13	F7	40% – 65%	65% – 75%	80% – 90%
MERV 14	F8	65% – 90%	75% – 95%	90% – 100%
MERV 15	F9	80% – 90%	85% – 95%	90% – 100%

EN 779 – EN ISO 16890 comparison courtesy of Eurovent.

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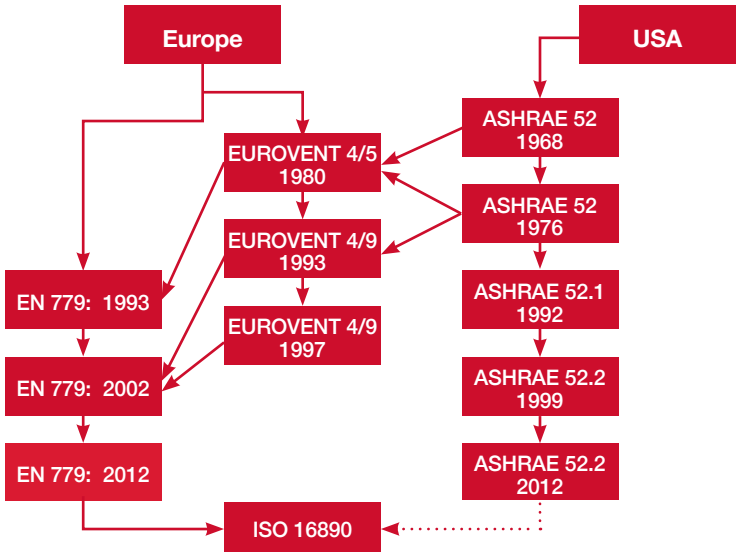
History of HVAC Air Filter Standards



- **1968** ASHRAE published the first unified filter testing standard, measuring:

  – Arrestance

  – Efficiency via dust spot testing

  – Dust holding capacity

  This test was improved/revised as ASHRAE 52-76 and then as ASHRAE 52.1:1992, but the underlying methodology were largely unchanged until 1999.

- **1999** ASHRAE 52.2 replaced 52.1, most notably eliminating the Dust Spot test and replacing it with MERV ratings. Filter efficiency is now measured via particle counter against 12 particle sizes.

  European filter testing standards have followed a similar trajectory. The Eurovent 4/5 standard was developed in 1980 based on the ASHRAE 52-76 standard and was the first to classify filters into categories based on their efficiency. Eurovent 4/5 led to the development of the EN779 standard. The revised standard, Eurovent 4/10, was the first to measure efficiency via optical particle counters and classify via fractional efficiency. However, the EN779 standard, measuring only 0.4µm particles, was more widely used until 2018.

- **2018** EN779 has been replaced by ISO 16890, offering a rating system more clearly aimed at fractional efficiency, especially against fine particulates. See comparison below. Note: The U.S. continues to use the ASHRAE 52.2 Standard.

Comparison of Standards

Standard	ASHRAE 52.2: 2012	ISO 16890	EN 779: 2012
Aerosol	KCl	DEHS/KCL	DEHS
Aerosol Range	0.3 to 10.0 µm	DEHS: 0.3 to 1.0 µm KCL: 1.0 – 10 µm	0.4 µm
Particle Sizes for Rating	E1: 0.3 – 1.0 µm E2: 1.0 – 3.0 µm E3: 3.0 – 10.0 µm	PM1: 0.3 – 1.0 µm PM2.5: 0.3 – 2.5 µm PM10: 0.3 – 10 µm	0.4 µm
Loading Dust	ASHRAE 52.2 Dust	ISO Fine	ASHRAE 52.2 Dust
Conditioning	Optional: Appendix J (whole filter)	Mandatory: IPA Vapor (whole filter)	Mandatory: IPA Liquid (flat sheet)
Conditioning Substance	0.03 µm KCL	IPA Vapor	IPA Liquid
Conditioning Time	Efficiency measured after minimum increments of $6.4x10^7$ particles/cm^3 min. Conditioning stops after no further significant drop in efficiency.	24 h	2 min soak
Classification	MERV 4 – MERV 16	ePM1, ePM2.5, ePM10	G1 – G4, M5 – M6, F7 – F9
Rating	Worst case	Average of initial and discharged condition	Worst case

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Underwriters Laboratories (UL) Filter Testing

UL Standards

Underwriters Laboratories, Inc. (UL) is an agency that lists products they have tested against criteria deemed appropriate for public safety. For AAF Flanders' Commercial and Industrial filter product lines, the UL criteria are set forth in UL Standard 900.

Smoke and flammability limits for clean air filters are established with UL 900. However, the toxicity of products of combustion, which result from a filter's exposure to flame, is outside the scope of UL 900. The filter's filtration capability before or after flame exposure is also outside this scope.

To obtain a UL listing on a product, application is made to Underwriters Laboratories. Several samples are then submitted for test, and all of these samples must pass the criteria established successfully. The manufacturer further agrees to a follow-up service procedure, in order for the listing to be granted. A UL representative visits each point of manufacture during this procedure and selects at random a sample of the listed product. This sample is returned to UL for retest, ensuring continued compliance with the appropriate test criteria.

Only products that have met the criteria for listing may use the UL label. Products manufactured by AAF Flanders that specifically do not bear the UL label are not required by UL to comply with UL 900 requirements, even though they may be similar in appearance to other listed products.

Listings and Classifications for a company's products are published on the Underwriters Laboratories website in their Online Certifications Directory at ul.com.

AAF Flanders prints the above logo, as provided by Underwriters Laboratories, directly on our products, or on a product label, signifying the product is UL qualified. The logo is a registered trademark of Underwriters Laboratories.

Underwriters Laboratories (UL) UL 900, Standard for Air Filter Units

UL 900 is a test standard that determines flammability and smoke characteristics on a clean air filter. Only filters that do not exceed the stated limits of flammability and smoke generation of UL Standard 900 can carry the UL symbol. All of AAF Flanders' HEPA/ULPA filters have been UL tested and are certified to meet the requirements of UL Standard 900.

A complete listing of AAF Flanders' products that are UL classified is available on UL's website on the Online Certifications Directory page at ul.com.

CAN/ULC S111-13, Standard Method of Fire Tests for Air Filter Units

Many filters manufactured by AAF Flanders are also classified as meeting the requirements of CAN/ULC S111-13, Class 2. The test requirements are similar to those of UL 900, except that the filters are tested at their rated airflow and the standard approved by the Standard Council of Canada. According to CAN/ULC S111-13, a clean Class 2 unit burns moderately or emits moderate amounts of smoke when tested.

UL compliance with both Canadian and U.S. requirements.

High Purity

FILTER SELECTION, STANDARDS & TESTING

High Purity

History of High Purity Filtration

How Did the Cleanroom Industry Evolve?

Today's global cleanroom industry sprang from the simple realization that airborne particles posed a threat to people and products. In the late 1800s, Swiss watch makers allegedly developed controlled environments to prevent particles from settling on their precious merchandise by covering them with small bell jars. Then, about 150 years ago, surgeons started to become increasingly aware of contamination from bacteria causing infection in healthcare environments. In the early 20th century, a ball bearing producer made a major investment to introduce air filtration into their existing facility to mitigate particle contamination that affected its manufacturing process.

At the heart of the modern cleanroom is either a high-efficiency particulate air (HEPA) filter or an ultra-low penetration air (ULPA) filter, which emerged later. The first major breakthrough in air filtration contamination control occurred when the HEPA was developed around the middle of the 20th century in or near 1940.

Willis Whitfield from Sandia National Labs invented the first true cleanroom in 1962. A revolution at the time, the design schematics for the first "ultra-clean room" actually has a patent: US3158457 A. In a recorded interview in 1993, Whitfield explained that before his design, most "cleanroom contamination control" was managed by sealing all potential leak paths and vacuuming constantly. He and his team designed a room that recirculated the air through HEPA filters, completely replacing the air in the room 600 times per hour!

When Were HEPA Filters First Commercially Available?

The R&D firm Arthur D. Little designed the HEPA filter under a classified government assignment as part of the larger Manhattan Project. The firm developed this new class of air filter for the Atomic Energy Commission to isolate deadly nuclear particles. The Manhattan Project, which resulted in the development of the atomic bomb, began modestly in 1939 but eventually employed more than 130,000 people at more than 30 sites in three countries and cost nearly U.S. $2 billion.

From there, the industry started to spread into the world regions where nuclear power was produced in the 1950s. Upon its founding in 1950, **Flanders Filter Corporation** started production of HEPA filters at their New York facility. **Nippon Muki** in Japan, a sister company to AAF Flanders launched in 1939, began manufacturing HEPA filters in the 1950s. With roots that trace back to 1921, **AAF Flanders** (then "American Air Filter") produced its first commercial HEPA filter in 1964 in its Shelbyville, KY plant. HEPA filters came into demand for nuclear applications in developed countries across the globe, especially in northern Europe, North America, and Japan.

Cleanroom Construction Boomed

The modern cleanroom evolved rapidly in the 1960s and 1970s when the need for increasingly clean environments for industrial manufacturing of everything from instrumentation to weapons accelerated. During this period, the National Aeronautics and Space Administration (NASA)'s space travel program was in full swing, and the concept of "laminar flow" for the assembly of optics, electronics, and sub-assembly for satellites marked a turning point in cleanroom technology.

In the 1970s and 1980s, the mass production of the microprocessor demanded significantly cleaner and larger cleanrooms, which were frequently the size of football fields. Cleanroom garments continually improved as operators recognized that people were the main source of contamination in these spaces. During this same period in the 1970s and 1980s, contamination control also improved in terms of the materials used and flush finishes in construction of these environments.

Building "rooms within a room" or mini-environments to further isolate or minimize cross-contamination became the norm. Room pressurization regimes and controls for temperature and humidity all advanced as technology evolved and specialized HVAC, controls, and cleanroom vendors developed standards. Around this same time, researchers sought to introduce sealants and media separators used in the construction of HEPA filters that would minimize offgassing and contamination. The expectations of air quality in these spaces grew even more stringent as gaseous contamination and even minute particles could cause fouling of these products.

Airborne molecular contamination **(AMC)** filtration and polytetrafluoroethylene **(PTFE)** ULPA membrane media product development accelerated in the 1990s and continued to evolve to protect the most critical process steps for the most state-of-the-art manufacturing facilities. **PTFE** and fluororesin media **(FRM)** membrane technology, developed by AAF Flanders parent company **Daikin**, offers the lowest resistance and highest efficiency at the most penetrating particle size (MPPS), all without the risk of offgassing. Even better, filters constructed with membrane technology also deliver the lowest possible Total Cost of Ownership (TCO) over the filter's lifetime. (See pages 34-35 for HEPA media types and comparison.)

High Purity

History of High Purity Filtration

Increasingly Complex Applications

In applications such as Bio-Safety Level (BSL-3 and BSL-4) spaces, operators maintain negative room pressurization. One of the critical containment protocols utilizes the concept of cascading differential pressure, meaning that air in a bio containment facility follows the desired path by maintaining slightly lower (more negative) room pressures between each adjacent space, with the dirtiest space featuring the most negative pressure and exhaust filters. The extremely low differential pressure offered by FRM membrane technology helps to regulate and maintain this cascading effect from room to room.

The containment housings in which HEPA and ULPA filters are installed vary by the combination of components, such as upstream and downstream test sections, HEGA (high-efficiency gas absorbers) bubble-tight dampers, integrated spark arrestors, automated scanning, pre and HEPA sections, decontamination ports, and multiple gauges and measurement devices. The housing construction can also vary depending on the application and geographic region of the world where it is installed. A number of cleanroom operators prefer to obtain their containment housings from the same manufacturers who make their air filters, since this manufacturer knows how each of the components work with one another from a performance and certification standpoint. (The full line of HEPA/ULPA filters and housings from AAF Flanders may be found within the High Purity Product Section of this guide.)

Industry Regulation

Standards and regulations started to play a more influential role in the construction and classification of rooms as the industry grew. The Microelectronics industry remains essentially self-regulated, although working groups and bodies such as Semiconductor Equipment and Materials International **(SEMI)** and International Roadmap for Devices and Systems **(IRDS)** have formed. These groups function mainly to provide guidance for AMC controls in Microelectronics facilities, thereby protecting equipment and processes.

The Life Science industry faces much more regulation due to the nature of the products they produce. The Centers for Disease Control (CDC) and Food and Drug Administration (FDA) in the United States and the European Medicines Agency (EMA) in Europe regulate Life Science manufacturers and have global counterparts, especially in advanced markets such as China and India. Most of the global agencies from around the world that influence the industry are listed within the Glossary of Terms Section of this guide.

Cleanroom Standards

As cleanroom construction took off in the 1960s, the industry recognized the need to establish standards. In 1963 the Institute of Environmental Science and Technology (IEST) published Federal Standard 209 (FS 209), which became the first internationally recognized standard for cleanroom classifications. Many countries adopted or made their own versions of the standard, primarily to account for conversion to the metric system.

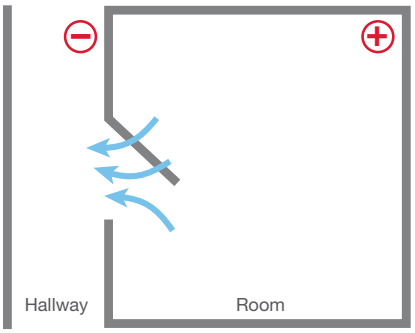
As a multitude of applications and industries evolved over the last decades, it has taken quite a while to settle on an internationally acceptable cleanroom standard that suited them all. The ISO Technical Committee ISO/TCO209 on “clean rooms and other associated controlled environments” started in 1993 and has effectively rendered FS 209 obsolete. This committee introduced new standards within the first draft of ISO-14644, which continues to evolve. Within ISO-14644 currently, 16 different standards exist. ISO-14644-1 Clause 2.1.1 defines cleanrooms thusly:

> ***A room in which the concentration of airborne particles is controlled and which is constructed and used in a manner to minimize the introduction, generation, and retention of particles inside the room and in which other relevant parameters, e.g., temperature, humidity, and pressure are controlled as necessary.***

One of the latest additions to the standard, ISO-14644-16 focuses on optimizing energy in cleanrooms and clean air devices. Latter portions of this guide expound on the concepts of **system economy** and **system integrity**. As will be discussed later, **VisionAir™ Clean** (VAC) software from AAF Flanders identifies opportunities to minimize energy consumption within a clean environment, especially in the area of air change rate optimization. To gain access to VAC, contact your AAF Flanders representative.

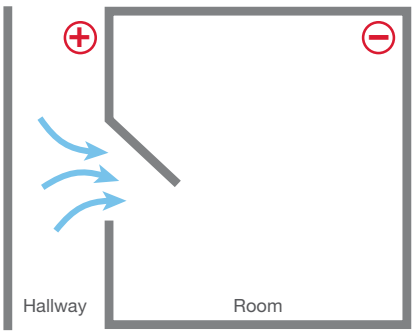
Room and Air Pressure

Positive Pressure is a pressure within a system that is greater than the environment that surrounds that system. Positive pressure cleanrooms are designed to use this positive pressure to prevent potentially contaminated air from flowing into clean areas. A differential air pressure of 0.03 (7PA) to 0.05 (12PA) inches water gauge is typically recommended between spaces.



Positive room pressures are present when air flows from the room to the hallway.

Negative Pressure is generated and maintained by a ventilation system that removes more exhaust air from the room than air is allowed into the room. Air is allowed into the room through a gap under the door (typically about one half-inch high). Except for this gap, the room should be as airtight as possible. Negative air pressure cleanrooms are used in industries that manufacture pharmaceutical products (potent compounds), Bio Safety Level (BSL) 3 & 4 Rooms, and also in hospitals to quarantine seriously contagious patients. Any air that flows out of the room has to first flow through a HEPA filter, ensuring that no contaminants can escape.



Negative room pressures are present when air flows from the hallway to the room.

High Purity

History of High Purity Filtration

Future Industry Trends

Looking at where the cleanroom and biosafety industry is today and where it is going in the future, a number of trends start to emerge.

Microelectronics Industry

- MEGA cleanroom facilities constructed primarily for the flat panel display (FPD) market and foundries to a lesser extent, 80% of which are owned and operated by Asian firms.
- Days of "fully filtered" ceilings essentially over, giving way to an ISO 5 background with clean zones or mini-environments to control contamination.
- Open plenum or ducted HEPA designs rare by comparison with scenarios involving FFUs, which are the standard due to their flexibility on many fronts, but especially for the smaller footprint required of the facility. (See FFU product line in Product Section of this guide.)
- Increased need for control of airborne molecular contamination (AMC) with chemical filters coupled with the lowest contaminant-generating ULPA (PTFE) filters.
- Expectations for major developments in the next 5-10 years of IoT-driven solutions to control and monitor the most critical process steps.
- Energy cost at the forefront of product selection, with contamination control a close second, due to the huge costs associated with operating these facilities (100MW in annual energy consumption in these larger facilities not unusual).
- Further consolidation of the major manufacturing base in Asia, primarily China, Korea, and Taiwan, with 80% of today's capacity coming from homegrown talent of TSMC, UMC, and SMIC in the top tier, and Samsung and Global Foundries rounding out the top five.

Life Science Industry

- Continued pressure within Big Pharma to reduce their cost base, driving further consolidation and outsourcing, but market expects major brands to be localized.
- Continued growth in Generic and Biosimilar drugs as R&D budgets shrink and worldwide political pressure on healthcare costs escalates.
- Wider adoption of Open, Active, and Passive Random Access Barrier Systems (RABS) while Isolator Technology will decrease in cost due to economies of scale.
- Shift to modular or POD cleanroom assembly to speed up construction time and offset rising validation costs.
- Decisions on production equipment and processes dominated by sustainability focus, driving demand for **system economy** for reduced energy consumption and **system integrity** for risk minimization.
- Increased challenges to historic design parameters established 30+ years ago as regulators dictate reduction of Air Changes per Hour (ACPH) and Room Velocities (Grade A space), as well as introduce new certification/validation norms.
- Rapid adoption of IoT-driven solutions by manufacturers, and acceptance of this development by regulatory agencies.

Biosafety

- Further discussion of HEPA filter efficiency and breakthrough as viruses and bacteria evolve different structures or mutate into different organisms.
- Intensified study on how airflow uniformity or distribution within a containment housing affects the MPPS in terms of media penetration.
- More attention focused on how containment BIBO or Safe-Change housings are assembled, tested, and certified in the factory and the field, leading to discussion of system economy and system integrity.
- Improvements in HEPA filter scanning, controlling airflow through automated bubble- or gas-tight dampers, and real-time monitoring of system integrity driven by automation and IoT.
- Major investment growth in high containment labs globally, but especially in China and India.

Conclusion

At AAF Flanders, we take pride in our ability to help customers in their ongoing efforts to protect people, processes, and products. We continue to innovate new means, but the goal remains to mitigate risk while minimizing total cost of ownership.

High Purity

HEPA Media Types

Glass Fiber or Microglass (wet laid) Media:

First developed in the 1940s

The manufacturing process starts with a slurry of glass fibers in water with binder, which is then poured on a moving screen conveyor, water vacuumed from below, baked dry in an oven, formed into media rolls that are shipped to filter manufacturer, pleated into packs, potted in urethane in filter frames, tested, and packed.

The basic recipe has remained the same for 75+ years, with the biggest exception being the introduction of a low Boron Media for specific semiconductor applications.

There is a wide range of filter efficiencies available, and glass media has been the industry standard for high efficiency filtration.

The fact remains, the media is delicate and vulnerable at every stage of the manufacturing and assembly process, filter installation, certification, and shipping or transportation process.

- Slurry of glass fibers in water with binder
- Poured on a moving screen conveyor
- Water vacuumed from below
- Baked dry in an oven
- Pleated into packs
- Potted in urethane in filter frames
- **Media is delicate and vulnerable at every stage of manufacturing, filter installation to testing**
- **Media is extremely fragile**

Membrane Media or ePTFE/eFRM

In 1938, Dr. Roy Plunkett accidentally discovered PTFE while working for DuPont. Polytetrafluoroethylene was abbreviated to Teflon as a registered trademark in 1945. 1958 Jan: W.L. "Bill" Gore (1912-1986) left his job at DuPont to pursue his belief in the untapped potential of PTFE and launched together with his wife W. L. Gore & Assoc. in the basement of their home in Newark, DE.1969 Oct: Their son Bob Gore accidentally discovered expanded PTFE (ePTFE). 1988 Daikin (AAF Parent) discovered ultrafine fiber structure.

The manufacturing process starts with a ‘fine powder’ recipe, which then undergoes a process of mixing and pre-forming a paste, then a paste extrusion, then stretching/drying/calendering, then stretching-scoring, laminating/pleating/assembly testing. The whole manufacturing and assembly process is in a cleanroom environment.

The main benefits of the membrane technology are: VERY robust media, low pressure drop, and chemically inert.

The ePTFE membrane media is now the media of choice for Microelectronic applications from the critical mini-environments to the larger FABS and FPD facilities due to its low energy consumption, lighter weight, and as of today, economies of scale and lower cost.

The eFRM membrane is a relatively new media enjoying rapid adoption in the Life Science/Healthcare industry due to the same benefits but also now ‘PAO compatibility’, which was one of the original challenges with the first generations of ePTFE membranes.

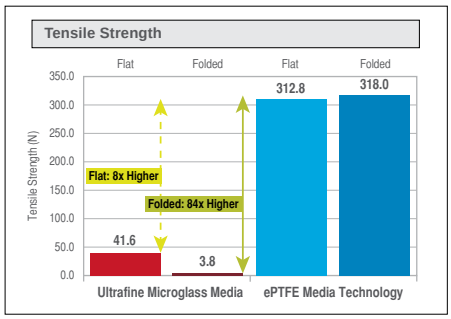
1988 Daikin discovered ultrafine fiber structure

- Starts with ‘fine powder’ depending on grade/layers
- Mixing & pre-forming paste
- Paste extrusion
- Stretching/drying/calendering
- Stretching-scoring
- Laminating/pleating
- **Whole process controlled in a cleanroom environment**
- **Media is VERY robust**

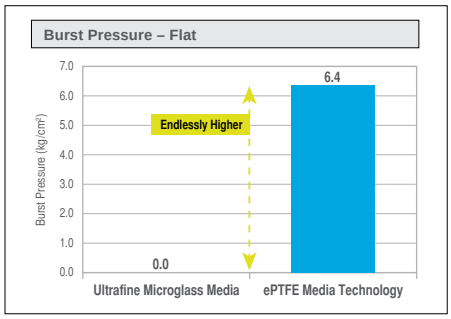
High Purity

HEPA Media Types

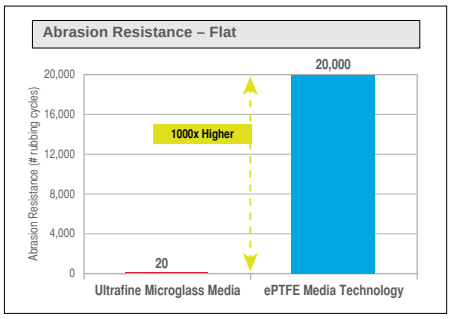
Proven Durability— 84x the Pleated Strength of Microglass



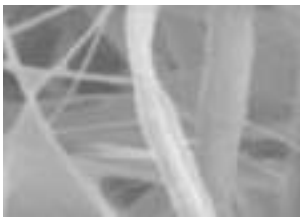
Results based on Test Standard DIN EN 29073-3.



Results based on Test Standard DIN EN 13938-2.



Results based on Test Standard DIN EN 12947-2.



ePTFE Membrane Media

Single layer of expanded PTFE supported by a layer of spun bonded synthetic media on the upstream and downstream side.

- Available in H13 – U17
- Standard for Microelectronic and Tool Market
- Compatible with Discrete Particle Counters (DPC) testing

eFRM Membrane Media

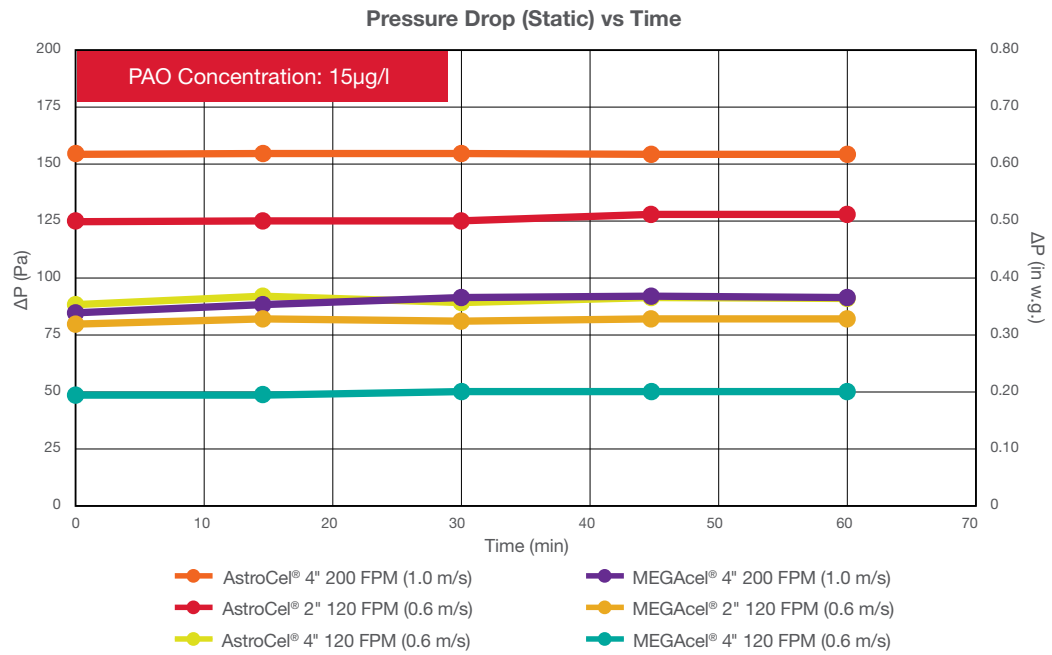
Dual layers of expanded Fluororesin supported by a layer of spun bonded synthetic media on the upstream and downstream side.

- Available in H13 – H14
- Suitable for Life Science Applications
- Compatible with photometric test methods

Laskin Nozzle 'Cold' PAO Pressure Drop Data

- Stable pressure development for 1 hour with local injection

Average PAO Concentration: 15µg/l



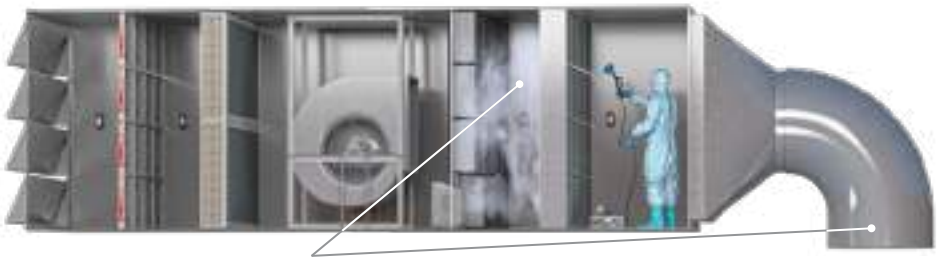
HIgh Purity

Testing and Certification

Monitoring and maintaining system integrity in the field is a critical step to ensuring that each system provides the clean air protection required for its specific application. Therefore, understanding the testing requirements for your facility and how that testing is accomplished will help you to select the ideal system for your needs.

The examples shown of various test methods and access points will help serve as a guide for identifying key considerations in the selection and maintenance of your filtration system.

AHU O/E and Scan Test



When access is difficult or the SOP does not call for an actual manual scan test of the HEPA filters in the AHU, it is common to carry out an overall efficiency test. This normally means injecting an aerosol upstream allowing the aerosol to mix at a minimum of 10 duct diameters downstream and then taking a single or multiple point measurement downstream. Some applications request a multiple probe design that can be permanently fixed in the duct to get an even better representative sample downstream. The typical allowable limit is 0.01% or 0.005% of the upstream concentration.

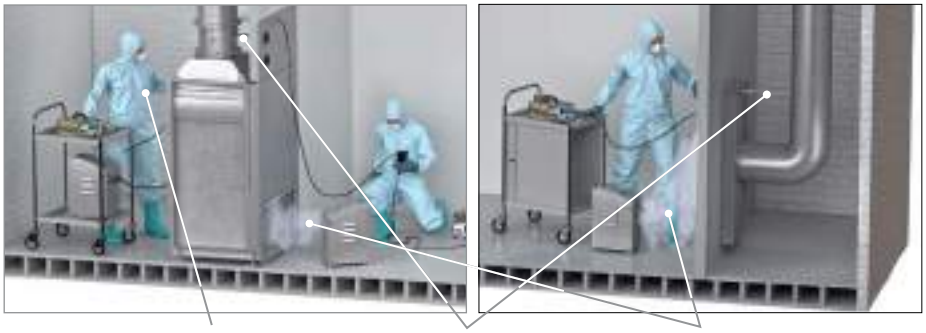
Supply Scan or Leak Testing in Room

Leak testing with a photometer or DPC

Injection of the aerosol from the plenum

Upstream measurement of aerosol if no access from the room side from injection at the AHU

Exhaust Scan or Leak Testing



Leak testing from the interstitial space (BIBO or Non BIBO)

Overall efficiency testing from within the room

Injection of the aerosol from within the room

Equipment Tested in Room

Bench testing of a HEPA/ULPA filter

Aerosol Injection Dispersion Ring upstream of the filter

Aerosol Injection for a FFU

Typical Cleanroom Testing/Monitoring Requirements

Other less critical areas may include the following tests and frequencies

		Frequency
Test	Particle Monitoring in Air	Regular— May be 6 monthly
	HEPA Integrity Testing	Yearly— (Grade A/B: 6 monthly, D: 1-2 Years)
	Verification of A/C Rates	6 Monthly
	Air Pressure Differentials	Continuous / Daily
	Temperature & Humidity	Continuous / Daily
	Microbial Monitoring	Regularly— Daily / Weekly / Monthly
	Smoke Visualization	3 - 5 Year Cycle Smoke Visualization

As determined by HACCP

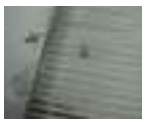
Hazard Analysis and Critical Control Points. This is a preventative food safety system in which every step in the manufacture, storage and distribution of a food product is scientifically analyzed for microbiological, physical and chemical hazards.

HIgh Purity

Where and How is the Test Aerosol Generated?

Aerosol Generator Location	How Aerosol is Typically Generated	Positive	Negative
Supply Air AHU	Thermal	Good aerosol distribution, dispersed over multiple filters simultaneously which saves time	Excess aerosol exposure; Potential risk of 'bleedthru' if correct filter efficiency is not specified
Supply Duct Work in the Plenum	Laskin Nozzle	Good aerosol distribution, dispersed over multiple filters simultaneously which saves time	Access to the plenum-ability to measure upstream concentrations
Locally through Aerosol Dispersion Ring in the Housing	Laskin Nozzle	Minimizes aerosol exposure to multiple filters	Aerosol dispersion ring or distribution needs to be validated to ensure adequate upstream challenge
Low Wall Return Air Ductwork	Thermal	Good aerosol distribution, dispersed over multiple filters simultaneously which saves time	Excess aerosol exposure; Potential risk of 'bleedthru' if correct filter efficiency is not specified

Guidelines for Factory and Field Repairs

Location	Repair Limits	Guideline	Repair Equipment
Factory	Up to 13 cm^2 (2sq in) in any one patch or a total of 1% on the area of the face being patched	IEST-RP-CC001.6	EFD Dispense Gun 
Factory	Up to 0.5% of the face area. No single repair larger than 1.2" (30mm) in any dimension	EN-1822-4	EFD Dispense Gun 
Field	Up to an additional 3% of the face area. No single repair larger than 1.5" (38mm) in any dimension	IEST-RP-CC034.2	RTV 162 or 108 or Dow 732 is a suitable repair material
Field	No repairs allowed in a Grade A Space. Some will specify no factory repairs for which there is typically a premium from the manufacturer. (Average factory repairs are 5-8%) 95% of end users follow industry norms/repair levels.	End Users	Manufacturers will repair with urethane, media or hot melts used in the production process. Repairs should be recorded on the scan test reports for a given filter. Filters should always be re-scanned after repair in the factory and re-tested in the field.
Field	Less is more 	Experience 	Covering filters with more silicone does not mean you will 'seal the leak'. Leaks 'travel' and you will end up chasing leaks. Leave repairs to professionals.

High Purity

System Integrity and System Economy

Is it the filter integrity that's important or is it the system integrity?

What % of leaks are in the filter media? Is it the frame of the filter? The seal? Which seal? The housing to filter seal? The housing to grid/ceiling seal? The media to the frame? The gasket seal? The gel seal? Is the room positive or negative? Is the leak nothing to do with the filter but is from entrainment of particles from a different source? Is the leak from an adjacent housing or filter? Is it from a nearby door? Is it through the light fixture? The list goes on, we are sure many certifiers reading this will add some additional 'traveling leak' stories.

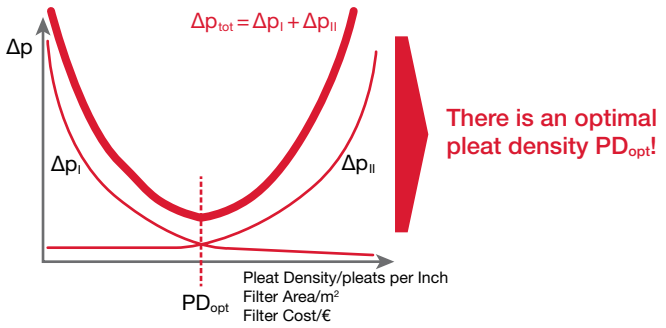
The point being, the filter is only as good as the housing or frame it is mounted in and by default, the frame or housing is only as good as the ceiling or unit they are mounted in, so yes. It's the SYSTEM integrity that's important.

Filter + Housing + Seal = SYSTEM INTEGRITY.

We'll come back to what to look for when we discuss system integrity later. Let's first review what we mean by system economy. What does the perfect filter look like? It has 100% efficiency, zero resistance and lasts forever! We in the filter industry are fixated on reducing the resistance in the finished filter by normally optimizing the configuration or construction of the finished product. This is not a negative but there are limitations today in the type of media commercially available (there are some new developments we'll touch on later with membrane technology) and how much **effective** filter media can be configured in a way that makes technical and commercial sense. We highlighted the word effective for a reason. More media does not always mean less resistance, slower media velocity and higher efficiency. It is the optimum use of media in a given boundary (pack depth, density, outer frame and so on) that ensures best performance.

Depending on the filter type and design (both 'good and bad' design) the construction (how the manufacturer pleats a pack, shapes a pocket, what frame design/type is used and so on), resistance or pressure drop can exceed in some cases 60-70% of the initial pressure drop of the filter. In other words the flat sheet media before it is converted into a pack, or pocket, is only 30% of the initial pressure drop and the construction pressure drop is 70%. That said, generally speaking it's about a 50/50 split so there is equal opportunity to optimize design through filter design (configuration) and media selection/specification.

Pressure Drop as Function of Pleat Density



English Units

Product Type	Media Pressure Drop at Media Face Velocity (IWG)	Filter Pressure Drop (IWG)	Structure Dp (IWG)	Structure Contribution to Dp (%)	Media Contribution to Dp (%)
AstroCel® I (HCX)	1.01	1.45	0.44	30	70
AstroCel® II (2 inch)	0.45	0.53	0.08	15	85
AstroCel® III	0.47	0.85	0.38	45	55
MEGAcel® I	0.56	0.7	0.14	20	80
MEGAcel® II (2 inch)	0.23	0.27	0.04	15	85
MEGAcCel® III	0.23	0.76	0.53	70	30

SI Units

Product Type	Media Pressure Drop at Media Face Velocity (Pa)	Filter Pressure Drop (Pa)	Structure Dp (Pa)	Structure Contribution to Dp (%)	Media Contribution to Dp (%)
AstroCel® I (HCX)	251	361	109	30	70
AstroCel® II (2 inch)	112	132	20	15	85
AstroCel® III	117	212	95	45	55
MEGAcel® I	139	174	35	20	80
MEGAcel® II (2 inch)	57	67	10	15	85
MEGAcel® III	57	189	132	70	30

High Purity

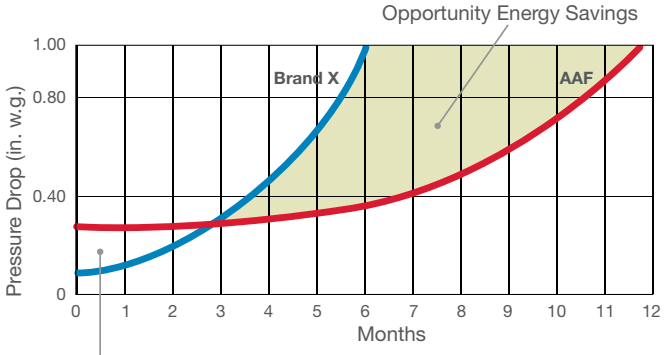
System Integrity and System Economy

The filter industry has seen no real change or paradigm shift in how filters are constructed in the last 50+ years. The design is essentially the same. From filter manufacturers globally, it is either a Box, V-bank, Pockets or Minipleats. The majority of manufacturers try to improve filter performance over the other by squeezing another 10-20PA from the media suppliers and/or re-shaping a frame or pleat density to get another 20PA from the filter design. Where is the limit? Have we already reached the limit on current design? Is there a revolutionary new media that has 100% efficiency and zero resistance? Never say never but not yet.

We are not minimizing the quest for lower resistance. Pressure drop = money. For every PA we save equates to approximately $1 in energy saving ($100 for every 0.4" of static) which is worth pursuing especially when there are multiple stages and large volumes of high efficiency filters in advanced facilities.

% Reduction in Resistance is Proportional to % Reduction in Energy

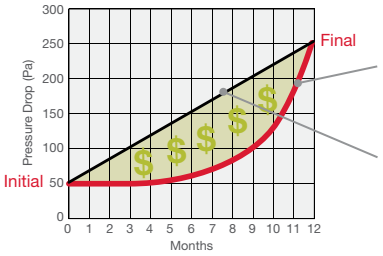
While on this topic it's important to remember that the configuration of the filter has a significant influence on how the filter loads over time. Some filters that start off with a low initial resistance might not maintain this advantage due to inferior construction of the filter and will see an accelerated loading curve and ultimately a much higher total cost of ownership (TCO) over the filters working life. Equally important when benchmarking pressure development over the filters life we ensure we are comparing apples to apples with efficiency.



Although Brand X had a lower initial resistance, the AAF 'equivalent' filter demonstrated a longer life and lower energy cost due to the superior configuration of the media and frame, even at the same efficiency.

How is average pressure drop calculated?

There is the simple straight line average calculation which means Δ Initial + Δ Final / 2 = Average. This is not how a well-constructed filter loads. The loading has a parabolic trajectory (as shown in the next column) which means the true average is much lower than the simple straight line calculation and more reflective of real life. These calculations are important when it comes to calculating energy through TCOD (Total Cost of Ownership Diagnostics) simulation software in order to optimize design and the economy of an installation.



A well-constructed filter will have a parabolic loading curve (shown in red) where the actual true average pressure drop is approximately 25% lower than the straight line calculation (shown in black).

This 25% reduction in average resistance results in approximately the same reduction in energy consumption.

HEPA filter construction pressure drop has less influence from the pleating or configuration and more from the media selection itself. For cleanroom ceiling applications the options are limited from a construction or pleat pack type standpoint.

The 'mini-pleat' design is utilized by most of the major manufacturers. There are different separator types. Hot melt separators are probably the most common globally, string, ribbon, aluminum, embossed are others. Glass fiber is by far the most common media in use today and has been around for 75+ years, well established and reliable although the media itself is susceptible to damage due to the nature of the wet laid glass construction. A pin hole can cause failure, as well as damage from transport is common in the form of media shear, which is when the pack splits vertically across the pleats.

- The media that has grabbed the most attention over the last decade or so has been the membrane technology **PolyTetraFluoroEthylene (PTFE)**

PTFE has some really interesting characteristics especially with durability, almost impossible to damage and has a very low resistance due to its unique structure. The resistance of glass media is 30-50% higher than PTFE for the same pack depth and construction type. This can have significant benefits in energy consumption for major cleanroom operators especially in the microelectronics world where the media has been widely deployed in the form of FFU's (Fan Filter Units).

Very Fragile During:

- Filter Installation
- Filter Validation
- Cleaning of Ceiling
- Cleanroom Modifications
- Working Activities in the Cleanroom

Risks of Filter Damage, Resulting In:

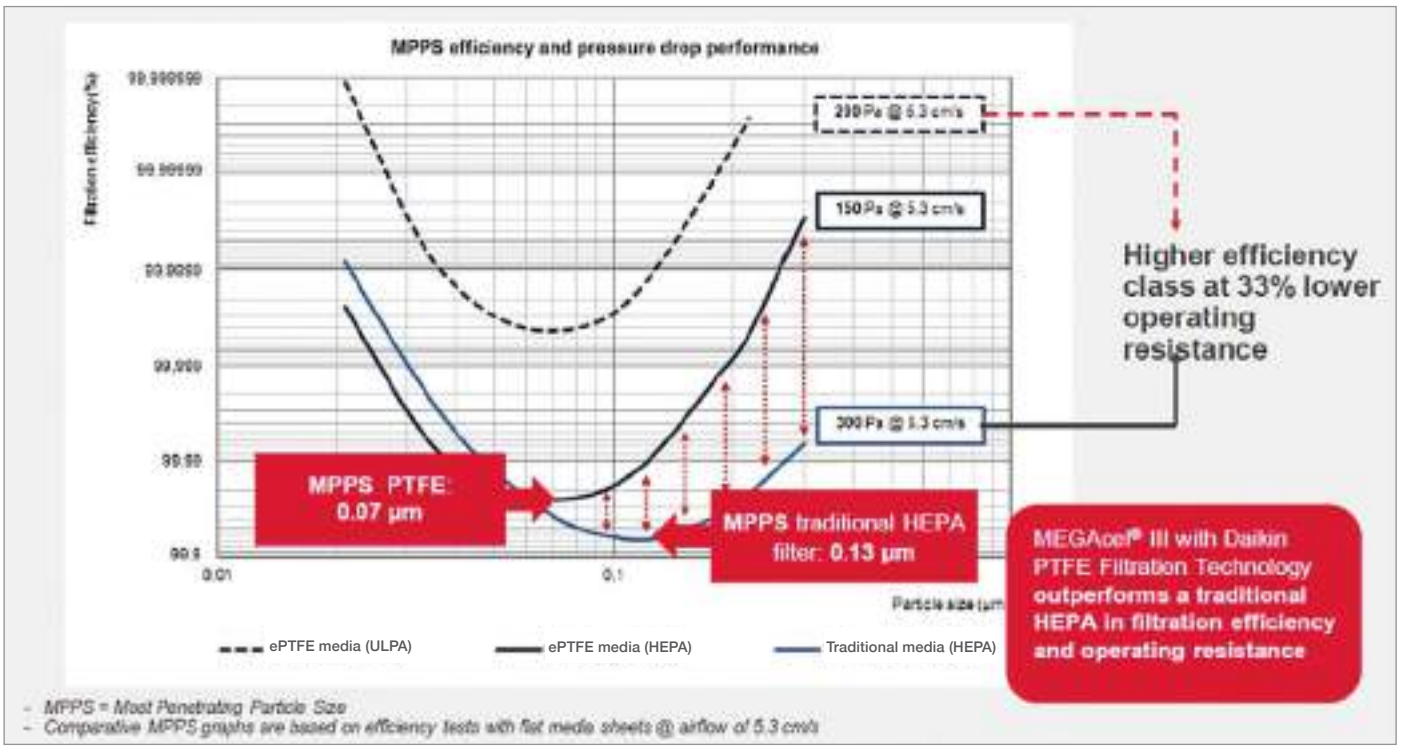
- Cleanroom Downtime
- Unscheduled Replacements
- Costly Recovery Actions
- Cross Contamination
- Uncontrolled Release of Harmful Substances

High Purity

System Integrity and System Economy

MEGAcel® ePTFE Membrane Media

High Filtration Efficiency Combined with Low Operating Resistance:



So, the media pressure drop is important, construction pressure drop has less influence on the combined factors of configuration and media in a HEPA filter. It has an approximate 30/70 split (the opposite is true with PTFE due to the low PD) in favor of the media. Adoption of the membrane technology will continue to accelerate as availability and cost has comes closer to glass. The well-known durability benefits of PTFE and/or FRM (PAO testable media) along with the reduced energy costs will ensure more wide spread adoption in the future.

Many engineers focus on specifying the lowest pressure drop HEPA or ULPA filter in order to minimize energy consumption and the total static in the system. Most engineers will calculate with the tried and tested 'double the initial' pressure drop as a rule of thumb for the dirty condition. In reality, assuming good pre-filtration and 'normal' cleanroom operating conditions these filters rarely meet the projected 'double the initial' as the change out point.

In Microelectronic applications the vast majority of the air is recirculated. Installations with 20+ years of service will see only a nominal increase in pressure drop. It is not unusual to see a 20% to 50% increase over this 20 year period in this environment. Life Science applications can be more challenging and varied from a load standpoint depending on the product being produced (tablets, powders, liquids) and environment (cleaning, decontamination, test aerosols etc) but again these filters are rarely changed because they have reached their final resistance, it's mainly because of an internal protocol or SOP.

The 'dirty' additional static is in fact often absorbed by miscalculated, forgotten or simply unknown resistance within the housing itself.

High Purity

System Integrity and System Economy

Where does this static come from?

The common denominator is the damper.

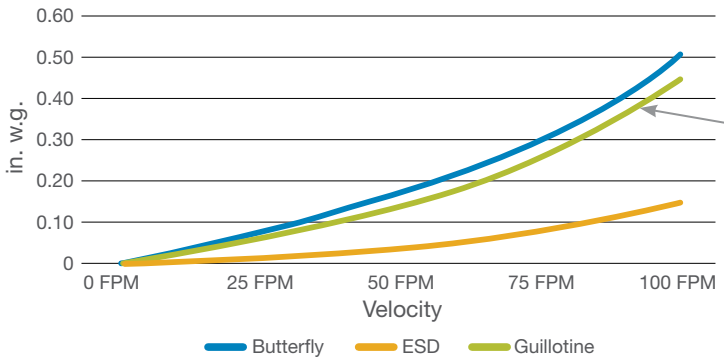
Supply housings in Life Science applications in particular are commonly installed with a balancing or sometimes full volume control damper in the form of a Guillotine or Butterfly design. There are dampers known as ESD or ATEC's style designs now utilized that have significantly lower pressure drops (normally 50% less) than the aforementioned dampers. FFU's by the way have low static through the housing itself (excluding coils or additional features for specialized applications). Typical static is about 25PA..

You can see in the table and graph the actual inlet velocity necessary through the collar to deliver the desired CFM and the resulting resistance generated through the common dampers utilized today.

	Filter Velocity (FPM)		Inlet Velocities (FPM)			
System Desired CFM	2x2	2x4	8"	10"	12"	14"
0	0	0	0	0	0	0
100	43	18	300	205	159	57
200	87	37	520	330	274	151
300	130	55	800	520	380	246
400	174	73	1100	700	500	360
500	217	92	1300	850	610	420
600	261	110	1600	1025	745	530
700	304	128	1900	1200	850	645
800	348	147	2100	1400	950	710
900	391	165	2400	1550	1100	800
1000	435	183	2700	1725	1200	875
1100	478	202	2900	1800	1300	975
1200	522	220	3200	2100	1400	1150

Nominal air volume or inlet velocity on a '4x2' housing. Measurements are when the dampers are 100%

Filter face velocity is often more than expected due to the reduced filter size of the nominal '4x2' housing



Actual resistance on a guillotine or split butterfly damper is above the typical HEPA filter pressure drop efficiency required (H14) in these applications

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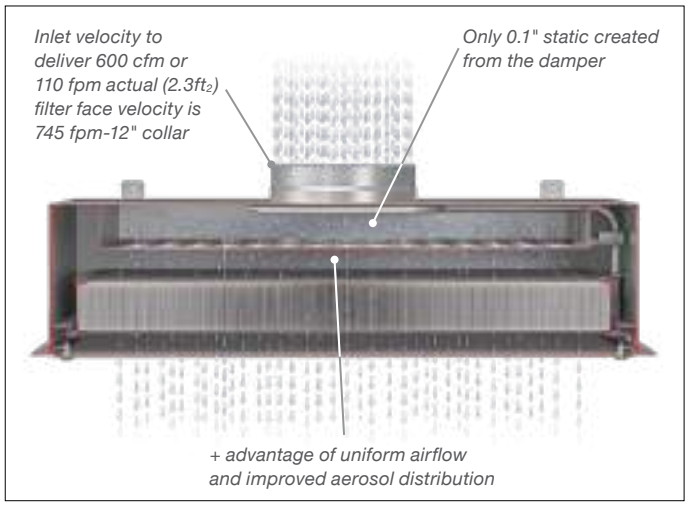
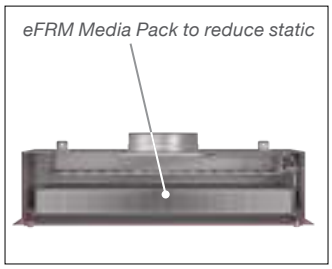
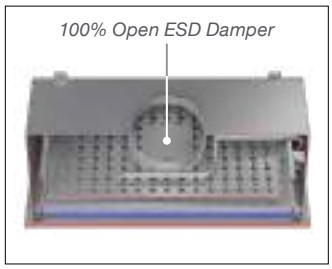
System Integrity and System Economy

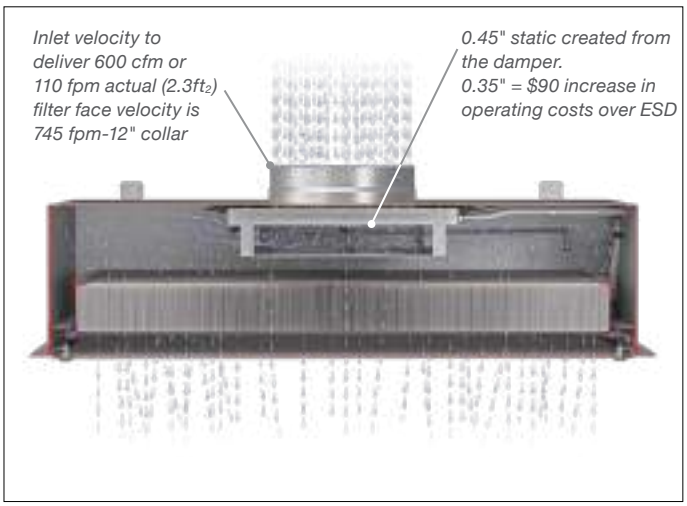
AstroHood® ESD Damper Static:

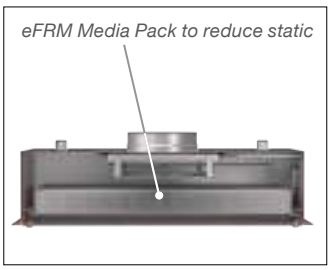


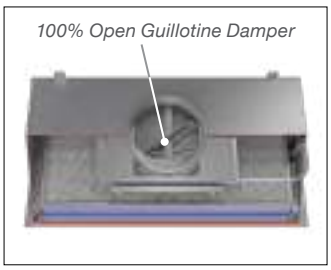




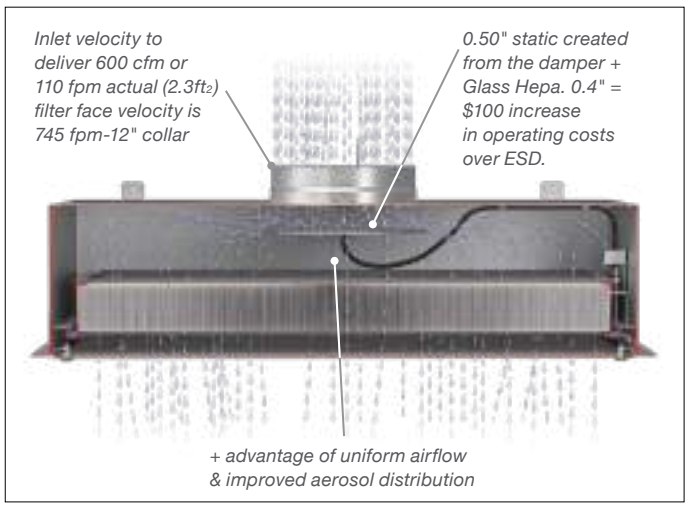
AstroHood® II Guillotine Damper Static:

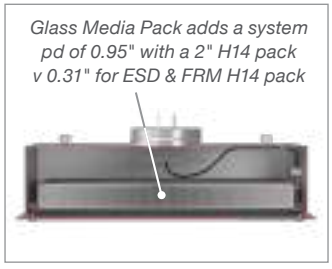


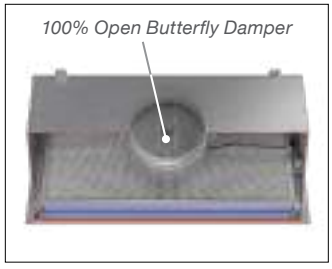




AstroHood® Butterfly Damper Static:







BIBO or safe change housings are the biggest culprits with some linear style bubble tight dampers exceeding 250PA in static in the fully open position. These dampers are sometimes specified on the inlet of a supply housing used to minimize migration of decontamination agents or contamination back into the HVAC system and when specified for their original design are necessary. There have been misapplication of these dampers and unnecessary static of 0.5"+ (125PA) is absorbed for what could be an avoided operating expense.

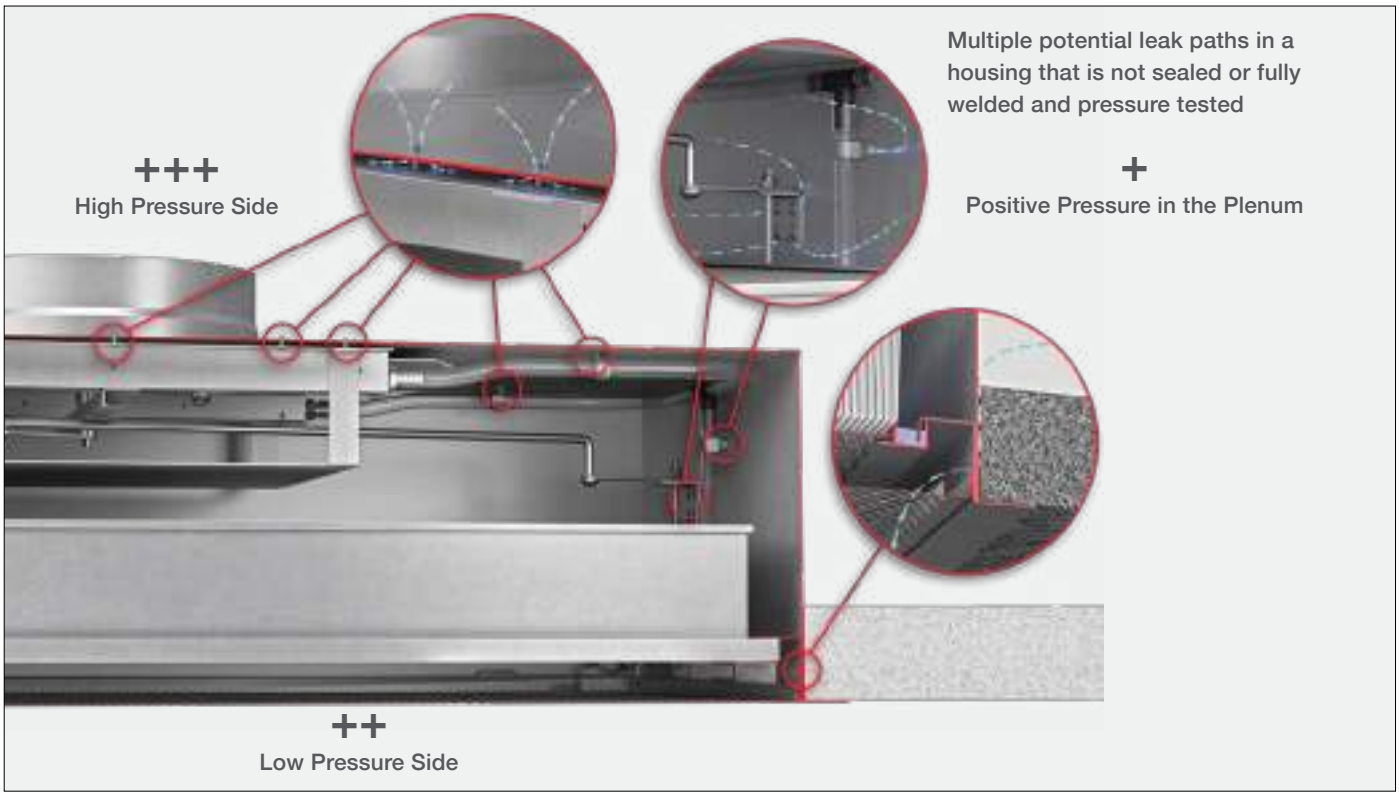
In addition to the housing or damper resistance there is an additional resistance again often not taken into account from the supply diffuser. In the US a Perforated diffuser with a nominal pressure drop is the most common solution. In Europe and Asia however a Swirl or 4-Way diffuser is the diffuser of choice. Static pressure of 50PA+ is common especially at the elevated velocities of 1m/s+ (200FPM) in these regions.

High Purity

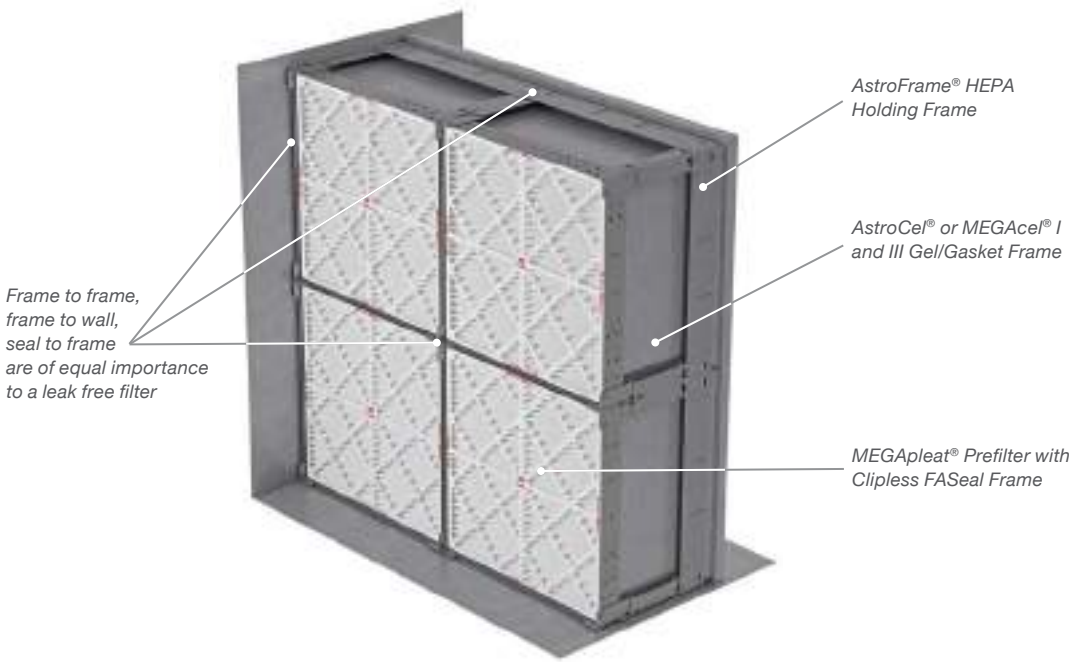
System Integrity and System Economy

It is clear there are opportunities to first understand and then optimize the system static by utilizing energy efficient dampers (ESD) and HEPA filters (PTFE or FRM) but the system economy will always come second to the system integrity. We mentioned at the beginning of this section that the filter is only as good as the housing or frame it is housed and installed in.

Supply Housing Leak Paths



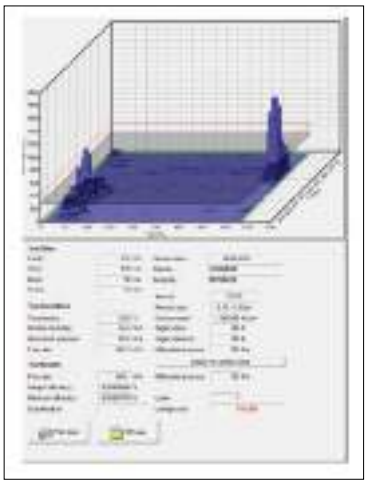
AHU Leak Paths



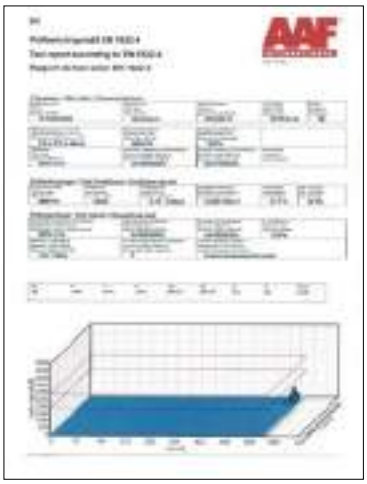
High Purity

System Integrity and System Economy

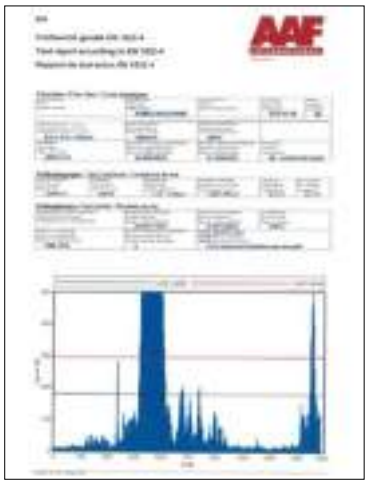
As a user or specifier of filters and housings it is common knowledge to expect a test certificate for the HEPA filter as shown below.



Typical Scan Test Protocol



PASS

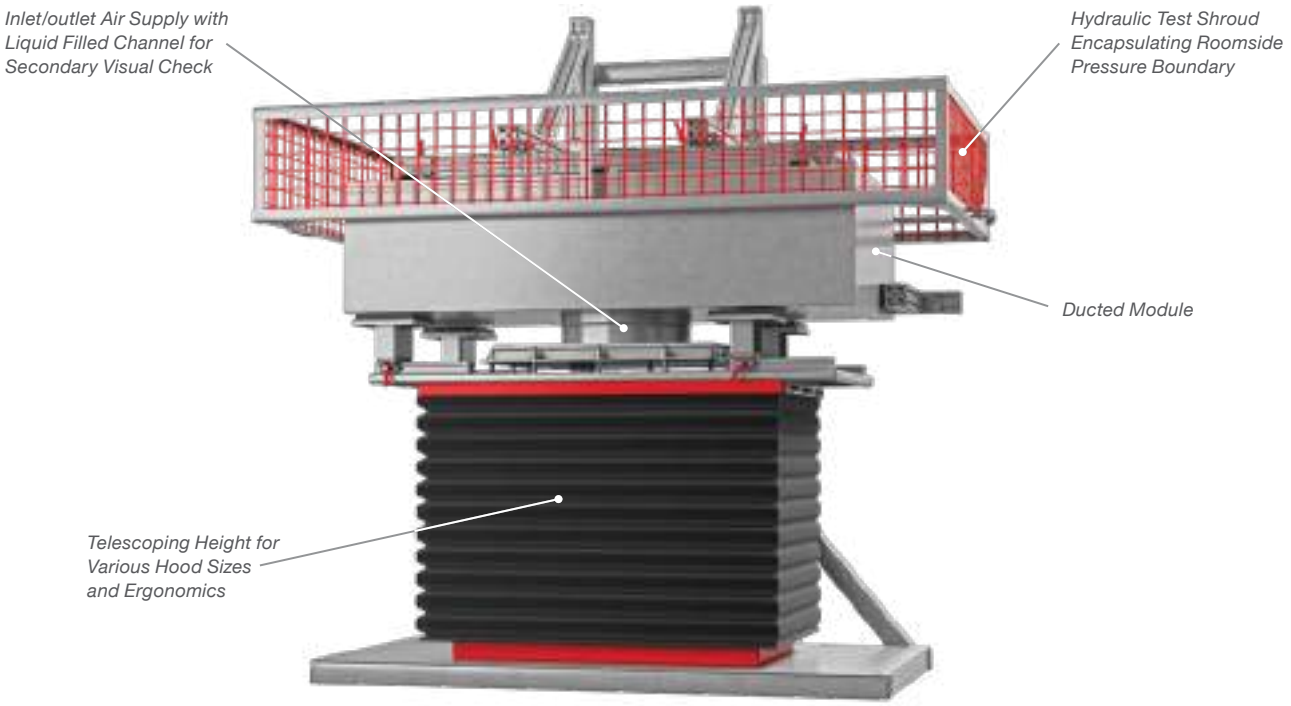


FAIL

We should treat the housing as we should treat the filter by performing a leak test (essentially a pressure decay test) to ensure there are no leaks in the body of the housing and all penetrations through the pressure boundary. Some manufacturers use caulk which will increase the risk of failure over time if applied in the critical leak paths identified in the schematic on the previous page.

Even though all these penetrations are on the dirty side or above the filter, these penetrations if not properly sealed are all potential leak paths into the plenum and then through the housing to trim penetration of trim to ceiling penetration.

Pressure Decay Housing Test Rig



High Purity

EN-ISO 14644-1 2015: Classification by Particles

		Maximum Concentration Limits (Particles/m³)					
		0.1 µm	0.2 µm	0.3 µm	0.5 µm	1.0 µm	5.0 µm
ISO 14644-1 Classification Number (N)	1	10					
	2	100	24	10			
	3	1,000	237	102	35		
	4	10,000	2,370	1,020	350	83	
	5	100,000	23,700	10,200	3,500	830	
	6	1,000,000	237,00	100,200	35,200	8,320	298
	7				352,000	83,200	2,930
	8				3,520,000	832,000	29,300
	9				35,200,000	8,320,000	293,000

Major change from 1999 is the elimination of the max concentration limit of 29 particles at 0.5 µm in the ISO 5 space.
This **does not replace EU GMP requirements. 0.5 and 5.0 µm need to be assessed for monitoring.*

Comparison of Regulatory Requirements

			EU; PIC/S; WHO; ANVISA; TGA; HCA; S-FDA								
			In Operation (particles/m³)	Microbiological Active Air Action Levels (cfu/m³)			In Operation (particles/m³)		At Rest (particles/m³)		Microbiological Active Air Action Levels (cfu/m³)
FDA	ISO	USP	1	Limits	EU, WHO, PIC/S	Grade	0.5µm	5.0µm	0.5µm	5.0µm	Limits
	5	100	3,520	1		A	3,520	20	3,520	20	<1
	6	1,000	35,200	7							
	7	10,000	352,000	10		B	352,000	2,900	3,520	29	10
	8	100,000	3,520,000	100		C	3,520,000	29,000	352,000	2,900	100
						D			3,520,000	29,000	
	9	1,000,000	35,200,000	100							

- All values are averages
- Samples from Grade A areas should normally show no viable organisms
- Recovery from the "In-Operation" to the "At-Rest" state should be verified to occur within 15-20 minutes. The recovery test as defined in ISO 14644-3
- (20) 5.0µ particles is equivalent to ISO 4.8, not ISO 5

Measurement of MCP's. *An active air sampler draws a fixed flow of air over agar plates.*
These plates are incubated over 5-7 days, any viable organisms grow and are counted. Limits are given in FDA and EU regulatory docs.

FDA Sterile Guide 2004

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Relevant/Useful Documents Specific to the Life Science Industry

Publisher	International Guideline Documents for the Life Science Industry	
	Description	**Reference Document**
EN 1822	European Norm for Classification & Testing of HEPA/ULPA Filters	EN-1822 Parts 1-5
EN 779	European Norm for Air Filters for General Ventilation	CSN EN-779 2012
PICS	Pharmaceutical Inspection Convention & Co-operation Scheme	Improve co-operation with GMP between regulatory authorities and the Pharmaceutical industry
ANVISA	Brazilian Health Regulatory Agency	
FDA	Federal Drug Agency	Section 1V Bldgs & Facilities D (Air Filtration)
CFDA (SFDA)	China Federal Drug Agency	
TGA	Therapeutic Goods Administration	
HGA	Hospital Corporation of America	
NOM	Norma Official Mexicana	SSA1 164, SSA1 059, SSA1 241
ISPE	International Society of Pharmaceutical Engineers	HVAC & Industry Guidelines
WHO	WHO Expert Committee for Pharmaceutical Preparations	TRS-961
ASHP	Pharmaceutical Compounding Sterile Preparations	USP 797
US DOH	USA Department of Health	CGMP
Eurovent	In Situ HVAC Testing	4 10
ISO	International Standards Organization	14644-16890-29463-29462-12249
IEST	Institute of Environmental Sciences	IEST-RP-CC001-007,021,034
ASHRAE	American Society Heating, Refrigeration, A/C Engineers	Standard 52.2, Guideline 26 In-Situ Testing, Standard 180 HVAC Equipment Maintenance, Standard 170 Hospitals

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Air Change Rates

Hypothesis

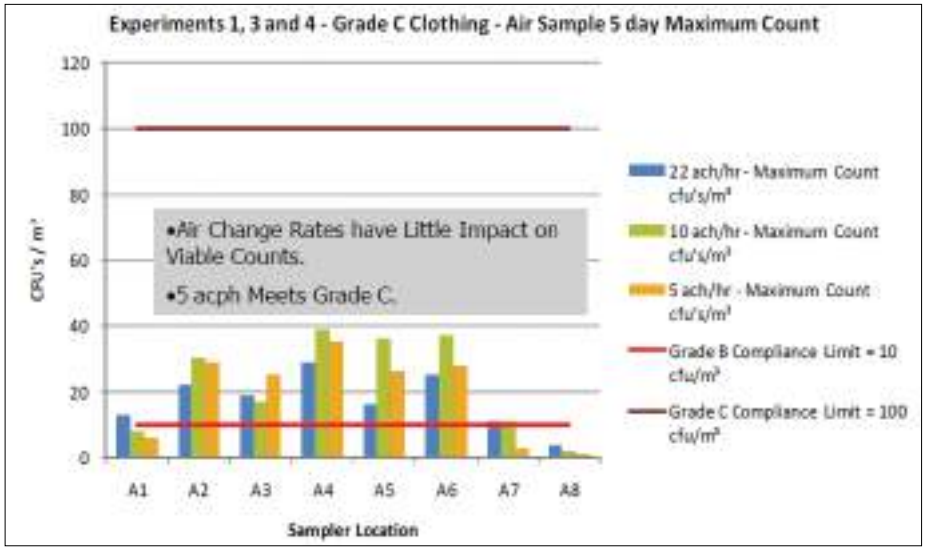
Factoring in guidelines from regulatory bodies such as the FDA, Pharmacopea, and GMP Annex 1, a risk based approach to airflow reduction can be taken in which key components are validated to ensure product quality and compliance are retained.
Air change rates are not cast in stone!

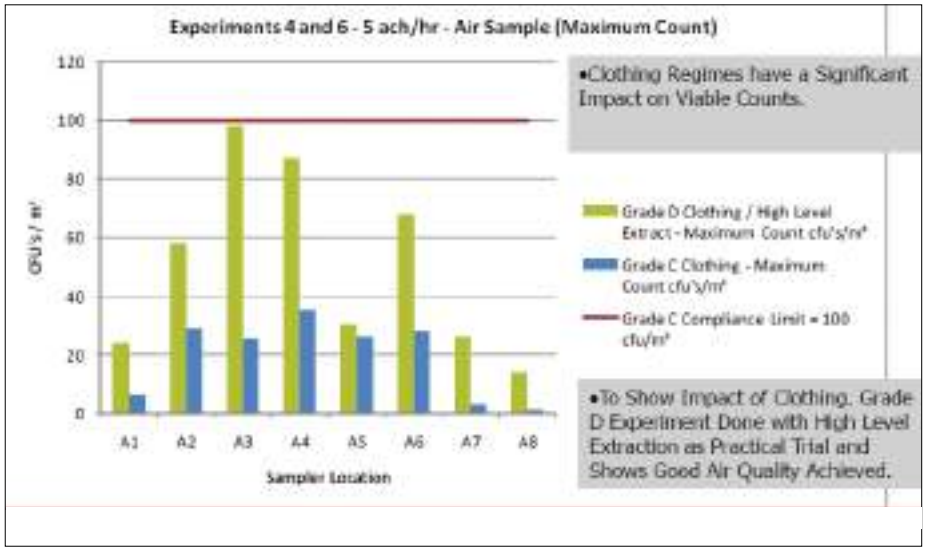
ISPE Case Study

A study commissioned by the International Society of Pharmaceutical Engineers (ISPE) tested this hypothesis. In particular, the study compared and contrasted the impact of airflow reductions with other variables, such as clothing standards.

Experience from Industry Subject Matter Experts

- Regulatory guidance often misinterpreted by regulatory bodies and facility managers.
- Cleanliness levels in Life Science facilities generally exceed internal or regulatory requirements.
- Cleanliness is dependent on multiple factors, with ventilation having only a secondary effect.
- Airflows and resulting air change rates are generally higher than required.
- Number of supply housings and HEPA filters are often excessive as a result.
- Powering of fans is expensive, but related energy costs can be significantly reduced.
- Risks to product and compliance due to airflow reduction can be mitigated with proper management, quality assurance protocols, and control measures.
- Effective ventilation is key to contamination dilution, so ventilation effectiveness must be part of any airflow reduction project.
- Other considerations in airflow reduction efforts include the type of environment and risk of air turbulence.
- Traditional and cultural barriers to airflow reduction exist in the industry.





Conclusions:

- Air changes have an impact on particle levels, but compliance can be achieved at levels significantly below the currently established norms.
- Clothing standards impact room cleanliness significantly more than do air change rates.
- Grade A compliance can be achieved at air velocities down to 0.15m/s.
- Trends in particle levels showed that notable quality concerns emerge at velocities below 0.25m/s.

Source: Stanway/Third ISPE Dallas 2011

Implications:

- The over-engineering of Life Science facilities wastes energy and money.
- Compliance and product quality depends on many factors beyond ventilation – chiefly people, gowning, and cleaning.
- Substantial cost and CO_2 reductions can be achieved by optimizing ventilation in cleanroom design.
- Engage all stakeholders from the A&E firm to facility managers and quality assurance from the start of a project.
- Use vendors who have the requisite experience and understanding to optimize the design with minimal risk.

For information on AAF Flanders' cleanroom design and configuration software VisionAir™ Clean, see page 69.

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Understanding Fire Classifications for HEPA Filtration

There are three primary agencies that affect the Air Filtration Industry as it applies to fire events in the US and often applied around the world; United Laboratories (UL), the National Fire Protection Association (NFPA), and Factory Mutual (FM). Each agency provides guidance and states requirements for Air Filtration in the interest of public safety. UL specifies the requirements and provides testing and listing services of discrete commercial products - air filters as it relates to this document. NFPA specifies the requirements regarding fire prevention and retardation for air moving systems of commercial and residential building construction. FM, as an insurance underwriter, specifies and performs testing to meet their underwriting requirements.

Underwriters Laboratories (UL):

Underwriters Laboratories (UL) is the world's largest product safety testing and certification organization. Founded in 1894 in the United States, it permits the use of its listing mark (the UL mark) as its stamp of approval on goods and materials after standardized and stringent testing. Thereafter its inspectors regularly visit the producer to audit compliance with its certification requirements. UL has some 46 laboratories and 200 inspection centers in over 70 countries and applies its 750 standards to more than 18 thousand types of products manufactured by about 60 thousand firms. The UL mark, however, guarantees only the safety of the item in use, not its performance or quality.

UL 900 - Standard for Safety for Air Filters

In the United States filter industry, UL 900 is generally accepted as a fundamental requirement as it relates to air filters. The UL 900 classification assures design and construction engineers as well as end users these air filters will meet local requirements for most applications.

UL 900 specifies the allowable combustibility and smoke generated for air filters, both washable and throwaway, used for removal of dust and other airborne particulates from mechanically circulated air. This is in accordance with National Fire Protection Association, NFPA 90A - Installation of Air Conditioning and Ventilating Systems, of Other Than Residence Type, and NFPA 90B, Installation of Residence Type Warm Air Heating and Air Conditioning Systems.

The requirements of UL 900 apply only to air filters in a clean, like-new condition. It is important to note, once fielded and after a period of service, the combustibility and quantity of smoke generated will depend upon the nature and quantity of the material collected by the filter. When filters are susceptible to the accumulation of combustible deposits, maintenance and inspection practices should be followed as proposed in Appendix B of NFPA 90A.

A UL 900 Classified Filter is an air filter which, when clean, will burn moderately when attacked by flame, or emit moderate amounts of smoke, or both. The air filter unit shall not produce flame or extensive sparks, which are sustained beyond the discharge end of the test duct when subjected to the flame-exposure test and shall not cause the development of an area of more than 9 square inches (58 cm^2) as measured below the smoke-density time curve, all of which is specified within the standard. It is important to note, UL 900 does not provide requirements or guidance with respect to the toxicity of materials as a result of combustion.

Additionally, any adhesive material used for coating the filtering medium or other part of an air filter unit shall have a flash point of not less than 325°F (163°C) as determined by ASTM D92, Standard Test Method for Flash and Fire Points by Cleveland Open Cup.

UL 900 provides a uniform test protocol as well as a follow-up auditing program to ensure air filter units meet a specific level of quality as it relates to fire safety. Upon submission of a product for evaluation by UL, a unique product file number is given to which the technical aspects of the product are documented. The product is tested in accordance with UL 900 and must meet the stated requirements:

- No flame beyond the end of the test duct.
- Less than 25 sparks sustained beyond the end of the test duct.
- Less than 9 square inches of smoke measured below the smoke density time curve.

Once a product is listed, to be UL Marked, it must be incorporated into the Follow-Up Service (FUS) auditing program for routine inspections at each manufacturing location. Inspections compare current product production with the UL file, identifying variations in either construction process or materials of construction. Material designation, material vendor, and the amount of material utilized must match with the UL file. Material measurement instrumentation calibration certifications can also be inspected.

The UL 900 standard has seen numerous changes since inception. It is now in its eighth revision. The most notable change was the removal of references to Class 1 and Class 2 in 2010, dictating that all air filter units adhere to the Class 2 requirements by May 2012.

UL 586- Standard for Safety – High-Efficiency Particulate Air Filter Units

While technically not a fire rating, UL 586, Standard for Safety – High-Efficiency Particulate Air Filter Units, is an Underwriters' Laboratories standard that applies to HEPA filter construction and filtration performance, most notably when subjected to various environmental extremes.

The construction of the frame shall be made of metal or other inorganic material, or of wood treated to reduce combustibility by pressure impregnation or the equivalent. The filter medium shall be glass fiber or other equivalent inorganic material and may include an organic binder material; it shall not contain un-bonded asbestos fiber materials. The gasket, when provided, shall be securely attached to the frame and shall provide a continuous seal about the face.

Aerosol Penetration tests are performed after the filter unit is subjected each of a Heated Air Test, Moist Air Test, and Low Temperature Test. Additionally, a Spot Flame Test is performed to ensure the filter will self-extinguish.

The Heated Air Test subjects the HEPA filter unit to heated air at 700°F (371°C) for 5 minutes at a test flow rate no less than 40% of rated flow. The Moist Air Test subjects the HEPA filter unit to static atmosphere at a relative humidity of 90 +/- 5% at 77°F (25°C) for 24 hours. The Low Temperature Test subjects the HEPA filter unit first to a static atmosphere at a relative humidity of 50 +/- 5% at 77°F (25°C) for 24 hours, then transferred to a static atmosphere of 27 +/-4°F (minus 3 +/- 2°C) for an additional 24 hours, then the sample is allowed to warm up to room temperature 77°F (25°C) prior to aerosol penetration testing.

HIgh Purity

Understanding Fire Classifications for HEPA Filtration

The Spot Flame Test utilizes a Bunsen burner applied to the corner of the filter, where the media and adhesive meet, and, once removed, the filter is required to self-extinguish within two seconds.

The U.S. Department of Defense and U.S. Department of Energy have adopted UL 586 as a requirement for ASME AG-1, Code on Nuclear Gas and Air Treatment, qualified HEPA filters.

Glass fiber is the traditional media of choice for these type applications. Both ePTFE and eFRM, will adhere to all but the 700°F Heated Air Requirement of UL 586. Applications such as Biological, Radiological, and Nuclear Containment may specify UL 586; however, the features and benefits of membrane technology vs. traditional glass filter media products should be considered where appropriate.

A listing of product Certifications, for all manufacturers is available on the UL website at http://www.ul.com.

National Fire Protection Association (NFPA):

NFPA is a United States trade association, with some international membership, that creates and maintains private, copyrighted standards and codes for usage and adoption by local governments. The NFPA 90A standard dates from 1899, when committee attention was first given to blower and exhaust systems. Since 1955, the two parts of NFPA 90 have been published separately as NFPA 90A, Standard for the Installation of Air-Conditioning and Ventilating Systems, and NFPA 90B, Standard for the Installation of Warm Air Heating and Air Conditioning Systems. The former of which is addressed in this document.

NFPA 90A specifically addresses HVAC Systems, how these systems are integrated with Building Construction, the Controls associated with these systems, and the Acceptance Testing necessary to adhere to this standard. Filters are considered an HVAC system component and are defined as "A device used to reduce or remove airborne solids from heating, ventilating, and air-conditioning systems". With respect to Air Filters, whether pleated, box, terminal, or any other classification, NFPA 90A Section 4.2.2.2 states they shall comply with UL 900, Standard for Safety Air Filter Units.

NFPA 90A also offers general Air Filter Maintenance guidance. Annex B specifies air filters should be kept free of excess dust and combustible material, unit filters should be renewed or cleaned when the resistance to airflow has increased to two times the original resistance or when the resistance has reached a value of recommended replacement by the manufacturer, and that a suitable gauge should be provided for that purpose. Furthermore, when filters are replaced, care should be taken to use the proper type and size and to avoid gaps between filter sections, mounting frames, or hardware. And that damaged filter sections or media should not be used and throw away filters should never be cleaned and reused.

In the United States, all AAF Flanders ePTFE, eFRM, and Glass HEPA/ULPA air filtration products are UL 900 classified. UL 900 is necessary to comply with National Fire Prevention Association (NFPA) standard 90A and 90B, both of which specify UL 900 with respect to air filters. NFPA 90 is the basis for nearly all building fire codes in the USA.

In summary, when asked whether an air filter is NFPA 90 compliant, you can rest assured in knowing that if the filters utilized are UL 900 compliant they will, by definition, comply with NFPA 90 requirements.

Factory Mutual (FM):

Factory Mutual (FM) Approvals is the independent testing arm of international insurance carrier, FM Global. FM Approvals use scientific research and testing to make sure products conform to the highest standards for safety and property loss prevention. Products that pass the requirements set by FM Approvals can use the "FM APPROVED" mark and are preapproved for FM Global underwriting.

FM Approvals Standard 4920 states the requirements for filter assemblies used in cleanroom facilities; final stage wall and ceiling filters and prefiltration filters. The requirements may include performance and marking, examination of manufacturing facilities, audit of quality assurance procedures, and a follow-up program.

In 2014, FM radically changed FM Approvals Standard 4920. Historically, filters were mounted horizontally in a ceiling grid and a pan containing 90% isopropyl alcohol (IPA) was placed a few feet below the filters and ignited. If the filters or grid were not considered a fuel source, and never were under these conditions, the filter passed and was listed in the FM Approvals Guide.

The 2014 revision states testing of the cleanroom filter assembly shall be in accordance with FM Approvals Clean Room Materials Flammability Test Method for the Parallel Panel Test, Class 4910, FM Approvals, LLC. In this test, two vertical parallel panels (i.e. filter assemblies) are separated by 1ft. (0.31m) and an ignition source consisting of a 2ft. (0.61m) long, 1ft. (0.31m) wide, and 1ft. (0.31m) high 57 BTU/s (60kW) propane sand burner is located at the bottom of and between the filter panels. The ignition source is applied for 12 minutes and the Conditions of Acceptance for this Fire Exposure Test are:

1. The visual flame height shall not exceed 6 feet (1.83 m)
2. The heat release rate, measured 2 minutes after the burner is shut off is to be at or below 25% of the maximum heat release rate observed up to 10 seconds before the burner is shut down.
3. The cumulative smoke generation shall be less than or equal to 0.13 lb (60 g).
4. The smoke generation rate shall be less than or equal to 0.0005 lb/s (0.23g/s).
5. The smoke generation rate at 12 minutes shall be less or equal to 0.0002 lb/s (0.07 g/s).

It is AAF Flanders' position that the FM Standard 4920 test methodology adds little value unless the filters are wall mounted. Since the vast majority of cleanroom applications utilize ceiling mounted HEPA filters, this testing methodology does not adequately represent real world conditions. However, since Factory Mutual is both an insurance underwriter and testing organization, they often require their test specification for any facility they underwrite.

Standard Glass fiber media HEPA filters can pass the FM test. No commercially available membrane filter, ePTFE or eFRM, from ANY manufacturer can meet the current FM Standard 4920 test methodology.

Source, UL, FM, NFPA

Gas-Phase

FILTER SELECTION, STANDARDS & TESTING

Gas-Phase

History of Gas-Phase Filtration

History

The first documented use of activated carbon (commonly known as charcoal) can be traced back to around 3750 B.C., when it was first used by the Egyptians for smelting ores to create bronze. By 1500 B.C., the Egyptians had expanded its use to healing intestinal ailments, absorbing unpleasant odors, and for writing on papyrus. By 400 B.C., the Ancient Hindus and Phoenicians recognized the antiseptic properties of activated charcoal and began using it to purify their water.

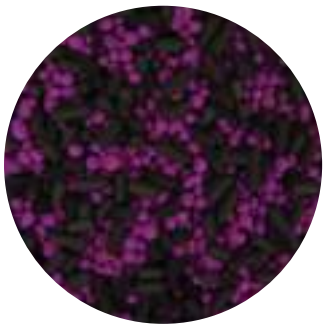
Between 400 B.C. and the 1800s, activated charcoal was used to remove odors from wounds, preserve water during ocean voyages, and by the military to treat battle wounds by removing toxins.

The earliest use of activated carbon for gas-phase contaminant removal dates back to 1854, when a Scottish chemist invented the first mask that utilized activated carbon to remove noxious gases. Wood was originally used as the base material for gas masks, since it was good at capturing poisonous gases when converted to activated carbon. By 1918, it was determined that shells and nuts converted to activated carbon performed even better than wood.

Around this same time, activated carbon began to be produced on a large scale, and its use spread to decolorization in the chemical and food industries. In the later 1900s, other industries such as corn and sugar refining, gas adsorption, alcoholic beverage production, and wastewater treatment plants began to use activated carbon.

Today, activated carbon is available in many different shapes and sizes, and its applications are growing every day. For air filtration, the most common types of activated carbon are granular activated carbon (GAC), pelletized activated carbon (PAC), and structured activated carbon. In addition, other substrates such as alumina and zeolite are used in lieu of activated carbon due to their tremendous pore structures. The most common applications of these different media types include corrosion control, odor control, and protection from toxic gases.

AAF Flanders' SAAFCarb™ Chemical Media



AAF Flanders' SAAFBlend™ GP Chemical Media

Gas-Phase

Gaseous Contaminant Guidance

What are Gaseous Contaminants?

Gaseous contaminants are undesirable airborne molecules mixed with the normal molecular oxygen and nitrogen in the atmosphere. Because of their molecular size, in the sub-nano range, they are not visible. Also not visible, but present in the air, is desirable molecular water, which is referred to as humidity. Some common offensive undesirable gaseous contaminants are hydrogen sulfide, the rotten egg smell, or skatole, the dirty diaper smell. Many gases that evolve from combustion are considered to be contaminants, such as carbon monoxide, oxides of nitrogen, oxides of sulfur, and polyaromatic hydrocarbons.

Size – Gaseous and Particulate Contaminants

The graphic in Figure 1 illustrates the relative size differences of airborne contaminants. Some particulate contaminants, such as viruses and bacteria, although not visible, have a mass size large enough to be filtered with specialized particulate filters. Gaseous contaminants can only be effectively removed using molecular gas-phase filtration technologies.

Types and Sources of Gaseous Contaminants

Gaseous contaminants are generally classified as Odorous, Corrosive, or Harmful/Toxic. Examples of their sources are shown in Figure 2.

Control of Gaseous Contaminants

The principle of specialized gas-phase filtrations systems, as seen in Figure 3, most often in combination with particulate filters, are used to remove molecular gaseous contaminants.

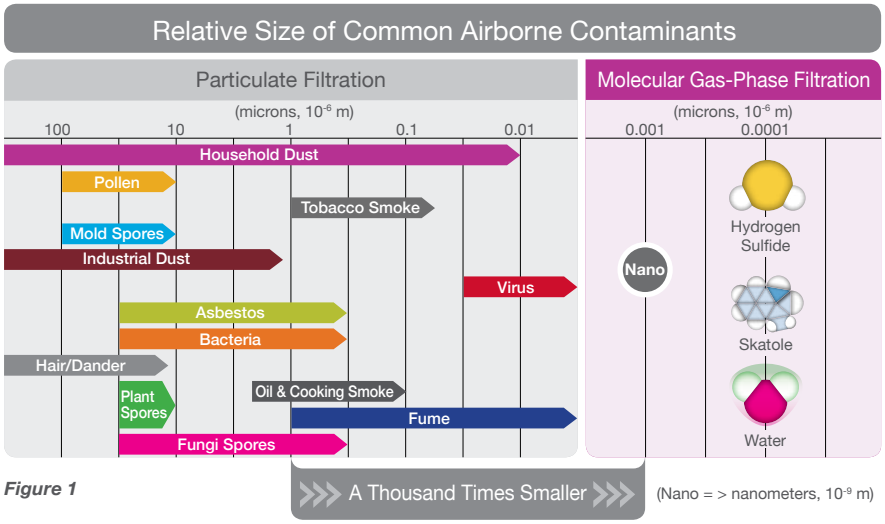


Figure 1

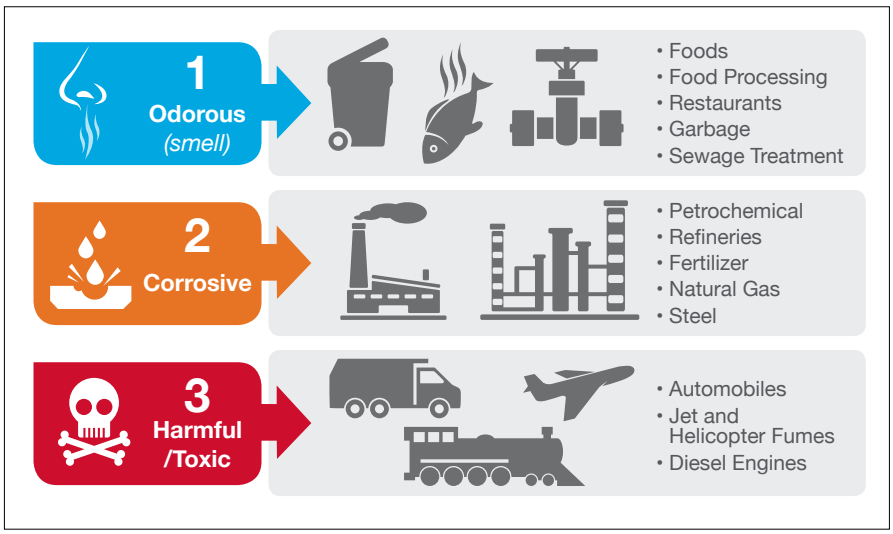


Figure 2

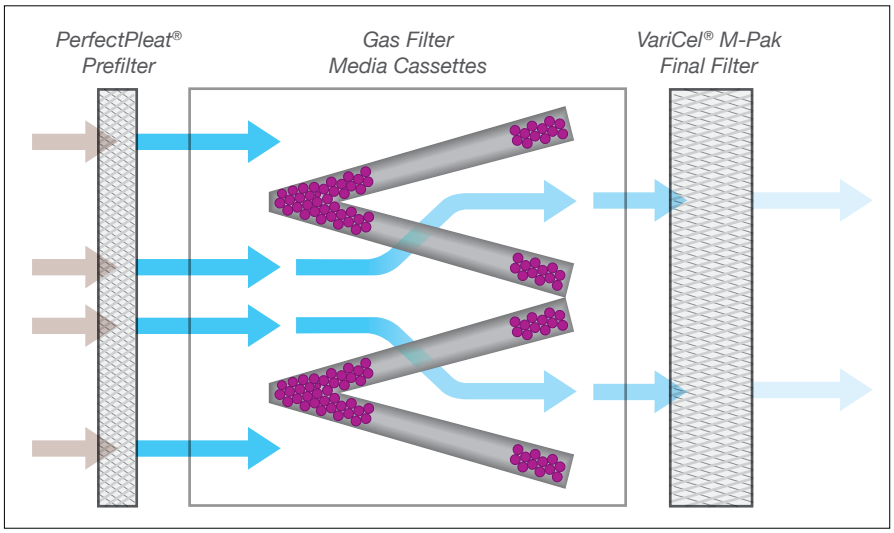
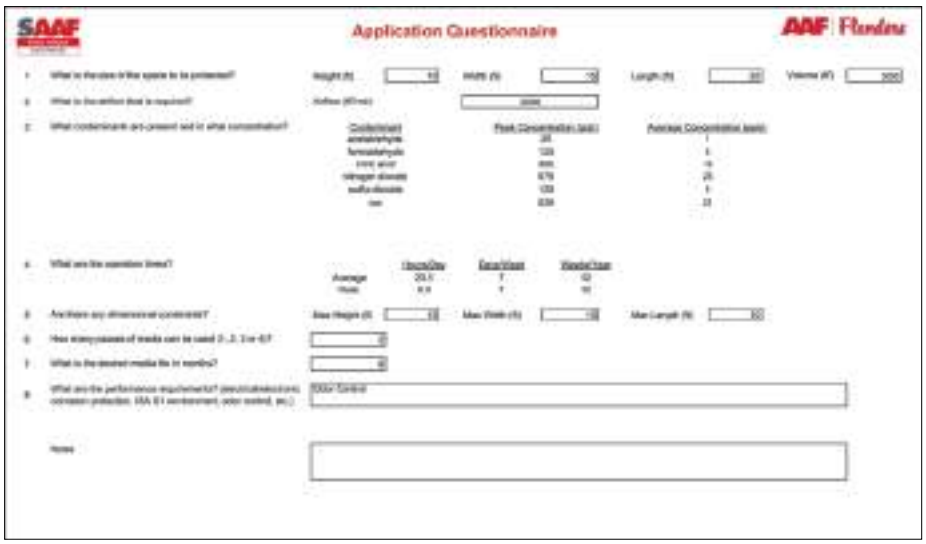


Figure 3

Gas-Phase

Selecting Gas-Phase Air Filters

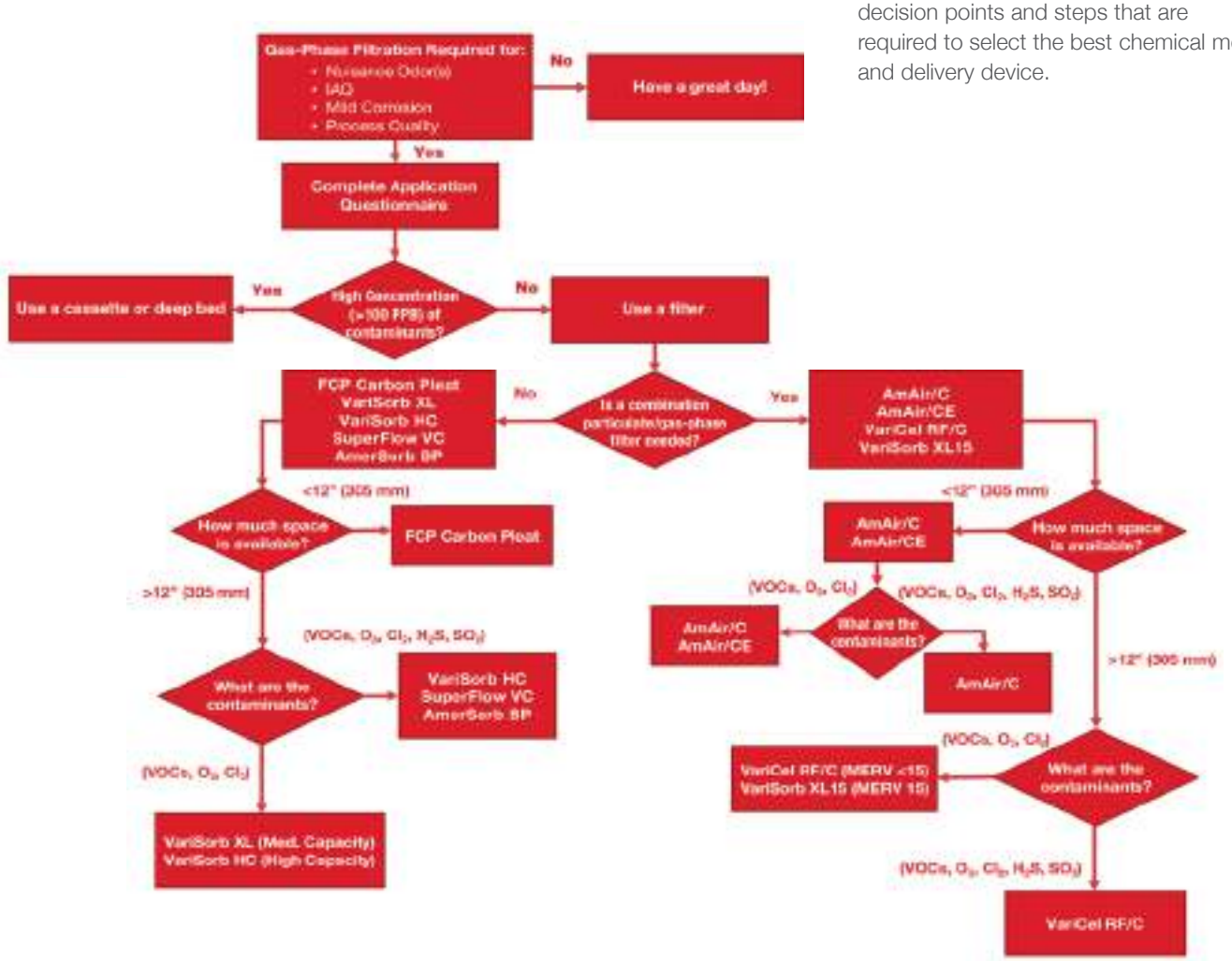
Choosing the correct chemical media type and the correct chemical media delivery product is a daunting task. There is a lot of information that must be gathered first, such as the contaminants of concern (COC), the concentrations of the COC, the air volume, the desired media life, and the space available as examples. A good starting point is to complete an application questionnaire like the one below to document as much of this information as possible.



This gathering of the data is the first step in determining the correct type of media. In most applications, there is one chemical media type that will work best. There are times, however, when more than one media type will work. In other cases, more than one media type is required as part of a comprehensive solution due to the list of contaminants that need to be removed.

To further complicate matters, there are multiple chemical media delivery devices available, and most of the time, more than one of those devices will work. The amount of space that is available, along with the number of media types required, are the two main factors that determine which delivery device will best serve the application at hand.

Due to this complexity, it is recommended that you reach out to your local AAF Flanders representative to assist you with making the proper selection. The sample flowchart below shows the various decision points and steps that are required to select the best chemical media and delivery device.



Gas-Phase

Gas-Phase Standards

Standards

As the methods and uses of gas-phase air-cleaning grew and diversified, the air filtration industry recognized the need to establish standards for measuring performance and efficiency within gas-phase applications. The table below provides at-a-glance information on some of these standards that are commonly used.

STANDARD	PURPOSE	CONDITIONS
ASHRAE Standard 145.1 Laboratory Test Method for Assessing the Performance of Gas-Phase Air Cleaning Systems: Loose Granular Media (ANSI Approved)	Compare gas-phase media options	Elevated gas challenge concentrations that exceed those in typical applications
ASHRAE Standard 145.2-2016 Laboratory Test Method for Assessing the Performance of Gas-Phase Air Cleaning Systems: Air Cleaning Devices	Compare gas-phase device options	Elevated gas challenge concentrations that exceed those in typical applications but mimic the mix of contaminants and/or gases in these applications
ASHRAE Guideline 27P Measurement Procedures for Gaseous Contaminants in Commercial Buildings	Plan and implement measurement and sampling of gaseous contaminants	Actual conditions in live commercial building applications
ASTM D6646 Standard Test Method for Determination of the Accelerated Hydrogen Sulfide Breakthrough Capacity of Granular and Pelletized Activated Carbon	Establish relative breakthrough performance of activated carbon in granular or pelletized form in terms of removal of hydrogen sulfide	Elevated challenge concentration and humidified gas stream that does not simulate actual conditions in typical applications
ISO 10121-1:2014 Test Method for Assessing the Performance of Gas-Phase Air Cleaning Media and Devices for General Ventilation – Part 1: Gas-Phase Air Cleaning Media	Compare gas-phase media options	Elevated gas challenge concentrations that exceed those in typical applications
IEST-RP-CC008 High-Efficiency Gas-Phase Adsorber Cells	Specify suggested design and testing of modular gas-phase adsorber cells in single-pass or recirculating air cleaning systems	Applications that require high-efficiency removal of gaseous contaminants

Please refer to the Gas-Phase Testing information in the next section for additional details.

Gas-Phase

Gas-Phase Testing

ASHRAE Standard 145.1

Laboratory Test Method for Assessing the Performance of Gas-Phase Air Cleaning Systems: Loose Granular Media (ANSI Approved)

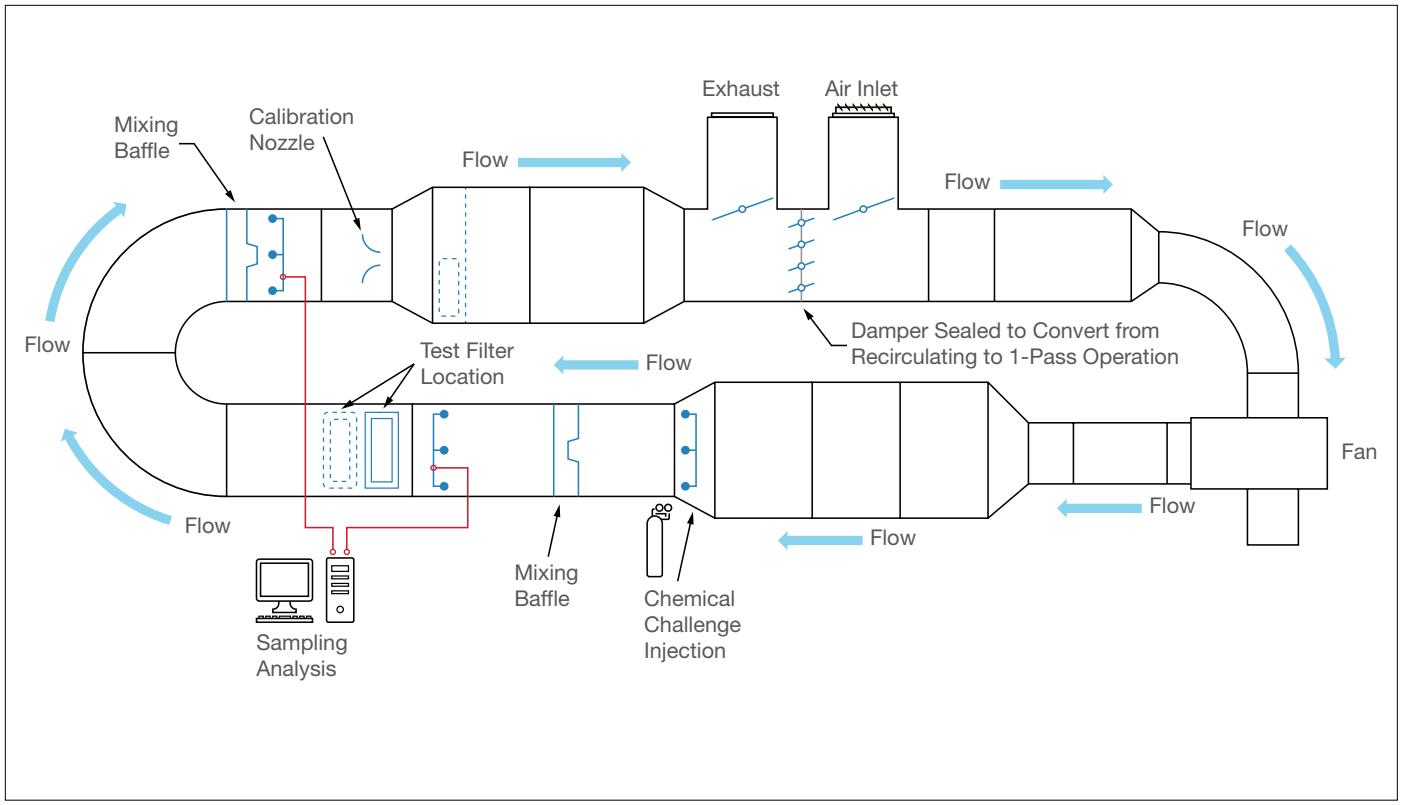
The purpose of this standard is to provide a standard laboratory test method for assessing the performance of loose granular media used in gas-phase air-cleaning systems. The standard details a small-scale laboratory test method for measuring the contaminant removal efficiency of loose granular sorptive media used in gas-phase air-cleaning equipment as installed in a test apparatus in an airstream challenged with test gases under steady-state conditions. The testing is conducted at elevated gas challenge concentrations relative to actual applications, and this testing should therefore be used to compare media rather than directly predict the performance in a particular application.

ASHRAE Standard 145.2-2016

Laboratory Test Method for Assessing the Performance of Gas-Phase Air Cleaning Systems: Air Cleaning Devices

The purpose of this standard is to provide a standard laboratory test method for assessing the performance of in-duct sorptive media gas-phase air-cleaning devices. The standard details a small-scale laboratory test method for measuring the contaminant removal efficiency of loose granular sorptive media used in gas-phase air-cleaning equipment as installed in a test apparatus in an airstream challenged with test gases under steady-state conditions. The testing is conducted at elevated gas challenge concentrations relative to actual applications, and therefore this testing should be used to quantify the performance of air cleaning devices for removing one or more specified gaseous contaminants or gas mixtures intended to simulate operation during service life.

Laboratory Test Method for Assessing the Performance of Gas-Phase Air-Cleaning Systems: Air Cleaning Devices

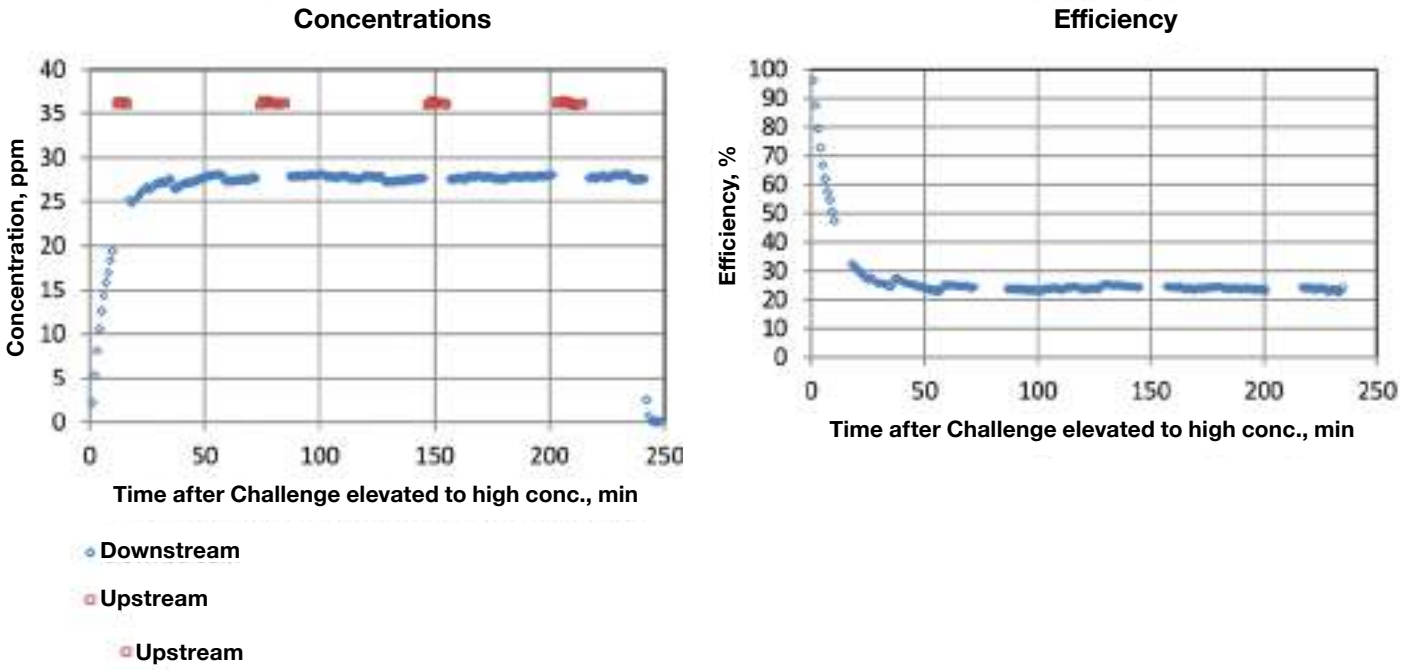


Source: ASHRAE

Gas-Phase

Gas-Phase Testing

Example of Test Report: Capacity Test Results



ASHRAE Guideline 27P

Measurement Procedures for Gaseous Contaminants in Commercial Buildings

The purpose of this guideline is to assist engineers and other professionals with planning and implementing the measurement and sampling of gaseous contaminants in commercial buildings.

ASTM D6646

Standard Test Method for Determination of the Accelerated Hydrogen Sulfide Breakthrough Capacity of Granular and Pelletized Activated Carbon

This test method is intended to evaluate the performance of virgin, newly impregnated or in-service, granular or pelletized activated carbon for the removal of hydrogen sulfide from an air stream, under laboratory test conditions. The method determines the relative breakthrough performance of activated carbon for removing hydrogen sulfide from a humidified gas stream. This test does not simulate actual conditions encountered in an odor control application, and it therefore is meant only to compare the hydrogen sulfide breakthrough capacities of different carbons under the conditions of the laboratory test.

ISO 10121-1:2014

Test Method for Assessing the Performance of Gas-Phase Air Cleaning Media and Devices for General Ventilation -- Part 1: Gas-Phase Air Cleaning Media

This standard provides an objective laboratory test method, a suggested apparatus, normative test sections, and normative tests for evaluation of three different solid gas-phase air cleaning media (GPACM) or GPACM configurations for use in gas-phase air cleaning devices intended for general filtration applications.

IEST-RP-CC008

High-Efficiency Gas-Phase Adsorber Cells

This Recommended Practice (RP) covers the design and testing of modular gas-phase adsorber cells in single-pass or recirculating air-cleaning systems where the need for high-efficiency removal of gaseous contaminants is a requirement.

Technology and Services

Clean Air Innovation & Research Center

NOTES

Opened in September 2016, the AAF Flanders Clean Air Innovation and Research Center (Clean AIR Center) represents a significant advancement in research and development efforts for the entire global air filtration industry. For nearly 100 years, AAF and Flanders have been innovating solutions that bring clean air to life, and the Clean AIR Center ensures that we will remain the industry leader for decades to come. This $5.4 million, 39,000-square foot facility offers unrivaled capabilities and technology, ensuring that every filter we produce is backed by advances in every component of the filter, and in every phase of its design and production. Ultimately, this means that we produce products fine-tuned to deliver the highest quality and lowest total cost of ownership for our customers.

Creating New Possibilities

The way that many organizations approach research and development is a top-down method, where a select few determine the products and product direction. This approach limits the bandwidth of products and ideas. AAF Flanders' Global R&D team exercises a bottom-up approach to product development. This approach encourages ideas to flow from customers throughout the product development process, while also spurring collaboration with multiple business units within Daikin to achieve the product goals of the global entity.

The key to continue AAF Flanders' forward progress in the industry is to not only retain our current products and development processes, but to also create disruptive technologies for the air filtration industry. The standard industry approach is to take a current product and upgrade it with additional features and benefits. The Clean AIR Center utilizes this approach, but also enhances the product offering by targeting disruptive products and technologies that will transform how customers view and integrate with air filtration.

Bringing Clean Air to Life™

AAF Flanders' Global R&D team creates open lines of communication to all regions and customers to support an active and fluid product pipeline, and to deliver key innovative products and processes throughout the world. With this seamless and synergistic communication, as well as continued product innovation, our team will maintain AAF Flanders' position as the number one global air filtration company. The Global R&D team will achieve success in every aspect of product formulation, encompassing design, performance, and customer-focused innovation.

Clean Air Innovation & Research Center – Lab Services

NOTES

The following are some of the lab services offered at the Clean AIR Center:

Filter Testing

Our test ducts meet or exceed all industry standards and can test via all common protocols. We regularly perform the full range of filter tests as per ASHRAE (including Appendix J), ISO, UL 900, and other standards. These in-house capabilities mean that every new AAF Flanders filter design undergoes rigorous testing before release to ensure optimized performance. All existing products face periodic retesting to make certain that they continue to meet our high standards. Additionally, we use these ducts to perform end-of-life tests of filters from the field. When combined with our advanced Total Cost of Ownership Diagnostic® modeling software, we factor in the conditions experienced by that filter to determine the best possible solution for a customer's specific application.

Media Lab

In our Media and Materials laboratory, we test, specify, and design the most crucial component of the filter – the media. We employ state-of-the-art analytical techniques so that each filter delivers superior performance. Starting with theoretical modeling, we then work with our partners to prototype exclusive media formulations. Next, we test and qualify the performance parameters of every potential new media before developing prototype filter designs with that superior media at their core. Our GIGABOT 3D printers give us the capability to go from concept to prototype in mere hours, and we can then test the resulting prototypes in our on-site ASHRAE test ducts. This unparalleled ability to fully prototype in-house enables an agile and accurate response to rapidly changing industry demands. Even better, it means that every new design we produce has gone through a multi-stage, rigorous testing process, typically with multiple designs iterations to ensure only the best possible design is produced and released to our customers.

However, our capabilities don't stop at just media and filter design development. We also have made significant investments in advanced technology to, once again, be able to find and recommend the best solution for every application. Filters submitted by customers can be examined with using FTIR and EDX Spectroscopy and viewed under our 20,000X magnification scanning electron microscope. This technology allows us to determine the exact type and concentration of all the various contaminants present within a customer's application, so that can recommend the perfectly tailored solution.

Biosafety Lab

The CAC also features a Biological Safety Level 2 (BSL-2) laboratory with microbiological and molecular biological testing capabilities. This lab allows AAF Flanders to perform viral efficacy testing for PRRS, PED, and Influenza A, which is crucial to our customers in the agriculture industry. Our ability to make rapid quantitative assessments for viral load using real-time PCR technology provides our customers with actionable information on, and protection from, the biological and viral agents that threaten their most crucial assets.

Air Filtration Audit

Extensive Studies Show:

- 34% of American workers feel that **poor IAQ had caused them to miss work**
- 50% or more of **energy spending** is related to moving air
- 80% of Americans rate clean air as a **very important priority**—up from 75% in 2012
- 88% of facility managers say that **deferred maintenance is an issue at their facility**
- The system most affected by deferred maintenance is **HVAC**
- There are **175,268 pages on IAQ** in the U.S. Code of Federal Regulations
- 56% of commercial maintenance teams *actually admit that* their **IAQ maintenance is not carried out per IAQ guidelines**

NOTES

Sources: The real cost of poor IAQ; Gallup Environmental Poll, Gallup, 2015; Deferred Maintenance, Facilities.net, 2015; Database of state indoor air quality laws, Environmental Law Institute, 2015; Perceptions in the U.S. building industry of the benefits and costs of improving indoor air quality, M. Hamilton et al, 2015

Improper Air Filtration = Higher Energy Costs

Air filtration and maintaining healthy Indoor Air Quality (IAQ) levels are only a couple of the many different operational functions for which companies are responsible. And due to deferred maintenance, the significant impact of HVAC and filtration-related decisions can often be overlooked. But in-depth analysis of current preventative maintenance schedules, procedures, and products can pay off in a significant way for Facility Management teams by indicating the optimal filtration system that will save them both time and money.

Considering the above, it is essential that Executives and Facility Management teams have a trusted advisor to support them in the optimal selection and operation of their air filtration systems.

Have Concerns About Your Energy Spend? Here is Where We Can Start:

A thorough air filter audit of your HVAC Systems is the first step that AAF Flanders takes, in order to provide you with professional guidance and analysis for cost savings and risk reduction. By conducting this audit, we will be able to understand exactly how you compare to the best practices of companies that are similar to you. We strive to understand your current state and identify how you can perform even better.

Our mission is to utilize our core skill sets and products to aid you in protecting your environment, reducing your overall risk, and optimizing your filter-related spending. We will always invest our time and expertise to help you improve your business, not just to sell you a product.

5 Benefits You Will Receive From an Air Filter Audit:

1. Analysis of your current state by a team of industry experts
2. Professional guidance and analysis to reduce your energy spend, decrease your risk, and save you time
3. Valuable and detailed benchmark data
4. TCO Diagnostic® report which will show you where you could be performing even better
5. An optimized preventative maintenance schedule, including a standardized list of filters by air handler unit (AHU) and application

While the value of this audit is worth thousands of dollars, it is currently being offered at no charge and could give you significant benefits by helping you save money, reduce risk, and gain time.

TCO Diagnostic®

Extensive Studies Show:

- **88%** of facility managers say that **deferred maintenance is an issue**
- **$5 million** – annual facility **cost of deferred maintenance**
- **HVAC**—the system **most affected by deferred maintenance**
- Approximately **50% of a building's energy consumption** goes to the heating, cooling, and moving of air
- Up to **37% more energy is consumed** by AHUs with **dirty coils** vs. clean coils
- 56% of commercial maintenance teams *actually admit* that their **IAQ maintenance is not carried out per IAQ guidelines**
- Facilities with poor IAQ can expect an overall **daily productivity drop** of around 9% with individual losses **up to 33%**

NOTES

Sources: Department of Energy, 2006 Buildings Energy Data Book; The real cost of poor IAQ; The effects of indoor air quality on performance and productivity, D.P. Wyon, 2004; 90 percent of people show up to work sick, Staples Employee Study, 2013

The High Cost of Deferred Maintenance

Today's competitive business landscape is becoming increasingly complex and competitive, which means everyone must do "more with less." Unfortunately, this culture is wreaking havoc on facilities in the form of deferred maintenance. By reacting to issues, rather than preventing them, even the smallest delays can add up to exorbitant costs due to:

- Equipment failure
- Safety risks and insurance claims
- Facility disrepair
- Energy overspending

HVAC—The System Most Affected by Deferred Maintenance

When HVAC systems are not maintained on time or as planned, they do not perform as they should, costing you time and money. Energy costs are up to 81% higher in facilities with deferred maintenance. 71% of this increase is HVAC related. With half of a facility's energy costs attributed to heating, cooling, and moving air, proper filter maintenance is essential to keeping HVAC systems operating effectively and efficiently. The proper selection of air filters is critical to a system's performance and can extend the life of components, decrease energy spend, and reduce labor costs.

Optimize Preventative Maintenance Schedules & Total Cost of Ownership

Filters play an important role in reducing your deferred maintenance backlog, so having an optimized program for filter maintenance and replacement is vital to a facility's operations. TCO Diagnostic® is an HVAC filtration system analysis program that helps reduce deferred maintenance backlogs and decrease reactive time by analyzing each facility's HVAC data, optimizing preventative maintenance schedules, and extending changeout cycles at the lowest total cost of ownership. This tool provides a complete optimization of your filtration system to determine the most effective and efficient filter selection based on your facility's needs, saving you time and money while reducing risk.

Sensors and Internet of Things (IoT)

Definition:

Machine-to-machine communication that is built on cloud computing and networks of data-gathering sensors with mobile, virtual, and instantaneous connection.

4th Generation

1G: Protection of HVAC Equipment

2G: Protection of Downstream Assets

3G: Protection of People (IAQ)

4G: Making the Invisible Visible® (IoT)

How to Optimize Your Change-Out Cycle?

On the Clock/Calendar method often results in replacing filters that are still relatively clean, wasting time and money.

On the Pressure Gauge method requires regular pressure gauge monitoring, frequent gauge maintenance and record-keeping, and adjustments based on airspeed to be effective.

On the Money method allows data-driven approach to changeout cycles based upon intelligent, Internet-connected sensors. Change filters only as necessary at the time that offers the lowest possible combination of materials, labor, and energy costs.

Sensors and Internet of Things (IoT)

Multiple Assumptions Made in Current Calculations of TCO by ALL Filter Companies

- Outside Contamination
- Airflow
- Filter Efficiency
- Change Based on Final PD
- Change Based on PM
- Estimated Average DP

IoT and Air Filtration – Sensor Technology

Placement of sensors, at a minimum, to measure and monitor:

- Outside air quality
- Upstream air quality
- Downstream air quality ➔ IAQ
- Differential pressure ➔ Energy usage
- Dashboard & Mobile View

Real-time data that allows optimization of:

- Intelligent air filter selection
- Intelligent air filter change-outs
- Indoor air quality (IAQ)
- Energy usage
- Filter efficiency

Sensor360®

Extensive Studies Show:

- Particles with an aerodynamic diameter of **2.5 micron** are small enough to reach the **human lung and deposit in the bronchia**
- Particles smaller or equal to **1 micron** in diameter are small enough to find their way through the cell membranes of the alveoli into the human blood stream, and **cause life-threatening diseases**

NOTES

Making the Invisible Visible

With Sensor360® filtration monitoring technology, what was once invisible is now visible. At any given moment, the air surrounding us and filling our lungs contains billions of particles too small to be seen, but powerful enough to impact our health, the operation of equipment and instrumentation, and manufacturing processes. Sensor360 uses innovative technology to monitor air quality and provide early warning of air contamination and failure.

This app-driven HVAC sensor technology, proactively tracks and notifies facility teams of filtration system performance, including unit location, pressure drop, MERV rating, PM levels 1, 2.5, and 10, filter type, filter size, and quantity. By proactively monitoring air quality, facilities can optimize preventive maintenance scheduling, decrease deferred maintenance, save money, reduce risk, and gain time while optimizing your total cost of ownership for clean indoor air.

24/7 Monitoring and Early Warning System

Sensor360 is the first IoT (Internet of Things) patented technology platform that directly correlates filtration system performance and Indoor Air Quality (IAQ) by tracking and communicating particulate penetration levels in real-time. The Sensor360 app immediately alerts facility managers when particulate levels are at an unacceptable concentration. The 24/7 monitoring and early warning system detects IAQ threats enabling facility teams to resolve issues before a negative impact occurs. In addition, the program also analyzes trends to identify opportunities for improvement and optimize process performance.

On-Demand Air Quality Analytics

Sensor360 technology detects and monitors particles using sensors to measure particulate matter and pressure differential across air filters. Battery-powered sensors are installed to measure both particulate concentration before the air is filtered and to measure the filtered indoor air quality. The sensors are connected to a network gateway that communicates through a cloud service platform to the Sensor360 app installed on the user's phone, tablet, or computer.

Air filter performance data is sent continuously, real-time through the app, which can be customized for user-defined alerts. Rather than manually collecting and auditing filter data, facility managers can now access filter information anywhere at any time. No other building automation system or monitoring tool in the marketplace offers this combination of rich filtration data and responsiveness.

Sensor360®

Sensor360 Predictive Maintenance Solutions

Sensor360 makes the invisible visible through the power of IoT – Internet of Things. Through this system, sensors installed within air filtration systems collect data on particulate removal and pressure differential. Sensor360 subscribers receive resulting alerts and recommendations for improved performance via an app for desktops, tablets, and smartphones – available anytime, anywhere.

Sensor360 provides:

- Optimized TCO Diagnostic® solution design
- Enterprise-wide system monitoring with at-a-glance information on:
  - Environmental air quality
  - Filter system performance
  - System air quality
  - Differential pressure
  - Predictive maintenance warnings and alerts
  - Energy consumption
  - Total cost of ownership
  - Optimal replacement point
- 90-day risk-free trial
- Your choice of three levels of service:
  - Basic Plan
  - Active Plan
  - Worry-Free Plan

Basic Plan	Active Plan	Worry-Free Plan
Predictive maintenance solution on-demand	Predictive maintenance solution with guaranteed performance	Predictive maintenance solution with **Clean Air as a Service**
Features: • Flexible monthly billing • Air filters purchased as needed	**Features:** • Full system refresh, including: – Replacement of all current filters – Refresh or repair of existing clip systems – Filter seal replacement or repair – Fixed budget pricing • Usable filter life tracking and maximization	**Features**: • All features of the Active Plan, plus: • Turnkey service and transparency, including: – Guaranteed PM 2.5 efficiency – Ongoing filter system service and management – Remote monitoring – Occupant dashboards that demonstrate clean air performance
Ideal for customers who: • Have dedicated maintenance staff with ample time for filter changeouts and disposal • Need financial flexibility of month-to-month billing	**Ideal for customers who:** • Need to relieve burden of reactive maintenance for staff • Need predictable preventive maintenance schedules with data to respond proactively to changing conditions	**Ideal for customers who:** • Need to focus maintenance staff on activities other than filter changeouts and disposal • Desire continually optimized HVAC system performance • Need the stability of predictable spending on filters, monitoring, and all related maintenance – no unpleasant surprises

Exclusively from AAF Flanders, you can now subscribe to **Clean Air as a Service**. We monitor and optimize your air filtration system, even changing out filters and making adjustments as needed. Sit back and breathe the clean air!

Sensor 360® Making the Invisible Visible®

Field Services

AAF Branch Services

As AAF Flanders has grown and changed over the years, we remain focused on one basic goal – providing our customers with clean air. As maintenance budgets and staffing levels decrease, and operational complexity increases, organizations increasingly look to partners to help manage their HVAC systems.

Along with our production plants, AAF Flanders operates strategically located branch offices to better serve the needs of organizations such as facility management companies, contractors, and end users. These branch offices provide expedited availability of commonly ordered air filters, on-site production of special sizes, and additional specialized HVAC services. We are planning to open even more branch locations every year, so if there's not one in your area, look for one opening soon!

Along with providing local access to filters, our branch offices perform on-site HVAC services. Not just filter experts, our dedicated HVAC technicians also perform critical services on air handlers and everything attached to them, freeing up maintenance staff to address other critical areas on schedule. To that end, we added the expertise of such companies as Aire Filter Products in the western U.S. and Air Filter Maintenance in the east. Both outfits have decades of experience providing local service to our customers wherever they are: in grocery stores, commercial buildings, medical facilities, government buildings, and other settings. We now offer the services identified below.

On-site filter replacement programs

These programs ensure that all filters are replaced on time and as-needed. First, an AAF Flanders representative works with the building engineer or facility manager at each location to understand your unique needs and establish changeout cycles. Once we've established a changeout plan, we ensure both physical and electronic records are kept, recording the date that clean filters are installed. We also dispose of spent filters, saving additional costs and labor. Our techs can handle any type of HVAC unit, from large banks to single-filter package units, and heat pumps to rooftop air handlers. For challenging access areas, we transport filters to the roof via ropes, cranes, and lifts, and we equip our trucks with multiple ladders to ensure we can access any unit regardless of location.

Duct cleaning

Unfortunately, outstanding filter performance and maintenance matters little if your ducts downstream of the filters contain built-up dust and dirt. In this scenario, the air flowing into your facility will not be as clean as needed, and your system cannot operate efficiently. However, keeping your ducts clean and well-maintained is a frequently forgotten, yet critical, step in HVAC maintenance. Our experienced service personnel are equipped to handle this chore as well. Typically they perform this service during off hours, so that they don't disrupt day-to-day operations. Their collective experience ensures that the crew accesses the ducts at the correct location to provide the most thorough cleaning possible.

Coil cleaning

The cleaning of heating and cooling coils represents another often-overlooked but crucial HVAC service. Even very light buildup of dust on coils inhibits your HVAC system's ability to transfer heat, increasing energy usage and reducing its life. For example, studies have shown that with equipment operating with scaling of .036" of dust on coils increases related energy costs by more than 30%. Additionally, the dust clogging the coil increases pressure drop, adding to the strain on your system and energy consumption. In fact, we've found that often the resistance added by dirty coils far outweighs the resistance introduced by HEPA filters! Our service technicians restore your equipment to operate at its intended efficiency by deep cleaning both sides of each coil and fully clearing the condensate P-trap so that spent water drains properly.

Clean Air as a Service

With our unique combination of premium, long-lasting products, field service capabilities, and a portfolio of innovative technology tools, including Sensor360®, AAF Flanders is uniquely positioned to be able to provide Clean Air as a Service. This program removes the burden of HVAC system management from your organization while ensuring:

- **Equipment Protection** –Sensor360® alerts us to issues in real-time, so that we can address problems before equipment and facilities are compromised.
- **Reduction in Reactive Work** – If equipment remains in good working order and filters are changed at the right time, then you spend less time dealing with issues caused by equipment damage or failures.
- **Proof of Optimized Maintenance** – Sensor360® maintains a history of the performance of air filtration systems, including energy use, filter changeout records, and seasonal changes in environmental conditions.
- **Waste Reduction** – Optimized filter changeouts help avoid unnecessary physical waste and energy use, thereby reducing the release of greenhouse gases.
- **Energy Optimization** – We will choose the filters that provide the most energy savings and lowest overall Total Cost of Ownership, based on the unique needs and conditions at your facility.

We strongly believe that this is the future of our industry – clean, comfortable air provided at the lowest overall total cost. AAF Flanders removes the headaches associated with air filtration and provides an unprecedented level of data that accumulates as long as you are a customer, improving our analytic and predictive abilities.

Only AAF Flanders is positioned to offer everything required – filters, service, technology, and expertise – to deliver Clean Air as a Service. At AAF Flanders, we are truly *Bringing clean air to life*.

Containment Testing

Setting the Standard

For over 40 years, AAF Flanders has been the prime manufacturer of HEPA and HEGA containment systems for the most advanced military, pharmaceutical, hospital, and biotech lab facilities.

AAF Flanders sets the standard for the control of nuclear, biological, pharmaceutical, and chemical airborne hazards. Our products have established the benchmark for conscientious design in quality containment air filtration and have led to dramatic improvements in:

- Bag-in/bag-out housings
- Remote in-place filter testing capabilities
- Remotely operated hot cell housings
- Low leak and bubble-tight isolation damper systems
- Seismic qualification
- The use of gel seal and gasket seal techniques

NOTES

Methods for Testing

Containment housings capture particles and/or gases that can cause great harm if not removed from an airstream. Because of the critical nature of these products, it is essential to perform periodic checks on the performance of the filter in the containment housing. There are two methods for testing the filter in the housing: **overall efficiency testing** and **scanning.**

Overall efficiency testing determines performance by measuring and comparing the concentration of a test aerosol upstream and downstream of each filter. The test measures the filter as an entire unit, as well as its seal in the housing.

Scanning represents a more stringent test that measures the entire face, looking for any evidence of pinhole leaks that can compromise the filter's performance. These pinhole leaks that can be detected with a scan test may be missed by an overall efficiency test due to dilution effects.

Upstream, Combination, Downstream Overall Efficiency

Inlet Test Housing - Used upstream of a HEPA filter to introduce challenge aerosol and measure the upstream aerosol concentration.

Combination Test Housing - Used between two HEPA filters, allows for overall efficiency to be measured on the HEPA immediately upstream of the Test housing and allows for introduction of aerosol challenge and measurement upstream of the second HEPA. Combination Test housings are only required on systems where there are two HEPAs in series, and overall efficiency measurement of each HEPA filter is required. In such an application, an Inlet Test housing should be used upstream of the first HEPA, a Combination Test housing should be used between the two HEPAs, and an Outlet Test Housing should be used downstream of the second HEPA.

Outlet Test Housing - Used downstream of a HEPA filter to measure the overall efficiency of the HEPA located immediately upstream of the Test Housing.

After filter installation, the challenge agent is injected upstream of the HEPA filter(s) or carbon adsorber(s). An upstream and downstream concentration is determined, and a system penetration value is calculated. The value is compared to acceptable performance criteria, and the system passes for operation or fails and requires corrective action.

In some cases, an additional test combination housing, as shown in Figure 1, is used for sampling upstream filter challenges and injecting an additional challenge for downstream filters. This type of system is designed for testing according to ASME N510, Testing of Nuclear Air Treatment Systems.

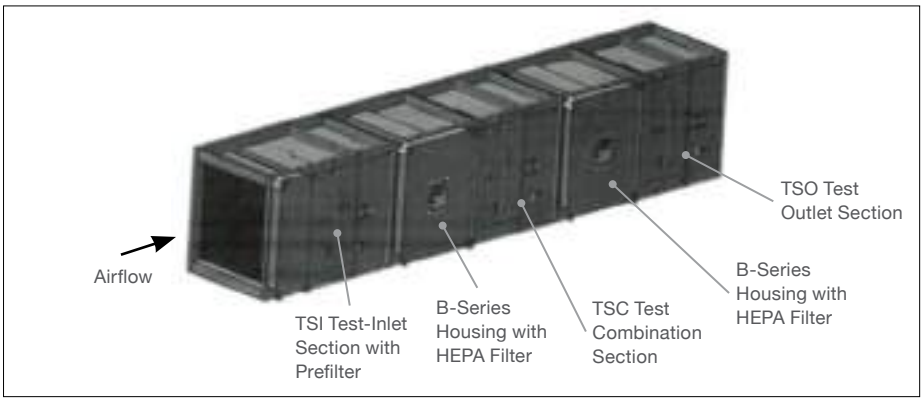


***Figure 1**: Filter Train with the ability to perform efficiency testing.*

***Note:** The system in Figure 1 shows an inlet test housing with integral prefilter track, containment components including a first stage HEPA filter housing, combination test housing, second stage HEPA housing, and a downstream test housing for efficiency testing.*

Containment Testing

Downstream PrecisionScan Test Housing

In some systems, assurance of the overall filter performance is not enough. The contaminants in some processes may be so hazardous that a pinhole leak could compromise the application's integrity.

The PrecisionScan Test Housing allows for individual scan testing of filters to ensure that the filter is leak-free. Typically, this type of system incorporates an upstream test housing (for introducing the appropriate challenge as previously described), a primary filter section, and a downstream PrecisionScan test housing with an internal filter scanning assembly.

The AAF Flanders PrecisionScan Test Housing includes an access door that is removed during the scanning process, a door flange with a bagging ring, and a clear PVC bag to allow the test personnel to operate the scan probe within one (1) inch across the entire surface of the filter per the requirements of IEST RP-CC034.3. The built-in assembly ensures that correct paths for the fixed scan probe are followed.

A PrecisionScan Test Housing is usually integrated in systems where the primary filter for testing is a HEPA filter. The scanning assembly allows correct evaluation of the filter media and any airflow paths associated with the reliability of the filter-to-housing seal.

Manually operated scan systems provide a good way for the end user to run these periodic checks on the penetration of the HEPA filter in a containment housing. These scan systems require a test technician to open a door to access the scan probe through a containment bag. Once the technician introduces the test aerosol into the containment housing, an operator then scans the filter looking for any pinhole leaks. The control of the probe speed depends entirely upon the technician, and if the scan occurs too quickly or erratically, a pinhole leak might still be missed.

AAF Flanders' AstroScan® option eliminates this potential problem. With the AstroScan option, internally driven components control the probe location and speed via externally mounted motors. Additionally, this AstroScan process does not require the opening of any access doors to scan the HEPA filter. This repeatability and precision makes AstroScan the premier automatic scanning system on the market.

For more information on AstroScan and containment housings, contact your local AAF Flanders representative.

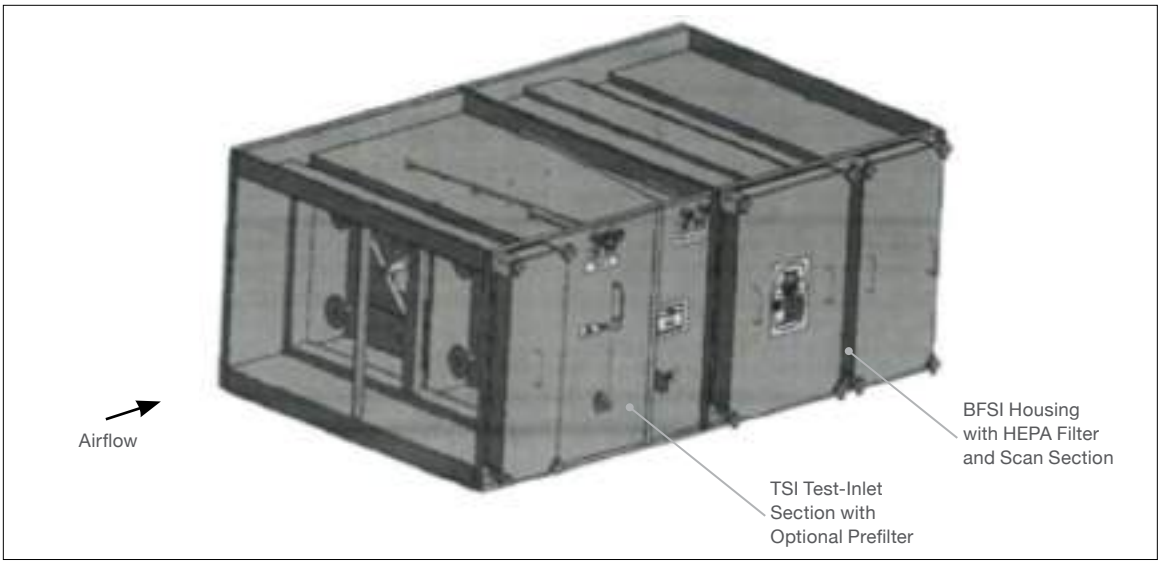
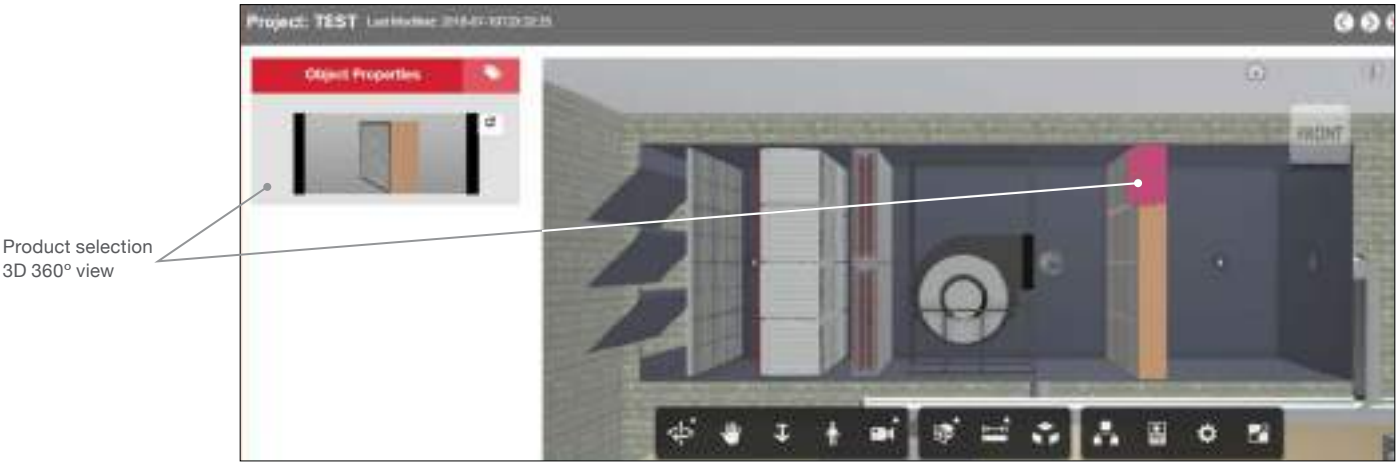


***Figure 2**: Filter Train with the ability to perform a scan test.*

***Note:** The system in Figure 2 shows inlet test housing with integral prefilter track, containment components including HEPA filter housing, and a downstream PrecisionScan Test Housing.*

VisionAir™ Clean with TCO Diagnostic® Software

VisionAir™ Clean is a revolutionary new cleanroom design, configuration, and air filter selection program. Form meets function in this breakthrough new offering from AAF Flanders, designed specifically for energy optimization of air filtration systems in clean environments.



VisionAir Clean allows users to:

- Design and build multiple-room clean environments.
- View 3D renderings of your virtual designs & configurations.
- Obtain Revit files and technical drawings.
- Perform Total Cost of Ownership (TCO) calculations on the entire air filtration system.
- Generate reports on recovery time and air change rate optimization.

With VisionAir Clean, AAF Flanders puts all this power at your fingertips.

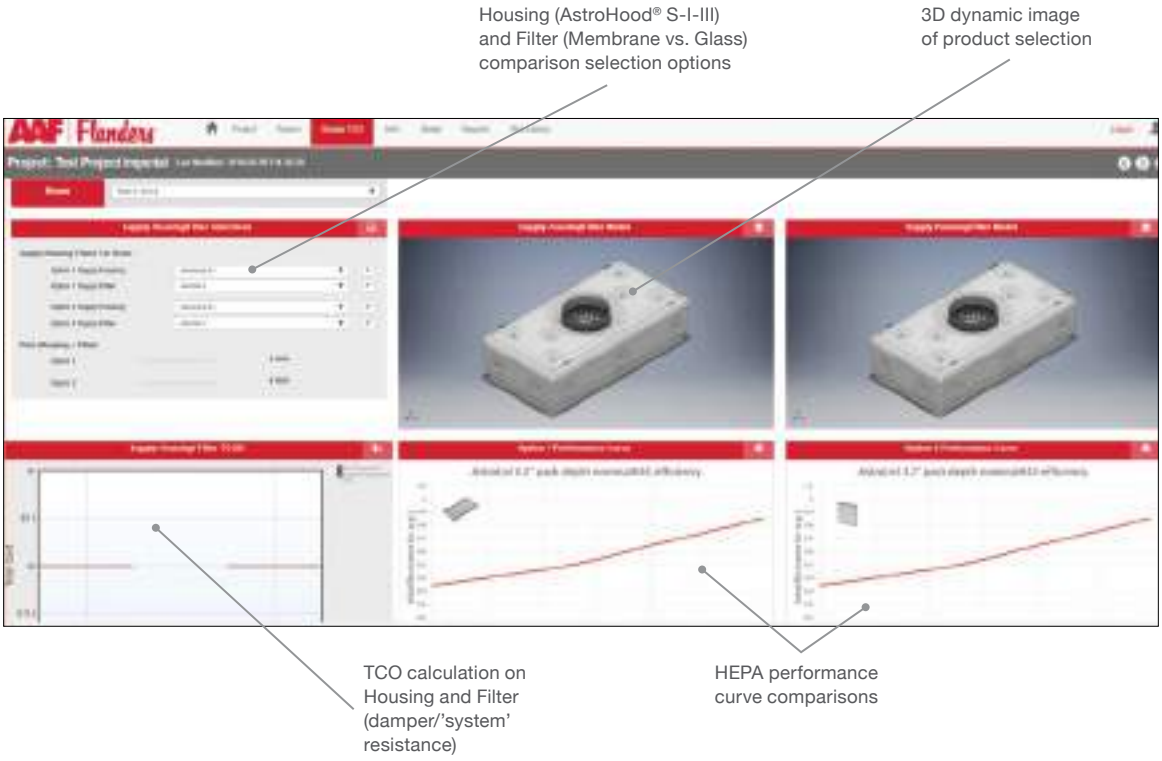
As the leading filter company worldwide, AAF Flanders has been in pretty much every type of cleanroom there is. Through the decades, we've found that in most cases cleanrooms are, understandably, overdesigned. Typically, engineers strive to ensure compliance under even the worst conditions. However, these well-meaning engineers often do so without the information and tools required to model how their design will be affected by various circumstances and conditions. Now, with VisionAir Clean, you can model the impact of nearly every potential scenario on your proposed cleanroom, including:

- Very clean or very dirty outside air (per EPA/ISO 16890 classification)
- Street clothes or multiple levels of cleanroom garments
- Room size
- Number of air changes per hour
- Different types and number of filters and/or housings

Once you've made your selections, adjust variables to view their impact on required air change rates, standard compliance, and Total Cost of Ownership for all stages of filtration – in real time.

VisionAir™ Clean with TCO Diagnostic® Software

Cleanrooms are far from one-size-fits-all. That's why VisionAir™ Clean was designed to help you model whatever your application demands. For the Life Sciences industry, for example, the program can create custom designs around 14 different cleanroom applications per ISPE and HVAC guidelines, and can even calculate multiple rooms for a cross-functional facility. There are multiple cleanroom classification options as well, for any worldwide standard that must be met, including EU GMP, ISO, FDA, or custom standards. Whether creating a cleanroom as part of new building construction or adding clean space in an existing facility, VisionAir Clean ensures that you've created the best possible design for your customer.



Once you've optimized the design of the clean space and AAF Flanders filter selections, we ensure you will have everything required to specify and demonstrate the design to the customer per their requirements. VisionAir Clean enables you to:

- Generate Revit drawings for BIM models
- Generate 2D CAD drawings
- Review detailed recovery time and air change rate optimization reports
- View 3D dynamic animations and models of selected products
- Create 3D-animated walkthroughs of the room design, from AHU to supply-exhaust devices

You'll also have access to our technical library, including product specifications and white papers, our entire high purity guide, cleanrooms calculation formulas, and all relevant standards and international guidelines.

VisionAir Clean is *Bringing Clean Air to Life* in a whole new way. For more information on how you can gain access to this software, contact your AAF Flanders representative.

Equipment Configurator

Intelligently Built

- Allows the user to configure products to meet their specific needs
- Built on years of product and manufacturing experience
- Provides a cost for and a drawing of the configured product in less than 30 minutes
- Intelligent design at the speed of business

NOTES

Equipment Configuration—Accelerated

Equipment Configurator is a design software tool for configuring products ranging from industrial HEPA filters to complex containment housings. The configuration software walks you through the entire design process using application-specific data and predefined product features, including industry-specific information and product customization options based on decades of manufacturing experience.

Equipment Configurator guides the user through various screens of input data that build on one another. To accelerate the configuration process, each screen has a number of prepopulated fields containing typical configuration parameters that can be changed as necessary. These screens contain images and/or help fields that provide design details to clarify configuration choices. The program has built-in checks and balances that automatically link or restrict certain options to prevent a design error, and to further accelerate the process.

Optimized Solution Design

While working within the tool, this program conveniently displays the name of every screen required to configure the product, with previous and upcoming options indicated at all times. Depending on the complexity of the product and design, the entire process can be completed in ~15–30 minutes. For greater ease of use, prior projects can be opened and modified to reduce the configuration process time even further.

Once the configuration is complete, the user is provided several options to choose from with a scale drawing of the configured product that includes the specification, a summary of the configuration showing each input field and selected value, and the price of the configured product. The user can download the product specification directly into the project job specification, along with a DXF of the product that can be uploaded to a project drawing.

All documents within the tool can be emailed directly from the program to others working on the project. In addition, the collaboration feature allows the user to email a link to other project members to access the product configuration online and add review comments. Equipment Configurator provides you with crucial time savings while improving air quality, minimizing total cost of ownership, and optimizing solution design.

SAAF™ Tech Tools

The Reality of Gas-Phase Applications:

- Corrosion is non-reversible and often takes time to make its presence known…ticking time bomb effect
- Gas-phase filtration solutions are most effective when designed for a specific application

NOTES

Gas-Phase Applications—Simplified

SAAF™ Tech Tools is a decision science solution program for configuring clean air products to remove airborne gaseous contaminants. This decision science software walks you through the entire process by using application-specific data and predefined applications, including industry-specific information. Our software works to identify optimal media solutions, the size or volume required, their projected efficiency on a given application, and the equipment needed—ultimately creating a rapidly customized submittal package.

SAAF Tech Tools simplifies the complexities surrounding gas-phase applications through a guided problem-solving experience. It starts with a built-in table of over 900 gas-phase contaminants, 10 different chemical medias designed to target and remove those contaminants, and over 30 possible equipment solutions per application. From there, the chemical media life, operating cost index, and other key variables can be set within a user-specified range to narrow down the results, based on which factor or factors are most important for the application being analyzed.

Optimize Your Application

Using chemical media utilization algorithms, SAAF Tech Tools estimates an optimized chemical media solution for you. Based on the data entered, a quick look chemical media report is generated with your initial assessment, results, and proposed solution. In addition, a full chemical media submittal may be generated that includes spec sheets, safety data sheets, and all pertinent literature for the proposed solution.

After the media selection phase, the next step is to select the proper equipment design from a comprehensive list of possible solutions that is based on your application requirements. This program gives you the ability to sort and filter equipment options to arrive at the optimum solution. A quick look equipment report showing your assessment, results, and operating cost index is generated, as well as a full equipment submittal, including all selected chemical media details, equipment drawings, equipment IOMs, and all pertinent literature.

Minimize Total Cost of Ownership

The Total Cost of Ownership (TCO) analysis is the final step in determining the solution to your gas-phase application. A financial considerations report is generated indicating the capital investment of the solution and ongoing chemical media replacement requirements, along with a TCO report outlining the total cost of the solution over a ten-year period. AAF Flanders delivers the latest advancements in gas-phase filtration system design, analysis, and optimization to help organizations save time and money while reducing risk.

Gas-Phase Environmental, Analytical, and Design Services

SAAF™ Chemical Media Remaining Life Analysis (RLA)

SAAF Remaining Life Analysis (RLA) measures chemical media properties to help facilities predict remaining life, replacement schedules, and inventory requirements.

Engineers and end users often ask, “How long will the media last?” or “How frequently should the media be changed?” The answer depends on the application and the gas concentrations in the environment. Various tools can help answer these questions, ranging from air measurements to occupant surveys. AAF Flanders recommends Remaining Life Analysis (RLA) for standard SAAF media. RLA assists customers in estimating remaining media life, confirming media activity, optimizing media selection, and controlling costs with timely media replacement.

Gas-phase filtration media include a wide range of materials. Virgin activated carbon, impregnated carbon, and impregnated alumina are the most common. The life of each media depends on multiple factors, such as particle size, activity level, contaminant concentrations, operating temperature, operating RH, time of operation, minimum allowable breakthrough, type of impregnant, and percent impregnation. AAF Flanders estimates the impact of these factors on media life by comparing used media properties to those of fresh media.

For each analyzed sample, AAF Flanders produces a Remaining Life Analysis Report. The report contains the installation and equipment information, an explanation of the results, recommendations, and a summary table. This data can be logged over time to analyze the RLA trend of a system.

SAAFShield® Technology – Detecting Unit (DU), Reading Unit (RU), Communications Module (CM)

The SAAFShield Technology products work together as a real-time reactivity monitoring system. The information they provide helps facilities avoid the costly consequences of electronic equipment corrosion (failures of data servers, control room equipment, or other critical microelectronics).

The SAAFShield Detecting Unit works together with either the SAAFShield Reading Unit or the SAAFShield Communications Module to display and trend corrosion data over time. The Detecting Unit is the sensing side of the technology. The Detecting Unit is non-powered, providing a low-cost option that can be easily deployed at multiple locations and read periodically with the Reading Unit. Alternatively, constant trending of corrosion rates is possible when connected with

a Reading Unit or Communications Module. The Reading Unit can log data on a USB drive to be graphed through the SAAFShield website. The Communications Module transmits data to building management software through a 4–20 mA signal, allowing for facility-wide monitoring.

SAAF™ Reactivity Monitoring Coupons (RMCs)

The SAAF Reactivity Monitoring Coupons (RMC’s) provide information on the average air reactivity over 30 days. The information they provide helps facilities evaluate area or room conditions in relation to air reactivity and take any needed action to protect their electronics, equipment, processes, artifacts, and historic assets.

RMCs determine environment reactivity through exposure in the environment and subsequent lab analysis. This technology is used to investigate the condition of control rooms or other protected environments housing electronic equipment in industrial facilities, such as pulp and paper mills, petrochemical refineries, and chemical plants. RMCs are also used to investigate the condition of facilities such as data centers, museums and archives, and microelectronic production or storage areas. Additionally, mechanical equipment such as compressors can be affected by reactive gases in the air and can be evaluated with RMCs. Various standards and classification schemes correlate corrosion film amounts to reactivity classifications. Therefore, AAF Flanders offers RMC reports in four different formats, each reflecting a different scale for characterizing the overall reactivity level.

Clean Air University

Clean Air University hosted by AAF Flanders

In keeping with our vision of "Bringing clean air to life," AAF Flanders offers university-style classroom training at our Clean Air Center (CAC), our research & development facility in Jeffersonville, IN, across the Ohio River from Louisville, KY. The training deepens the knowledge base of our employees and customers on the advantages of AAF Flanders' differentiated products and technologies. Through the course of these sessions, we also discuss science-based solutions that maximize indoor air quality (IAQ) at the lowest possible total cost of ownership (TCO) within real-world applications.

AAF Flanders begins this progressive training program with a preliminary training event on the Principles of Air Filtration, Product Applications, and Strategic Selling Techniques. Upon completion of this material, Clean Air University curriculum escalates to additional technically-based classes.

Advanced classes combine a mix of classroom and hands-on training. One track covers subjects such as cleanroom testing, standards, and design, as well as the measures and controls associated with air filtration in Life Sciences, Microelectronics, Containment, and Healthcare applications. Throughout these sessions, we explain how our solutions help mitigate risks inherent in these critical environments. Another track features modules on the appropriate use of ASHRAE products in commercial and industrial applications, including data collection from an actual air handling unit (AHU), the selection of the correct filter for an application, and the determination of an optimized filter changeout cycle.

Examples of Clean Air University experiential training:

- Using real-world scenarios to construct a Report of Findings based on a facility audit
- Presenting Total Cost of Ownership Diagnostic (TCOD)-based findings that mimic the applications of potential clients
- Installing and setting up Sensor360® in an air duct
- Designing and modeling different ISO-classified cleanrooms based on changing customer requirements and environmental conditions
- Installing, disposing, and aerosol testing of a HEPA filter in a mock cleanroom environment

Clean Air University attendees exit the program and return to the field with enhanced understanding thanks to education and hands-on training experiences based on real-world environments.

Clean Air University
LIVE & ONLINE LEARNING

Industries and Applications

Agriculture

Animal Science

Extensive Studies Show:

- The **annual cost of productivity losses** due to Porcine Reproductive and Respiratory Syndrome Virus (PRRSV) in the U.S. national breeding and growing pig herds is **$664 million, up from $560 million in 2005**, equating to a **loss of $1.8 million per day** by the U.S. pork industry
- An additional **$477.8 million is estimated to be lost each year** on outbreak related costs, including animal care and biosecurity
- Acute PRRS outbreaks in four breeding herds in Illinois **cost an estimated $100, $170, $428, and $510 respectively per breeding female**, based on decreases in the production of weaned pigs and increased treatment costs
- A four-month outbreak in a 250-sow herd in Minnesota **cost an estimated $59,000, $236 per breeding female**, for one year following the outbreak
- A feeder pig operation with an endemic PRRSV infection in the nursery reported a **70% loss in profits** due to a reduction of over $5.00 per pig attributed to the nursery stage alone, based on decreased growth rates, increased feed conversion, and increased mortality

Source: Journal of Swine Health and Production (2013); Hoefling DC. Overview and history of SIRS. Proc Ann Meet Livest Conserv Inst. 1992;239-242; Polson DD, Marsh WE, Ding YZ, Christianson WT. Financial impact of porcine epidemic abortion and respiratory syndrome (PEARS). Proc IPVS. The Hague, the Netherlands. 1992;132; Kerkaert BR, Pijoan C, Dial G. Financial impact of chronic PRRS. Proc Allen D. Leman Swine Conf. 1994;217-218.

Preventing Costly PRRS Outbreaks

The pandemic PRRSV was first recognized in the United States in the late 1980s. Despite more than 25 years of intensive research and efforts to combat the virus, it remains a significant threat to sow farms in the U.S. and abroad. While productivity losses resulting from the impact of the disease on growing herds have been reduced over the past decade, this progress is offset by significantly increased losses in breeding herds.

While a PRRS outbreak is not the only risk a sow farm has to consider when allocating capital for operations, it is one that should be given serious consideration, based on its potential to significantly impact production and costs. The likelihood of sustaining such losses due to an outbreak of PRRS is increased if your operation is located within a five mile radius of other sow farms. The virulent virus can travel airborne for five miles or more, and its ability to constantly change creates the potential for genetic evolution of the strain.

Ensure Maximum Protection and Efficiency from Your Air Filtration System

When you are ready to invest in an air filtration system to protect your herd and your bottom line from the ravages of PRRSV, adhere to the following requirements to ensure maximum protection and efficiency:

- Choose filters with a low resistance to airflow, which reduces the number of filters needed, eliminating or decreasing the need for additional filter housings and building extensions; lowers energy consumption and labor costs; and reduces waste
- Ensure buildings are airtight
- Accurately monitor differential pressure between the interior and exterior of your building
- Ensure filter brackets are airtight upon installation
- Choose filters with the recommended level of filtration for your facility and level of risk
- Follow manufacturer recommendations for replacing filters
- Install an efficient backdraft damper

Agriculture

Animal Science

It Pays to Invest in Air Filtration

While cost is always a significant consideration, you must consider whether your operation can afford not to invest in an air filtration system. A single outbreak of PRRS can cost two times more than investing in a filtration system, or the equivalent of operating the system for four to five years. The bottom line is that if your decision prevents one severe outbreak, it has paid for itself.

The cost of equipping your facility with filters varies based upon the configuration, age, and maintenance history of your building and equipment, with newer facilities generally requiring less of an investment to filter.

Air Filtration Is Your Front Line Defense Against PRRSV

Trials conducted by the University of Minnesota Swine Disease Eradication Center found that the risk of the indirect spread of PRRSV can be reduced with a comprehensive biosecurity program that includes air filtration. Unfortunately, most ventilation systems in swine facilities are typically designed to supply fresh air and control the inside temperature, not to provide air filtration. However, an effective air filtration system traps the airborne virus and its contaminants, preventing them from entering a facility and spreading throughout.

PRRS is a major concern not only for sow farms, but for cattle, dairy, and poultry farms as well. Air filtration prevents airborne pathogens, including PRRSV, from entering and spreading throughout a farm, preventing costly outbreaks of a broad range of diseases that impact both animal health and production, and operating costs.

At AAF Flanders, we understand the threat that sow and other animal farming operations face from the virulent and costly PRRS virus, as well as other pathogens with the potential to have a significant impact on your herd, production levels, and operating costs. Our goal is to provide you with comprehensive information for assessing your risk, and filtration investment strategies to reduce your risk and the projected return on your investment. AAF Flanders offers air filtration solutions and climate control options to meet the unique needs of your farming operation, protecting animal health, and profitability.

Filtration Solutions

Pleated Filters

The AAF Flanders pleated filters line provides the industry's broadest selection of high performance, high capacity filters, including specialty and standard capacity options. Pleated filters can be used as prefilters to protect and extend the life of higher efficiency, more expensive final filters. In many applications, they are the only filter used in an HVAC system.

PerfectPleat® HC M8
(see page 122)

Box Filters

These rigid, extended surface filters are ideal for use in all high efficiency applications. The supported pleat filters provide strength and integrity in high flow, turbulent, and variable airflow conditions. These filters are designed to remove airborne biological contaminants in critical areas.

VariCel® VXL
(see page 132)

FASeal™ SS Framing System

Clip-free and easy to install, the FASeal SS framing system is designed specifically for the unique requirements of your operation. With an interlocking design that allows a combination of frames to form a grid, it provides the ability to build-up modular filter banks of prefilters and final filters that will hold in place in horizontal applications. These frames are durable and corrosion resistant, creating a lasting, airtight seal to prevent the entry of pathogens into your facility.

FASeal™ SS Framing System
(see page 146)

Agriculture

Cannabis

Our Experience in this Industry Reveals a Need for:

- Quality air to improve crop yield
- Odor control
- Air filtration to ensure regulatory compliance

Filtration Solutions

VariSorb® HC
(see page 227)

MEGAcel® I eFRM
(see page 161)

SAAF™ Cassettes
(see page 213)

Improving Indoor Air Quality and Preventing Contamination

Cannabis has a very complex chemistry due to the large number of its constituents and the interaction of those constituents with one another. These constituents primarily include mono- and sesquiterpenes, sugars, hydrocarbons, steroids, flavonoids, nitrogen compounds, amino acids, and terpenophenolic cannabinoids. Many of these are odorous, with terpenes and terpenoids being the primary offenders.

While nuisance odors are most prevalent with cannabis cultivation, other sources of cannabis odors include test labs, extraction rooms, warehouses, and dispensaries. Proper air filtration will not only eliminate these odors, but also provide a better environment for growing plants, reduce impurities when testing products, and provide cleaner air for personnel and customers.

Controlling Airborne Particulates and Odor

Filtration is recommended for the following cannabis applications:

- Outdoor Air for Grow Rooms
  - Particulate filtration to remove outdoor particulate matter such as pollen, bacteria, dirt, and dust
  - Gas-phase filtration to remove outdoor contaminants such as ozone, VOCs, and acid gases
- Indoor Air for Grow Rooms, Extraction, and Dispensaries
  - Gas-phase filtration to remove plant odors
  - Gas-phase filtration to remove butane or ethanol vapor from cannabis oil extraction
- Exhaust Air for Grow Rooms and Warehouses
  - Particulate filtration to remove indoor particulate matter
  - Gas-phase filtration to remove plant odors

Filtration Solutions

The recommended products for these applications are as follows and can be found in the Product Section of this Guide:

Particulate Filtration	Good	Better	Best	Gas-Phase Fitration	Good	Better	Best
Outdoor Air for Grow Rooms	VariCel® VXL M13	VariCel® VXL M15	MEGAcel® I	**Outdoor Air for Grow Rooms**	VariSorb® XL	VariSorb® HC	SAAF™ Cassette
Indoor Air for Grow Rooms and Dispenseries	VariCel® M11	VariCel® VXL M14	VariCel® VXL M15	**Indoor Air for Grow Rooms, Extraction and Dispenserie**	VariCel® RF/C	VariSorb® XL	VariSorb® HC
Indoor Air for Oil Extraction	VariCel® VXL M14	VariCel® VXL M15	MEGAcel® I				
Exhaust Air for Grow Rooms and Warehouses	VariCel® VXL M13	VariCel® VXL M15	MEGAcel® I	**Exhaust Air for Grow Rooms and Warehouses**	VariSorb® XL	VariSorb® HC	SAAF™ Cassette

Agriculture

Farming and Tobacco

Protect Your Product and Customers

The air inside one of these facilities can contain:

- Mold, spores, pollen
- Milling dust
- Bacteria and byproducts
- Volatile Organic Compounds (VOCs) used in processing agricultural raw materials
- Fumigants

Filtration Solutions

VariCel® VXL
(see page 132)

SAAF™ Cassettes
(see page 213)

Source: Building air quality, a guide for building owners and facility managers, Environmental Protection Agency, 1991

Prevention of Cross-Contamination

Filtration is vital in preventing cross-contamination, ensuring consistent and superior quality products, and protecting people and process equipment. Cross-contamination can lead to production downtime and product loss, both of which impact the yield and profitability of farmers. Having a well-sealed environment is the first step to preventing cross-contamination, and having superior filtration is key to maintaining the integrity of the process.

Toxic Fumigant

A unique niche in the agricultural production arena is tobacco harvesting, storage, drying, and packaging. The types of fumigation, the storage times and limits, and the throughput are very specific for tobacco crops. Methyl bromide is commonly used to fumigate the tobacco product as it is being dried and stored. Since this is a highly toxic fumigant, gaseous contaminant remediation is necessary.

AAF Flanders' gas-phase filtration media is ideally suited for remediation of methyl bromide and the other specialized fumigants used in the tobacco industry. Additionally, high efficiency filtration, coupled with antimicrobial treatment, is needed when moving and storing tobacco products.

Optimize Your Environment

Air filtration, as it pertains to the growing and refining of grain and crops, is very important for both particulate and gaseous contaminant remediation. With regard to grains and other agricultural products, particulate filtration is of substantial importance. Air filtration systems in facilities that deal with these products must handle relatively large volumes of air with various sizes of particulates that need to be removed.

A thorough air filter audit of your HVAC Systems is the first step that AAF Flanders takes in order to provide you with professional guidance and analysis for cost savings and risk reduction. By conducting this audit, we will be able to understand your current state and then utilize TCO Diagnostic®, an advanced analytical software tool, to identify how you can improve air quality, energy savings, and operational flexibility while reducing total cost of ownership.

Commercial Buildings

Extensive Studies Show:

- 34% of American workers feel that **poor IAQ had caused them to miss work**
- For every 1,000 workers, **poor IAQ** results in 600 sick days per year
- 56% of commercial maintenance teams actually admit that their **IAQ maintenance is not carried out per IAQ guidelines**
- 88% of facility managers say that **deferred maintenance is an issue**

Sources: The real cost of poor IAQ; The effects of indoor air quality on performance and productivity, D.P. Wyon, 2004; The causes and costs of absenteeism in the workplace, Forbes, 2013; Perceptions in the U.S. building industry of the benefits and costs of improving indoor air quality, M. Hamilton et al, 2015

Indoor Air Quality (IAQ) is of Primary Concern

In commercial office buildings, Indoor Air Quality (IAQ) is a primary concern. IAQ refers to the indoor air breathed in by a building's occupants. The pollution levels in this indoor air can be up to five times higher than outdoor levels, and poor IAQ ranks as one of the top five environmental risks to public health.

The Air Inside These Buildings Can Contain:

- Molds, spores, pollens
- Carbon monoxide, radon, volatile organic compounds (VOCs)
- Bacteria, viruses, and byproducts
- Vehicle engine exhaust, exhaust from industrial plants
- Asbestos, clays, elemental particles, and man-made fibers

Critical Importance of IAQ

In commercial facilities, controlling airborne pollutants is necessary to maintain a comfortable, healthy, and odor-free environment. In many commercial buildings. While the majority of commercial facilities use common particulate filters, these filters cannot resolve all problems related to poor air quality. In addition, gas-phase filtration must be used to control the harmful effects of gaseous contaminants.

Gaseous contaminants originate from a variety of sources, such as automotive exhaust and chemical offgassing of new furnishings. Commercial facilities face a unique challenge in combating gases from various occupant activities, building operating equipment, and maintenance areas, as well as airborne particulate from renovations and construction. The hustle and bustle in gymnasiums, science classes, and cafeterias pose some of the biggest challenges for educational facilities.

Jet fuel emissions pose a threat to protecting patrons and workers in airport terminals, control towers, and transportation areas. Museums and historic storage areas are susceptible to chemicals in the air, especially gases of an acidic nature that can damage precious works of art and historic significance. Clean air is vital to healthcare facility operations, in order to protect patients, staff, and visitors from potential airborne diseases and infections, and to protect occupants from chemical odors resulting from laboratories, morgues, and other areas within the facility.

Commercial Buildings

Optimize Your Environment

Air filtration systems in commercial facilities must handle relatively large volumes of air. Approximately 50% of a building's energy consumption goes to the heating, cooling, and moving of air. In considering the Total Cost of Ownership (TCO), it is important to keep in mind that in order to have a cost-effective building, planning maintenance is an important step in maintaining energy efficiency, minimizing costly repairs, and extending the lifespan of your equipment.

LEED® Accreditation

AAF Flanders can assist you in the processes required to earn Leadership in Energy and Environmental Design (LEED) credits. The LEED Green Building Rating System,™ administered by the U.S. Green Building Council, is the nationally accepted benchmark for designing and sustaining green buildings.

Proper Air Filtration Strategies Contribute to Four of the Six LEED Credit Categories:

- Energy and Atmosphere (Efficiency)
- Indoor Environmental Quality
- Materials and Resources
- Innovation in Design/Operations

Comprehensive Purchase Perspective

Selecting the proper filtration for your HVAC system can help your commercial facility to reduce spend, decrease risk, and save time. Commercial facilities need the support of a trusted advisor who can perform Air Filtration Audits and Diagnostics to ensure that the most optimal effective solution is selected and installed in their air filtration systems.

Filtration Solutions

Pleated Filters

The AAF Flanders pleated filters line provides the industry's broadest selection of high performance, high capacity filters, including specialty and standard capacity options. Pleated filters can be used as prefilters to protect and extend the life of higher efficiency, more expensive final filters. In many applications, they are the only filter used in an HVAC system.

MEGApleat® M8
(see page 118)

Box Filters

These rigid, extended surface filters are ideal for use in all high efficiency applications. The supported pleat filters provide strength and integrity in high flow, turbulent, and variable airflow conditions. These filters are designed to remove airborne biological contaminants in critical areas.

VariCel® VXL
(see page 132)

Bag Filters

Non-supported pocket filters are the most economical, high-efficiency filters available, and an excellent choice for healthcare facilities, automotive paint booths, commercial buildings, and various industrial applications. Designed for high performance in demanding operating conditions, AAF Flanders extended surface pocket filters are perfect as both prefilters and final filters for particulate removal where clean air is required.

Sensor360® Real-Time Air Filtration Optimization

As maintenance budgets and staffing levels decrease, organizations struggle to plan and perform routine maintenance on their HVAC systems. Our Sensor360 intelligent data tool puts facility personnel in position to streamline the management of their equipment and systems. With real-time air filtration performance information, including pressure drop and airborne particle removal, facility personnel can perform maintenance proactively and minimize reactive tasks. Even better, changing filters at or near the optimal time leads to less strain on HVAC systems and lower energy spending.

Additionally, Sensor360 air filtration technology allows AAF Flanders to offer outsourced air filtration optimization and maintenance services, so that facility personnel may focus on other pressing tasks. For more information, see page 64.

Data Centers

Types of Failures

Failures due to particulate and contaminant dust are generally classified as:

- Mechanical effects, including obstruction of cooling airflow, interference of moving or optical parts, and deformation of surfaces
- Chemical effects, including corrosion of electrical components, due to dust comprised of sulfur and chlorine bearing salts
- Electrical effects, including impedance changes and electronic circuit conductor bridging

Critical Importance of Indoor Air Quality (IAQ)

Air quality within data centers is more important today than ever. Data centers have unique requirements and strict regulations, compared to a typical commercial site. Particulate and corrosive gaseous contaminants have become a serious problem for data centers and server rooms. In some cases, corrosion of electronic components has resulted in catastrophic failures of equipment, due to environmental conditions such as low concentrations of corrosive gases. These contaminants enter data centers in a variety of ways, including outdoor ventilation systems, adjacent interior areas, and with individuals entering and exiting the facility or critical areas.

While the connection between contamination and hardware failures is often overlooked, the need to maintain a high level of equipment dependability in data centers is not. AAF Flanders is experienced in the prevention and control of particulate and gaseous contamination, as well as air quality testing and analysis in mission critical applications.

Gaseous Contamination Risk

Sulfur-bearing gases, such as sulfur dioxide (SO2) and hydrogen sulfide (H2S), are the most common gases causing corrosion of electronic equipment. Once introduced in a data center or server room environment, these gaseous contaminants lead to deterioration of copper surfaces and silver solder used on computer circuit boards, leading to intermittent and hard failures. These forms of corrosion can cause failure by either impeding the flow of electricity or forming unintended circuit paths. Elimination of corrosive contaminants is therefore essential in maintaining data center equipment reliability.

Corrosion of Electronics

Corrosion of electronics due to ambient air pollution has been documented for many years. Historically, the problem occurred only at industrial sites, such as pulp and paper mills and petrochemical refineries. These industrial facilities produce relatively high levels of sulfur content—hydrogen sulfide, sulfur dioxide, mercaptans, or sulfur laden particulates. Therefore, electronic components in these plants are subject to corrosion, due to reactions with environmental sulfur and humidity.

Data Centers

There are various types of electronic circuitry corrosion, including whisker growth and creep corrosion. Stricter environmental guidelines have forced many manufacturers to replace lead-based solders with lead-free solutions, which are more susceptible to corrosion from airborne gaseous and particulate contaminants. These forms of corrosion can cause failure by either impeding the flow of electricity or forming unintended circuit paths. Silver whisker growth will cause failures by forming unintended circuit paths on a circuit board. The growth of silver whiskers is the notable indicator to server manufacturers that sulfur contamination exists in their equipment.

Optimize Your Environment

In data centers with air-side economizers, supplemental real-time monitoring, such as AAF Flanders' SAAFShield® Technology, is recommended to enable quick reaction to outdoor events that may introduce corrosive gases into data centers. Real-time monitoring is also recommended in data centers with gas-phase filtration air cleaning systems, in order to track the efficiency of the filters.

For data centers with or without air-side economizers that do not fall within the ISA-71.04 severity level G1 for copper and silver corrosion, remediation through gas-phase filtration is recommended. Blowers at air inlets, fitted with particulate and gas-phase filters, can be used to fill the data center with clean air and pressurize it to prevent contaminated outdoor air from leaking into the data center. The air in the data center can be recirculated through gas-phase filters to remove contaminants that are generated within the data center.

Filtration Solutions

Pleated Filters

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MEGApleat® M8
(see page 118)

Box Filters

These rigid, extended surface filters are ideal for use in all high efficiency applications. The supported pleat filters provide strength and integrity in high flow, turbulent, and variable airflow conditions. These filters are designed to remove airborne biological contaminants in critical areas.

VariCel® VXL
(see page 132)

Gas-Phase Products

AAF Flanders has assumed an industry leading position with the development of its innovative SAAF product line designed to reduce or eliminate harmful gaseous contaminants. In combination with our expertise in airborne particulate filtration, SAAF products and solutions allow us to develop unique and effective total filtration solutions to protect people, processes, and equipment.

Gas-Phase Filtration
(see page 211)

Firing Range

Controlling Contaminant Levels

By law, contaminant levels within an indoor firing range facility must be controlled.

- Lead must be limited to a level of 50 ug/m(3) averaged over an 8-hour period
- Carbon monoxide must be controlled to 50 ppm
- Surveys from the National Institute for Occupational Safety and Health (NIOSH) indicate that the majority of indoor firing ranges operate with air contamination levels far exceeding acceptable standards

Source: OSHA Regulations (Standards-29 CFR) Part 1910 Occupational Safety & Health Standards

Contaminant Risk

Indoor firing ranges produce large quantities of airborne pollutants, including lead and noxious gases. The most significant potential source of airborne lead at the firing line is caused by the hot flames of burning gunpowder acting on the exposed lead base of a projectile. The metallic lead in the projectile can also become airborne lead particles through heat from friction between the bore of the firearm and an unjacketed lead projectile. Downrange, lead may become airborne from splatter caused by projectiles hitting backstops, floors, walls, or baffles.

In addition, maintenance and/or repair of the backstop or other range equipment may cause settled lead dust to become airborne. Improper cleaning of a range may also cause lead dust to become airborne. Ranges that allow lead dust to accumulate have increased lead exposure risks, since the accumulated dust can become airborne from muzzle blast and/or shooter movement. Concentrations can easily exceed safe levels of exposure to workers and shooters, and failure to comply with the Occupational Safety and Health Administration (OSHA) and National Institute for Occupational Safety and Health (NIOSH) regulations can result in significant fines for range owners.

Regulations and Standards

While by law OSHA regulations only apply to employees, every indoor range, including club ranges, can use them as an important reference. OSHA has a comprehensive lead regulation (29 CFR 1910.1025). Failure to comply with the requirements of the Lead Standard could result in fines to range owners, in addition to jeopardizing the health and well-being of those exposed to the contaminated air.

Signs and Symptoms of Lead Poisoning

Lead can enter the body by being inhaled or swallowed. Lead can be inhaled when lead dust or fumes are released into the air. When lead enters the bloodstream, it circulates throughout the body. Early signs and symptoms of lead poisoning include:

- Fatigue
- Sleeplessness
- Metallic “Taste”
- Headaches
- Nervousness
- Irritability
- Uneasy Stomach
- Poor Appetite
- Reproductive Problems

Firing Range

Optimize Your Environment

The primary purpose of an air filtration system in these facilities is to prevent the buildup of toxic gases (CO_2, CO, NO) and particulates, including lead and other discharge products. The benefits of proper air filtration include:

- Elimination of dangerous air contaminants, resulting in improved quality of life for employees and users alike
- Compliance with EPA and OSHA regulations
- Reduced liability from lawsuits resulting from employee health problems
- Reduced employee absenteeism and disability
- Improved fire range capability

A thorough air filter audit of your HVAC Systems is the first step that AAF Flanders takes in order to provide you with professional guidance and analysis for cost savings and risk reduction. By conducting this audit, we will be able to understand your current state and then utilize TCO Diagnostic®, an advanced analytical software tool, to identify how you can improve air quality, energy savings, and operational flexibility while reducing total cost of ownership.

Air Cleaning for Indoor Firing Ranges

AAF Flanders can help mitigate the risks associated with airborne pollutants and fumes that are created by the firing process.

- Meeting compliance standards for OSHA regulations pertaining to lead exposure
- Removing dangerous airborne contaminants and improving air quality, health, and comfort of employees and customers
- Mitigating potential consequences and hazards attributed to toxic elements generated within firing ranges

Filtration Solutions

Pleated Filters

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MEGApleat® M8
(see page 118)

Box Filters

These rigid, extended surface filters are ideal for use in all high efficiency applications. The supported pleat filters provide strength and integrity in high flow, turbulent, and variable airflow conditions. These filters are designed to remove airborne biological contaminants in critical areas.

HEPA/ULPA Filters

HEPA filters are the most efficient air filters commercially available. They are used in cleanroom and other applications requiring ultra-clean air—semiconductor, electronics, pharmaceutical manufacturing, food processing, hospitals, and labs. AAF Flanders HEPA filters are individually tested before shipment to ensure they meet rated efficiency and resistance. AAF Flanders HEPA and ULPA filters are available in a variety of efficiencies—from 99.97% tested on .3 µm particles to 99.9995% and higher tested on .1 to .2 µm particles. All filters are available scan-tested.

AstroCel® III
(see page 163)

Gas-Phase Products

AAF Flanders has assumed an industry leading position with the development of its innovative SAAF product line designed to reduce or eliminate harmful gaseous contaminants. In combination with our expertise in airborne particulate filtration, SAAF products and solutions allow us to develop unique and effective total filtration solutions to protect people, processes, and equipment.

Food and Beverage

Extensive Studies Show:

- **Government regulation** continues to rapidly **change and increase**
- There are **175,268 pages on IAQ** in the U.S. Code of Federal Regulations
- **56%** of commercial maintenance teams actually admit that **their IAQ maintenance is not carried out per IAQ guidelines**
- Indoor pollution levels can be **up to 5 times higher** than outdoor levels (in many cases up to 100 times higher)
- Lack of proper air filtration is the **#1 cause of poor IAQ**

Filtration Solutions

PerfectPleat® HC M8
(see page 122)

VariCel® 2+ HC
(see page 135)

AstroCel® II
(see page 180)

Sources: State of the Air 2015, American Lung Association, 2015; Database of state indoor air quality laws, Environmental Law Institute, 2015; The impact of air pollution on cognitive performance and human capital formation, Victor Levy et al, 2012

Prevention of Cross-Contamination

Within the Food and Beverage manufacturing facility, filtration is vital in preventing cross-contamination, ensuring consistent and superior quality products, and protecting people and process equipment.

Cross-contamination can lead to production down time and product loss, both of which impact the yield and profitability of the food and beverage producer. Having a well-sealed environment is the first step to preventing cross-contamination, and having superior filtration is key to maintaining the integrity of the process.

Protect Your Product, Customers, and Reputation

When any food or beverage producer wants to make a consistent and high quality product, filtration is the line of defense that prevents mold, spores, bacteria, viruses, and other byproducts from entering the manufacturing space. Environmental, health, and safety concerns factor into the equation both inside and outside of a manufacturing space. Both production workers and the outside environment need protection from the types of contamination that could be released into the air.

The Air Inside These Facilities Can Contain:

- Molds, spores, bacteria, or viruses
- Volatile organic compounds (VOCs)
- Malodorous compounds (e.g., vinegar)
- Fine dusts from sugar, flour, and/or other dry ingredients

Optimize Your Environment

AAF Flanders is ideally positioned to assess a food and beverage facility for room sealing, filtration efficiency and effectiveness, and for continuous improvement opportunities. Using a collaborative and consultative approach, AAF Flanders strives to understand your complete filtration needs and applications, as well as advising you on regulatory requirements for total air quality.

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Healthcare

Extensive Studies Show:

- Three to four million hospital-acquired infections (HAI) occur annually, with **up to 80,000 fatalities**
- Up to one-third of hospital-acquired infections involve **airborne transmission**
- There are **175,268 pages on IAQ** in the U.S. Code of Federal Regulations
- 56% of commercial maintenance teams actually admit that their **IAQ maintenance is not carried out per IAQ guidelines**
- Lack of proper air filtration is the **#1 cause of poor IAQ**

Sources: Air-treatment systems for controlling hospital-acquired infections, HPAC Engineering, April 2, 2008; Database of state indoor air quality laws, Environmental Law Institute, 2015; Perceptions in the U.S. building industry of the benefits and costs of improving indoor air quality, M. Hamilton et al, 2015; State of the Air 2015, American Lung Association, 2015

Indoor Air Quality (IAQ) is Critical to Patient and Worker Safety

Clean air is vital in hospital and healthcare facility operations to protect patients, staff, and visitors from airborne diseases and infections, as well as to provide a comfortable, healthy, and odor-free environment.

Healthcare facilities pay particular care to Indoor Air Quality (IAQ) concerns, because patients may have suppressed immune systems, making them more susceptible to adverse health effects. Healthcare workers, who spend many hours a day in facilities with potentially poor IAQ, are frequently at greater risk of exposure to infectious agents. Gaseous contaminants originate from a wide variety of sources, such as vehicle emissions, cleaning compounds, disinfectants, medical laboratories, office equipment, and waste removal areas..

The Air Inside These Facilities Can Contain:

These facilities face unique challenges in controlling airborne pollutants and gaseous contaminants.

- Molds, spores, pollens
- Carbon monoxide, radon, volatile organic compounds (VOCs)
- Bacteria, viruses, and byproducts
- Vehicle engine exhaust, exhaust from industrial plants
- Asbestos, clays, elemental particles, and man-made fibers

Strategic Approach to Air Filtration Solutions for Healthcare

Healthcare facilities pose a unique design challenge for heating, ventilation, and air conditioning (HVAC) system engineers. These systems fulfill a broad range of ventilation requirements and provide protection from airborne hazards. From operating rooms and laboratories to waiting areas and patient rooms—the risks and appropriate safety measures vary from space to space.

Our experts provide total filtration solutions to respond to every area in your healthcare facility—protecting patients, workers, and visitors is what we do.

Healthcare

Optimize Your Environment

Faced with an influx of potentially contagious patients and their families, it is clearly imperative to reduce risk by removing airborne contaminants generated inside and outside the doors of the facility. In addition to the effects of contaminants on patients and hospital workers, corrosive gases can damage HVAC units, control rooms and electronic instrumentation, diagnostic equipment, X-ray machines, and office equipment.

A thorough air filter audit of your HVAC Systems is the first step that AAF Flanders takes in order to provide you with professional guidance and analysis for cost savings and risk reduction. By conducting this audit, we will be able to understand your current state and then utilize TCO Diagnostic®, an advanced analytical software tool, to identify how you can improve air quality, energy savings, and operational flexibility while reducing total cost of ownership.

Filtration Solutions

HEPA/ULPA Filters

MEGAcel® II eFRM
(see page 177)

HEPA filters are the most efficient air filters commercially available. They are used in cleanroom and other applications requiring ultra-clean air—semi-conductor, electronics, pharmaceutical manufacturing, food processing, hospitals, and labs. AAF Flanders HEPA filters are individually tested before shipment to ensure they meet rated efficiency and resistance. AAF Flanders HEPA and ULPA filters are available in a variety of efficiencies—from 99.97% tested on .3 µm particles to 99.9995% and higher tested on .1 to .2 µm particles. All filters are available scan-tested.

Pleated Filters

The AAF Flanders pleated filters line provides the industry's broadest selection of high performance, high capacity filters, including specialty and standard capacity options. Pleated filters can be used as prefilters to protect and extend the life of higher efficiency, more expensive final filters. In many applications, they are the only filter used in an HVAC system.

Box Filters

VariCel® VXL
(see page 132)

These rigid, extended surface filters are ideal for use in all high efficiency applications. The supported pleat filters provide strength and integrity in high flow, turbulent, and variable airflow conditions. These filters are designed to remove airborne biological contaminants in critical areas.

Bag Filters

Non-supported pocket filters are the most economical, high-efficiency filters available, and an excellent choice for healthcare facilities, automotive paint booths, commercial buildings, and various industrial applications. Designed for high performance in demanding operating conditions, AAF Flanders extended surface pocket filters are perfect as both prefilters and final filters for particulate removal where clean air is required.

Gas-Phase Products

AAF Flanders has assumed an industry leading position with the development of its innovative SAAF product line designed to reduce or eliminate harmful gaseous contaminants. In combination with our expertise in airborne particulate filtration, SAAF products and solutions allow us to develop unique and effective total filtration solutions to protect people, processes, and equipment.

Hospitality

Extensive Studies Show:

- In the United States alone, hotels represent more than 5 billion square feet of space, nearly 5 million guest rooms, and close to **$4 billion in annual energy use**
- 56% of commercial maintenance teams actually admit that their **IAQ maintenance is not carried out per IAQ guidelines**
- Lack of proper air filtration is the **#1 cause of poor IAQ**
- 88% of facility managers say that **deferred maintenance is an issue**

Filtration Solutions

MEGApleat® M8 (see page 118)

VariCel® VXL (see page 132)

VariCel® M-Pak (see page 137)

Sources: LEED & the Hospitality Industry FAQ, www.usgbc.org/hospitality; Perceptions in the U.S. building industry of the benefits and costs of improving indoor air quality, M. Hamilton et al, 2015; State of the Air 2015, American Lung Association, 2015; CHP in the Hotel & Casino Market Sectors, U.S. Environmental Protection Agency CHP Partnership, December 2005; Assessing Green Building Performance, GSA Public Buildings Service

Critical Importance of Indoor Air Quality (IAQ)

The hotel guest experience is critical to the highly competitive and ever-changing hospitality industry. Excellent IAQ is a key component of that experience. In a hotel, convention, or casino environment, people spend 80% of their time inside the buildings. The indoor environment is therefore the most fundamental element of service quality. Guests want a healthy and comfortable environment in order to be productive at meetings and enjoy their leisure time, be it in their rooms, in restaurants, or around establishment premises. At the same time, employees need to be able to concentrate to work efficiently. To meet these expectations, good indoor air quality is essential.

The Air Inside These Facilities Can Contain:

- Molds, spores, pollens
- Carbon monoxide, radon, volatile organic compounds (VOCs)
- Bacteria, viruses, and byproducts
- Vehicle engine exhaust, exhaust from industrial plants
- Asbestos, clays, elemental particles, and man-made fibers

Optimize Your Environment

Air filtration systems in hotels must handle relatively large volumes of air. Approximately 50% of a building's energy consumption goes to the heating, cooling, and moving of air. In considering the Total Cost of Ownership (TCO), it is important to keep in mind that in order to have a cost-effective building, planning maintenance is an important step in maintaining energy efficiency, minimizing costly repairs, and extending the lifespan of your equipment.

Cost-Efficient Green Building Design

The U.S. Green Building Council (USGBC) works to promote cost-efficient and resource-saving green building design, construction, and operations, with the goal of protecting the global environment and human health. Green buildings use on average 26% less energy, emit 33% less carbon dioxide, use 30% less indoor water, and send 50%-75% less solid waste to landfills and incinerators. The opportunities for hospitality venues to integrate green building strategies into their design, construction, and daily operations makes good business sense and can be an important part of a company's commitment to sustainability.

AAF Flanders can assist you in the processes required to earn Leadership in Energy and Environmental Design (LEED) credits. The LEED Green Building Rating System,™ administered by USGBC, is the nationally accepted benchmark for designing and sustaining green buildings.

Life Sciences

Critical Environments

Containing Dangerous Airborne Particulates

Closed filtration systems with multiple barriers ensure hazardous particulates are contained in Nuclear, Biosafety, and Biotechnology applications.

- Government
- Nuclear Power Plants
- Dept. of Energy
- Laboratory Research
- Biosafety Labs (BSL)
- Universities
- Military Facilities
- Biotechnology
- Pharmaceutical Research
- Critical Infrastructure
  - Information Technology
  - National Monuments and Icons
  - Postal/Shipping
  - Communications

Filtration Solutions

AstroHood® S-I
(see page 195)

HEGA Filters
(see page 237)

Protection from Hazardous Biological Agents, Nuclear Radiation and Infectious Pathogens

Many of the technologies that lead to vast improvements in modern living and protect our health and safety also require work in critical environments with dangerous airborne particulates. These particulates could compromise public health and safety if these facilities suffered a breach. In these environments, you need equipment that is certain to perform.

Single Source Expertise and Customization for Critical Applications

AAF Flanders specializes in the design, manufacturing, and testing of complete, custom containment filtration systems incorporating HEPA filters with maximum filtration efficiency to prevent contamination of products and people. These systems contain various combinations of fan filters units, terminal modules, and hoods for fail-safe filtration and a virtually particulate-free environment.

All AAF Flanders contaminant products are designed, developed, and manufactured to exact standards for control of dangerous, toxic, or noxious contaminants. Containment systems are extremely high-efficiency systems used to filter and contain dangerous particulate and/or gaseous contaminants. In addition to its standard systems, AAF Flanders designs, manufactures, and tests custom filtration systems. High-quality, customized total containment filtration systems made by a single source ensure maximum performance reliability in adherence with required standards for clean air.

AstroSafe®
(see page 205)

Life Sciences

Pharmaceutical

Extensive Studies Show:

- Up to **65% of energy spending** at a pharma facility is related to moving air
- **77% of production downtime** can be attributed to **failures of equipment** and **environmental problems**
- **The time it takes to address a filter leak:**
  - **Five to ten minutes** planned time for an experienced team to scan a filter
  - At least **two labor hours** unplanned downtime to remove, replace, and retest a leaking filter
- Loss from a single microglass filter leak:
  - **$250,000+/hr** (two hours of unplanned downtime)
  - **$20,000** (documentation and meetings)

  Total Cost: $520,000+
- **$3,000 to $20,000 documentation costs** associated with a **single** filter **leak**

Sources: State of the Air 2015, American Lung Association, 2015; Database of state indoor air quality laws, Environmental Law Institute, 2015

Strict Standards Require the Highest Levels of Protection

Within the pharmaceutical industry, strict requirements on air purity levels are necessary because of the direct effect that airborne contamination has on the quality of the pharmaceutical products. Anything that could come into direct contact with a pharmaceutical product is a potential risk toward contamination. Especially for aseptically prepared parenteral medicine (such as injectables and infusions), no contamination can be allowed, otherwise severe harm or life-threatening health risks to the patient can result.

The Air Inside These Facilities Can Contain:

- Molds, spores, pollens
- Carbon monoxide, radon, volatile organic compounds (VOCs)
- Bacteria, viruses, and byproducts
- Vehicle engine exhaust, exhaust from industrial plants
- Asbestos, clays, elemental particles, and man-made fibers

Balancing High Level Protection with Total Cost of Ownership

Clean air is not possible without a carefully selected and reliably functioning air filtration system. The performance of installed air filters, whether terminal filters or prefilters, directly determines how effectively harmful contaminants are prevented from entering the airstream in process environments.

Leak-free and high filtration efficiency performance of the HEPA filter is vital for ensuring that air purity is optimized, the pressure differentials between rooms are met, and healthy working conditions are achieved. At all times air in critical areas should be supplied at the terminal stage by HEPA-filtered unidirectional airflow, preceded by sequential prefiltration steps. However, if the air filter selection process does not also consider the lifetime operating costs of a given product, facilities could be exposed to unnecessary risks and expenses.

A thorough air filter audit of your HVAC Systems is the first step that AAF Flanders takes in order to provide you with professional guidance and analysis for cost savings and risk reduction. By conducting this audit, we will be able to understand your current state and then utilize TCO Diagnostic®, an advanced analytical software tool, to identify how you can improve air quality, energy savings, and operational flexibility while reducing risk and total cost of ownership.

Life Sciences

Pharmaceutical

Providing Contaminant-free Environments for Pharmaceutical Drug Compounding

Compounding pharmacies prepare personalized prescription medications from individual ingredients mixed together in the exact strength and dosage required. Compounded medications can include capsules or tablets, creams or gels, and injectables. Because the risk of infection is greater with injectables, they must be prepared according to strict standards established by the United States Pharmocopeia (USP) Chapter 797 regulations for compounding sterile products.

Based on these standards, the air in the compounding area must meet ISO Class 5 standards for clean air, which specify the number of particles permitted per cubic meter of air, to prevent microbial contamination that could cause infection in patients.

Containment air filtration systems are essential to ensuring an environment free of dangerous microbial contaminants for compounding drugs safely.

Single Source Manufacturing and Expertise in Critical Pharmaceutical Applications

Containment filtration systems are designed, developed, and manufactured to exact standards for control of microbial contamination in compounding pharmacies. High quality, customized total containment filtration systems manufactured by a single source ensure maximum performance reliability in adherence with required ISO Class 5 standards for clean air.

AAF Flanders specializes in the design, manufacturing, and testing of complete, custom containment filtration systems incorporating HEPA filters with maximum filtration efficiency for a virtually particulate-free environment to prevent contamination of compounded drugs. The systems also contain fan filters units, terminal modules, and Model 22 hoods (PharmaGel™ modules) for fail-safe filtration.

AAF Flanders' leading expertise in critical applications and single-source, total system approach ensure compliance with stringent regulatory requirements for clean air and sterility, providing an environment free of microbial contamination that could lead to serious and deadly infections in patients.

Filtration Solutions

HEPA/ULPA Filters

MEGAcel® II eFRM
(see page 177)

HEPA and ULPA filters are the most efficient air filters commercially available. They are used in cleanroom and other applications requiring ultra-clean air—semiconductor, electronics, pharmaceutical manufacturing and research. AAF Flanders HEPA and ULPA filters are individually tested before shipment to ensure they meet rated efficiency and resistance. AAF Flanders HEPA and ULPA filters are available in a variety of efficiencies—from 99.97% tested on .3 µm particles to 99.9995% and higher tested on .1 to .2 µm particles. All filters are available scan-tested.

Box Filters

These rigid, extended surface filters are ideal for use in all high efficiency applications. The supported pleat filters provide strength and integrity in high flow, turbulent, and variable airflow conditions. These filters are designed to remove airborne biological contaminants in critical areas, such as hospitals and pharmaceutical processing.

Gas-Phase Products

AAF Flanders has assumed an industry leading position with the development of its innovative SAAF product line designed to reduce or eliminate harmful gaseous contaminants. In combination with our expertise in airborne particulate filtration, SAAF products and solutions allow us to develop unique and effective total filtration solutions to protect people, processes, and equipment.

Containment Filtration

All AAF Flanders contaminant products are designed, developed, and manufactured to exact standards for control of dangerous, toxic, or noxious contaminants. Containment systems are very high quality, high efficiency systems used to filter and contain dangerous particulate and/or gaseous contaminants. In addition to manufacturing standard components, AAF Flanders specializes in the design, manufacturing, and testing of complete custom filtration systems.

Containment Systems
(see page 205)

Microelectronics

Improve Yield and Reduce Risk

Proper deployment of particulate and gaseous filtration systems in semiconductor manufacturing will:

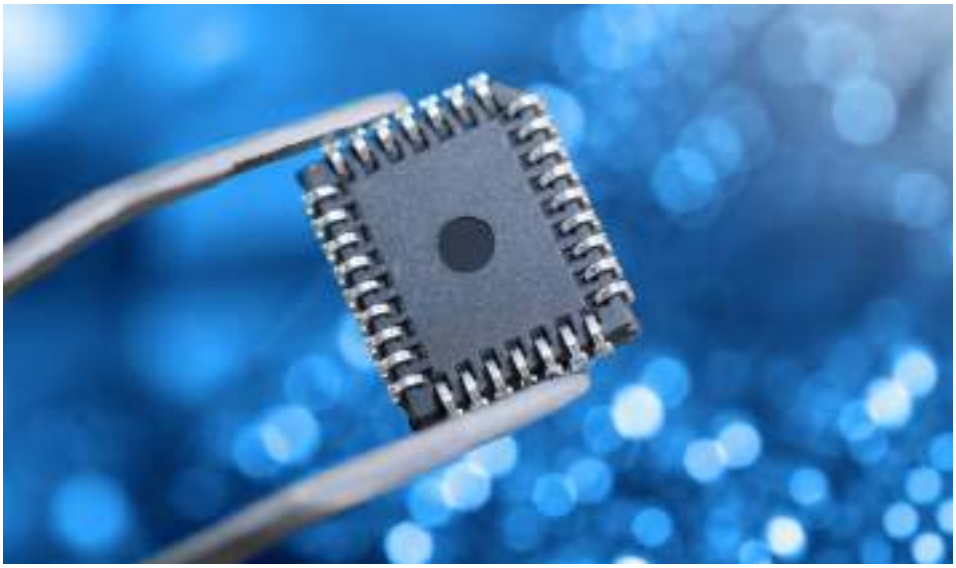
- Maintain high levels of component dependability
- Reduce unplanned shutdowns to avoid potentially large business and financial losses
- Reduce failures due to:
  - Obstruction of cooling airflow
  - Interference with moving or optical parts
  - Deformation of surfaces
  - Corrosion of electrical components
  - Impedance changes
  - Circuit conductor bridging

Filtration Solutions

VisionAir™ Clean/ SAAF™ Tech Tools (see pages 69 and 72)

MEGAcel® II ePTFE (see page 179)

Gas-Phase Products (see page 211)



Critical Importance of Indoor Air Quality (IAQ)

Air quality within high-yield, low-reject semiconductor manufacturing facilities is more important than ever. Particulate and corrosive gaseous contaminants have become a serious problem in these facilities. Contaminants enter the facilities in a variety of ways, including outdoor ventilation systems, adjacent interior areas, and with individuals entering and exiting.

Manufacturing memory chips, wafers, and other microelectronic components requires a very precise and exacting process. The conducting pathways that form a circuit on a chip or wafer continue to grow more narrow and closer to each other, which helps increase the processing speed of the chip. The distance between lines etched on modern chips is now measured in nanometers. ULPA filters, (U15 or higher per EN1822), the terminal filter of choice for chip manufacturing, provide the extreme efficiency required to prevent a dust speck from landing on two lines, causing a short-circuiting event that would negatively affect performance.

Controlling Risks from Airborne Molecular Contamination (AMC)

AMCs also presents problems for semiconductor manufacturers. Phosphorus, boron, arsenic, and antimony, collectively known as dopants, are used in the manufacturing process to alter the conductivity of certain parts of the chip. Any extraneous dopant in the environment results in more than the precise amount required by the manufacturer, ruining the finished component. Conventional boro-silicate glass filter media may contribute unwanted quantities of boron. This side effect drove the development and adoption of boron-free expanded PolyTetraFluoroEthylene (ePTFE) media filters as the preferred filter to situate over semiconductor tools. Combined with phosphorus-free polyurethane sealant, ePTFE filters prevent the exposure of microchips to damaging chemicals during the manufacturing process.

Additionally, sulfur-bearing AMCs such as sulfur dioxide (SO_2) and hydrogen sulfide (H_2S) present the risk of corrosion to equipment. These gaseous contaminants lead to deterioration of copper surfaces and silver solder used on circuit boards, leading to failures by either impeding the flow of electricity or forming unintended circuit paths. Elimination of corrosive contaminants is therefore essential in maintaining equipment reliability. Along with boron-free HEPA and ULPA filters, gas-phase filtration is recommended to control AMCs in microelectronics manufacturing facilities.

Microelectronics

Aerospace

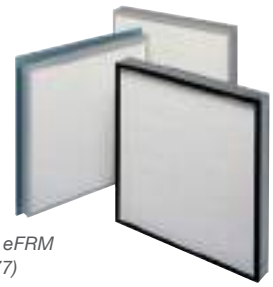
Controlling Critical Issues

Objects and equipment bound for interplanetary travel or orbits must be protected against extremely harsh conditions. Aerospace cleanroom designers need to control two critical issues:

- Molecule contamination occurs when molecular components (AMCs) come to rest on sensitive electrical or optical components, damaging them or resulting in lower resolution optics
- Particle contamination can occur when extraneous AMCs or particles compromise optics and electronics during assembly. A speck of dust, a hair follicle, or a fingerprint can compromise sensitive components

Filtration Solutions

MEGAcel® I eFRM
(see page 161)



MEGAcel® II eFRM
(see page 177)

Gas-Phase Products
(see page 211)

Protection in Extremely Harsh Conditions

Assembly of aerospace components can range from small electronic components to objects large enough to be carried in a mission's payload, such as the Hubble Space Telescope. NASA's Goddard Space Flight Center houses an example of such an aerospace cleanroom. This Greenbelt, MD facility contains a HEPA filter-supplied, horizontal flow, ISO 7 cleanroom.

In aerospace, cleanroom designers need to control for two critical issues: molecular and particle contamination. Objects and equipment bound for interplanetary travel or orbits around celestial bodies must be protected against extremely harsh conditions much more severe than that experienced on Earth. Take, for example, the aforementioned NASA's Hubble Space Telescope. When orbiting the earth, the telescope must withstand widely variable temperature swings. The energy of the sun will heat it to temperatures that can literally boil components. During preparations for launch, susceptible components must be heated in a vacuum chamber to eliminate off-gassing of these materials. If not removed, these molecular components (AMCs) can come to rest on sensitive electrical or optical components, damaging them or resulting in lower resolution optics.

Reducing the Risk to Sensitive Components

Particle control represents a major concern as well. The same optics and electronics require protection during assembly, or extraneous AMCs or particles can damage multimillion-dollar projects. To compound the problem, this damage caused by contamination is almost impossible to correct once a spacecraft is launched. A speck of dust, a hair follicle, or a fingerprint can compromise sensitive components. The assembly of aerospace devices and components takes place in a cleanroom to protect against such contaminants. The HEPA and AMC filters supplied in critical aerospace applications prevent these potential problems from occurring.

Museums and Historic Storage

Damage to Artifacts and Artwork Can Be Caused by:

- Uncontrolled temperature
- Relative humidity
- Dust and dirt
- Gaseous pollutants, such as ozone and sulfur dioxide

Filtration Solutions

SAAF™ Cassettes
(see page 213)

MEGApleat® M8
(see page 118)

VariCel® VXL
(see page 132)

Source: The impact of air pollution on cognitive performance and human capital formation, Victor Levy et al, 2012

Protecting Precious and Priceless Objects

In preservation environments, Indoor Air Quality (IAQ) is a primary concern. The pollution levels in this indoor air can be up to five times higher than outdoor levels, and in some cases 100 times higher. Controlling airborne pollutants and gaseous contaminants is fundamental to protecting priceless collections of artifacts, national historical assets and documents, artwork, and literature. By maximizing the life of these objects, we essentially protect our heritage, as well as our vintage treasures.

Environmental Factors

Damage to collectibles can be caused by uncontrolled temperature and relative humidity, dust and dirt, as well as gaseous pollutants such as ozone and sulfur dioxide. Temperature and humidity, if not controlled properly, can speed up the rate of chemical reactions that cause much of the deterioration of sensitive objects. Dust and dirt contamination can cause artifacts to discolor and can potentially scratch precious gems, while gaseous pollutants may cause significant and irreversible deterioration of artifacts, metals, historic records, photographs, and marble through chemical reactions. Poor Indoor Air Quality (IAQ) can also have adverse health effects on employees and visitors.

Optimize Your Environment

Using SAAF™ Tech Tools, a decision science solution program for configuring gas-phase applications, AAF Flanders experts can identify optimal media and equipment solutions. SAAF Tech Tools simplifies the complexities surrounding gas-phase applications through a guided problem solving experience.

A thorough air filter audit of your HVAC Systems is the first step that AAF Flanders takes in order to provide you with professional guidance and analysis for cost savings and risk reduction. By conducting this audit, we will be able to understand your current state and then utilize SAAF Tech Tools and TCO Diagnostic®, advanced analytical software tools, to identify how you can improve air quality, energy savings, and operational flexibility while reducing risk and total cost of ownership.

Pulp and Paper

There Are Several Ways a Plant Can Produce Pulp:

The four primary processes employed in the U.S. and Canada are:

1. Kraft (a chemical process)
2. Sulfite (a chemical process)
3. Mechanical
4. Thermomechanical

Filtration Solutions

MEGApleat® M8
(see page 118)

SAAF™ Cassettes
(see page 213)

Contaminant Risk

The primary source for gaseous contamination in pulp and paper mills is the pulping process. In the Kraft pulping process, highly malodorous emissions of reduced sulfur compounds are produced. These compounds are measured as total reduced sulfur (TRS) and include hydrogen sulfide, methyl mercaptan, dimethyl sulfide, and dimethyl disulfide. These sulfur compounds are often described as smelling like rotten cabbage. In the sulfite pulping process, sulfur oxides are also emitted in fairly significant concentrations. Other pulping processes, such as the mechanical and thermomechanical methods, generate significantly lower quantities of air emissions.

In addition, steam and electricity-generating units using coal or fuel oil emit fly ash, sulfur oxides, and nitrogen oxides. A secondary source of corrosive gases in the pulping process is during the bleaching step. These bleaching chemicals, which often include lime, are caustic and cause corrosion to occur.

Optimize Your Environment

For particulate filtration, dust collectors (wet and dry), bag houses, and several stages of HVAC-type air filtration products are employed to help keep the wood fiber and associated dust to a minimum. Ensuring that this dust is removed is extremely important to both the paper quality and the maintenance of the pulping equipment and paper production machines.

At a minimum, protection of the control room includes pressurization with purified air. This prevents corrosive gases from infiltrating the control room and causing corrosion problems. Additionally, recirculation air may require cleaning, if the room is a high traffic area or there are other internal sources of contaminants.

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Refineries

Types of Failures

Failures due to particulate and contaminant dust are generally classified as:

- Mechanical effects, including obstruction of cooling airflow, interference of moving or optical parts, and deformation of surfaces
- Chemical effects, including corrosion of electrical components, due to dust comprised of sulfur and chlorine bearing salts
- Electrical effects, including impedance changes and electronic circuit conductor bridging

Filtration Solutions

MEGApleat® M8
(see page 118)

SAAF™ Cassettes
(see page 213)

Critical Importance of Air Quality

Control rooms are utilized by large-scale refineries to monitor and control plant operations. The control room and network of control equipment are essential to plant operation and enable these facilities to maintain the highest efficiency possible. If the control room malfunctions, it can cost a plant tens of thousands of dollars per hour.

Particulate and corrosive gaseous contaminants have become a serious problem for these control rooms, sometimes resulting in catastrophic failures of equipment. These contaminants enter the control rooms in a variety of ways, including outdoor ventilation systems, adjacent interior areas, and with individuals entering and exiting the room.

Corrosive Contaminant Risk

Sulfur-bearing gases, such as sulfur dioxide (SO_2) and hydrogen sulfide (H_2S), are the most common gases causing corrosion of electronic equipment. Once introduced into a control room, these gaseous contaminants lead to deterioration of copper surfaces and silver solder used on computer circuit boards, leading to intermittent and hard failures. These forms of corrosion can cause failure by impeding the flow of electricity. Elimination of corrosive contaminants is therefore essential in maintaining data center equipment reliability.

In response to these problems, ISA (Instrumentation, Systems, and Automation Society) developed a standard to classify control rooms and process control environments – ISA 71.04. Most equipment manufacturers require that the control room environment meet the ISA G1 – Mild classification to maintain a reliable communication network in industrial environments.

Optimize Your Environment

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Residential

AAF Flanders is proud to offer a broad range of state-of-the-art air filters designed for use in Residential applications, made to the same high standards as our Commercial products.

We manufacture replacements for all the most common sizes and types of residential filters, including 1″ and 4″ deep pleated filters, at most of our 11 plants across North America. These products are designed to keep your HVAC equipment running smoothly and capture contaminants such as:

- Dust and lint
- Dust mite debris
- Pollen
- Pet dander
- Mold
- Bacteria
- Microscopic allergens
- Virus carriers
- Most smoke
- Smog
- Oil smoke
- Lead dust

Indoor Air Quality (IAQ) Solutions

We spend the bulk of our time indoors, and yet the Environmental Protection Agency warns that **air inside buildings – including your home** – could be anywhere from **two to five times more polluted** than outdoor air. While pollen, smoke, and vehicle emissions are widely recognized outdoor threats to clean air, indoor pollutants such as building materials, cleaning chemicals, candle smoke, mold spores, and other household sources generally go unnoticed.

Protecting Families

These same indoor pollutants present even more challenges for families who struggle with allergies and asthma. To make matters worse, young children can be even more sensitive to allergy and asthma triggers than adults. Combat these issues by selecting air filters of sufficient efficiency to remove these particles from indoor air, and changing out these filters as appropriate.

Easy to Install

Installing and changing out filters to ensure that you and your family breathe quality air does not have to be a major chore. We ensure that our filters are made to fit snugly in your system, so that they are easy to change out while maintaining a tight seal during operation. All you need to know is where your furnace is located, the size of the filter that it takes, and which way the air flows.

If you are unsure about these points, you can find helpful tips and information on our website: www.aafintl.com/en/residential/resources

Residential

We offer Residential air filters under various brands and make them available via many fine retailers both in-store and online.

NaturalAire

NaturalAire pleated filters remove dramatically more potentially harmful airborne particles compared to basic fiberglass filters. Even better, they are designed to last at least 90 days in operation, freeing you from the monthly filter changes required by lower-efficiency filters. We offer these products in a range of efficiencies, from MERV 8 to MERV 13, with certain filters specifically designed to control odors and allergens.

Other Residential Products

Through our strong partnerships with great retailers, we are also proud to offer a complete line of high-performance residential filters under brand names such as Honeywell, Rheem, ACE, and Do it Best. We work with our retail partners to design exclusive filters tailored to the needs of their customers and, where appropriate, tested and labeled in accordance with their proprietary standards. AAF Flanders filters made for such brands are available in stores across the U.S.

Schools and Universities

Extensive Studies Show:

- Students attending schools with poor indoor air quality score **11% lower on standardized tests** than those students attending schools in good condition, according to the U.S. Department of Education's Office of Education Research and Improvement
- A third or more of U.S. schools have **mold, dust, and other indoor air problems** serious enough to provoke respiratory issues like asthma in students and teachers
- An average of one out of every 10 school-age children has asthma, which is a l**eading cause of school absenteeism**
- The economic cost of asthma amounts to more than **$56 billion annually**, including direct medical costs from hospital stays and indirect costs (e.g. lost school and work days)
- Up to **65%** of asthma cases in school-aged children **could be prevented with proper IAQ**

Filtration Solutions

MEGApleat® M8
(see page 118)

Sources: Creating healthy indoor air quality in schools, U.S. Environmental Protection Agency, www2.epa.gov/iaq-schools; Asthma Facts, U.S. Environmental Protection Agency, Indoor Environments Division, Office of Air and Radiation, August, 2015

Critical Importance of Indoor Air Quality (IAQ)

IAQ is a primary concern for both schools and universities, due in part to the age and overall condition of a number of educational buildings. In 2014, the National Center for Education Statistics surveyed a sample of school districts and estimated that the average age of the nation's main school buildings was 55 years old. Additionally, nearly one-fourth of the nation's schools have one or more buildings in need of extensive repair or replacement, and nearly half have been reported to have problems related to IAQ. Students spend more than 1,300 hours in a school building each year and need to be protected.

The Air Inside These Facilities Can Contain:

- Molds, spores, pollens
- Carbon monoxide, radon, volatile organic compounds (VOCs)
- Bacteria, viruses, and byproducts
- Vehicle engine exhaust, exhaust from industrial plants
- Asbestos, clays, elemental particles, and man-made fibers

The health and comfort of students and teachers are among the many factors that contribute to learning and productivity in the classroom, which in turn affect performance and achievement. In addition, failure to respond promptly and effectively to poor indoor air quality in schools can lead to an increase in long-term health problems, costly repairs, and potential liability problems.

Optimize Your Environment

Quality air filtration system design, operation, and maintenance are critical for providing clean and healthy IAQ in schools. Properly functioning filtration systems clean the air of dirt, dust, pollen, dander, and fibers, control odors, and reduce the pollutants that cause most IAQ problems inside school buildings. In addition to improving occupant health and performance, regular HVAC maintenance also saves energy.

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Transportation

Poor Intake Air Quality Can:

- Reduce engine performance
- Create higher fuel consumption
- Increase exhaust fumes

Filtration Solutions

AmerKleen™ Bags

AmerKleen™ M80

ASC® Cartridges

For more information on Engine Air Filtration, contact AAF at 888-388-0529

Corrosive Contaminant Risk

For diesel engines, contaminants and particulates in the air such as fumes, dust, and smog can lead to severe damage of engine components. The air that these engines “breathe” needs to be as clean as possible. Poor intake air quality can reduce engine performance, create higher fuel consumption, and increase exhaust fumes.

Optimize Your Environment

Constructed from two layers of glass fiber media, AAF Flanders’ AmerKleen™ filter provides an extremely high dust holding capacity, allowing it to remain in service longer than most other intake air filters. With this long service life, low resistance, and high filtration efficiency, the AmerKleen filter provides an excellent filtration solution for the scheduled engine maintenance cycle. This results in extended engine life and reduced life cycle costs.

AAF Flanders is one of a few producers of this nonflammable glass fiber media, as well as the prime supplier of the AmerKleen cartridge housing.

Wastewater Treatment

Corrosive Contaminant Risk

Not only is hydrogen sulfide potentially dangerous at high concentrations, but electronic corrosion at these plants can occur when corrosive, acidic gases attack sensitive computer controls and other critical electronics that affect the reliability of plant processes.

If Not Controlled, Corrosion Leads To:

- Blocked currents
- Brittle connection points
- Overheated systems
- Costly repairs
- Failed boards in control systems
- Plant downtime
- Reduced production efficiency in compressed air systems and increased maintenance costs

Filtration Solutions

MEGApleat® M8
(see page 118)

BioCel® VXL
(see page 143)

SAAF™ PORTA-Scrubber
(see page 242)

Critical Importance of Air Quality

Control rooms are utilized by large-scale wastewater treatment plants to monitor and control plant operations. The control room and network of control equipment are essential to plant operation and enable these plants to maintain the highest efficiency possible. If the control room malfunctions, it can cost a plant tens of thousands of dollars per hour.

Particulate and corrosive gaseous contaminants have become a serious problem for these control rooms, sometimes resulting in catastrophic failures of equipment. These contaminants enter the control rooms in a variety of ways, including outdoor ventilation systems, adjacent interior areas, and with individuals entering and exiting the room.

Dangerous Odors

Industrial wastewater treatment generates odors that can be strong, persistent, and a nuisance to employees, residents, businesses, and industries located near the wastewater treatment plant. Strong odors develop at several areas within a wastewater treatment facility, such as headworks, primary clarifiers, pump stations, and sewage sludge areas. Nuisance odors often emerge from the following sources: combined sewer overflow (BTEX, TCE, and other VOCs); industrial sewage (benzene, industrial chemical effluents such as amines, and other VOCs); and residential sewage (ammonia, hydrogen sulfide, and mercaptans).

Optimize Your Environment

Using SAAF™ Tech Tools, a decision science solution program for configuring gas-phase applications, AAF Flanders experts can identify optimal media and equipment solutions. SAAF Tech Tools simplifies the complexities surrounding gas-phase applications through a guided problem solving experience.

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Wildfires

Extensive Studies Show:

- Two-thirds of the US, **nearly 212 million people**, live in counties beset by wildfire smoke
- For places that had medium- to high-density smoke for at least 12 days, the smoke covered an area **nearly 50 times larger** than the areas directly burned by the fire

Filtration Solutions

AmAir/C®
(see page 231)

VariCel® VXL
(see page 132)

VariSorb® XL15
(see page 225)

Source: Alisa Opar, Smoke Gets in Your Eyes (From Distant Flames), National Resources Defense Council, August 2015; National Resources Defense Council (NRDC) analysis, 2011; Kim Knowlton, Up in smoke: stifling heat, wildfires and the toll on human health, National Resources Defense Council, September 2014; Keith Matheny, Smell of Tennessee wildfire smoke reaches lower Michigan, Detroit Free Press, November 29, 2016; H. Ammann et al.,Wildfire Smoke: A Guide for Public Health Officials, Environmental Protection Agency, 2001

The Threat from Wildfires—Hundreds of Miles Away

Smoke plumes can carry dangerous gases and toxins hundreds or thousands of miles, exposing hundreds of millions of Americans each fire season to harmful particulates. The National Weather Service's Grand Rapids station noted a number of residents in the southern Lower Peninsula of Michigan reported smelling the smoke from the wildfires that recently destroyed more than 150 homes and businesses in Gatlinburg and Pigeon Forge, Tennessee, some 600 miles or more away.

The wide variety of pollutants released by wildland fire includes:

- greenhouse gases (carbon dioxide (CO_2)
- methane (CH_4)
- nitrous oxide (N_2O)
- photochemically reactive compounds
  - carbon monoxide (CO)
  - nonmethane volatile organic carbon (NMVOC)
  - nitrogen oxides (NOx)
- fine and coarse particulate matter (PM)
- light hydrocarbons and polycyclic aromatic hydrocarbons (PAH)
- ammonia (NH_3)
- peroxides
- chlorine and bromine compounds

Now is the Time to Be Proactive

AAF Flanders can protect your environment from exposure and reduce your risk from the affects of wildfire smoke with our high efficiency carbon filters. Carbon filters are designed to improve indoor air quality through the effective removal of indoor and outdoor particulate and harmful gaseous contaminants.

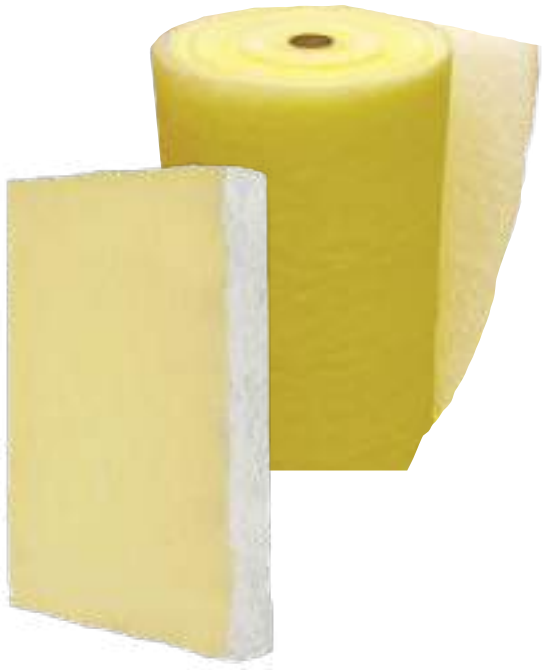
Available solutions include:

- Highest activity carbon = highest adsorption
- Energy efficient mini-pleat design
- High capacity disposal filter options
- Retrofit into existing HVAC systems
- Economical solutions available for gaseous contaminant problems including odors

HVAC Products

HVAC

FrontLine™ Gold Media



Product Overview

- Heavy-duty, industrial grade fiberglass media
- Extra high fiber content
- Heavy application of Viscosine™ adhesive
- Very high compression strength

Specifications

Efficiency	75%–90% Arrestance
Depth	1″, 2″
Media Type	Fiberglass
Special Size Available	Yes
Antimicrobial Available	No
Max Operating Temperature	175°F (79°C)
Air Filtration Certification	UL 900, ULC-S111

Product Information

Part Number	Nominal Size (W x H x D)	Std. Pkg. Qty.	Shipping Wt. Lbs. per Box (± 10%)	Cubic Ft.
1″ Pads				
629-151-319	12″ x 24″ x 1″	50	7.0	4.9
629-151-500	16″ x 20″ x 1″	50	7.4	2.1
629-151-600	16″ x 25″ x 1″	50	9.3	2.6
629-151-700	20″ x 20″ x 1″	50	9.3	2.6
629-151-800	20″ x 25″ x 1″	50	11.3	3.3
629-151-863	24″ x 24″ x 1″	50	12.7	3.9
1″ Rolls				
630-151-080	8″ x 85′ x 1″	2	6.0	2.1
630-151-120	12″ x 85′ x 1″	2	8.9	2.9
630-151-240	24″ x 85′ x 1″	2	17.9	6.4
630-151-250	25″ x 85′ x 1″	2	18.6	6.4
630-151-360	36″ x 85′ x 1″	2	26.8	8.8
630-151-480	48″ x 85′ x 1″	2	35.7	11.4
630-151-600	60″ x 85′ x 1″	1	24.0	14.0
2″ Pads				
629-252-328	12″ x 24″ x 2″	40	9.5	4.9
629-252-608	16″ x 20″ x 2″	30	6.8	2.1
629-252-611	16″ x 25″ x 2″	30	8.5	2.6
629-252-516	18″ x 24″ x 2″	40	11.0	7.0
629-252-805	20″ x 20″ x 2″	30	8.5	2.6
629-252-517	20″ x 24″ x 2″	30	10.0	3.3
629-252-813	20″ x 25″ x 2″	30	10.3	3.3
629-252-858	24″ x 24″ x 2″	30	11.6	3.9
2" Rolls				
630-252-120	12″ x 85′ x 2″	2	13.3	2.9
630-252-240	24″ x 85′ x 2″	2	26.2	6.4
630-252-250	25″ x 85′ x 2″	2	27.3	6.4
630-252-360	36″ x 85′ x 2″	2	39.3	8.8
630-252-480	48″ x 85′ x 2″	2	52.4	11.4
630-252-600	60″ x 85′ x 2″	1	34.0	7.3

Additional sizes available upon request.

HVAC

PolyKlean™ Blue Media

Product Overview

- Medium to heavy-duty applications
- Durable 100% polyester fibers
- Pressure sensitive dry tack adhesive on air leaving side
- Non-toxic, non-allergenic
- Fully incinerable
- Easy to handle
- ½″, 1″, and 2″ thicknesses

Specifications

Filter Depth	½″, 1″, 2″
Media Type	Synthetic
Special Size Available	Yes
Antimicrobial Available	No
Max Operating Temperature	175°F (79°C)
Air Filtration Certification	UL 900

Product Information

Part Number	Nominal Size (W x H x D)	Std. Pkg. Qty.	Shipping Wt. Lbs. per Box (± 10%)	Cubic Ft.
½″ Pads				
358-015-319	12″ x 24″ x ½″	60	6.5	4.0
358-015-700	20″ x 20″ x ½″	60	9.1	5.6
358-015-782	20″ x 24″ x ½″	60	11.0	6.7
358-015-863	24″ x 24″ x ½″	60	13.0	7.7
1″ Pads				
358-011-319	12″ x 24″ x 1″	40	6.3	4.0
358-011-700	20″ x 20″ x 1″	40	7.9	5.4
358-011-782	20″ x 24″ x 1″	40	10.0	6.7
358-011-863	24″ x 24″ x 1″	40	11.0	7.7
2″ Pads				
358-012-319	12″ x 24″ x 2″	20	5.3	4.0
358-012-700	20″ x 20″ x 2″	20	6.6	5.4
358-012-782	20″ x 24″ x 2″	20	8.0	6.7
358-012-863	24″ x 24″ x 2″	20	9.0	8.1
1/2″ Rolls				
357-015-120	12″ x 135′	3	11.1	25.5
357-015-240	24″ x 135′	2	14.9	34.0
357-015-360	36″ x 135′	1	11.8	25.5
357-015-480	48″ x 135′	1	14.9	34.0
357-015-600	60″ x 135′	1	18.6	42.5
1″ Rolls				
357-011-120	12″ x 90′	3	11.1	25.5
357-011-240	24″ x 90′	2	14.9	34.0
357-011-360	36″ x 90′	1	10.8	25.5
357-011-480	48″ x 90′	1	14.4	34.0
357-011-600	60″ x 90′	1	18.0	42.5
2″ Rolls				
357-012-120	12″ x 75′	3	12.6	33.3
357-012-240	24″ x 75′	2	16.8	44.4
357-012-360	36″ x 75′	1	10.4	33.3
357-012-480	48″ x 75′	1	13.8	44.4
357-012-600	60″ x 75′	1	17.3	55.6

Additional sizes available upon request.

HVAC

PolyKlean™ White Media

Product Overview

- Light to medium-duty applications
- Durable 100% polyester fibers
- Dry media—no adhesive
- Non-toxic, non-allergenic
- Fully incinerable
- Easy to handle
- ½″, 1″, and 2″ thicknesses

Specifications

Filter Depth	½″, 1″, 2″
Media Type	Synthetic
Special Size Available	Yes
Antimicrobial Available	No
Max Operating Temperature	175°F (79°C)
Air Filtration Certification	UL 900

Product Information

Part Number	Nominal Size (W x H x D)	Std. Pkg. Qty.	Shipping Wt. Lbs. per Box (± 10%)	Cubic Ft.
½″ Pads				
358-035-319	12″ x 24″ x ½″	60	6.0	4.0
358-035-700	20″ x 20″ x ½″	60	8.7	5.6
358-035-782	20″ x 24″ x ½″	60	10.0	6.7
358-035-863	24″ x 24″ x ½″	60	12.0	8.0
1″ Pads				
358-031-319	12″ x 24″ x 1″	40	5.3	4.2
358-031-700	20″ x 20″ x 1″	40	7.5	5.4
358-031-782	20″ x 24″ x 1″	40	9.5	6.7
358-031-863	24″ x 24″ x 1″	40	10.5	8.1
2″ Pads				
358-032-319	12″ x 24″ x 2″	20	4.0	4.0
358-032-700	20″ x 20″ x 2″	20	5.5	5.6
358-032-782	20″ x 24″ x 2″	20	7.0	7.0
358-032-863	24″ x 24″ x 2″	20	8.0	8.0
½″ Rolls				
357-035-120	12″ x 135′	3	11.2	25.5
357-035-240	24″ x 135′	2	15.0	17.0
357-035-360	36″ x 135′	1	11.2	25.5
357-035-480	48″ x 135′	1	15.0	34.0
357-035-600	60″x 135′	1	18.7	42.5
1" Rolls				
357-031-120	12″ x 90′	3	10.5	25.5
357-031-240	24″ x 90′	2	14.0	34.0
357-031-360	36″ x 90′	1	10.5	25.5
357-031-480	48″ x 90′	1	14.0	34.0
357-031-600	60″ x 90′	1	17.5	42.5
2" Rolls				
357-032-120	12″ x 75′	3	14.1	33.3
357-032-240	24″ x 75′	2	18.8	44.4
357-032-360	36″ x 75′	1	14.1	33.3
357-032-480	48″ x 75′	1	18.8	44.4
357-032-600	60″ x 75′	1	23.4	55.6

Additional sizes available upon request.

HVAC

Roll-O-Mat® Gold with Scrim

Product Overview

- Premium quality 2″ thick, continuous filament fiberglass media
- Progressive density media to prevent face-loading
- Replacements available for all common autoroll types and sizes
- Scrim-backed to prevent bypass leakage
- Heavy application of Viscosine™ adhesive for superior dust retention
- 65′ long rolls

Specifications

Efficiency	80%–85% Arrestance
Filter Depth	2″
Media Type	Fiberglass
Antimicrobial Available	No
Air Filtration Certification	UL 900, ULC-S111

Product Information

Part Number	Filter Size	Media Core Dimensions (Length x I.D.)	Nominal Roll Size (Media Only)	Std. Pkg. Qty.	Shipping Wt. Lbs. per Box (± 10%)	Cubic Ft.
800-205-100	21	24½″ x 1⅛″	22¼″ x 65′	1	16.0	2.3
800-222-100	22	22¼″ x 1⅛″	24″ x 65′	1	16.0	2.3
800-248-100	25	24⅞″ x 1⅛″	26⅝″ x 65′	1	16.0	2.7
800-318-100	32	31⅞″ x 1⅛″	34″ x 65′	1	20.7	3.3
800-327-100	33 or 3′	32¾″ x 1⅛″	34¾″ x 65′	1	22.7	3.3
800-385-100	39	38½″ x 1⅛″	40⅝″ x 65′	1	26.0	4.0
800-398-100	40	39⅞″ x 1⅛″	42⅛″ x 65′	1	26.9	4.0
800-447-100	45 or 4′	44¾″ x 1⅛″	47¼″ x 65′	1	27.6	4.5
800-567-100	57 or 5′	56¾″ x 1⅛″	59¼″ x 65′	1	33.2	5.6
800-687-100	69 or 6′	68¾″ x 1⅛″	71½″ x 65′	1	37.4	6.7

Replacement rolls for AAF Flanders Roll-O-Mat® units shown above. Replacement rolls for other manufacturer's equipment and additional sizes available upon request.

HVAC

Roll-O-Mat® Green

Product Overview

- Replacements available for all common autoroll types and sizes
- Tackified with Viscosine™ adhesive to retain dust
- Scrim-backed to prevent bypass leakage
- Available in ½″ and 1″ thicknesses
- 100% polyester fibers
- 65′ long rolls

Specifications

Efficiency	70%–75% Arrestance
Filter Depth	½″, 1″
Media Type	Synthetic
Antimicrobial Available	No
Air Filtration Certification	UL 900, ULC-S111

Product Information

Part Number	Filter Size	Media Core Dimensions (Length x I.D.)	Nominal Roll Size (Media Only)	Std. Pkg. Qty.	Shipping Wt. Lbs. per Box (± 10%)	Cubic Ft.
1″						
870-222-300	22	22¼″ x 1⅛″	22½″ x 65′	1	13.0	2.3
870-248-300	25	24⅞″ x 1⅛″	25¼″ x 65′	1	13.7	2.7
870-318-300	32	31⅞″ x 1⅛″	33″ x 65′	1	15.6	3.3
870-327-300	33 or 3′	32¾″ x 1⅛″	33″ x 65′	1	15.8	3.3
870-385-300	39	38½″ x 1⅛″	38¾″ x 65′	1	17.4	4.0
870-398-300	40	39⅞″ x 1⅛″	40¼″ x 65′	1	18.0	4.0
870-447-300	45 or 4′	44¾″ x 1⅛″	45″ x 65′	1	20.1	4.5
870-567-300	57 or 5′	56¾″ x 1⅛″	57″ x 65′	1	23.3	5.6
870-687-300	69 or 6′	68¾″ x 1⅛″	69″ x 65′	1	26.6	6.7
½″						
860-205-300	21	20½″ x 1⅛″	20¾″ x 65′	1	10.9	2.3
860-222-300	22	22¼″ x 1⅛″	22½″ x 65′	1	11.3	2.3
860-248-300	25	24⅞″ x 1⅛″	25¼″ x 65′	1	11.8	2.7
860-318-300	32	31⅞″ x 1⅛″	33″ x 65′	1	13.2	3.3
860-327-300	33 or 3′	32¾″ x 1⅛″	33″ x 65′	1	13.4	3.3
860-385-300	39	38½″ x 1⅛″	38¾″ x 65′	1	14.5	4.0
860-398-300	40	39⅞″ x 1⅛″	40¼″ x 65′	1	15.8	4.5
860-447-300	45 or 4′	44¾″ x 1⅛″	45″ x 65′	1	16.7	4.5
860-567-300	57 or 5′	56¾″ x 1⅛″	57″ x 65′	1	19.1	5.6
860-687-300	69 or 6′	68¾″ x 1⅛″	69″ x 65′	1	21.4	6.7

Replacement rolls for AAF Flanders Roll-O-Mat® units shown above. Replacement rolls for other manufacturer's equipment and additional sizes available upon request.

HVAC

AmerKleen™ M80

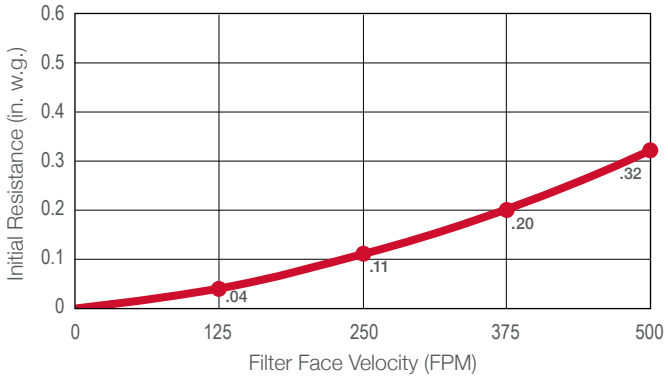
Product Overview

- Glass fiber pad with progressive density
- Strong resilient design
- Impregnated with gel-like adhesive
- High Dust Holding Capacity (DHC)
- Disposable

Specifications

Efficiency	85%–90% Arrestance
Filter Depth	4″
Media Type	Fiberglass
Special Size Available	Yes
Antimicrobial Available	No
Max Operating Temperature	175° (79°C)
Air Filtration Certification	UL 900

Initial Resistance vs. Filter Face Velocity



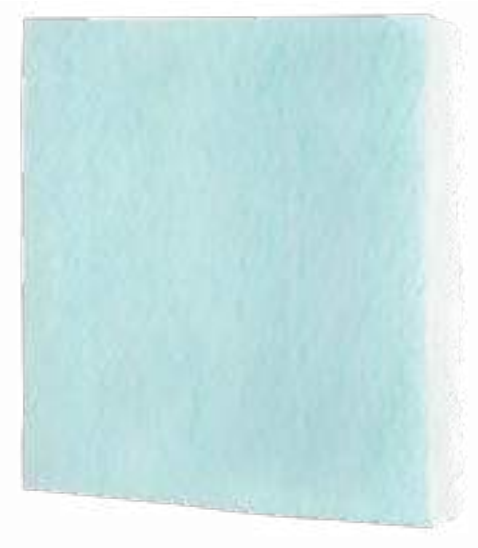
Product Information

Part Number	Nominal Size Inches (W x H x D)	Actual Size Inches (W x H x D)	Std. Pkg. Qty.	Shipping Wt. Lbs. per Box (± 10%)	Cubic Ft.
159-608-880	16 x 20 x 4	16¼ x 20¼ x 4	25	14.9	7.0
159-611-880	16 x 25 x 4	16¼ x 25¼ x 4	25	16.4	7.0
159-805-880	20 x 20 x 4	20¼ x 20¼ x 4	25	16.1	5.6
159-813-880	20 x 25 x 4	20¼ x 25¼ x 4	25	19.6	7.0
159-858-880	24 x 24 x 4	24¼ x 24¼ x 4	20	18.1	6.7

Additional sizes available upon request.

HVAC

AG-28 Paint Arrestor Media



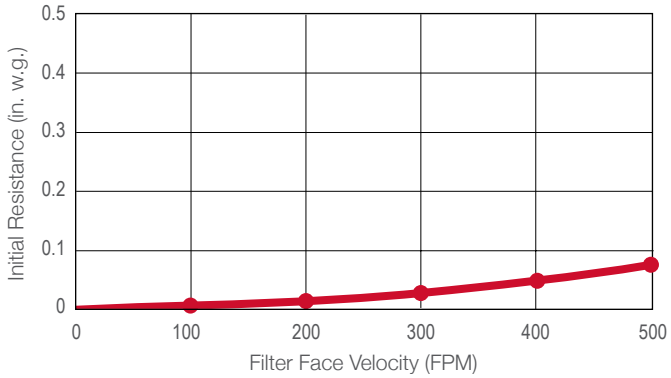
Product Overview

- Effectively removes paint overspray solids of all types – lacquer, air dry, or baked enamel
- Open weave design allows paint to collect throughout the depth of the pad
- Skin backing prevents paint from penetrating through the media
- 99.06% paint removal efficiency
- 4.4 lb. paint-holding capacity
- High compression strength prevents sagging or collapsing
- Protects exhaust ducts, fans, and motors from paint buildup
- Clean exhaust air is discharged to the atmosphere
- Easy installation, removal, and space-saving packing for an overall reduction in operating costs

Specifications

Filter Depth	2″
Media Type	Fiberglass
Special Size Available	Yes
Antimicrobial Available	No
Max Operating Temperature	200°F (93°C)
Air Filtration Certification	UL 900

Initial Resistance vs. Filter Face Velocity



Product Information

Part Number	Nominal Size Inches (W x H x D)	Std. Pkg. Qty.	Shipping Wt. Lbs. per Box (± 10%)	Cubic Ft.
Pads				
150-512-628	16½ x 20½ x 2	60	8.5	2.1
150-601-628	16½ x 25½ x 2	60	10.2	2.6
150-806-628	20½ x 20½ x 2	60	8.4	2.6
150-807-628	20½ x 25½ x 2	60	10.1	3.3
150-863-628	24 x 24 x 2	60	11.3	3.9
Rolls				
150-814-228	20″ x 85′	2	14.0	4.9
150-819-228	25″ x 85′	2	18.0	6.4
150-894-228	30″ x 85′	2	20.7	8.8
150-914-228	36″ x 85′	2	28.6	8.8
150-942-228	40″ x 85′	2	30.5	11.4
150-950-228	48″ x 85′	2	32.2	11.4
150-963-128	60″ x 85′	1	21.7	7.3

Additional sizes available upon request.

HVAC

SureFlow® Supreme Media

Product Overview

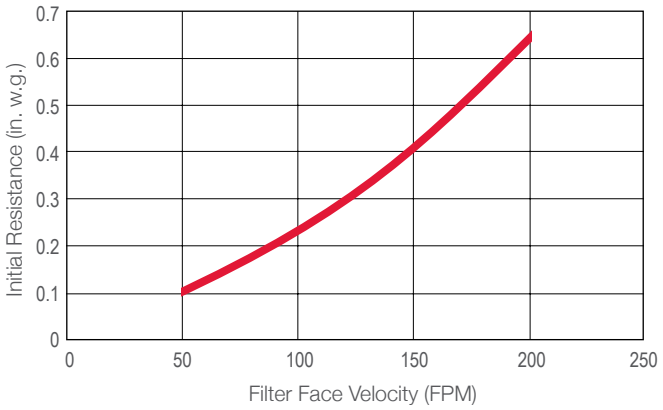
- Specifically designed for use as final filter in the supply air system of paint spray booths operating in the 50–150 FPM velocity range
- Forms a highly effective final protective barrier to prevent particles from entering through the makeup air system
- Non-migrating tackifier applied through entire media depth, along with woven scrim backing, prevents migration of fibers or particulate onto painted surfaces
- Serves as a baffle to ensure even air distribution
- Media available in pads, rolls, and ring panels

Specifications

Filter Depth	1″
Media Type	Synthetic
Special Size Available	Yes*
Antimicrobial Available	No
Max Operating Temperature	212°F (100°C)
Air Filtration Certification	UL 900

**Special sizes available in pads and rolls only.*

Initial Resistance vs. Filter Face Velocity



Product Information

Part Number	Nominal Size Inches (W x H x D)	Std. Pkg. Qty.	Shipping Wt. Lbs. per Box (± 10%)
348-002-319	12 x 24	40	31.5
348-002-500	16 x 20	40	37.5
348-002-585	19 x 19	40	42.0
348-002-700	20 x 20	40	46.5
348-002-800	20 x 25	40	57.0
348-002-863	24 x 24	40	63.0
348-002-884	25¾ x 32¼	per order	per order

Note: 7″-85″ wide media rolls and pads in lengths up to 65′ 6″ also available upon request.
Contact your local AAF Flanders representative for more information.

HVAC

SureStop™ Media

Product Overview

- Designed specifically for paint booth operations
- Reduces downtime by protecting equipment and improving operating conditions
- Extends capital equipment life cycles by decreasing exposure to overspray solids
- Reduces fire hazards by removing airborne paint solids
- Designed specifically for paint booths with horizontal or downdraft airflow
- Removes paint overspray solids from all of the following:
  - Lacquers
  - Epoxies
  - Vinyls
  - Primers and Enamels (Air Dry Solvent and Baked Solvent)
  - Water-Based Emulsions (Acrylic or Latex)

Specifications

Filter Depth	1″, 1¼″
Media Type	Expanded Paper, Paper/Synthetic
Special Size Available	No
Antimicrobial Available	No
Air Filtration Certification	UL 900

Product Information

Part Number	Nominal Size Inches (W x H x D)	Actual Size Inches (W x H x D)	Std. Pkg. Qty.	Shipping Wt. Lbs. per Box (± 10%)
P-SC (1″ Thick, Paper, Standard Capacity) Pads				
370-111-500	16″ x 20″	16½″ x 20½″	70	13.0
370-111-600	16″ x 25″	16½″ x 25½″	70	16.0
370-111-700	20″ x 20″	20½″ x 20½″	70	14.0
370-111-800	20″ x 25″	20½″ x 25½″	70	18.0
P-SC (1″ Thick, Paper, Standard Capacity) Rolls				
371-101-853	22″ x 40′	22½″ x 40′	2	8.0
371-101-871	45" x 12′	45" x 12′	3	8.0
371-101-955	45″ x 40′	45″ x 40′	1	8.0
P-HC (1⅜″ Thick, Paper, High Capacity) Rolls				
370-115-700	20″ x 20″	20½″ x 20½″	30	12.0
370-115-800	20″ x 25″	20½″ x 25½″	30	14.0
P-SCS (1″ Thick, Paper/Synthetic) Pads				
372-012-700	20″ x 20″	20½″ x 20½″	60	13.0
372-012-800	20″ x 25″	20½″ x 25½″	60	16.0
P-SCS (1″ Thick, Paper/Synthetic) Rolls				
372-012-923	45″ x 6′	45½″ x 6′	5	7.0
372-012-929	45″ x 8′	45½″ x 8′	4	8.0
372-012-935	45″ x 10′	45½″ x 10′	3	7.0
372-012-947	45″ x 12′	45½″ x 12′	3	9.0
372-012-953	45″ x 30′	45½″ x 30′	1	7.0
P-SCDS (1¼″ Thick, Paper/Synthetic) Pads				
373-001-700	20″ x 20″	20½″ x 20½″	60	13.0
373-001-800	20″ x 25″	20½″ x 25½″	60	16.0
P-SCDS (1¼″ Thick, Paper/Synthetic) Rolls				
373-001-923	45″ x 6′	45″ x 6′	5	10.0
373-001-929	45″ x 8′	45″ x 8′	4	10.0
373-001-003	45″ x 9′	45″ x 9′	3	10.0
373-001-935	45″ x 10′	45″ x 10′	3	10.0
373-001-947	45″ x 12′	45″ x 12′	3	12.0
373-001-953	45″ x 30′	45″ x 30′	1	10.0

Note: Paint Booth floor paper also available, contact your local AAF Flanders representative for details.

HVAC

AmerSeal® Green 225RT/ Blue 325RT/Gold 425RT

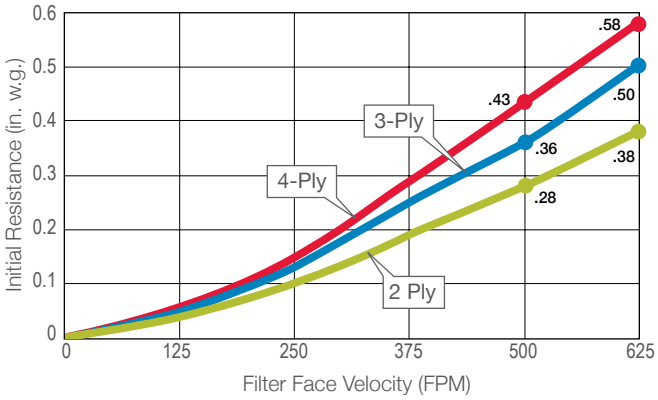
Product Overview

- Self-sealing for fast and easy installation, no clips or latches required to install
- Leak-free, no dirty air bypass
- Moisture-resistant polyester media with internal wire frame
- Lightweight, space-saving design saves on shipping and storage costs
- Available in Gold (4-ply), Blue (3-ply), and Green (2-ply)
- All models available in both panels and links
- All models available with antimicrobial
- MERV 8

Specifications

Frame Material	9-Gauge Steel, Internal (Self-Sealing)
Efficiency	MERV 8
Max Operating Temperature	175°F (79°C)
Special Size Available	Yes
Antimicrobial Available	Yes
Filter Depth	2-, 3-, and 4-Ply
Air Filtration Certification	UL 900, ULC-S111

Initial Resistance vs. Filter Face Velocity



Product Information

Green (2-Ply) Part Number	Cubic Ft.	Blue (3-Ply) Part Number	Cubic Ft.	Gold (4-Ply) Part Number	Cubic Ft. (H x L)	Nominal Size Inches (H x L)	Actual Size[1] Inches	Std. Pkg. Qty.
523-200-200	2.0	523-200-300	3.0	523-200-400	3.4	10 x 20	9¼ x 19¼	24
523-319-200	2.8	523-319-300	2.8	523-319-400	2.8	12 x 24	11¼ x 23¼	24
523-500-200	2.2	523-500-300	4.8	523-500-400	4.8	16 x 20	15¼ x 19¼	24
523-600-200	5.8	523-600-300	3.3	523-600-400	3.3	16 x 25	15¼ x 24¼	24
523-700-200	3.3	523-700-300	5.9	523-700-400	5.9	20 x 20	19¼ x 19¼	24
523-782-200	4.7	523-782-300	4.7	523-782-400	4.7	20 x 24	19¼ x 23¼	24
523-800-200	4.7	523-800-300	4.7	523-800-400	4.7	20 x 25	19¼ x 24¼	24
523-803-200	7.4	523-803-300	14.6	523-803-400	14.0	20 x 48	19¼ x 47¼	24
523-863-200	4.9	523-863-300	8.8	523-863-400	8.8	24 x 24	23¼ x 23¼	24
523-870-200	4.9	523-870-300	8.7	523-870-400	8.8	25 x 25	24¼ x 24¼	24

[1]The actual size is the size of the internal wire ring.
Additional sizes available upon request.

HVAC

EZ Flow®

Product Overview

- Designed for protection of furnace and central air units in residential and light commercial applications
- Economical and environmentally friendly chipboard frame
- One-piece frame design eliminates corner separation
- Metal retainer on downstream side for added rigidity
- Hot-melt sealant around full perimeter on both sides

Specifications

Filter Depth	1″, 2″
Media Type	Fiberglass
Frame Material	1-Piece Heavy Chipboard
Special Size Available	Yes
Air Filtration Certification	UL Classified

Product Information

Part Number	Nominal Size Inches (W x H x D)	Actual Size Inches (W x H x D)	Std. Pkg. Qty.	Shipping Wt. Lbs. per Box	Cubic Ft.
1″					
10155.011212	12 x 12 x 1	11⅝ x 11⅝ x ¾	12	3.2	0.9
10155.011224	12 x 24 x 1	11⅝ x 23⅝ x ¾	12	5.5	1.9
10155.011420	14 x 20 x 1	13⅝ x 19⅝ x ¾	12	5.1	1.8
10155.011520	15 x 20 x 1	14⅝ x 19⅝ x ¾	12	5.6	2.0
10155.011616	16 x 16 x 1	15⅝ x 15⅝ x ¾	12	5.0	2.1
10155.011620	16 x 20 x 1	15½ x 19½ x ¾	12	5.3	2.1
10155.011624	16 x 24 x 1	15⅝ x 23⅝ x ¾	12	5.9	2.5
10155.011625	16 x 25 x 1	15⅝ x 24⅝ x ¾	12	6.2	2.5
10155.012020	20 x 20 x 1	19½ x 19½ x ¾	12	6.2	2.5
10155.012024	20 x 24 x 1	19⅝ x 23⅝ x ¾	12	7.2	3.1
10155.012025	20 x 25 x 1	19½ x 24½ x ¾	12	7.8	3.1
10155.012030	20 x 30 x 1	19⅝ x 29⅝ x ¾	12	8.9	3.9
10155.012424	24 x 24 x 1	23⅜ x 23⅜ x ¾	12	8.7	3.7
10155.012525	25 x 25 x 1	24⅜ x 24⅜ x ¾	12	9.0	4.3
2″					
10155.021224	12 x 24 x 2	11½ x 23½ x 1⅜	12	7.0	3.7
10155.021420	14 x 20 x 2	13⅜ x 19⅜ x 1⅜	12	7.2	4.1
10155.021520	15 x 20 x 2	14⅜ x 19⅜ x 1⅜	12	7.4	4.1
10155.021616	16 x 16 x 2	15⅜ x 15⅜ x 1⅜	12	7.7	4.1
10155.021620	16 x 20 x 2	15⅜ x 19½ x 1⅜	12	7.7	4.1
10155.021624	16 x 24 x 2	15⅜ x 23½ x 1⅜	12	8.8	5.1
10155.021625	16 x 25 x 2	15⅜ x 24½ x 1⅜	12	8.6	5.1
10155.021824	18 x 24 x 2	17⅜ x 23⅜ x 1⅜	12	9.7	6.3
10155.022020	20 x 20 x 2	19½ x 19½ x 1⅜	12	8.4	5.1
10155.022024	20 x 24 x 2	19½ x 23½ x 1⅜	12	10.2	6.3
10155.022025	20 x 25 x 2	19½ x 24½ x 1⅜	12	10.6	6.3
10155.022424	24 x 24 x 2	23½ x 23½ x 1⅜	12	11.2	7.7
10155.022525	25 x 25 x 2	24⅜ x 24⅜ x 1⅜	12	12.2	9.0

1/2″ deep filters and additional sizes available upon request.

HVAC

EZ Flow® II

Product Overview

- Economical and environmentally friendly chipboard frame
- One-piece frame design eliminates corner separation
- Self-retaining media pack eliminates need for metal retainer
- Hot-melt sealant around full perimeter on both sides

Specifications

Filter Depth	1″, 2″
Media Type	Fiberglass, PolyStrand™
Frame Material	1-Piece Heavy Chipboard
Special Size Available	Yes
Air Filtration Certification	UL Classified

Product Information

Fiberglass Part Number	PolyStrand Part Number	Nominal Size Inches (W x H x D)	Actual Size Inches (W x H x D)	Case. Qty.	Fiberglass Shipping Wt. Lbs. per Box	PolyStrand Shipping Wt. Lbs. per Box	Cubic Ft.
1″							
10055.011010	11250.011010	10 x 10 x 1	9⅞ x 9⅞ x ¾	12	2.1	2.2	0.9
10055.011020	11250.011020	10 x 20 x 1	9⅞ x 19⅞ x ¾	12	2.9	3.2	1.3
10055.011212	11250.011212	12 x 12 x 1	11⅞ x 11⅞ x ¾	12	2.3	2.5	0.9
10055.011220	11250.011220	12 x 20 x 1	11⅞ x 19⅞ x ¾	12	3.3	3.5	5.6
10055.011224	11250.011224	12 x 24 x 1	11⅞ x 23⅞ x ¾	12	3.7	4.0	1.9
10055.011420	11250.011420	14 x 20 x 1	13⅞ x 19⅞ x ¾	12	3.5	3.9	1.8
10055.011425	11250.011425	14 x 25 x 1	13⅞ x 24⅞ x ¾	12	3.9	4.5	2.3
10055.011520	11250.011520	15 x 20 x 1	14⅞ x 19⅞ x ¾	12	3.9	4.2	2.0
10055.011616	11250.011616	16 x 16 x 1	15⅞ x 15⅞ x ¾	12	3.1	3.7	2.1
10055.011620	11250.011620	16 x 20 x 1	15¾ x 19½ x ¾	12	3.4	4.3	2.1
10055.011624	11250.011624	16 x 24 x 1	15⅞ x 23⅞ x ¾	12	4.1	5.0	2.5
10055.011625	11250.011625	16 x 25 x 1	15¾ x 24⅝ x ¾	12	4.1	5.1	2.5
10055.011824	11250.011824	18 x 24 x 1	17⅞ x 23⅞ x ¾	12	4.5	5.2	2.9
10055.012020	11250.012020	20 x 20 x 1	19⅝ x 19⅝ x ¾	12	3.9	5.1	2.5
10055.012024	11250.012024	20 x 24 x 1	19⅞ x 23⅞ x ¾	12	4.6	5.3	3.1
10055.012025	11250.012025	20 x 25 x 1	19⅝ x 24⅝ x ¾	12	4.7	5.8	3.1
10055.012030	11250.012030	20 x 30 x 1	19⅞ x 29⅞ x ¾	12	5.6	6.3	3.9
10055.012424	11250.012424	24 x 24 x 1	23⅞ x 23⅞ x ¾	12	5.4	6.3	3.7
10055.012430	11250.012430	24 x 30 x 1	23⅞ x 29⅞ x ¾	12	6.4	6.5	4.6
10055.012525	11250.012525	25 x 25 x 1	24⅞ x 24⅞ x ¾	12	5.7	6.7	4.3
2″							
10055.021020	11250.021020	10 x 20 x 2	9⅞ x 19⅞ x 1⅝	12	4.6	5.8	2.5
10055.021224	11250.021224	12 x 24 x 2	11½ x 23½ x 1⅝	12	5.8	7.3	3.7
10055.021420	11250.021420	14 x 20 x 2	13⅞ x 19⅞ x 1⅝	12	6.0	7.0	4.1
10055.021425	11250.021425	14 x 25 x 2	13⅞ x 24⅞ x 1⅝	12	7.1	7.3	5.1
10055.021520	11250.021520	15 x 20 x 2	14⅞ x 19⅞ x 1⅝	12	6.3	7.6	4.1
10055.021620	11250.021620	16 x 20 x 2	15¾ x 19½ x 1⅝	12	6.2	7.8	4.1
10055.021624	11250.021624	16 x 24 x 2	15¾ x 23½ x 1⅝	12	6.7	8.4	5.1
10055.021625	11250.021625	16 x 25 x 2	15¾ x 24½ x 1⅝	12	6.8	8.3	5.1
10055.021824	11250.021824	18 x 24 x 2	17⅞ x 23⅞ x 1⅝	12	6.8	9.9	5.7
10055.022020	11250.022020	20 x 20 x 2	19½ x 19½ x 1⅝	12	6.7	8.5	5.1
10055.022024	11250.022024	20 x 24 x 2	19½ x 23½ x 1⅝	12	7.6	9.9	6.3
10055.022025	11250.022025	20 x 25 x 2	19½ x 24½ x 1⅝	12	7.6	9.5	6.3
10055.022424	11250.022424	24 x 24 x 2	23½ x 23½ x 1⅝	12	9.0	11.1	7.7
10055.02253	11250.022525	25 x 25 x 2	24⅞ x 24⅞ x 1⅝	12	9.8	11.7	9.0

Additional sizes available upon request.

EZ Flow® is a registered trademark of Flanders Corporation in the U.S.

HVAC

Permanent Metal Air Filters

Product Overview

- Low maintenance
- Washable and reusable
- Ideally suited for high moisture and high temperature conditions (up to 350°F)
- Lightweight construction makes filters easy to handle
- Designed with drain holes to ensure removal of excess water
- Frame made from aluminum, galvanized steel, or stainless steel

Specifications

Filter Depth	½″, 1″, 2″, 4″
Media Type	Aluminum, Galvanized Steel, Stainless Steel
Frame Material	Aluminum, Galvanized Steel, Stainless Steel
Special Size Available	Yes
Max Operating Temperature	350°F (177°C)

Product Information

Part Number	Nominal Size Inches (W x H x D)	Actual Size Inches (W x H x D)	Std. Pkg. Qty.	Shipping Wt. Lbs. per Box (± 10%)
½″				
316-005-500	16 x 20 x ½	15½ x 19½ x 7⁄16	12	11.3
316-005-600	16 x 25 x ½	15½ x 24½ x 7⁄16	12	13.3
316-005-700	20 x 20 x ½	19½ x 19½ x 7⁄16	12	13.6
316-005-800	20 x 25 x ½	19½ x 24½ x 7⁄16	12	15.3
316-005-863	24 x 24 x ½	23½ x 23½ x 7⁄16	12	18.0
1″				
316-001-500	16 x 20 x 1	15½ x 19½ x ⅞	12	16.1
316-001-600	16 x 25 x 1	15½ x 24½ x ⅞	12	19.0
316-001-700	20 x 20 x 1	19½ x 19½ x ⅞	12	19.4
316-001-782	20 x 24 x 1	19½ x 23½ x ⅞	12	20.9
316-001-800	20 x 25 x 1	19½ x 24½ x ⅞	12	21.8
316-001-863	24 x 24 x 1	23½ x 23½ x 7⁄16	12	25.7
2″				
316-002-319	12 x 24 x 2	11½ x 23½ x 1¾	12	18.2
316-002-500	16 x 20 x 2	15½ x 19½ x 1¾	6	9.8
316-002-600	16 x 25 x 2	15½ x 24½ x 1¾	6	12.0
316-002-700	20 x 20 x 2	19½ x 19½ x 1¾	6	12.2
316-002-782	20 x 24 x 2	19½ x 23½ x 1¾	6	12.6
316-002-800	20 x 25 x 2	19½ x 24½ x 1¾	6	12.8
316-002-863	24 x 24 x 2	23½ x 23½ x 1¾	6	15.4
4″				
316-004-319	12 x 24 x 4	11½ x 23½ x 3⅝	6	18.2
316-004-500	16 x 20 x 4	15½ x 19½ x 3⅝	3	19.7
316-004-600	16 x 25 x 4	15½ x 24½ x 3⅝	3	24.0
316-004-700	20 x 20 x 4	19½ x 19½ x 3⅝	3	24.5
316-004-782	20 x 24 x 4	19½ x 23½ x 3⅝	3	25.2
316-004-800	20 x 25 x 4	19½ x 24½ x 3⅝	3	25.7

Product information listed is for aluminum version. Additional sizes available upon request. Also available in galvanized steel and stainless steel.

HVAC

MEGApleat® M8

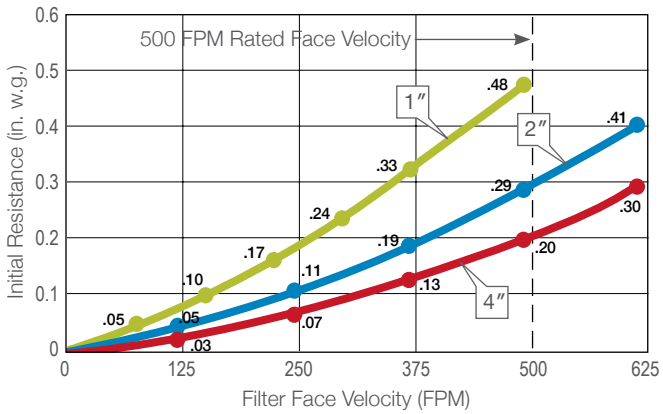
Product Overview

- Low operating resistance saves energy
- Highest Dust Holding Capacity (DHC) = Longest life
- Highest breach strength = strongest construction
- Guaranteed consistent performance – independent, third party testing
- Patent-pending filter design
- Heavy-duty, galvanized expanded metal support grid – no rust
- Moisture-resistant adhesive
- Available in 1″, 2″, and 4″ models
- High Capacity, MERV 8

Specifications

Efficiency	MERV 8
Filter Depth	1″, 2″, 4″
Media Type	Synthetic
Frame Material	Beverage Board
Special Size Available	No
Antimicrobial	No
Max Operating Temperature	200°F (93°C)
Air Filtration Certification	UL 900, ULC-S111

Initial Resistance vs. Filter Face Velocity



Product Information

Part Number	Nominal Size Inches (W x H x D)	Actual Size Inches (W x H x D)	Std. Pkg. Qty.	Shipping Wt. Lbs. per Box (± 7%)	Cubic Ft.
1″					
148-801-319	12 x 24 x 1	11⅜ x 23⅜ x ¾	12	7.1	3.7
148-801-500	16 x 20 x 1	15½ x 19½ x ¾	12	7.9	1.9
148-801-600	16 x 25 x 1	15½ x 24½ x ¾	12	9.8	2.4
148-801-700	20 x 20 x 1	19½ x 19½ x ¾	12	10.0	2.3
148-801-800	20 x 25 x 1	19½ x 24½ x ¾	12	12.3	3.0
148-801-863	24 x 24 x 1	23⅜ x 23⅜ x ¾	12	14.2	4.0
2″					
148-802-319	12 x 24 x 2	11⅜ x 23⅜ x 1¾	12	11.7	3.6
148-802-500	16 x 20 x 2	15½ x 19½ x 1¾	12	13.0	4.0
148-802-600	16 x 25 x 2	15½ x 24½ x 1¾	12	16.3	5.0
148-802-700	20 x 20 x 2	19½ x 19½ x 1¾	12	15.0	4.5
148-802-782	20 x 24 x 2	19⅜ x 23⅜ x 1¾	12	19.5	5.9
148-802-800	20 x 25 x 2	19⅜ x 24½ x 1¾	12	20.3	6.2
148-802-863	24 x 24 x 2	23⅜ x 23⅜ x 1¾	12	23.4	7.1
4″					
148-804-319	12 x 24 x 4	11⅜ x 23⅜ x 3¾	6	11.8	3.7
148-804-500	16 x 20 x 4	15⅜ x 19⅜ x 3¾	6	13.2	5.2
148-804-600	16 x 25 x 4	15⅜ x 24⅜ x 3¾	6	16.4	5.2
148-804-700	20 x 20 x 4	19⅜ x 19⅜ x 3¾	6	16.4	5.2
148-804-800	20 x 25 x 4	19½ x 24½ x 3¾	6	20.6	6.5
148-804-859	24 x 20 x 4	23⅜ x 19⅜ x 3¾	6	20.7	6.2
148-804-863	24 x 24 x 4	23⅜ x 23⅜ x 3¾	6	23.7	7.5

Additional sizes available upon request.

HVAC

PREpleat® LPD HC

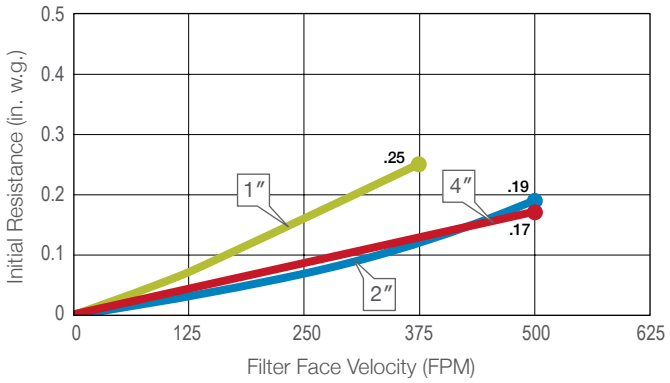
Product Overview

- Lowest initial resistance MERV 8 pleated filter
- High Dust Holding Capacity (DHC) for energy efficient performance
- Diagonal support members and wire-backed media contribute to overall strength of construction
- Filter media pack is bonded to the frame at all points of contact to eliminate air bypass
- High Capacity, MERV 8

Specifications

Efficiency	MERV 8
Filter Depth	1″, 2″, 4″
Media Type	Synthetic
Frame Material	Beverage Board
Special Size Available	No
Antimicrobial	No
Max Operating Temperature	180°F (82°C)
Air Filtration Certification	UL 900

Initial Resistance vs. Filter Face Velocity



Product Information

Part Number	Nominal Size Inches (W x H x D)	Actual Size Inches (W x H x D)	Std. Pkg. Qty.	Shipping Wt. Lbs. per Box	Cubic Ft.
1″					
80255.011224	12 x 24 x 1	11½ x 23½ x ¾	12	5.3	2.0
80255.011620	16 x 20 x 1	15½ x 19½ x ¾	12	5.4	2.1
80255.011625	16 x 25 x 1	15½ x 24½ x ¾	12	6.5	2.6
80255.012020	20 x 20 x 1	19½ x 19½ x ¾	12	6.2	2.5
80255.012024	20 x 24 x 1	19½ x 23½ x ¾	12	7.4	3.2
80255.012025	20 x 25 x 1	19½ x 24½ x ¾	12	7.9	3.2
80255.012424	24 x 24 x 1	23⅜ x 23⅜ x ¾	12	8.5	3.9
2″					
80255.021224	12 x 24 x 2	11⅜ x 23⅜ x 1¾	12	8.5	3.7
80255.021620	16 x 20 x 2	15½ x 19½ x 1¾	12	9.6	4.3
80255.021625	16 x 25 x 2	15½ x 24½ x 1¾	12	11.0	5.2
80255.022020	20 x 20 x 2	17½ x 24½ x 1¾	12	11.3	5.2
80255.022024	20 x 24 x 2	19½ x 19½ x 1¾	12	13.1	6.5
80255.022025	20 x 25 x 2	19⅜ x 23⅜ x 1¾	12	14.3	6.5
80255.022424	24 x 24 x 2	19½ x 24½ x 1¾	12	14.6	7.6
4″					
80255.041224	12 x 24 x 4	11⅜ x 23⅜ x 3¾	6	7.7	3.8
80255.041620	16 x 20 x 4	15½ x 19½ x 3¾	6	8.8	4.4
80255.041625	16 x 25 x 4	15½ x 24½ x 3¾	6	9.9	5.5
80255.042020	20 x 20 x 4	19½ x 19½ x 3¾	6	10.3	5.5
80255.042024	20 x 24 x 4	19⅜ x 23⅜ x 3¾	6	11.6	6.9
80255.042025	20 x 25 x 4	19½ x 24½ x 3¾	6	11.8	6.9
80255.042424	24 x 24 x 4	23⅜ x 23⅜ x 3¾	6	13.5	7.8

Additional sizes available upon request.

HVAC

PREpleat® LPD SC

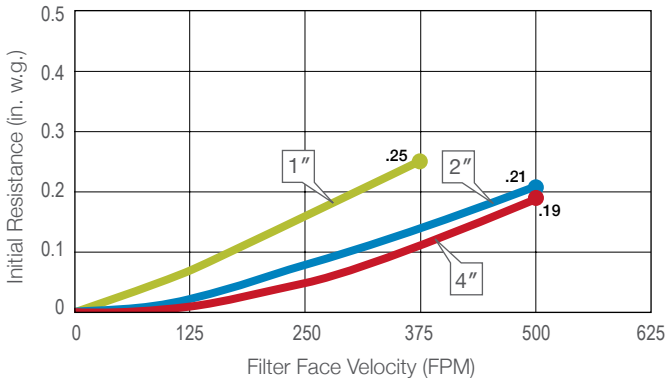
Product Overview

- Low resistance MERV 8 media
- High Dust Holding Capacity (DHC) media outperforms competitor's Standard Capacity filters
- Diagonal support members and wire-backed media contribute to overall strength of construction
- Filter media pack is bonded to the frame at all points of contact to eliminate air bypass

Specifications

Efficiency	MERV 8
Filter Depth	1″, 2″, 4″
Media Type	Synthetic
Frame Material	Beverage Board
Special Size Available	No
Antimicrobial	No
Max Operating Temperature	180°F (82°C)
Air Filtration Certification	UL 900

Initial Resistance vs. Filter Face Velocity



Product Information

Part Number	Nominal Size Inches (W x H x D)	Actual Size Inches (W x H x D)	Std. Pkg. Qty.	Shipping Wt. Lbs. per Box	Cubic Ft.
1″					
80055.011224	12 x 24 x 1	11½ x 23½ x ¾	12	5.1	2.0
80055.011620	16 x 20 x 1	15½ x 19½ x ¾	12	5.4	2.1
80055.011625	16 x 25 x 1	15½ x 24½ x ¾	12	6.4	2.6
80055.012020	20 x 20 x 1	19½ x 19½ x ¾	12	6.2	2.5
80055.012024	20 x 24 x 1	19½ x 23½ x ¾	12	7.2	3.2
80055.012025	20 x 25 x 1	19½ x 24½ x ¾	12	7.4	3.2
80055.012424	24 x 24 x 1	23⅜ x 23⅜ x ¾	12	8.4	3.9
2″					
80055.021224	12 x 24 x 2	11⅜ x 23⅜ x 1¾	12	7.9	3.7
80055.021620	16 x 20 x 2	15½ x 19½ x 1¾	12	8.5	4.3
80055.021625	16 x 25 x 2	15½ x 24½ x 1¾	12	9.9	5.2
80055.022020	20 x 20 x 2	17½ x 24½ x 1¾	12	10.0	5.2
80055.022024	20 x 24 x 2	19½ x 19½ x 1¾	12	11.5	6.5
80055.022025	20 x 25 x 2	19⅜ x 23⅜ x 1¾	12	11.5	6.5
80055.022424	24 x 24 x 2	19½ x 24½ x 1¾	12	13.2	7.6
4″					
80055.041224	12 x 24 x 4	11⅜ x 23⅜ x 3¾	6	7.5	3.8
80055.041620	16 x 20 x 4	15½ x 19½ x 3¾	6	8.2	4.4
80055.041625	16 x 25 x 4	15½ x 24½ x 3¾	6	9.6	5.5
80055.042020	20 x 20 x 4	19½ x 19½ x 3¾	6	9.3	5.5
80055.042024	20 x 24 x 4	19⅜ x 23⅜ x 3¾	6	10.7	6.9
80055.042025	20 x 25 x 4	19½ x 24½ x 3¾	6	11.0	6.9
80055.042424	24 x 24 x 4	23⅜ x 23⅜ x 3¾	6	12.6	7.8

Additional sizes available upon request.

HVAC

PerfectPleat® ULTRA

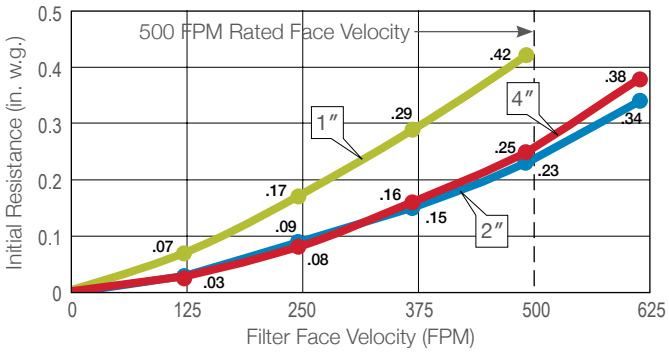
Product Overview

- Incorporates antimicrobial to support optimal Indoor Air Quality (IAQ)
- Highest performing self-supported pleated filter
- Mechanical efficiency – does not rely on electret charge technology
- Self-supporting DuraFlex® media made from virgin fiber; no wire support needed
- Consistent media performance with controlled fiber size and blend
- Environmentally friendly – no dies, no metal, fully incinerable

Specifications

Efficiency	MERV 8
Filter Depth	1″, 2″, 4″
Media Type	Self-Supporting DuraFlex® Synthetic
Frame Material	Beverage Board
Special Size Available	Yes
Antimicrobial	Yes
Max Operating Temperature	150°F (66°C)
Air Filtration Certification	UL 900, ULC-S111

Initial Resistance vs. Filter Face Velocity



Product Information

Part Number	Nominal Size Inches (W x H x D)	Actual Size Inches (W x H x D)	Std. Pkg. Qty.	Shipping Wt. Lbs. per Box (± 7%)	Cubic Ft.
1″					
176-319-001	12 x 24 x 1	11⅜ x 23⅜ x ¾	12	6.6	1.9
176-500-001	16 x 20 x 1	15½ x 19½ x ¾	12	5.3	2.1
176-600-001	16 x 25 x 1	15½ x 24½ x ¾	12	6.6	2.6
176-700-001	20 x 20 x 1	19½ x 19½ x ¾	12	6.6	2.6
176-800-001	20 x 25 x 1	19½ x 24½ x ¾	12	8.2	3.2
176-863-001	24 x 24 x 1	23⅜ x 23⅜ x ¾	12	9.4	3.6
2″					
175-102-319	12 x 24 x 2	11⅜ x 23⅜ x 1¾	12	8.3	3.8
175-102-500	16 x 20 x 2	15½ x 19½ x 1¾	12	8.7	4.2
175-102-600	16 x 25 x 2	15½ x 24½ x 1¾	12	10.4	5.2
175-102-700	20 x 20 x 2	19½ x 19½ x 1¾	12	9.4	5.2
175-102-782	20 x 24 x 2	19⅜ x 23⅜ x 1¾	12	12.4	6.5
175-102-800	20 x 25 x 2	19½ x 24½ x 1¾	12	11.6	6.5
175-102-863	24 x 24 x 2	23⅜ x 23⅜ x 1¾	12	13.0	7.5
4″					
179-402-319	12 x 24 x 4	11⅜ x 23⅜ x 3¾	6	6.9	4.0
179-402-500	16 x 20 x 4	15⅜ x 19⅜ x 3¾	6	7.6	5.2
179-402-600	16 x 25 x 4	15⅜ x 24⅜ x 3¾	6	9.5	5.3
179-402-700	20 x 20 x 4	19⅜ x 19⅜ x 3¾	6	9.5	5.5
179-402-800	20 x 25 x 4	19⅜ x 24⅜ x 3¾	6	12.0	6.6
179-402-859	24 x 20 x 4	23⅜ x 19⅜ x 3¾	6	11.5	6.6
179-402-863	24 x 24 x 4	23⅜ x 23⅜ x 3¾	6	13.8	7.9

Additional sizes available upon request.

HVAC

PerfectPleat® HC M8

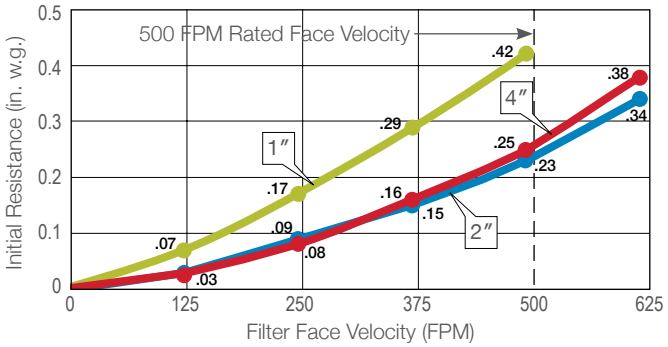
Product Overview

- Highest performing self-supported pleated filter
- Lower pressure drop and higher Dust Holding Capacity (DHC) reduces energy consumption and operating costs
- Mechanical efficiency – does not rely on electret charge technology
- Self-supporting DuraFlex® media made from virgin fiber; no wire support needed
- Consistent media performance with controlled fiber size and blend
- Environmentally friendly – no metal, fully incinerable

Specifications

Efficiency	MERV 8
Filter Depth	1″, 2″, 4″
Media Type	Self-Supporting DuraFlex® Synthetic
Frame Material	Beverage Board
Special Size Available	Yes
Antimicrobial	No
Max Operating Temperature	150°F (66°C)
Air Filtration Certification	UL 900, ULC-S111

Initial Resistance vs. Filter Face Velocity



Product Information

Part Number	Nominal Size Inches (W x H x D)	Actual Size Inches (W x H x D)	Std. Pkg. Qty.	Shipping Wt. Lbs. per Box (± 7%)	Cubic Ft.
1″					
173-319-011	12 x 24 x 1	11⅜ x 23⅜ x ¾	12	5.3	1.9
173-500-011	16 x 20 x 1	15½ x 19½ x ¾	12	6.2	2.1
173-600-011	16 x 25 x 1	15½ x 24½ x ¾	12	7.6	2.6
173-700-011	20 x 20 x 1	19½ x 19½ x ¾	12	7.4	2.6
173-782-011	20 x 24 x 1	19⅜ x 23⅜ x ¾	12	9.1	3.2
173-800-011	20 x 25 x 1	19½ x 24½ x ¾	12	9.5	3.2
173-863-011	24 x 24 x 1	23⅜ x 23⅜ x ¾	12	10.9	3.6
2″					
170-112-319	12 x 24 x 2	11⅜ x 23⅜ x 1¾	12	8.2	3.8
170-112-500	16 x 20 x 2	15½ x 19½ x 1¾	12	9.3	4.2
170-112-600	16 x 25 x 2	15½ x 24½ x 1¾	12	12.2	5.2
170-112-700	20 x 20 x 2	19½ x 19½ x 1¾	12	11.8	5.2
170-112-782	20 x 24 x 2	19⅜ x 23⅜ x 1¾	12	14.0	6.5
170-112-800	20 x 25 x 2	19½ x 24½ x 1¾	12	14.2	6.5
170-112-863	24 x 24 x 2	23⅜ x 23⅜ x 1¾	12	16.9	7.3
4″					
179-411-319	12 x 24 x 4	11⅜ x 23⅜ x 3¾	6	9.0	4.0
179-411-500	16 x 20 x 4	15⅜ x 19⅜ x 3¾	6	9.4	5.2
179-411-600	16 x 25 x 4	15⅜ x 24⅜ x 3¾	6	11.0	5.3
179-411-700	20 x 20 x 4	19⅜ x 19⅜ x 3¾	6	11.9	5.5
179-411-800	20 x 25 x 4	19⅜ x 24⅜ x 3¾	6	14.9	6.6
179-411-859	24 x 20 x 4	23⅜ x 19⅜ x 3¾	6	14.3	6.6
179-411-863	24 x 24 x 4	23⅜ x 23⅜ x 3¾	6	17.3	7.9

Additional sizes available upon request.

HVAC

PerfectPleat® SC M8

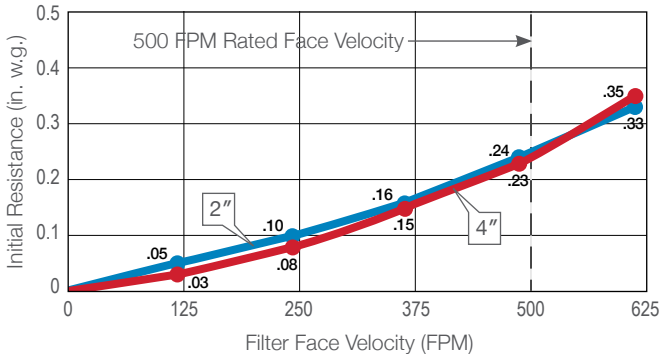
Product Overview

- Low initial resistance
- Lower pressure drop and higher Dust Holding Capacity (DHC) reduces energy consumption and operating costs
- Mechanical efficiency – does not rely on electret charge technology
- Self-supporting DuraFlex® media made from virgin fiber; no wire support needed
- Consistent media performance with controlled fiber size and blend
- Environmentally friendly – no metal, fully incinerable

Specifications

Efficiency	MERV 8
Filter Depth	2″, 4″
Media Type	Self-Supporting DuraFlex® Synthetic
Frame Material	Beverage Board
Special Size Available	Yes
Antimicrobial	No
Max Operating Temperature	150°F (66°C)
Air Filtration Certification	UL 900, ULC-S111

Initial Resistance vs. Filter Face Velocity



Product Information

Part Number	Nominal Size Inches (W x H x D)	Actual Size Inches (W x H x D)	Std. Pkg. Qty.	Shipping Wt. Lbs. per Box (± 7%)	Cubic Ft.
2″					
172-112-319	12 x 24 x 2	11⅞ x 23⅜ x 1¾	12	8.3	3.8
172-112-500	16 x 20 x 2	15½ x 19½ x 1¾	12	8.7	4.2
172-112-600	16 x 25 x 2	15½ x 24½ x 1¾	12	10.4	5.2
172-112-700	20 x 20 x 2	19½ x 19½ x 1¾	12	9.4	5.2
172-112-782	20 x 24 x 2	19⅜ x 23⅜ x 1¾	12	12.4	6.3
172-112-800	20 x 25 x 2	19½ x 24½ x 1¾	12	11.6	6.5
172-112-863	24 x 24 x 2	23⅜ x 23⅜ x 1¾	12	13.0	7.5
4″					
179-480-319	12 x 24 x 4	11⅞ x 23⅜ x 3¾	6	6.5	4.0
179-480-500	16 x 20 x 4	15⅜ x 19⅜ x 3¾	6	7.3	5.2
179-480-600	16 x 25 x 4	15⅜ x 24⅜ x 3¾	6	9.1	5.3
179-480-700	20 x 20 x 4	19⅜ x 19⅜ x 3¾	6	9.1	5.5
179-480-800	20 x 25 x 4	19⅜ x 24⅜ x 3¾	6	11.4	6.6
179-480-859	24 x 20 x 4	23⅜ x 19⅜ x 3¾	6	10.9	6.6
179-480-863	24 x 24 x 4	23⅜ x 23⅜ x 3¾	6	13.1	7.9

Additional sizes available upon request.

HVAC

VP-MERV8® SC

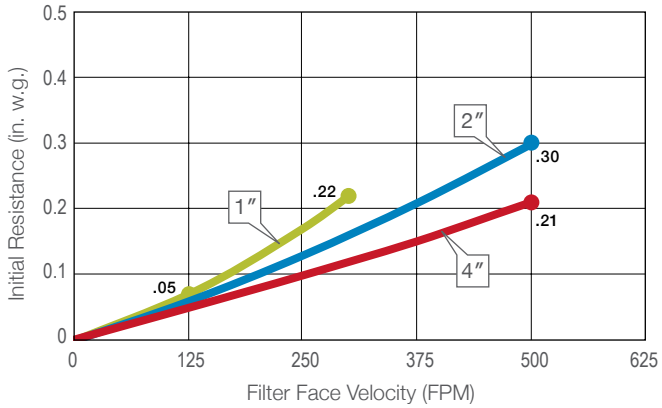
Product Overview

- Low initial resistance and strong Dust Holding Capacity (DHC) for performance and economy
- Ecologically friendly frame components made from recyclable materials
- Diagonal support members and wire-backed media contribute to overall strength of construction
- Filter media pack is bonded to the frame at all points of contact to eliminate air bypass

Specifications

Efficiency	MERV 8
Filter Depth	1″, 2″, 4″
Media Type	Synthetic
Frame Material	Kraft Board
Special Size Available	Yes
Antimicrobial	No
Max Operating Temperature	180°F (82°C)
Air Filtration Certification	UL 900

Initial Resistance vs. Filter Face Velocity



Product Information

Part Number	Nominal Size Inches (W x H x D)	Actual Size Inches (W x H x D)	Std. Pkg. Qty.	Shipping Wt. Lbs. per Box	Cubic Ft.
1″					
80085.011224	12 x 24 x 1	11½ x 23½ x ¾	12	5.1	1.9
80085.011620	16 x 20 x 1	15½ x 19½ x ¾	12	5.4	2.1
80085.011625	16 x 25 x 1	15½ x 24½ x ¾	12	6.4	2.6
80085.012020	20 x 20 x 1	19½ x 19½ x ¾	12	6.2	2.6
80085.012024	20 x 24 x 1	19½ x 23½ x ¾	12	7.2	3.2
80085.012025	20 x 25 x 1	19½ x 24½ x ¾	12	7.4	3.2
80085.012424	24 x 24 x 1	23⅜ x 23⅜ x ¾	12	8.4	3.7
2″					
80085.021224	12 x 24 x 2	11⅜ x 23⅜ x ¾	12	7.9	3.8
80085.021620	16 x 20 x 2	15½ x 19½ x ¾	12	8.5	4.3
80085.021625	16 x 25 x 2	15½ x 24½ x ¾	12	9.9	5.4
80085.022020	20 x 20 x 2	19½ x 19½ x ¾	12	10.0	5.4
80085.022024	20 x 24 x 2	19⅜ x 23⅜ x ¾	12	11.5	6.7
80085.022025	20 x 25 x 2	19½ x 24½ x ¾	12	11.6	6.7
80085.022424	24 x 24 x 2	23⅜ x 23⅜ x ¾	12	13.2	7.7
4″					
80085.041224	12 x 24 x 4	11⅜ x 23⅜ x 3¾	6	7.5	3.9
80085.041620	16 x 20 x 4	15½ x 19½ x 3¾	6	8.2	4.4
80085.041625	16 x 25 x 4	15½ x 24½ x 3¾	6	9.6	5.5
80085.042020	20 x 20 x 4	19½ x 19½ x 3¾	6	9.3	5.5
80085.042024	20 x 24 x 4	19⅜ x 23⅜ x 3¾	6	10.7	6.8
80085.042025	20 x 25 x 4	19½ x 24½ x 3¾	6	11.0	6.8
80085.042424	24 x 24 x 4	23⅜ x 23⅜ x 3¾	6	12.6	7.8

Additional sizes available upon request.

VP-MERV8® is a registered trademark of Flanders Corporation in the U.S.

HVAC

PREpleat® M11 HC

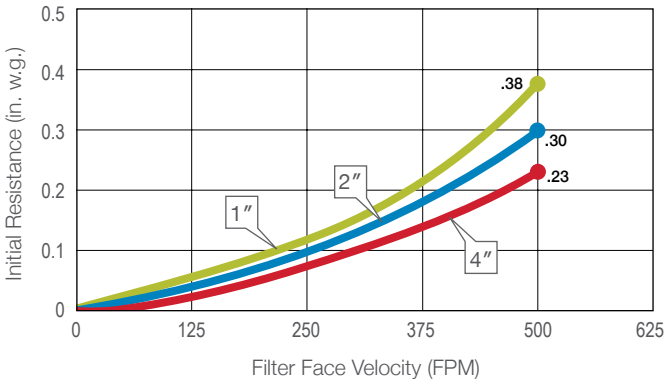
Product Overview

- High efficiency with low initial resistance
- 100% synthetic high loft media
- High capacity media configuration
- 2-piece die-cut double-wall frame
- Expanded metal backing
- Diagonal grid supports for maximum strength

Specifications

Efficiency	MERV 11
Filter Depth	1″, 2″, 4″
Media Type	Synthetic High Loft
Frame Material	Beverage Board
Special Size Available	Yes
Antimicrobial	No
Max Operating Temperature	180°F (82°C)
Air Filtration Certification	UL 900

Initial Resistance vs. Filter Face Velocity



Product Information

Part Number	Nominal Size Inches (W x H x D)	Actual Size Inches (W x H x D)	Std. Pkg. Qty.	Shipping Wt. Lbs. per Box	Cubic Ft.
1″					
85755.011224M11	12 x 24 x 1	11½ x 23½ x ¾	12	6.1	1.9
85755.011620M11	16 x 20 x 1	15½ x 19½ x ¾	12	6.0	2.0
85755.011625M11	16 x 25 x 1	15½ x 24½ x ¾	12	7.5	2.4
85755.012020M11	20 x 20 x 1	19½ x 19½ x ¾	12	7.4	2.4
85755.012024M11	20 x 24 x 1	19½ x 23½ x ¾	12	8.3	3.0
85755.012025M11	20 x 25 x 1	19½ x 24½ x ¾	12	8.4	3.0
85755.012424M11	24 x 24 x 1	23⅜ x 23⅜ x ¾	12	10.2	3.5
2″					
85755.021224M11	12 x 24 x 2	11⅜ x 23⅜ x 1¾	12	10.6	3.9
85755.021620M11	16 x 20 x 2	15½ x 19½ x 1¾	12	10.7	4.4
85755.021625M11	16 x 25 x 2	15½ x 24½ x 1¾	12	12.5	5.6
85755.022020M11	20 x 20 x 2	19½ x 19½ x 1¾	12	12.1	5.6
85755.022024M11	20 x 24 x 2	19⅜ x 23⅜ x 1¾	12	14.1	6.9
85755.022025M11	20 x 25 x 2	19½ x 24½ x 1¾	12	14.9	6.9
85755.022424M11	24 x 24 x 2	23⅜ x 23⅜ x 1¾	12	16.0	8.3
4″					
85755.041224M11	12 x 24 x 4	11⅜ x 23⅜ x 3¾	6	10.1	3.9
85755.041620M11	16 x 20 x 4	15½ x 19½ x 3¾	6	12.1	4.4
85755.041625M11	16 x 25 x 4	15½ x 24½ x 3¾	6	13.8	5.5
85755.042020M11	20 x 20 x 4	19½ x 19½ x 3¾	6	13.4	5.6
85755.042024M11	20 x 24 x 4	19⅜ x 23⅜ x 3¾	6	15.3	6.8
85755.042025M11	20 x 25 x 4	19½ x 24½ x 3¾	6	15.8	6.9
85755.042424M11	24 x 24 x 4	23⅜ x 23⅜ x 3¾	6	17.0	8.7

Additional sizes available upon request.

HVAC

PREpleat® M11 SC

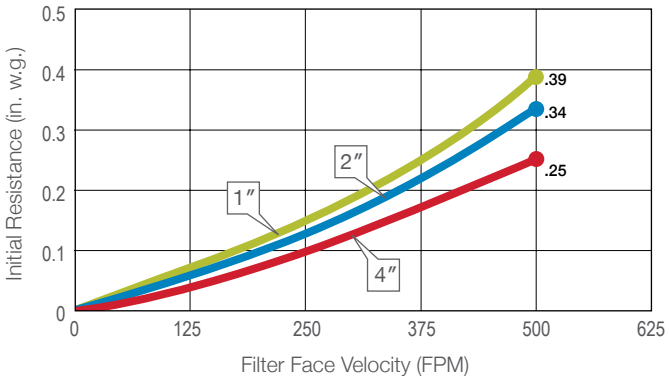
Product Overview

- High efficiency with low initial resistance
- 100% synthetic high loft media
- Standard capacity media configuration
- 2-piece die-cut double-wall frame
- Expanded metal backing
- Diagonal grid supports for maximum strength

Specifications

Efficiency	MERV 11
Filter Depth	1″, 2″, 4″
Media Type	Synthetic High Loft
Frame Material	Beverage Board
Special Size Available	Yes
Antimicrobial	No
Max Operating Temperature	180°F (82°C)
Air Filtration Certification	UL 900

Initial Resistance vs. Filter Face Velocity



Product Information

Part Number	Nominal Size Inches (W x H x D)	Actual Size Inches (W x H x D)	Std. Pkg. Qty.	Shipping Wt. Lbs. per Box	Cubic Ft.
1″					
85655.011224M11	12 x 24 x 1	11½ x 23½ x ¾	12	6.3	1.9
85655.011620M11	16 x 20 x 1	15½ x 19½ x ¾	12	6.1	2.0
85655.011625M11	16 x 25 x 1	15½ x 24½ x ¾	12	7.7	2.4
85655.012020M11	20 x 20 x 1	19½ x 19½ x ¾	12	7.6	2.4
85655.012024M11	20 x 24 x 1	19½ x 23½ x ¾	12	8.5	3.0
85655.012025M11	20 x 25 x 1	19½ x 24½ x ¾	12	8.7	3.0
85655.012424M11	24 x 24 x 1	23⅜ x 23⅜ x ¾	12	10.4	3.5
2″					
85655.021224M11	12 x 24 x 2	11⅜ x 23⅜ x 1¾	12	10.8	3.9
85655.021620M11	16 x 20 x 2	15½ x 19½ x 1¾	12	11.0	4.4
85655.021625M11	16 x 25 x 2	15½ x 24½ x 1¾	12	12.9	5.6
85655.022020M11	20 x 20 x 2	19½ x 19½ x 1¾	12	12.5	5.6
85655.022024M11	20 x 24 x 2	19⅜ x 23⅜ x 1¾	12	14.6	6.9
85655.022025M11	20 x 25 x 2	19½ x 24½ x 1¾	12	15.4	6.9
85655.022424M11	24 x 24 x 2	23⅜ x 23⅜ x 1¾	12	16.7	8.3
4″					
85655.041224M11	12 x 24 x 4	11⅜ x 23⅜ x 3¾	6	10.0	3.9
85655.041620M11	16 x 20 x 4	15½ x 19½ x 3¾	6	11.5	4.4
85655.041625M11	16 x 25 x 4	15½ x 24½ x 3¾	6	13.6	5.6
85655.042020M11	20 x 20 x 4	19½ x 19½ x 3¾	6	13.2	5.6
85655.042024M11	20 x 24 x 4	19⅜ x 23⅜ x 3¾	6	15.6	6.9
85655.042025M11	20 x 25 x 4	19½ x 24½ x 3¾	6	14.6	6.9
85655.042424M11	24 x 24 x 4	23⅜ x 23⅜ x 3¾	6	16.6	8.7

Additional sizes available upon request.

HVAC

PREpleat® M13

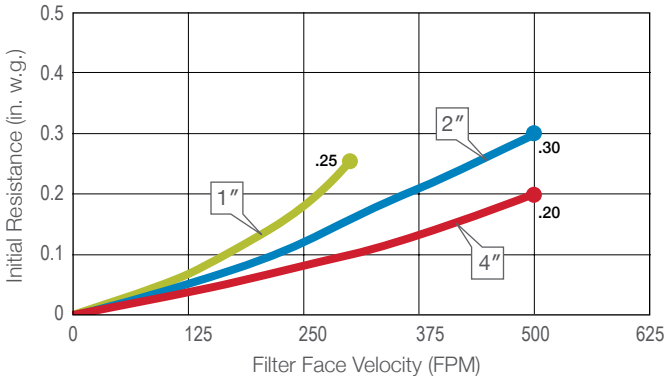
Product Overview

- High efficiency with low initial resistance
- 100% synthetic high loft media
- High capacity media configuration
- 2-piece die-cut double-wall frame
- Expanded metal backing
- Diagonal grid supports for maximum strength
- Can be used to meet LEED® Project Certification requirements for improved IAQ

Specifications

Efficiency	MERV 13
Filter Depth	1″, 2″, 4″
Media Type	Synthetic High Loft
Frame Material	Beverage Board
Special Size Available	Yes
Antimicrobial	No
Max Operating Temperature	180°F (82°C)
Air Filtration Certification	UL 900

Initial Resistance vs. Filter Face Velocity



Product Information

Part Number	Nominal Size Inches (W x H x D)	Actual Size Inches (W x H x D)	Std. Pkg. Qty.	Shipping Wt. Lbs. per Box	Cubic Ft.
1″					
90013.011224	12 x 24 x 1	11½ x 23½ x ¾	12	6.9	2.1
90013.011620	16 x 20 x 1	15½ x 19½ x ¾	12	6.9	2.2
90013.011625	16 x 25 x 1	15½ x 24½ x ¾	12	8.0	2.7
90013.012020	20 x 20 x 1	19½ x 19½ x ¾	12	7.9	2.6
90013.012024	20 x 24 x 1	19½ x 23½ x ¾	12	9.3	3.3
90013.012025	20 x 25 x 1	19½ x 24½ x ¾	12	9.3	3.3
90013.012424	24 x 24 x 1	23⅜ x 23⅜ x ¾	12	11.1	3.9
2″					
90013.021224	12 x 24 x 2	11⅜ x 23⅜ x 1¾	12	11.1	3.9
90013.021620	16 x 20 x 2	15½ x 19½ x 1¾	12	12.0	4.8
90013.021625	16 x 25 x 2	15½ x 24½ x 1¾	12	13.2	6.0
90013.022020	20 x 20 x 2	19½ x 19½ x 1¾	12	13.7	6.0
90013.022024	20 x 24 x 2	19½ x 23½ x 1¾	12	15.1	7.0
90013.022025	20 x 25 x 2	19⅜ x 23⅜ x 1¾	12	16.2	7.4
90013.022424	24 x 24 x 2	19½ x 24½ x 1¾	12	10.1	3.9
4″					
90013.041224	12 x 24 x 4	11⅜ x 23⅜ x 3¾	6	9.9	3.9
90013.041620	16 x 20 x 4	15½ x 19½ x 3¾	6	12.2	4.5
90013.041625	16 x 25 x 4	15½ x 24½ x 3¾	6	13.7	5.6
90013.042020	20 x 20 x 4	19½ x 19½ x 3¾	6	13.4	5.6
90013.042024	20 x 24 x 4	19⅜ x 23⅜ x 3¾	6	15.2	7.0
90013.042025	20 x 25 x 4	19½ x 24½ x 3¾	6	15.8	6.8
90013.042424	24 x 24 x 4	23⅜ x 23⅜ x 3¾	6	16.9	8.6

Additional sizes available upon request.

HVAC

PREpleat® HT HC

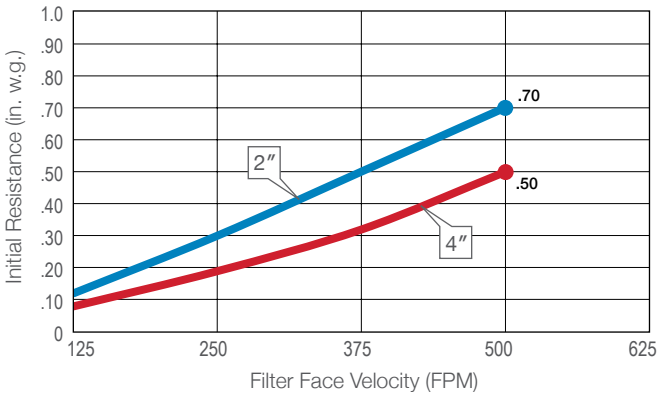
Product Overview

- Designed for applications with continuous operating temperatures up to 500°F (260°C)
- Media backed with woven fiberglass scrim will maintain efficiency even after repeated usage above 400°
- Ultra-fine high loft microglass media
- 24-gauge aluminized steel frame
- Media pack additionally supported by corrosion-resistant metal backing
- Aluminized steel faceguard welded to downstream side prevents blowouts
- Same construction that exceeded all requirements of now-removed UL Class 1

Specifications

Efficiency	MERV 8
Filter Depth	2″, 4″
Media Type	Microglass
Frame Material	Corrosion-Resistant Steel
Special Size Available	Yes
Antimicrobial Available	No
Max Operating Temperature	500°F (260°C)
Air Filtration Certification	UL 900

Initial Resistance vs. Filter Face Velocity



Product Information

Part Number	Nominal Size Inches (W x H x D)	Actual Size Inches (W x H x D)	Std. Pkg. Qty.	Shipping Wt. Lbs. per Box	Cubic Ft.
2″					
147-002-303	12 x 12 x 2	11 7/16 x 11 7/16 x 1 3/4	6	8.0	1.4
147-002-319	12 x 24 x 2	11 7/16 x 23 7/16 x 1 3/4	12	29.7	4.3
147-002-500	16 x 20 x 2	15 7/16 x 19 7/16 x 1 3/4	12	30.8	4.5
147-002-600	16 x 25 x 2	15 7/16 x 24 7/16 x 1 3/4	12	36.6	5.6
147-002-700	20 x 20 x 2	19 7/16 x 19 7/16 x 1 3/4	12	35.7	5.6
147-002-782	20 x 24 x 2	19 7/16 x 23 7/16 x 1 3/4	6	22.9	3.6
147-002-800	20 x 25 x 2	19 7/16 x 24 7/16 x 1 3/4	6	23.6	3.8
147-002-863	24 x 24 x 2	23 7/16 x 23 7/16 x 1 3/4	6	26.2	4.3
4″					
147-004-100	10 x 10 x 4	9 7/16 x 9 7/16 x 3 3/4	6	20.0	2.4
147-004-319	12 x 24 x 4	11 7/16 x 23 7/16 x 3 3/4	6	23.4	4.3
147-004-500	16 x 20 x 4	15 7/16 x 19 7/16 x 3 3/4	6	23.9	4.5
147-004-600	16 x 25 x 4	15 7/16 x 24 7/16 x 3 3/4	6	28.3	5.6
147-004-700	20 x 20 x 4	19 7/16 x 19 7/16 x 3 3/4	6	27.9	5.6
147-004-782	20 x 24 x 4	19 7/16 x 23 7/16 x 3 3/4	3	17.7	3.8
147-004-800	20 x 25 x 4	19 7/16 x 24 7/16 x 3 3/4	3	18.2	3.8
147-004-863	24 x 24 x 4	23 7/16 x 23 7/16 x 3 3/4	3	20.0	4.3

Additional sizes and high-temperature Thermotex gasketing available upon request.

HVAC

DriPak® 2000

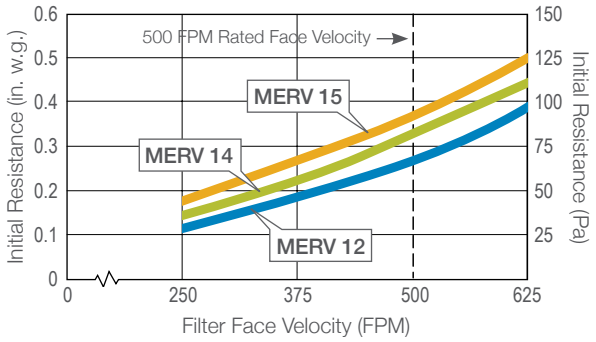
Product Overview

- Meltblown synthetic media provides lower initial resistance versus fiberglass
- Media is high-loft, layered, non-shedding, and water resistant
- Ultrasonically-welded pockets guarantee complete inflation without crowding or leakage
- Reinforced pocket supports prevent flexing or bucking in turbulent conditions
- Available with antimicrobial

Specifications

Efficiency	MERV 15, MERV 14, MERV 12
Available Depths	12″, 15″, 18″, 21″, 22″, 26″, 30″, 36″
Media Type	Synthetic
Frame Material	Galvanized Steel
Antimicrobial Available	Yes
Max Operating Temperature	200°F (93°C)

Initial Resistance vs. Filter Face Velocity



MERV 15, 14 & 12 based on 24″ x 24″ x 30″ – 8 pocket filter.

Product Information

Part Number	Nominal Size Inches (W x H x D)	Number of Pockets	Gross Media Area (sq. ft.)	Rated Airflow Capacity (SCFM)	Std. Pkg. Qty. Per Box	Shipping Wt. Lbs. per Box (± 7%)	Cubic Ft.
MERV 15							
709-110-300	24 x 24 x 30	10	107	2,000	4	38.0	9.4
709-124-300	12 x 24 x 30	4	43	1,000	4	18.0	3.1
709-118-210	24 x 24 x 21	8	60	2,000	4	32.0	4.5
709-124-210	12 x 24 x 21	4	30	1,000	4	18.0	2.9
709-116-210	24 x 24 x 21	6	45	1,500	4	22.0	5.3
709-123-210	12 x 24 x 21	3	22	750	4	13.0	2.1
MERV 14							
708-110-300	24 x 24 x 30	10	107	2,000	4	38.0	9.4
708-124-300	12 x 24 x 30	4	43	1,000	4	18.0	3.1
708-118-210	24 x 24 x 21	8	60	2,000	4	27.0	5.8
708-124-210	12 x 24 x 21	4	30	1,000	4	15.0	2.9
708-116-210	24 x 24 x 21	6	45	1,500	4	22.0	5.3
708-123-210	12 x 24 x 21	3	22	750	4	13.0	2.1
MERV 12							
706-110-300	24 x 24 x 30	10	107	2,000	4	38.0	9.4
706-124-300	12 x 24 x 30	4	43	1,000	4	18.0	3.1
706-118-210	24 x 24 x 21	8	60	2,000	4	27.0	4.5
706-124-210	12 x 24 x 21	4	30	1,000	4	15.0	2.9
706-116-210	24 x 24 x 21	6	45	1,500	4	22.0	5.3
706-123-210	12 x 24 x 21	3	22	750	4	13.0	2.1

Additional sizes, pocket quantities, and depths are available upon request.

HVAC

DriPak®

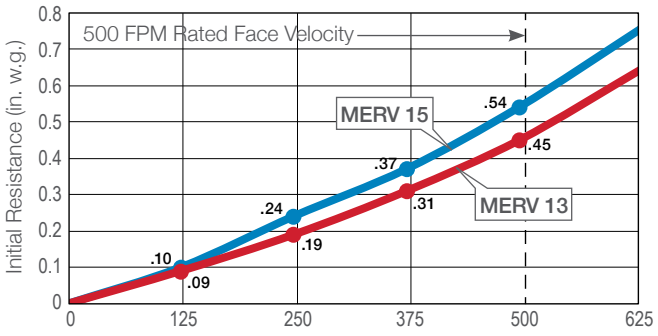
Product Overview

- Patented pocket design lengthens filter life
- Low resistance and high dust holding capacity
- Engineered for performance reliability
- Double-reinforced corrosion resistant steel header
- Aerodynamically balanced pockets significantly extend filter life

Specifications

Efficiency	MERV 15, MERV 13
Available Depths	12″, 15″, 18″, 21″, 22″, 26″, 30″, 36″
Media Type	Fiberglass
Frame Material	Galvanized Steel
Special Size Available	No
Antimicrobial Available	No
Header Style	Single
Max Operating Temperature	150°F (66°C)

Initial Resistance vs. Filter Face Velocity



Curves based on 24″x 24″x 30″, 8 pocket filter.

Product Information

Part Number	Nominal Size Inches (W x H x D)	Number of Pockets	Gross Media Area (sq. ft.)	Rated Airflow Capacity (SCFM)	Std. Pkg. Qty. Per Box	Shipping Wt. Lbs. per Box (± 7%)	Cubic Ft.
MERV 15							
729-110-300	24 x 24 x 30	10	105	2,000	4	28.0	9.4
729-124-300	12 x 24 x 30	4	43	1,000	4	15.0	3.1
729-136-300	20 x 24 x 30	6	64	1,675	4	20.0	6.2
729-146-300	20 x 20 x 30	6	55	1,400	4	16.0	5.5
729-118-210	24 x 24 x 21	8	60	2,000	4	22.0	6.1
729-124-210	12 x 24 x 21	4	30	1,000	4	14.0	2.9
729-116-210	24 x 24 x 21	6	46	1,500	4	18.0	5.6
729-123-210	12 x 24 x 21	3	23	750	4	11.0	2.9
MERV 13							
728-110-300	24 x 24 x 30	10	105	2,000	4	30.0	9.4
728-124-300	12 x 24 x 30	4	43	1,000	4	18.0	3.1
728-136-300	20 x 24 x 30	6	64	1,675	4	21.0	5.9
728-146-300	20 x 20 x 30	6	55	1,400	4	18.0	5.5
728-118-210	24 x 24 x 21	8	60	2,000	4	23.0	6.1
728-124-210	12 x 24 x 21	4	30	1,000	4	15.0	2.9
728-116-210	24 x 24 x 21	6	46	1,500	4	19.0	5.6
728-123-210	12 x 24 x 21	3	23	750	4	12.0	2.9

Additional sizes, pocket quantities, and depths are available upon request.

HVAC

AmerSeal® Cube Filters

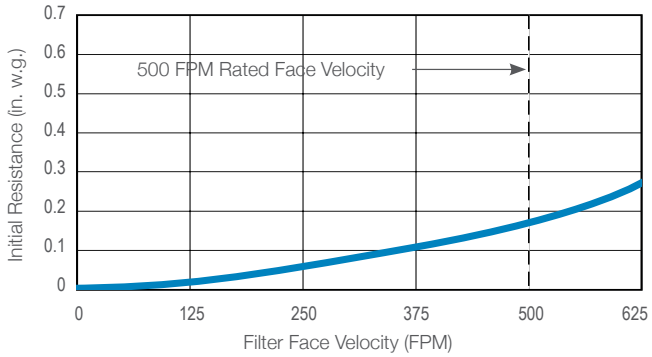
Product Overview

- Self-sealing design prevents dirty air bypass
- High dust holding capacity for long service life
- Fast installation; no clips or latches required
- Heat-sealed construction
- Tackified, progressive density media
- Synthetic 3-ply media is100% moisture resistant
- 9-gauge galvanized wire frame
- MERV 8
- Single header construction also available
- UL Classified

Specifications

Efficiency	MERV 8
Filter Depth	10″, 15″, 20″
Media Type	Synthetic
Special Size Available	No
Header Style	Self-Sealing or Single
Max Operating Temperature	175°F (79°C)

Initial Resistance vs. Filter Face Velocity



Product Information

Part Number	Nominal Size Inches (W x H x D)	Rated Airflow Capacity (SCFM)	Std. Pkg. Qty. Per Box	Shipping Wt. Lbs. per Box (± 7%)	Cubic Ft.
521-500-304	16 x 20 x 10	875	4	8	2.2
521-600-304	16 x 25 x 10	1,100	4	8	3.3
521-700-304	20 x 20 x 10	1,100	4	25*	3.3
521-782-304	20 x 24 x 10	1,325	4	25*	4.7
521-800-304	20 x 25 x 10	1,375	4	25*	4.7
521-863-304	24 x 24 x 10	1,600	4	25*	4.9
521-500-305	16 x 20 x 15	1,100	4	10	2.5
521-600-305	16 x 25 x 15	1,375	4	10	3.3
521-700-305	20 x 20 x 15	1,375	4	25*	3.3
521-782-305	20 x 24 x 15	1,650	4	25*	4.7
521-800-305	20 x 25 x 15	1,725	4	25*	4.7
521-863-305	24 x 24 x 15	2,000	4	25*	4.9
521-500-306	16 x 20 x 20	1,375	3	13	2.5
521-600-306	16 x 25 x 20	1,725	3	13	3.3
521-700-306	20 x 20 x 20	1,725	3	25*	3.3
521-782-306	20 x 24 x 20	2,075	3	25*	4.7
521-800-306	20 x 25 x 20	2,150	3	25*	8.3
521-863-306	24 x 24 x 20	2,500	3	25*	4.9

Product information listed above is for the two-pocket no header configuration. Single pocket, single header, and additional sizes available upon request.

**Carton may be oversized for Ground Shipping.*

HVAC

VariCel® VXL

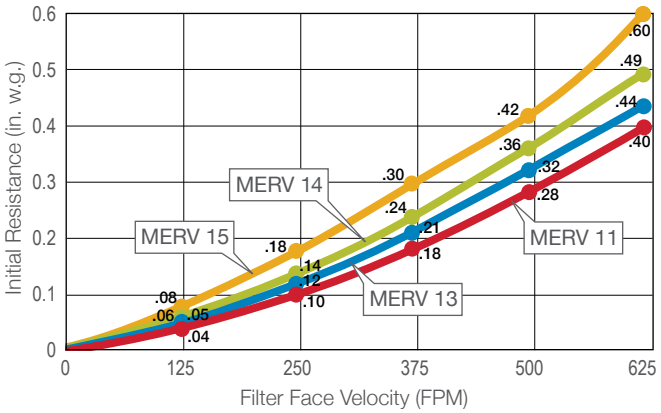
Product Overview

- 60% more media than standard rigid filters for reduced resistance, increased airflow capacity, and longer filter life
- Highest Dust Holding Capacity (DHC) in its class for superior filter life and minimal Total Cost of Ownership (TCO)
- Excellent performance under difficult conditions, including systems operating at air velocities up to 750 FPM
- Lightweight and easy to install
- Models rated MERV 13 and higher meet LEED® Project Certification efficiency requirements
- Fully incinerable, no metal components

Specifications

Efficiency	MERV 15, MERV 14, MERV 13, MERV 11
Filter Depth	12″
Media Type	Dual-Density Microfiberglass
Frame Material	High-Impact Plastic
Separator Style	Thermoplastic Gluebead
Special Size Available	No
Antimicrobial Available	Yes (MERV 14 and higher)
Header Style(s)	Single, Double
Max Operating Temperature	176°F (80°C)
Air Filtration Certification	UL 900

Initial Resistance vs. Filter Face Velocity



Maximum recommended final resistance for all VariCel® VXL filters is 2 in. w.g.

Product Information

Part Number	Nominal Size Inches (W x H x D)	Gross Media Area (Sq. Ft.)	Rated Airflow Capacity (CFM)	Std. Pkg. Qty. Per Carton	Shipping Wt. Lbs. per Box (± 7%)	Cubic Ft.
MERV 15						
3018413-001	24 x 12 x 12	88	1,000	1	9.0	2.2
3018413-002	24 x 20 x 12	161	1,650	1	14.5	3.6
3018413-003	24 x 24 x 12	197	2,000	1	17.0	4.3
3018413-037	20 x 20 x 12	137	1,400	1	11.8	3.3
MERV 14						
3018413-004	24 x 12 x 12	88	1,000	1	9.0	2.0
3018413-005	24 x 20 x 12	161	1,650	1	14.5	3.6
3018413-006	24 x 24 x 12	197	2,000	1	17.0	4.3
3018413-039	20 x 20 x 12	137	1,400	1	11.8	3.3
MERV 13						
3018413-007	24 x 12 x 12	88	1,000	1	9.0	2.2
3018413-008	24 x 20 x 12	161	1,650	1	14.5	3.6
3018413-009	24 x 24 x 12	197	2,000	1	17.0	4.3
3018413-041	20 x 20 x 12	137	1,400	1	11.8	3.3
MERV 11						
3018413-010	24 x 12 x 12	88	1,000	1	9.0	2.2
3018413-011	24 x 20 x 12	161	1,650	1	14.5	3.6
3018413-012	24 x 24 x 12	197	2,000	1	17.0	4.3
3018413-043	20 x 20 x 12	137	1,400	1	11.8	3.3

Also available in a double header construction style and/or with antimicrobial enhanced media.

HVAC

VariCel® VXLS

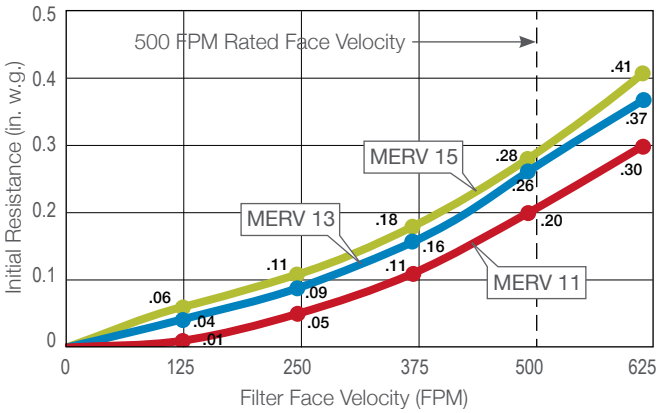
Product Overview

- Delivers superior air quality in difficult operating conditions such as turbulent airflow/repeated fan shut-down, and high humidity
- Gradient-density media for high Dust Holding Capacity (DHC) and longer filter life
- Very low initial resistance provides energy savings
- Fully incinerable, no metal components
- Lightweight and easy to install
- MERV 13 and higher meet LEED® Project Certification efficiency requirements

Specifications

Efficiency	MERV 15, MERV 13, MERV 11
Filter Depth	12″
Media Type	Gradient Density Synthetic
Frame Material	High-Impact Plastic
Separator Style	Gluebead
Special Size Available	No
Antimicrobial Available	No
Header Style(s)	Single
Max Operating Temperature	176°F (80°C)
Air Filtration Certification	UL 900, ULC-S111

Initial Resistance vs. Filter Face Velocity



Product Information

Part Number	Nominal Size Inches (W x H x D)	Gross Media Area (Sq. Ft.)	Rated Airflow Capacity (CFM)	Std. Pkg. Qty. Per Carton	Shipping Wt. Lbs. per Box (± 7%)	Cubic Ft.
MERV 15						
3081858-001	24 x 12 x 12	65	1,000	1	8.5	2.4
3081858-002	24 x 20 x 12	120	1,650	1	14.2	3.9
3081858-003	24 x 24 x 12	145	2,000	1	18.0	4.3
3081858-010	20 x 20 x 12	89	1,400	1	11.8	3.0
MERV 13						
3081858-004	24 x 12 x 12	65	1,000	1	8.5	2.4
3081858-005	24 x 20 x 12	120	1,650	1	14.2	3.9
3081858-006	24 x 24 x 12	145	2,000	1	18.0	4.3
3081858-011	20 x 20 x 12	89	1,400	1	11.8	3.0
MERV 11						
3081858-007	24 x 12 x 12	65	1,000	1	8.5	2.4
3081858-008	24 x 20 x 12	120	1,650	1	14.2	3.6
3081858-009	24 x 24 x 12	145	2,000	1	18.0	4.3
3081858-012	20 x 20 x 12	89	1,400	1	11.8	3.0

HVAC

SuperFlow® Q

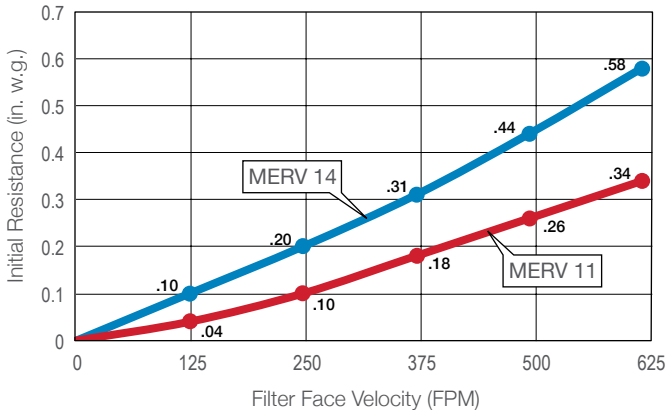
Product Overview

- May be operated from 0 to 500 FPM face velocity in either airflow direction
- Longer service life than standard rigid filters due to higher total media area
- Aerodynamic vertical supports minimize air entry turbulence
- Recommended for systems with Variable Air Volume (VAV) or turbulent airflows due to rigid construction
- Moisture resistant for humid air applications

Specifications

Efficiency	MERV 14, MERV 11
Filter Depth	12″
Media Type	Microfiberglass
Frame Material	Plastic
Separator Style	Gluebead
Special Size Available	No
Antimicrobial Available	No
Header Style(s)	Single
Max Operating Temperature	160°F (71°C)
Air Filtration Certification	UL 900

Initial Resistance vs. Filter Face Velocity



Product Information

Part Number	Nominal Size Inches (W x H x D)	Actual Size Inches (W x H x D)	Rated Airflow Capacity (CFM)	Media Area (Sq. Ft.)	Std. Pkg. Qty. Per Carton	Shipping Wt. Lbs. per Box
MERV 14						
F0625307	24 x 24 x 12	23⅜ x 23⅜ x 11½	2,000	100	1	17
F0625309	12 x 24 x 12	11⅜ x 23⅜ x 11½	1,000	45	1	8
F0625308	20 x 24 x 12	19⅜ x 23⅜ x 11½	1,600	85	1	13
MERV 11						
F0625226	24 x 24 x 12	23⅜ x 23⅜ x 11½	2,000	100	1	17
F0625228	12 x 24 x 12	11⅜ x 23⅜ x 11½	1,000	45	1	8
F0625227	20 x 24 x 12	19⅜ x 23⅜ x 11½	1,600	85	1	13

HVAC

VariCel® 2+HC

Product Overview

- AAF Flanders' Impress® pleating technology for maximized energy efficiency
- Combines high mechanical strength and low resistance for savings on overall operating costs
- Excellent performance under difficult conditions, including variable air volume, turbulent airflow, and high humidity
- Impress® technology maximizes media utilization for increased Dust Holding Capacity (DHC) and longer service life
- High capacity media pack provides lowest possible total cost of ownership with lower resistance and longer filter life
- Lightweight and easy to handle and install
- Slim-line design significantly reduces shipping, storage, and disposal cost
- Models rated MERV 13 and higher meet LEED® Project Certification efficiency requirements

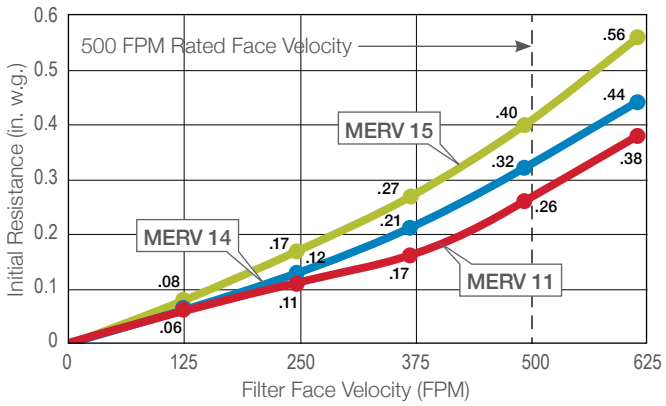
Specifications

Efficiency	MERV 15, MERV 14, MERV 11
Filter Depth	4″
Media Type	Synthetic
Frame Material	Plastic
Separator Style	Embossed
Special Size Available	No
Antimicrobial Available	No
Header Style(s)	Single, Box Style
Max Operating Temperature	150°F (66°C)
Air Filtration Certification	UL 900, ULC-S111

Impress® TECHNOLOGY

LPD® U.S. Patent No. 6,685,833 B2

Initial Resistance vs. Filter Face Velocity



Product Information

Part Number	Nominal Size Inches (W x H x D)	Actual Size Inches (W x H x D)	Rated Airflow Capacity (CFM)	Std. Pkg. Qty. Per Carton	Shipping Wt. Lbs. per Box (± 7%)	Cubic Ft.
MERV 15 Rated Filter Face Velocity: 500 FPM						
3102040-908	24 x 24 x 4	23⅜ x 23⅜ x 3¾	2,000	4	21.0	6.1
3102040-906	20 x 24 x 4	19⅜ x 23⅜ x 3¾	1,650	4	17.5	5.2
3102040-905	20 x 20 x 4	19⅜ x 19⅜ x 3¾	1,400	4	14.6	4.3
3102040-901	12 x 24 x 4	11⅜ x 23⅜ x 3¾	1,000	4	14.2	3.2
MERV 14 Rated Filter Face Velocity: 500 FPM						
3102040-808	24 x 24 x 4	23⅜ x 23⅜ x 3¾	2,000	4	21.0	6.1
3102040-806	20 x 24 x 4	19⅜ x 23⅜ x 3¾	1,650	4	17.5	5.2
3102040-805	20 x 20 x 4	19⅜ x 19⅜ x 3¾	1,400	4	14.6	4.3
3102040-801	12 x 24 x 4	11⅜ x 23⅜ x 3¾	1,000	4	14.2	3.2
MERV 11 Rated Filter Face Velocity: 500 FPM						
3102040-608	24 x 24 x 4	23⅜ x 23⅜ x 3¾	2,000	4	21.0	6.1
3102040-606	20 x 24 x 4	19⅜ x 23⅜ x 3¾	1,650	4	17.5	5.2
3102040-605	20 x 20 x 4	19⅜ x 19⅜ x 3¾	1,400	4	14.6	4.3
3102040-601	12 x 24 x 4	11⅜ x 23⅜ x 3¾	1,000	4	14.2	3.2

Product information listed above is for box style configuration. This product is also available in single header and reverse flow configurations.

Additional sizes available upon request.

HVAC

VariCel® 2+SC

Product Overview

- AAF Flanders' Impress® pleating technology for maximized energy efficiency
- Combines high mechanical strength and low resistance for savings on overall operating costs
- Excellent performance under difficult conditions, including variable air volume, turbulent airflow, and high humidity
- Impress® technology maximizes media utilization for increased Dust Holding Capacity (DHC) and longer service life
- Lightweight and easy to handle and install
- Slim-line design significantly reduces shipping, storage, and disposal costs
- Fully incinerable, no metal components
- Models rated MERV 13 and higher meet LEED® Project Certification efficiency requirements

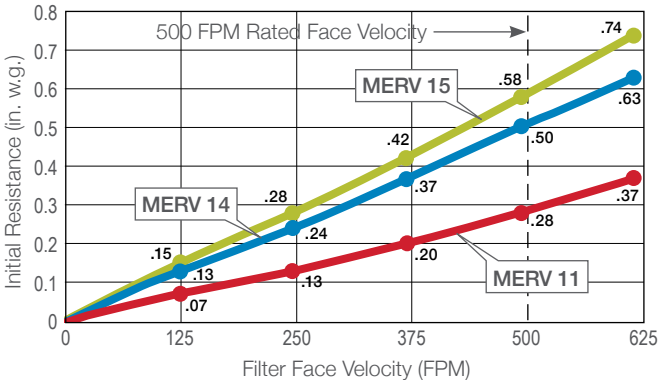
Specifications

Efficiency	MERV 15, MERV 14, MERV 11
Filter Depth	4″
Media Type	Synthetic
Frame Material	Plastic
Separator Style	Embossed
Special Size Available	No
Antimicrobial Available	No
Header Style(s)	Single, Box Style
Max Operating Temperature	150°F (66°C)
Air Filtration Certification	UL 900, ULC-S111

Impress® TECHNOLOGY

LPD® U.S. Patent No. 6,685,833 B2

Initial Resistance vs. Filter Face Velocity



Product Information

Part Number	Nominal Size Inches (W x H x D)	Actual Size Inches (W x H x D)	Rated Airflow Capacity (CFM)	Std. Pkg. Qty. Per Carton	Shipping Wt. Lbs. per Box (± 7%)	Cubic Ft.
MERV 15 Rated Filter Face Velocity: 500 FPM						
3102036-908	24 x 24 x 4	23⅜ x 23⅜ x 3¾	2,000	4	21.0	6.1
3102036-906	20 x 24 x 4	19⅜ x 23⅜ x 3¾	1,650	4	17.5	5.2
3102036-905	20 x 20 x 4	19⅜ x 19⅜ x 3¾	1,400	4	14.6	4.3
3102036-901	12 x 24 x 4	11⅜ x 23⅜ x 3¾	1,000	4	14.2	3.
MERV 14 Rated Filter Face Velocity: 500 FPM						
3102036-808	24 x 24 x 4	23⅜ x 23⅜ x 3¾	2,000	4	21.0	6.1
3102036-806	20 x 24 x 4	19⅜ x 23⅜ x 3¾	1,650	4	17.5	5.2
3102036-805	20 x 20 x 4	19⅜ x 19⅜ x 3¾	1,400	4	14.6	4.3
3102036-801	12 x 24 x 4	11⅜ x 23⅜ x 3¾	1,000	4	14.2	3.2
MERV 11 Rated Filter Face Velocity: 500 FPM						
3102036-608	24 x 24 x 4	23⅜ x 23⅜ x 3¾	2,000	4	21.0	6.1
3102036-606	20 x 24 x 4	19⅜ x 23⅜ x 3¾	1,650	4	17.5	5.2
3102036-605	20 x 20 x 4	19⅜ x 19⅜ x 3¾	1,400	4	14.6	4.3
3102036-601	12 x 24 x 4	11⅜ x 23⅜ x 3¾	1,000	4	14.2	3.2

Product information listed above is for box style configuration. This product is also available in single header and reverse flow configurations.

Additional sizes available upon request.

HVAC

VariCel® M-Pak

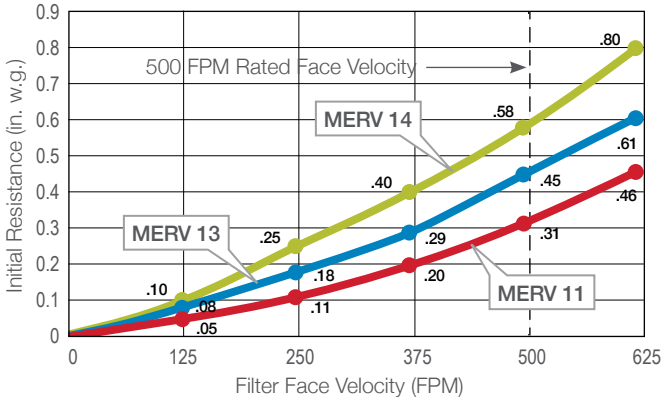
Product Overview

- Delivers comparable efficiency, pressure drop, and overall performance in half the footprint as standard 12″ deep box style filters
- Space-saving and lightweight 6″ deep design reduces freight, storage and handling costs, and is easier to install
- Sturdy high-impact polystyrene (HIPS) cell sides resist damage during shipping, handling, and operation
- Dual-density media for increased Dust Holding Capacity (DHC) and extended filter life
- Fully incinerable, no metal components
- MERV 14 and 11 models available with antimicrobial
- Models rated MERV 13 and higher meet LEED® Project Certification efficiency requirements

Specifications

Efficiency	MERV 14, MERV 13, MERV 11
Filter Depth	6″
Media Type	Dual-Density Microfiberglass
Frame Material	High-Impact Plastic
Separator Style	Thermoplastic Gluebead
Special Size Available	No
Antimicrobial Available	Yes
Header Style(s)	Single
Max Operating Temperature	176°F (80°C)
Air Filtration Certification	UL 900, ULC-S111

Initial Resistance vs. Filter Face Velocity



Filters are rated at 500 FPM filter face velocity. Recommended final resistance for all VariCel® M-Pak filters is 1.5″ w.g.

Product Information

Part Number	Nominal Size Inches (W x H x D)	Gross Media Area (Sq. Ft.)	Rated Airflow Capacity (CFM)	Std. Pkg. Qty. Per Carton	Shipping Wt. Lbs. per Box (± 7%)	Cubic Ft.
MERV 14 Rated Filter Face Velocity: 500 FPM						
3014883-008	24 x 24 x 6	125	2,000	2	19.0	4.4
3014883-006	20 x 24 x 6	103	1,660	2	16.5	3.7
3014883-005	20 x 20 x 6	84	1,400	2	14.0	3.1
3014883-001	12 x 24 x 6	57	1,000	2	11.5	2.2
MERV 13 Rated Filter Face Velocity: 500 FPM						
3014883-016	24 x 24 x 6	105	2,000	2	18.0	4.4
3014883-014	20 x 24 x 6	86	1,660	2	15.5	3.7
3014883-013	20 x 20 x 6	70	1,400	2	13.0	3.1
3014883-009	12 x 24 x 6	47	1,000	2	10.5	2.2
MERV 11 Rated Filter Face Velocity: 500 FPM						
3014883-024	24 x 24 x 6	105	2,000	2	18.0	4.4
3014883-022	20 x 24 x 6	86	1,660	2	15.5	3.1
3014883-021	20 x 20 x 6	70	1,400	2	13.0	3.1
3014883-017	12 x 24 x 6	47	1,000	2	10.5	2.2

Additional sizes, reverse flow configuration, and antimicrobial enhanced media available upon request.

HVAC

VariCel® II

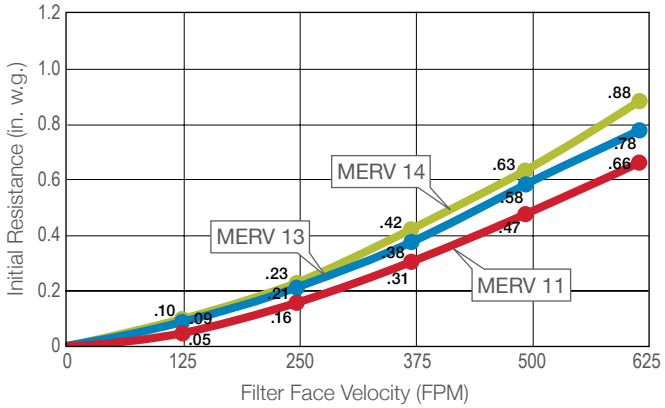
Product Overview

- High efficiency filtration and long filter life with a lightweight, durable space-saving design
- Double-wall, die-cut frame adds strength and prevents dirty air bypass
- Dual-density microglass media with consistent pleat spacing for complete media utilization
- Slim-line, mini-pleat construction lowers shipping, storage, handling, and disposal costs (as much as 3 times over conventional 12″ deep filters)
- Available with antimicrobial (MERV 14 efficiency)
- Fully incinerable, no metal components
- Models rated MERV 13 and higher meet LEED® Project Certification efficiency requirements

Specifications

Efficiency	MERV 14, MERV 13, MERV 11
Filter Depth	4″
Media Type	Dual-Density Microfiberglass
Frame Material	Beverage Board
Separator Style	Thermoplastic Gluebead
Special Size Available	No
Antimicrobial Available	Yes
Header Style(s)	Box Style
Max Operating Temperature	150°F (66°C)
Air Filtration Certification	UL 900, ULC-S111

Initial Resistance vs. Filter Face Velocity



Product Information

Part Number	Nominal Size Inches (W x H x D)	Gross Media Area (Sq. Ft.)	Rated Airflow Capacity (CFM)	Std. Pkg. Qty. Per Carton	Shipping Wt. Lbs. per Box (± 7%)	Cubic Ft.
MERV 14 Rated Filter Face Velocity: 500 FPM						
332-528-008	24 x 24 x 4	119	2,000	4	26.0	6.4
332-528-006	20 x 24 x 4	99	1,650	4	21.0	6.4
332-528-005	20 x 20 x 4	82	1,400	4	18.0	4.6
332-528-001	12 x 24 x 4	58	1,000	4	13.0	3.2
MERV 13 Rated Filter Face Velocity: 500 FPM						
332-510-008	24 x 24 x 4	119	2,000	4	26.0	6.4
332-510-006	20 x 24 x 4	99	1,650	4	21.0	6.4
332-510-005	20 x 20 x 4	82	1,400	4	18.0	16.0
332-510-001	12 x 24 x 4	58	1,000	4	13.0	3.2
MERV 11 Rated Filter Face Velocity: 500 FPM						
332-502-008	24 x 24 x 4	119	2,000	4	26.0	6.4
332-502-006	20 x 24 x 4	99	1,650	4	21.0	6.4
332-502-005	20 x 20 x 4	82	1,400	4	18.0	4.6
332-502-001	12 x 24 x 4	58	1,000	4	13.0	3.2

Additional sizes available upon request.

HVAC

VariCel® II MH

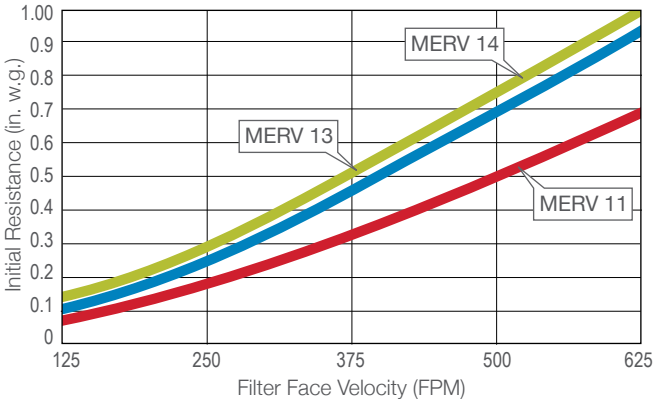
Product Overview

- Rugged metal construction provides excellent performance under difficult operating conditions
- Header allows for easy fit in side access systems and direct replacement of 12″ or 6″ deep headered filters
- Highly moisture resistant
- Slim-line, mini-pleat construction lowers shipping, storage, handling, and disposal costs (as much as 3 times over conventional 12″ deep filters)
- Dual-density microglass media with consistent pleat spacing for complete media utilization
- Available with antimicrobial (MERV 14 efficiency)
- High efficiency filtration and long filter life with a lightweight, durable, space-saving design
- Models rated MERV 13 and higher meet LEED® Project Certification efficiency requirements

Specifications

Efficiency	MERV 14, MERV 13, MERV 11
Filter Depth	4″
Media Type	Dual-Density Microfiberglass
Frame Material	Metal
Separator Style	Thermoplastic Gluebead
Special Size Available	No
Antimicrobial Available	Yes
Header Style(s)	Single
Max Operating Temperature	150°F (66°C)
Air Filtration Certification	UL 900, ULC-S111

Initial Resistance vs. Filter Face Velocity



Product Information

Part Number	Nominal Size Inches (W x H x D)	Actual Size Inches (W x H x D)	Gross Media Area (Sq. Ft.)	Rated Airflow Capacity (CFM)	Std. Pkg. Qty. Per Carton	Shipping Wt. Lbs. Per Box	Cubic Ft.
MERV 14							
335-080-200	24 x 24 x 4	23⅜ x 23⅜ x 4¼	111	2,000	2	19.6	6.4
335-060-200	20 x 24 x 4	19⅜ x 23⅜ x 4¼	91	1,650	2	17.6	5.3
335-050-200	20 x 20 x 4	19⅜ x 19⅜ x 4¼	75	1,400	2	15.8	4.4
335-010-200	12 x 24 x 4	11⅜ x 23⅜ x 4¼	50	1,000	2	13.5	3.2
MERV 13							
335-080-100	24 x 24 x 4	23⅜ x 23⅜ x 4¼	111	2,000	2	19.6	6.4
335-060-100	20 x 24 x 4	19⅜ x 23⅜ x 4¼	91	1,650	2	17.6	5.3
335-050-100	20 x 20 x 4	19⅜ x 19⅜ x 4¼	75	1,400	2	15.8	4.4
335-010-100	12 x 24 x 4	11⅜ x 23⅜ x 4¼	50	1,000	2	13.5	3.2
MERV 11							
335-080-000	24 x 24 x 4	23⅜ x 23⅜ x 4¼	111	2,000	2	19.6	6.4
335-060-000	20 x 24 x 4	19⅜ x 23⅜ x 4¼	91	1,650	2	17.6	5.3
335-050-000	20 x 20 x 4	19⅜ x 19⅜ x 4¼	75	1,400	2	15.8	4.4
335-010-000	12 x 24 x 4	11⅜ x 23⅜ x 4¼	50	1,000	2	13.5	3.2

Additional sizes and antimicrobial enhanced media available upon request.

HVAC

VariCel®

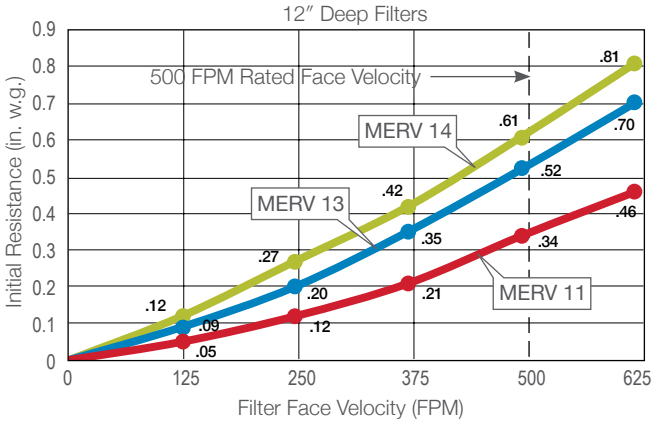
Product Overview

- Dual-density media increases filter life and reduces operating costs
- Open header design prevents dirty air bypass and makes handling safe and easy
- Designed to perform in the most difficult operating conditions, such as variable air volume, turbulent airflows, and repeated fan shutdown
- Rated for continuous operation at temperatures up to 350°F
- Available with antimicrobial (MERV 14 efficiency)
- Models rated MERV 13 and higher meet LEED® Project Certification efficiency requirements

Specifications

Efficiency	MERV 14, MERV 13, MERV 11
Filter Depth	6″, 12″
Media Type	Dual-Density Microfiberglass
Frame Material	Galvanized Steel
Separator Style	Corrugated Aluminum
Special Size Available	No
Antimicrobial Available	Yes
Header Style(s)	Single, Double
Max Operating Temperature	350°F (177°C)
Air Filtration Certification	UL 900, ULC-S111

Initial Resistance vs. Filter Face Velocity



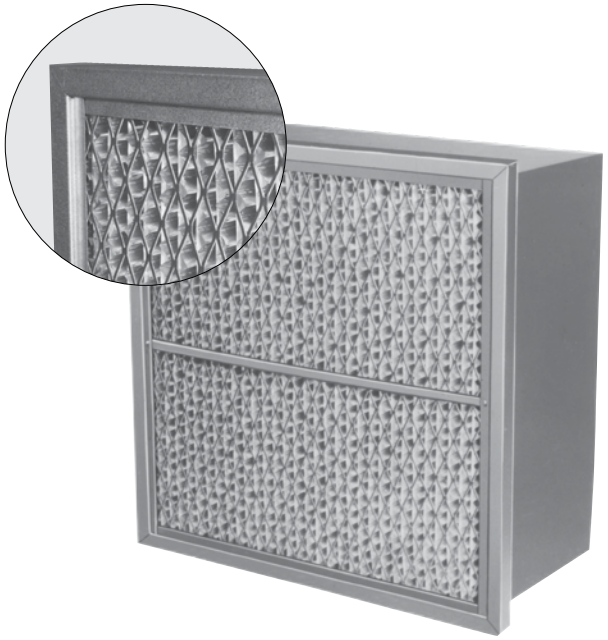
Product Information

Part Number	Nominal Size Inches (W x H x D)	Gross Media Area (Sq. Ft.)	Rated Airflow Capacity (CFM)	Std. Pkg. Qty. Per Carton	Shipping Wt. Lbs. per Box (± 7%)	Cubic Ft.
Header Style(s)	Standard Sizes	This product is also available in double header and reverse flow configurations.				
MERV 14 Rated Filter Face Velocity: 500 FPM						
331-946-148	24 x 24 x 12	125	2,000	1	19.0	4.7
331-946-189	20 x 24 x 12	103	1,650	1	16.5	3.6
331-946-136	20 x 20 x 12	84	1,400	1	14.0	3.0
331-946-150	12 x 24 x 12	57	1,000	1	11.5	2.2
MERV 14 Rated Filter Face Velocity: 250 FPM						
331-946-147	24 x 24 x 6	60	1,000	2	21.0	4.7
331-946-188	20 x 24 x 6	49	825	2	18.5	4.0
331-946-135	20 x 20 x 6	40	700	2	16.5	3.3
331-946-149	12 x 24 x 6	27	500	2	13.5	2.4
MERV 13 Rated Filter Face Velocity: 500 FPM						
331-765-148	24 x 24 x 12	105	2,000	1	18.0	4.3
331-765-189	20 x 24 x 12	86	1,650	1	15.5	3.6
331-765-136	20 x 20 x 12	70	1,400	1	13.0	3.0
331-765-150	12 x 24 x 12	47	1,000	1	10.5	2.2
MERV 13 Rated Filter Face Velocity: 250 FPM						
331-765-147	24 x 24 x 6	50	1,000	2	19.5	4.7
331-765-188	20 x 24 x 6	41	825	2	17.0	4.0
331-765-135	20 x 20 x 6	33	700	2	15.0	3.3
331-765-149	12 x 24 x 6	22	500	2	12.0	2.4
MERV 11 Rated Filter Face Velocity: 500 FPM						
331-953-148	24 x 24 x 12	105	2,000	1	18.0	4.3
331-953-189	20 x 24 x 12	86	1,650	1	15.5	3.6
331-953-136	20 x 20 x 12	70	1,400	1	13.0	3.0
331-953-150	12 x 24 x 12	47	1,000	1	10.5	2.2
MERV 11 Rated Filter Face Velocity: 250 FPM						
331-953-147	24 x 24 x 6	50	1,000	2	19.5	4.7
331-953-188	20 x 24 x 6	41	825	2	17.0	4.0
331-953-135	20 x 20 x 6	33	700	2	15.0	3.3
331-953-149	12 x 24 x 6	22	500	2	12.0	2.4

Additional sizes available upon request. Available options upon request include: antimicrobial enhanced media, gasketing, and/or faceguards (upstream, downstream, or both sides).

HVAC

VariCel® HT



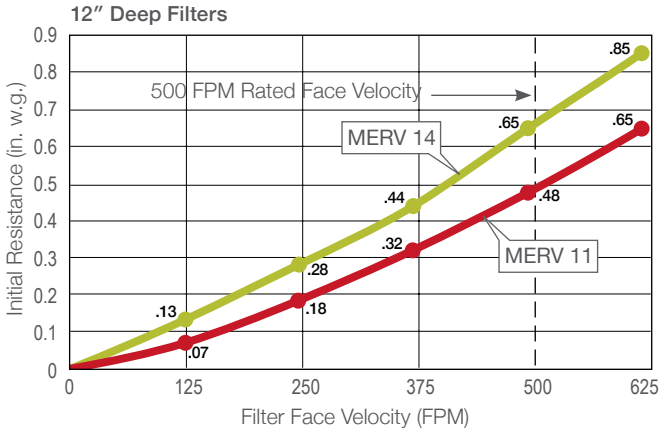
Product Overview

- Designed for continuous operating temperatures as high as 900°
- Aluminized steel frame with aluminized steel faceguards and bar braces on both sides for superior strength, along with heat and corrosion resistance
- Dual-density media increases filter life and reduces operating costs
- Can also be used at lower temperatures to extend service life
- MERV 14 meets LEED® Project Certification efficiency requirements
- UL Classified

Specifications

Efficiency	MERV 14, MERV 11
Filter Depth	12″
Media Type	Dual-Density Microfiberglass
Frame Material	Aluminized Steel
Separator Style	Corrugated Aluminum
Special Size Available	No
Antimicrobial Available	Yes
Header Style(s)	Single
Max Operating Temperature	500°F (260°C), 725°F (385°C), 900°F (482°C)
Air Filtration Certification	UL 900, ULC-S111

Initial Resistance vs. Filter Face Velocity



Product Information

Part Number	Nominal Size Inches (W x H x D)	Actual Size Inches (W x H x D)	Gross Media Area (Sq. Ft.)	Rated Airflow Capacity (CFM)	Std. Pkg. Qty. Per Carton	Shipping Wt. Lbs. per Box	Cubic Ft.
Single Header Standard Sizes							
500°F (Type HT-500) MERV 14							
331-082-001	24 x 24 x 12	23⅜ x 23⅜ x 11½	125	2,000	1	19.0	4.3
331-082-002	12 x 24 x 12	11⅜ x 23⅜ x 11½	57	1,000	1	11.5	2.2
500°F (Type HT-500) MERV 11							
331-108-001	24 x 24 x 12	23⅜ x 23⅜ x 11½	105	2,000	1	14.0	4.3
331-108-002	12 x 24 x 12	11⅜ x 23⅜ x 11½	47	1,000	1	11.0	2.2
725°F (Type HT-725) MERV 14							
331-041-001	24 x 24 x 12	23⅜ x 23⅜ x 11½	140	2,000	1	20.0	4.3
331-041-002	12 x 24 x 12	11⅜ x 23⅜ x 11½	62	1,000	1	12.0	2.2
725°F (Type HT-725) MERV 11							
331-066-001	24 x 24 x 12	23⅜ x 23⅜ x 11½	140	2,000	1	20.0	4.3
331-066-002	12 x 24 x 12	11⅜ x 23⅜ x 11½	62	1,000	1	12.0	2.2
900°F (Type HT-900) MERV 14							
331-828-005	24 x 24 x 12	23⅜ x 23⅜ x 11½	175	2,000	1	21.3	4.3
331-828-006	12 x 24 x 12	11⅜ x 23⅜ x 11½	79	1,000	1	13.1	2.2
900°F (Type HT-900) MERV 11							
331-828-001	24 x 24 x 12	23⅜ x 23⅜ x 11½	175	2,000	1	21.3	4.3
331-828-002	12 x 24 x 12	11⅜ x 23⅜ x 11½	79	1,000	1	13.1	2.4

Also available in double header configuration, and with glass fiber (high temp.) gasketing upon request.

HVAC

VariCel® RF

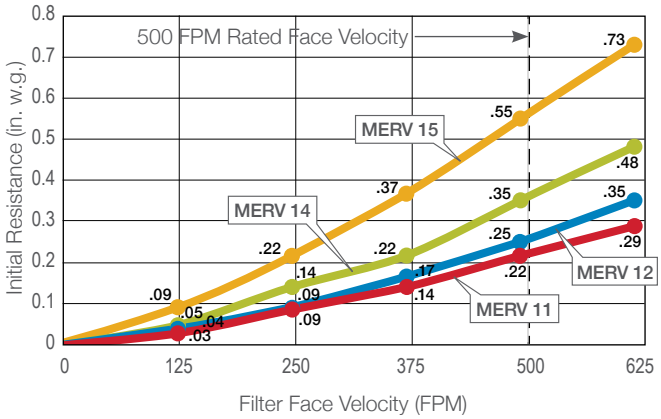
Product Overview

- Designed for excellent performance and durability
- Open header design prevents dirty air bypass and provides a handhold for safe and easy installation
- Meltblown, synthetic media will not shed, is water resistant, and is more resistant to handling damage than fiberglass
- Layered media captures both large and small particles for complete utilization
- Media pack is supported by plastic pleat spacers and expanded metal backing
- Recommended for applications with Variable Air Volume (VAV) and repeated fan shutdowns
  Models rated MERV 13 and higher meet LEED® Project Certification efficiency requirements

Specifications

Efficiency	MERV 15, MERV 14, MERV 12, MERV 11
Filter Depth	12″
Media Type	Meltblown Synthetic
Frame Material	Galvanized Steel
Separator Style	Plastic
Special Size Available	No
Antimicrobial Available	No
Header Style(s)	Single, Double
Max Operating Temperature	200°F (93°C)
Air Filtration Certification	UL 900, ULC-S111

Initial Resistance vs. Filter Face Velocity



Product Information

Part Number	Nominal Size Inches (W x H x D)	Gross Media Area (Sq. Ft.)	Rated Airflow Capacity (CFM)	Std. Pkg. Qty. Per Carton	Shipping Wt. Lbs. per Box (± 7%)	Cubic Ft.
MERV 15 Rated Filter Face Velocity: 500 FPM						
3011079-001	24 x 24 x 12	62	2,000	1	24.0	4.3
3011079-002	24 x 20 x 12	52	1,660	1	21.0	3.6
3011079-003	20 x 20 x 12	41	1,400	1	18.0	3.0
3011079-004	24 x 12 x 12	31	1,000	1	13.0	3.6
MERV 14 Rated Filter Face Velocity: 500 FPM						
3011079-005	24 x 24 x 12	62	2,000	1	24.0	4.3
3011079-006	24 x 20 x 12	52	1,660	1	21.0	3.6
3011079-007	20 x 20 x 12	41	1,400	1	18.0	3.0
3011079-008	24 x 12 x 12	31	1,000	1	13.0	2.2
MERV 12 Rated Filter Face Velocity: 500 FPM						
3011079-009	24 x 24 x 12	62	2,000	1	24.0	3.6
3011079-010	24 x 20 x 12	52	1,660	1	21.0	3.6
3011079-011	20 x 20 x 12	41	1,400	1	18.0	3.0
3011079-012	24 x 12 x 12	31	1,000	1	13.0	3.6
MERV 11 Rated Filter Face Velocity: 500 FPM						
3011079-013	24 x 24 x 12	62	2,000	1	24.0	4.3
3011079-014	24 x 20 x 12	52	1,660	1	21.0	3.6
3011079-015	20 x 20 x 12	41	1,400	1	18.0	3.0
3011079-016	24 x 12 x 12	31	1,000	1	13.0	2.2

Additional sizes available upon request. Product information above is for single header configuration with standard airflow; double header and reverse flow styles also available.

HVAC

BioCel® VXL

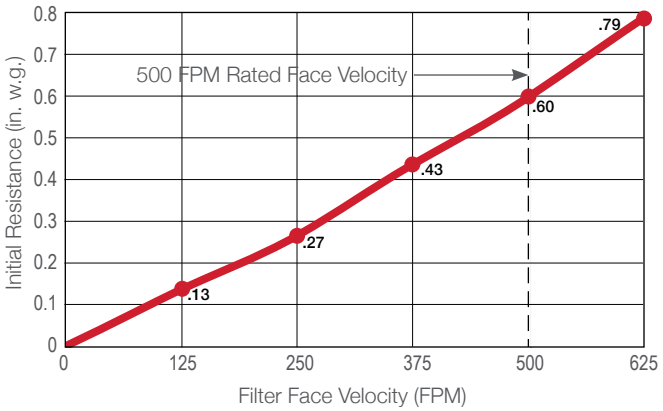
Product Overview

- Near HEPA filtration efficiency at a much lower pressure drop than traditional HEPA filters or 95% DOP filters
- Engineered to meet the exacting requirements of critical applications
- Sturdy, high-impact plastic cell sides resist damage during shipping, handling, and operation
- Weighs significantly less than traditional box style HEPA or ASHRAE filters, saving time and money during installation and removal
- Low initial pressure drop (.60 in w.g. @ 500 FPM) and high media area for extremely long filter life and low total cost of ownership
- Can upgrade efficiency of existing box style filters without requiring special frames or latches
- Fully incinerable, no metal components

Specifications

Efficiency	MERV 16
Filter Depth	12″
Media Type	Microfiberglass
Frame Material	High-Impact Plastic
Separator Style	Thermoplastic Gluebead
Special Size Available	No
Antimicrobial Available	Yes
Header Style(s)	Single, Double
Max Operating Temperature	176°F (80°C)
Air Filtration Certification	UL 900

Initial Resistance vs. Filter Face Velocity



Product Information

Part Number	Nominal Size Inches (W x H x D)	Gross Media Area (Sq. Ft.)	Rated Airflow Capacity (CFM)	Std. Pkg. Qty. Per Carton	Shipping Wt. Lbs. per Box (± 7%)	Cubic Ft.
Single Header **MERV 16** Standard Sizes						
No Gaskets						
3027026-001	24 x 12 x 12	88	1,000	1	9.0	2.0
3027026-002	24 x 20 x 12	161	1,650	1	14.5	3.6
3027026-003	24 x 24 x 12	197	2,000	1	17.0	4.0
Gasketing on the Air Leaving Side						
3027026-007	24 x 12 x 12	88	1,000	1	9.0	2.2
3027026-008	24 x 20 x 12	161	1,650	1	14.5	3.6
3027026-009	24 x 24 x 12	197	2,000	1	17.0	4.3
Double Header **MERV 16** Standard Sizes						
No Gaskets						
3027026-004	24 x 12 x 12	88	1,000	1	9.0	2.2
3027026-005	24 x 20 x 12	161	1,650	1	14.5	3.6
3027026-006	24 x 24 x 12	197	2,000	1	17.0	4.3
Gasketing on the Air Leaving Side						
3027026-010	24 x 12 x 12	88	1,000	1	9.0	2.4
3027026-011	24 x 20 x 12	161	1,650	1	14.5	3.6
3027026-012	24 x 24 x 12	197	2,000	1	17.0	4.3

Antimicrobial also available upon request.

HVAC

BioCel® M-Pak

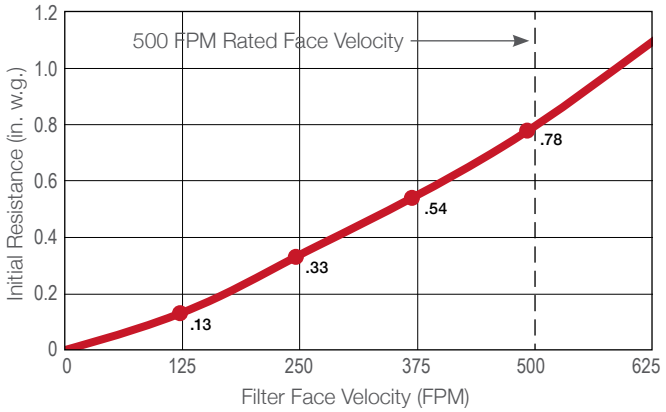
Product Overview

- Near HEPA (MERV 16) efficiency—upgrade efficiency of existing box style filters without requiring special frames or latches
- Space-saving and lightweight 6″ deep design reduces freight, storage, and handling costs, and is easier to install than traditional box style HEPA or ASHRAE filters
- Engineered to meet the exacting requirements of critical applications
- Sturdy, high-impact plastic cell sides resist damage during shipping, handling, and operation
- Fully incinerable, no metal components

Specifications

Efficiency	MERV 16
Filter Depth	6″
Media Type	Microfiberglass
Frame Material	High-Impact Plastic
Separator Style	Thermoplastic Gluebead
Special Size Available	No
Antimicrobial Available	No
Header Style(s)	Single
Max Operating Temperature	176°F (80°C)
Air Filtration Certification	UL 900

Initial Resistance vs. Filter Face Velocity



Filters are rated at 500 FPM filter face velocity. Recommended final resistance for all BioCel® M-Pak filters is 2″ w.g.

Product Information

Part Number	Nominal Size Inches (W x H x D)	Rated Airflow Capacity (CFM)	Std. Pkg. Qty. Per Carton	Shipping Wt. Lbs. per Box (± 7%)	Cubic Ft.
Single Header MERV 16 Standard Sizes					
Rated Filter Face Velocity: 500 FPM					
3016953-007	24 x 24 x 6	2,000	2	20.0	4.4
3016953-006	20 x 25 x 6	1,750	2	18.2	3.9
3016953-005	20 x 24 x 6	1,650	2	17.5	3.7
3016953-004	20 x 20 x 6	1,400	2	15.0	3.1
3016953-003	16 x 25 x 6	1,400	2	15.0	3.1
3016953-002	16 x 20 x 6	1,100	2	13.0	1.4
3016953-001	12 x 24 x 6	1,000	2	12.0	2.2

HVAC

BioCel® I

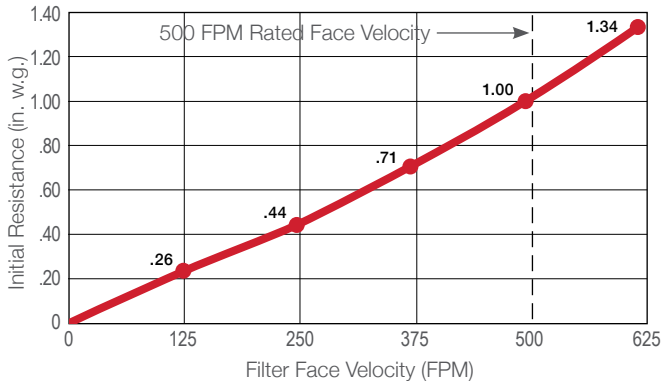
Product Overview

- Near HEPA (MERV 16) efficiency—upgrade efficiency of existing box style filters without requiring special frames or latches
- Open header design prevents dirty air bypass and makes handling safe and easy
- Designed to perform in the most difficult operating conditions, such as variable air volume, turbulent airflows, and repeated fan shutdown
- Rated for continuous operation at temperatures up to 350°F
- Recommended for use in high humidity or seacost applications
- Rigid, all-metal construction and water-resistant media

Specifications

Efficiency	MERV 16
Filter Depth	6″, 12″
Media Type	Microfiberglass
Frame Material	Galvanized Steel
Separator Style	Corrugated Aluminum
Special Size Available	Yes
Antimicrobial Available	No
Header Style(s)	Single, Double
Max Operating Temperature	350°F (177°C)
Air Filtration Certification	UL 900

Initial Resistance vs. Filter Face Velocity



Product Information

Part Number	Drawing Number	Nominal Size Inches (W x H x D)	Rated Airflow Capacity (CFM)	Std. Pkg. Qty. Per Carton	Shipping Wt. Lbs. per Box (± 7%)	Cubic Ft.
Single Header **MERV 16** Standard Sizes						
Rated Filter Face Velocity: 500 FPM						
510-532-014	105-1357532-14	24 x 24 x 12	2,000	1	20.0	4.3
510-532-012	105-1357532-12	24 x 20 x 12	1,650	1	17.0	3.6
510-532-016	105-1357532-16	12 x 24 x 12	1,000	1	12.0	2.2
Rated Filter Face Velocity: 250 FPM						
510-532-013	105-1357532-13	24 x 24 x 6	1,000	2	22.0	4.7
510-532-011	105-1357532-11	24 x 20 x 6	825	2	19.5	2.0
510-532-015	105-1357532-15	12 x 24 x 6	500	2	14.0	2.4
Double Header **MERV 16** Standard Sizes						
Rated Filter Face Velocity: 500 FPM						
511-631-001	105-1357631-1	24 x 24 x 12	2,000	1	21.5	4.3
511-631-007	105-1357631-7	24 x 24 x 12[1]	2,000	1	21.5	4.3
511-631-003	105-1357631-3	20 x 24 x 12	1,650	1	18.5	3.6
511-631-002	105-1357631-2	12 x 24 x 12	1,000	1	13.0	2.2
Rated Filter Face Velocity: 250 FPM						
511-631-004	105-1357631-4	24 x 24 x 6	1,000	2	24.0	4.7
511-631-008	105-1357631-8	24 x 24 x 6[1]	1,000	2	24.0	4.7
511-631-006	105-1357631-6	20 x 24 x 6	825	2	21.5	2.0
511-631-005	105-1357631-5	12 x 24 x 6	500	2	15.5	2.4

[1]Actual face dimensions are 24″ x 24″. Additional sizes available upon request. Additional options upon request include: AstroCel® I (HEPA-style) construction, gasketing, and/or faceguards (upstream, downstream, or both sides).

HVAC

FASeal™ Frame

Product Overview

- Unique design that makes filter installation quick and simple — no separate clips required
- Stainless spring steel compression catches won't rust and are permanently attached
- Pre-drilled frame-to-frame installation holes allow fast and secure built-up filter bank assemblies
- Designed for modular HVAC filter banks in applications such as commercial buildings, educational facilities, food, beverage, and industrial processing plants
- Frames available in 18-gauge stainless steel and 16-gauge galvanized steel
- Supports any of the following configurations: single header filter (such as Varicel® VXL, Varicel® M-Pak or Varicel® 2+) alone; single header filter in combination with a 1″, 2″, or 4″ prefilter (such as MEGAPleat,® PerfectPleat,® or PREpleat® LPD); 1″, 2″ or 4″ filter alone

Product Information

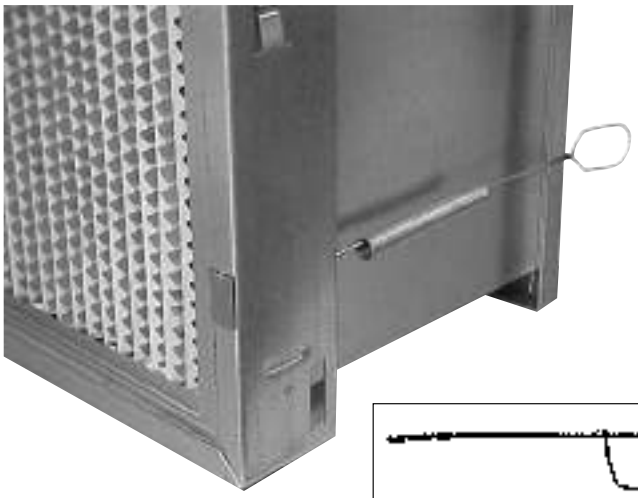
Part Number	Nominal Size Inches (W x H x D)	Std. Pkg. Qty.	Shipping Wt. Lbs. per Box (± 10%)	Cubic Ft.
Stainless Steel Frames with Gaskets				
3109372-002	12 x 24 x 3	1	5.8	0.5
3109372-004	16 x 20 x 3	1	5.8	0.6
3109372-005	16 x 25 x 3	1	6.5	0.7
3109372-006	20 x 20 x 3	1	6.3	0.7
3109372-003	20 x 24 x 3	1	6.8	0.8
3109372-007	20 x 25 x 3	1	6.9	0.9
3109372-001	24 x 24 x 3	1	7.3	1.0
Galvanized Steel Frames with Gaskets (Latches – 304 Stainless Spring Steel)				
3109372-009	12 x 24 x 3	1	5.3	0.5
3109372-011	16 x 20 x 3	1	5.3	0.6
3109372-012	16 x 25 x 3	1	6.0	0.7
3109372-013	20 x 20 x 3	1	5.8	0.7
3109372-010	20 x 24 x 3	1	6.3	0.8
3109372-014	20 x 25 x 3	1	6.4	0.9
3109372-008	24 x 24 x 3	1	6.8	1.0

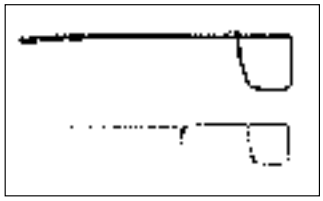
HVAC

Universal Holding Frames and Latches

Product Overview

- Galvanized steel, aluminized steel, or 304 stainless steel construction available
- No protrusions into filter loading area for easier installation and removal
- Seven standard sizes that can be used individually or combined to create virtually any size filter bank
- Supports all standard combinations of prefilters and final filters
- Latches available to hold a wide variety of filter types, depths, and combinations
- Double latches available which allow prefilters to be changed without disturbing final filter
- Actual frame depth: 2 13/16″
- Latches are zinc-plated to withstand harsh environments (Four latches are recommended for each frame)





Product Information

Part Number	Nominal Size Inches (W x H x D)	Std. Pkg. Qty.	Shipping Wt. Lbs. per Box (± 10%)	Cubic Ft.
Universal Holding Frames (Galvanized Steel with PVC Gaskets)				
321-000-319	12 x 24 x 3	8	31.5	2.4
321-000-500	16 x 20 x 3	4	12.5	2.4
321-000-600	16 x 25 x 3	4	18.5	3.0
321-000-700	20 x 20 x 3	4	18.0	3.0
321-000-750	20 x 24 x 3	4	20.0	3.6
321-000-800	20 x 25 x 3	4	20.2	3.8
321-000-863	24 x 24 x 3	4	21.5	4.3

Part Number	Model Number	Length (L)		Application
Single Latches (Prefilter can be changed without disturbing final filter)				
391-007-004	L-10	5/32″		Holds single header filter or 1″ filter in AAF Universal Holding Frame (UHF)
391-007-005	L-20	1 1/16″		Holds 2″ thick filter. Also holds single header filter with a 1″ prefilter in AAF UHF
391-007-006	L-30	1 7/8″		Holds single header filter with a 2″ prefilter in AAF UHF
391-007-003	L-40	3 1/16″		Holds two 2″ or one 4″ deep filter in AAF UHF
391-007-007	L-50	3 15/16″		Holds single header filter with a 4″ prefilter in AAF UHF
Double Latches (Prefilter can be changed without disturbing final filter)				
		L-1	**L-2**	
391-007-009	L-41	1 1/16″	3 1/16″	Holds 4″ filter with a 1″ prefilter in AAF UHF
391-007-002	L-42	1 11/16″	3 1/16″	Holds 4″ filter with a 2″ prefilter in AAF UHF
391-007-001	L-44	3 9/16″	3 1/16″	Holds 4″ filter with a 4″ prefilter in AAF UHF

HVAC

PF-1 Pureframe®

Product Overview

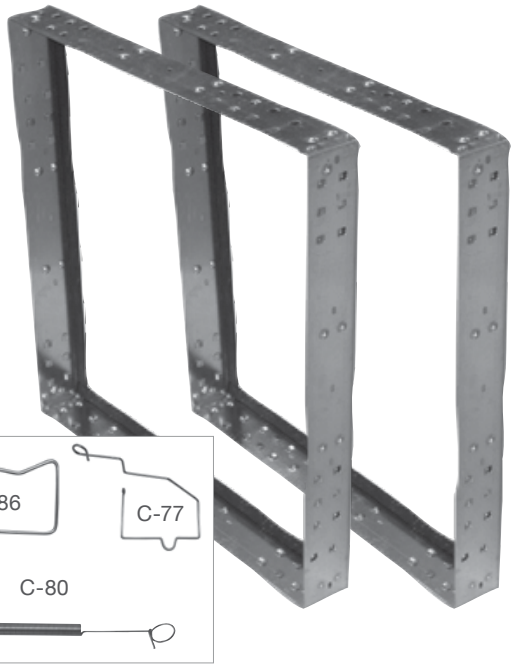
- Positive seal with spring-loaded fasteners and closed cell gasket
- 16-gauge stainless or corrosion-resistant steel
- Flush-mounted, totally-welded corners and deburred edges
- Accommodates any standard size box or header type air filter
- Easy to install and rugged with prepunched mounting holes, 3″ depth and centering dimples

Product Information

Model Number	Actual Size Inches (W x H x D)	Shipping Wt. Lbs. per Box (± 10%)	Frames per Carton
PPF11224	12 x 24 x 2⅞	4	8
PPF11620	16 x 20 x 2⅞	5	4
PPF11625	16 x 25 x 2⅞	5	4
PPF12020	20 x 20 x 2⅞	5	4
PPF12024	20 X 24 X 2⅞	5.5	4
PPF12025	20 x 25 x 2⅞	5.5	4
PPF12424	24 x 24 x 2⅞	6.5	4
304 STAINLESS STEEL			
PPF11224SS	12 x 24 x 2⅞	4	8
PPF11620SS	16 x 20 x 2⅞	5	4
PPF12020SS	20 x 20 x 2⅞	5	4
PPF12024SS	20 X 24 X 2⅞	5.5	4
PPF12424SS	24 x 24 x 2⅞	6.5	4

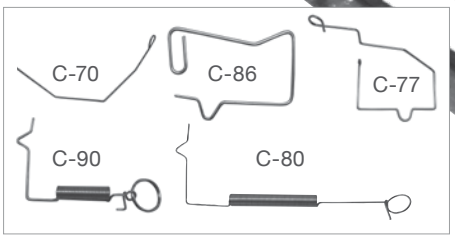
HVAC

Type A-8 Holding Frames and Latches



Product Overview

- Comes in seven standard sizes that can be used individually or may be combined to fit virtually any size filter bank
- Each frame includes our premium closed cell EPDM rubber gaskets to ensure a proper seal between the frame and filter to minimize dirty air bypass
- Frames are also available without gaskets or with dovetail gaskets
- Designed to hold the filter in place and create a positive seal
- Constructed of galvanized steel and 304 stainless steel, and also available in 316 stainless steel
- Latches can hold prefilters, headered filters, or both in the same frame
- Latches attach to one or two sets of knockouts near each corner (use four latches per frame)



Product Information

Part Number	Nominal Size Inches (W x H x D)	Std. Pkg. Qty.	Shipping Wt. Lbs. per Box (± 10%)	Cubic Ft.
Type A-8 Holding Frames (Galvanized Steel Frames with Gaskets)				
312-600-600	12 x 24 x 3	12	63.0	3.0
312-600-001	16 x 20 x 3	6	31.5	3.4
312-600-002	16 x 25 x 3	6	35.7	4.1
312-600-003	20 x 20 x 3	6	34.8	4.2
312-600-004	20 x 24 x 3	6	37.8	5.0
312-600-005	20 x 25 x 3	6	38.4	5.3
312-600-606	24 x 24 x 3	6	40.5	6.0
Type A-8 Holding Frames (Stainless Steel Frames with Gaskets)				
312-600-100	12 x 24 x 3	12	69.0	3.0
312-600-101	16 x 20 x 3	6	34.5	3.4
312-600-102	16 x 25 x 3	6	38.7	4.1
312-600-103	20 x 20 x 3	6	37.8	4.2
312-600-104	20 x 24 x 3	6	40.8	5.0
312-600-105	20 x 25 x 3	6	41.4	5.3
312-600-106	24 x 24 x 3	6	43.5	6.0

Part Number	Model Number	Material	Application
Latches for A-8 Frames			
315-004-003	C-70S	Stainless	Holds a 1″ (single header) or 2" filter in a Type A-8 Frame
315-004-000	C-86	Galvanized	Holds a 4″ filter or a single header filter with a 2″ prefilter in a Type A-8 Frame
315-004-100	C-86S	Stainless	Holds a 4″ filter or a single header filter with a 2″ prefilter in a Type A-8 Frame
315-004-006	C-89	Galvanized	Holds a single header filter with a 4″ prefilter in a Type A-8 Frame
315-004-106	C-89S	Stainless	Holds a single header filter with a 4″ prefilter in a Type A-8 Frame
315-004-002	C-90	Galvanized	Holds a 6″ deep double header filter or a reverse flow M-Pak in a Type A-8 Frame
315-004-001	C-80	Galvanized	Holds a 12″ deep double header filter in a Type A-8 Frame
315-004-101	C-80S	Stainless	Holds a 12″ deep double header filter in a Type A-8 Frame
315-004-007	C-77	Galvanized	Holds a single header filter with a 2″ prefilter or a 4″ filter in a Type A-8 Frame
315-004-107	C-77S	Stainless	Holds a single header filter with a 2″ prefilter or a 4″ filter in a Type A-8 Frame

HVAC

Knock-On Conversion Latches

Product Overview

- Zinc-plated to withstand harsh environments
- Latches available for a variety of filters and filter combinations
- Easy conversion of other manufacturers' holding frames to accept AAF Flanders filters
- For use with AAF Flanders aluminized and stainless steel frames
- Four latches recommended per frame

Product Information

Part Number	Length (L)		Application
Single Latches			
391-006-004	11⁄16″		Holds single header* filter or a 1″ filter
391-006-009	1″		Holds DriPak® or VariCel® with CA (1 1/8") header
391-006-005	1⅝″		Holds 2″ thick filter. Also holds single header* filter with a 1″ prefilter
391-006-006	2 9⁄16″		Holds single header* filter with a 2″ prefilter
391-006-008	3⅝″		Holds two 2″ filters or one 4″ deep filter
391-006-010	3 25⁄32″		Holds 4″ filter with a ring panel prefilter
391-006-007	4½″		Holds single header* filter with a 4″ prefilter
Double Latches (Prefilter can be changed without disturbing the final filter)			
	L-1	**L-2**	
391-006-003	11⁄16″	3⅝″	Holds 4″ filter with a 1″ prefilter
391-006-002	1 11⁄16″	3⅝″	Holds 4″ filter with a 2″ prefilter
391-006-001	3 9⁄16″	3⅝″	Holds 4″ filter with a 4″ prefilter

**A single header filter is any filter with a 13/16″ header, such as VariCel® SH, DriPak® 2000, VariCel® V, etc.*
Additional sizes available upon request.

HVAC

RenuFrame™

Product Overview

- Reduces filter and maintenance cost by allowing for easy changeout of filter media pads
- Rugged 18-gauge U-channel construction with full overlap corners
- Maintains square alignment over years of use without racking
- Heavy-duty design prevents dirty air bypass, sagging, or blowout even when heavily loaded
- 11-gauge wire retaining grid with spikes prevents pad movement, even under turbulent conditions
- Retainer is hinged for easy changeout
- 2″ thickness – fits in AAF Flanders Universal Holding Frames and 2″ side access tracks
- Can also be bolted together into frame banks without use of holding frames

Product Information

Part Number	Nominal Size Inches (W x H x D)	Std. Pkg. Qty.	Shipping Wt. Lbs. per Box (± 10%)	Cubic Ft.
325-319-003	12 x 24 x 2	6	32.0	2.1
325-500-003	16 x 20 x 2	6	30.0	2.4
325-600-003	16 x 25 x 2	6	36.0	2.9
325-700-003	20 x 20 x 2	6	36.0	3.0
325-782-003	20 x 24 x 2	6	42.0	3.8
325-800-003	20 x 25 x 2	6	44.0	3.8
325-863-003	24 x 24 x 2	6	45.0	4.3

HVAC

AmerFrame®

Product Overview

- Reduces filter and maintenance cost by allowing for easy changeout of filter media pads
- 22-gauge U-channel construction contains pad and prevents leakage
- Maintains square alignment over years of use without racking
- Rigid construction prevents dirty air bypass, sagging, or blowout even when heavily loaded
- 9-gauge expanded wire retainer for easy access to the media pads
- 1″ and 2″ thickness available – fits in AAF Flanders Universal Holding Frames and 2″ side access tracks

Product Information

With Retainer		Without Retainer		Nominal Size Inches (W x H x D)	Std. Pkg. Qty. per Box	Ship. Wt. Lbs. per Box (±10%)
Part Number	Cubic Ft.	Part Number	Cubic Ft.			
1″						
322-319-111	2.1	322-319-121	2.1	12 x 24 x 1	12.0	23.0
322-500-111	2.4	322-500-121	2.4	16 x 20 x 1	12.0	23.0
322-600-111	2.9	322-600-121	3.0	16 x 25 x 1	12.0	27.0
322-700-111	3.0	322-700-121	3.0	20 x 20 x 1	12.0	26.0
322-782-111	3.6	322-782-121	3.6	20 x 24 x 1	12.0	30.0
322-800-111	3.8	322-800-121	3.8	20 x 25 x 1	12.0	31.0
322-863-111	4.3	322-863-121	4.3	24 x 24 x 1	12.0	33.0
2″						
322-319-112	2.1	322-319-122	3.6	12 x 24 x 2	6.0	16.0
322-500-112	2.2	322-500-122	2.4	16 x 20 x 2	6.0	16.0
322-600-112	2.9	322-600-122	3.0	16 x 25 x 2	6.0	17.5
322-700-112	3.0	322-700-122	3.0	20 x 20 x 2	6.0	19.0
322-782-112	3.6	322-782-122	3.6	20 x 24 x 2	6.0	20.0
322-800-112	3.8	322-800-122	3.8	20 x 25 x 2	6.0	20.5
322-863-112	4.3	322-863-122	4.3	24 x 24 x 2	6.0	23.0

HVAC

UniFrame

Product Overview

- Designed for retaining air filter media pads in applications that require additional media support
- Fabricated of 26-gauge corrosion-resistant steel channel, with each corner of the frame mitered for squareness
- Filter pads are supported on the downstream side with a corrosion-resistant steel expanded metal lathe grid
- Retainer bars for the upstream side are available as an option

Product Information

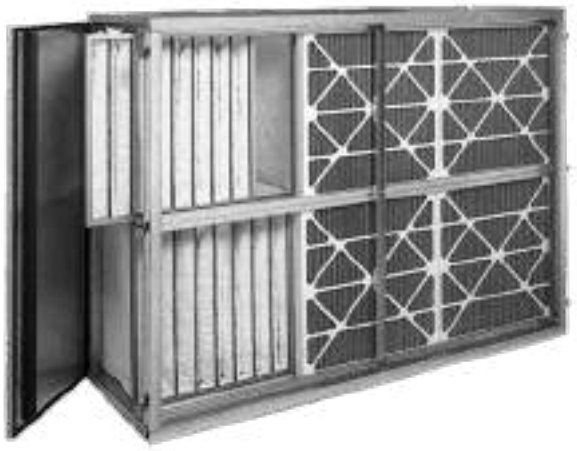
Part Number	Nominal Size Inches (W x H x D)	Actual Size Inches (W x H x D)
60355.011620	16 x 20 x 1	15½ x 19½ x ⅞
60355.011625	16 x 25 x 1	15½ x 24½ x ⅞
60355.012020	20 x 20 x 1	19½ x 19½ x ⅞
60355.012025	20 x 25 x 1	19½ x 24½ x ⅞
60355.012424	24 x 24 x 1	23½ x 23½ x ⅞
60355.021620	16 x 20 x 2	15½ x 19½ x 1⅞
60355.021625	16 x 25 x 2	15½ x 24½ x 1⅞
60355.022020	20 x 20 x 2	19½ x 19½ x 1⅞
60355.022025	20 x 25 x 2	19½ x 24½ x 1⅞
60355.022424	24 x 24 x 2	23½ x 23½ x 1⅞

HVAC

SureSeal™

Product Overview

- SureSeal side access filter housings are two-stage units designed to accommodate ASHRAE rated filters that are 6″ to 36″ in depth
- Requires as little as 22″ of inline depth with no need for holding frames or fasteners
- Easily serviced through quick opening access doors
- All tracks and doors fully gasketed to ensure a positive seal; even at 6″ of static pressure the leak rate is less than 0.5% of airflow
- Factory assembled flanged units suitable for installation in a duct or attached to an air handling unit
- Units are constructed of durable 16-gauge galvanized steel
- Z-channel support members reinforce all four corners



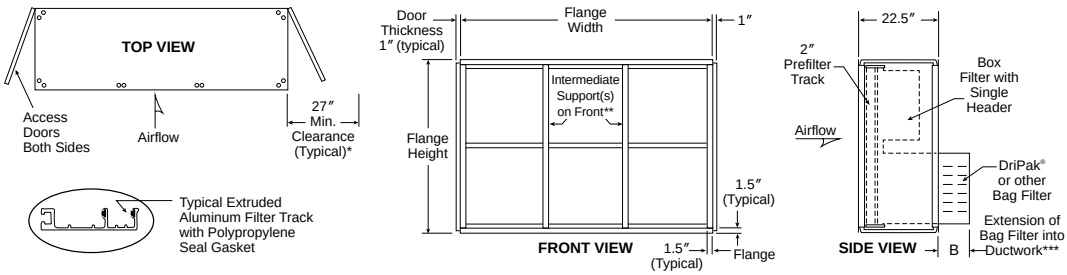
SS 2 20H 30W X

- **SS** — Type of Housing (SS = SureSeal™)
- **2** — Type of Prefilter Track (inches)
- **20H 30W** — Height and Width Code: The first numeral represents the number of 24″ x 24″ filters high or wide. If 24″ x 12″ filters are also used in the height or width, the second numeral is "5"
- **X** — For Special Features or Sizes, end with "X" and describe them

Product Information

Height Code	Overall Flange Height (inches)	Face Velocity (FPM)	CFM Capacities and Dimensions										
			Width Code										
			10W	15W	20W	25W	30W	35W	40W	45W	50W	55W	60W
			Overall Flange Width										
			23⅜	34¾	46¾	58⅛	70⅛	81½	93½	104⅞	116⅞	128¼	140¾
05H	15	375	750	–	1500	–	2250	–	3000	–	–	–	–
		500	1000	–	2000	–	3000	–	4000	–	–	–	–
		625	1250	–	2500	–	3750	–	5000	–	–	–	–
10H	27	375	1500	2250	3000	3750	4500	5250	6000	6750	7500	8250	9000
		500	2000	3000	4000	5000	6000	7000	8000	9000	10000	11000	12000
		625	2500	3750	5000	6250	7500	8750	10000	11250	12500	13750	15000
15H	39	375	2250	–	4500	–	6750	–	9000	–	11250	–	13500
		500	3000	–	6000	–	9000	–	12000	–	15000	–	18000
		625	3750	–	7500	–	11250	–	15000	–	18750	–	22500
20H	51	375	3000	4500	6000	7500	9000	10500	12000	13500	15000	16500	18000
		500	4000	6000	8000	10000	12000	14000	16000	18000	20000	22000	24000
		625	5000	7500	10000	12500	15000	17500	20000	22500	25000	27500	30000
25H	62⅞	375	3750	–	7500	–	11250	–	15000	–	25000	–	22500
		500	5000	–	10000	–	15000	–	20000	–	30000	–	30000
		625	6250	–	12500	–	18750	–	25000	–	31250	–	37500
30H	74⅞	375	4500	6750	9000	11250	13500	15750	18000	20250	22500	24750	27000
		500	6000	9000	12000	15000	18000	21000	24000	27000	30000	33000	36000
		625	7500	11250	15000	18750	22500	26250	30000	33750	37500	41250	45000
35H	86⅞	375	5250	–	10500	–	15750	–	21000	–	26250	–	31500
		500	7000	–	14000	–	21000	–	28000	–	35000	–	42000
		625	8750	–	17500	–	26350	–	35000	–	43750	–	52500
40H	98⅞	375	6000	9000	12000	15000	18000	21000	24000	27000	30000	33000	36000
		500	8000	12000	16000	20000	24000	28000	32000	36000	40000	44000	48000
		625	10000	15000	20000	25000	30000	35000	40000	45000	50000	55000	60000

Notes: *1. Dimensions are based on using nominal size 24″ x 24″ and 24″ x 12″ filters.*
2. To determine capacity on sizes other than those shown, multiply square feet of filter face area by FPM.



Filter	Depth (in.)	B (in.)
Dripak or Cube Filter	10	0
	12	0
	15	0
	21	4
	26	9
	30	13
	36	19
Box-Style	6 or 12	0

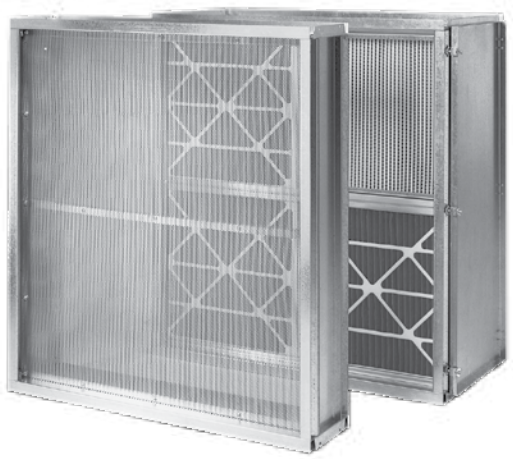
**Allow 27″ minimum clearance on one or preferably both sides for filter installations.*
***Intermediate support(s) furnished on housings over 4 ft. wide.*
****If 4″ prefilter tracks are specified, add 2″ to Dimension B*

HVAC

SureAire™

Product Overview

- Recommended for use on the positive side of the fan where high velocity or turbulent airflow conditions may occur
- Furnished with a diffuser plate that promotes evenly distributed mixing of air
- Space saving design requires as little as 12″ of inline depth
- Diffuser sections are factory assembled flanged units suitable for installation in a duct upstream of a SureSeal housing or attached to an air handling unit
- Units are constructed of durable 16-gauge galvanized steel
- Z-channel support members reinforce all four corners



SA 20H 35W X

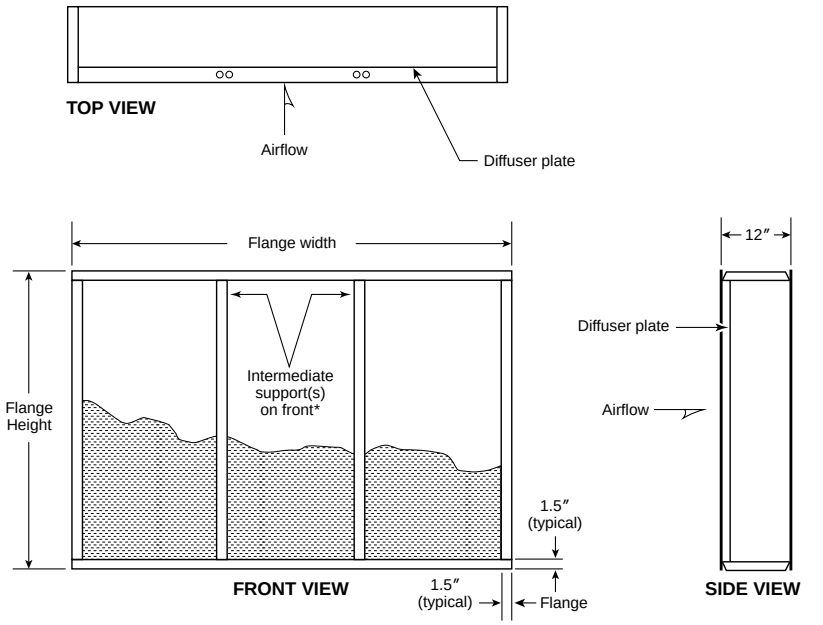
Type of Housing (SA = SureAire™)

Height and Width Code: The first numeral represents the number of 24″ x 24″ filters high or wide. If 24″ x 12″ filters are also used in the height or width, the second numeral is "5"

For Special Features or Sizes, end with "X" and describe them

Product Information

Height Code	Width Code				
	10W	15W	20W	25W	30W
05H	20	N/A	30	N/A	44
10H	29	37	44	54	61
15H	38	N/A	56	N/A	77
20H	47	60	68	86	95
25H	56	N/A	82	N/A	112
30H	69	85	100	123	136
35H	79	N/A	113	N/A	153
40H	92	110	131	161	177



**Intermediate support(s) are furnished on housings over 4 ft. wide.*

HVAC

SureFlo™

Product Overview

- V-bank design effectively doubles filter face area as compared to flat filter housings
- Allows for 50% reduction in pressure drop and increased filter life, reducing maintenance and energy costs
- All tracks and doors fully gasketed to ensure a positive seal
- Requires as little as 27″ of inline depth with no need for holding frames or fasteners
- Easily serviced through quick opening access doors
- Constructed of durable 16-gauge galvanized steel with Z-channel supports at all four corners
- Designed to accommodate 2″ deep ASHRAE filters
- Can be installed in a duct or in an air handling unit

SF 40H 35W X

Type of Housing (SF = SureFlo™)

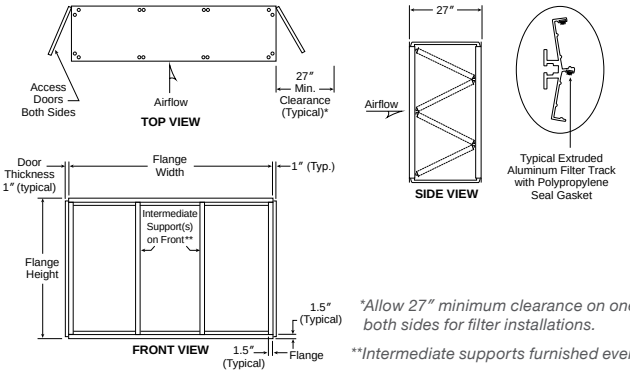
Height and Width Code: The first numeral represents the number of 24″ x 24″ filters high or wide. If 24″ x 12″ filters are also used in the height or width, the second numeral is "5"

For Special Features or Sizes, end with "X" and describe them

Product Information

Height Code	Overall Flange Height (inches)	Face Velocity (FPM)	Housing Approach Velocity (FPM)	CFM Capacities and Dimensions										
				Width Code										
				10W	15W	20W	25W	30W	35W	40W	45W	50W	55W	60W
				Overall Flange Width										
				23⅜	34¾	46¾	58⅛	70⅛	81½	93½	104⅞	116⅞	128¼	140¾
05H	15	125	250	500	750	1000	1250	1500	1750	2000	2250	2500	2750	3000
		250	500	1000	1500	2000	2500	3000	3500	4000	4500	5000	5500	6000
		375	750	1500	2250	3000	3750	4500	5250	6000	6750	7500	8250	9000
		500	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000	11000	12000
10H	27	125	250	1000	1500	2000	2500	3000	3500	4000	4500	5000	5500	6000
		250	500	2000	3000	4000	5000	6000	7000	8000	9000	10000	11000	12000
		375	750	3000	4500	6000	7500	9000	10500	12000	13500	15000	16500	18000
		500	1000	4000	6000	8000	10000	12000	14000	16000	18000	20000	22000	24000
15H	39	125	250	1500	2250	3000	3750	4500	5250	6000	6750	7500	8250	9000
		250	500	3000	4500	6000	7500	9000	10500	1200	13500	15000	16500	18000
		375	750	4500	6750	9000	11250	13500	15750	18000	20250	22500	24750	27000
		500	1000	6000	9000	12000	15000	18000	21000	24000	27000	30000	33000	36000
20H	51	125	250	2000	3000	4000	5000	6000	7000	8000	9000	10000	11000	12000
		250	500	4000	6000	8000	10000	12000	14000	16000	18000	20000	22000	24000
		375	750	6000	9000	12000	15000	18000	21000	24000	27000	30000	33000	36000
		500	1000	8000	12000	16000	20000	24000	28000	32000	36000	40000	44000	48000
25H	62⅞	125	250	2500	3750	5000	6250	7500	8750	10000	11250	12500	13750	15000
		250	500	5000	7500	10000	12500	15000	17500	20000	22500	25000	27500	30000
		375	750	7500	11250	15000	18750	22500	26250	30000	33750	37500	41250	45000
		500	1000	10000	15000	20000	25000	30000	35000	40000	45000	50000	55000	60000
30H	74⅞	125	250	3000	4500	6000	7500	9000	10500	12000	13500	15000	16500	18000
		250	500	6000	9000	12000	15000	18000	21000	24000	27000	30000	33000	36000
		375	750	10500	15750	21000	26250	31500	36750	42000	47250	52500	57750	63000
		500	1000	12000	18000	24000	30000	36000	42000	48000	54000	60000	66000	72000
35H	86⅞	125	250	3500	5250	7000	8750	10500	12250	14000	15750	17500	19250	21000
		250	500	7000	10500	14000	17500	21000	24500	28000	31500	35000	38500	42000
		375	750	10500	15750	21000	26250	31500	36750	42000	47250	52500	57750	63000
		500	1000	14000	21000	28000	35000	42000	49000	56000	63000	70000	77000	84000
40H	98⅞	125	250	4000	6000	8000	10000	12000	14000	16000	18000	20000	22000	24000
		250	500	8000	12000	16000	20000	24000	28000	32000	36000	40000	44000	48000
		375	750	12000	18000	24000	30000	36000	42000	48000	54000	60000	66000	72000
		500	1000	16000	24000	32000	40000	48000	56000	64000	72000	80000	88000	96000

Note: Recommended 2″ deep filters include MEGAPleat,® PerfectPleat,® and PREpleat.® Consult your AAF Flanders sales representative to determine the best filter for your application.



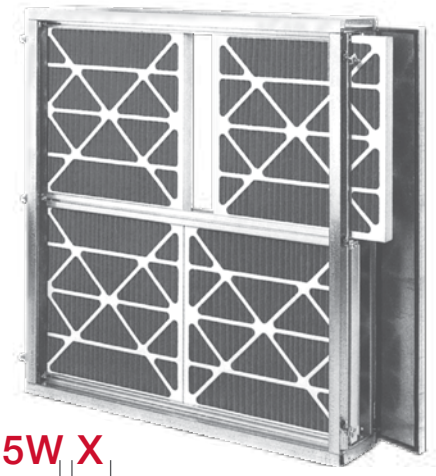
Size Combinations and Weight (lbs.) of the Resulting Frame					
Height Code	Width Code				
	10W	15W	20W	25W	30W
10H	90	105	120	150	170
15H	105	125	145	175	198
20H	120	135	175	195	225
25H	150	172	194	215	235

**Allow 27″ minimum clearance on one or preferably both sides for filter installations.*

***Intermediate supports furnished every 24″ of width.*

HVAC

SurePleat™



Product Overview

- All tracks and doors fully gasketed to ensure a positive seal
- Space saving design requires as little as 12″ of inline depth with no need for holding frames or fasteners
- Easily serviced through quick opening access doors
- Constructed of durable 16-gauge galvanized steel with Z-channel supports at all four corners
- Available in a wide range of configurations and can accommodate filters up to a MERV 15 rating
- Aluminum or stainless steel construction available

SP 2/4 20H 35W X

Type of Housing (SP = SurePleat™)

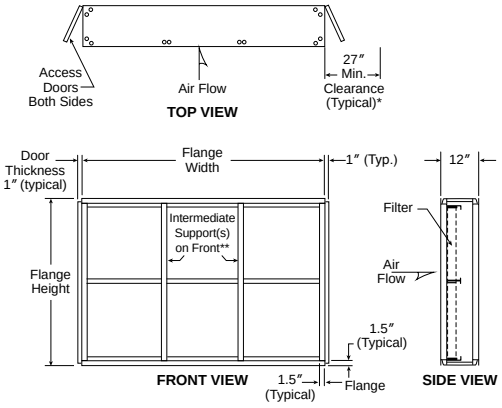
Type of filter track: 1 for 1″ track (for single-header box style filters with up to nominal 6″ depths), 2 for 2″ track (for 2″ filters), 4 for 4″ track (for 4″ filters), or 2/4 (for a combination of 2″ tracks for prefilters and a 4″ track for Varicel® or PrecisionCell® final filters)

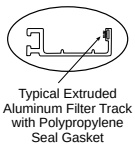
Height and Width Code: The first numeral represents the number of 24″ x 24″ filters high or wide. If 24″ x 12″ filters are also used in the height or width, the second numeral is "5"

For Special Features or Sizes, end with "X" and describe them

Product Information

Height Code	Overall Flange Height (inches)	Face Velocity (FPM)	CFM Capacities and Dimensions										
			Width Code										
			10W	15W	20W	25W	30W	35W	40W	45W	50W	55W	60W
			Overall Flange Width										
			23⅜	34¾	46¾	58⅛	70⅛	81½	93½	104⅞	116⅞	128¼	140¾
05H	15	375	750	–	1500	–	2250	–	3000	–	–	–	–
		500	1000	–	2000	–	3000	–	4000	–	–	–	–
		625	1250	–	2500	–	3750	–	5000	–	–	–	–
10H	27	375	1500	2250	3000	3750	4500	5250	6000	6750	7500	8250	9000
		500	2000	3000	4000	5000	6000	7000	8000	9000	10000	11000	12000
		625	2500	3750	5000	6250	7500	8750	10000	11250	12500	13750	15000
15H	39	375	2250	–	4500	–	6750	–	9000	–	11250	–	13500
		500	3000	–	6000	–	9000	–	12000	–	15000	–	18000
		625	3750	–	7500	–	11250	–	15000	–	18750	–	22500
20H	51	375	3000	4500	6000	7500	9000	10500	12000	13500	15000	16500	18000
		500	4000	6000	8000	10000	12000	14000	16000	18000	20000	22000	24000
		625	5000	7500	10000	12500	15000	17500	20000	22500	25000	27500	30000
25H	62⅞	375	3750	–	7500	–	11250	–	15000	–	18750	–	22500
		500	5000	–	10000	–	15000	–	20000	–	25000	–	30000
		625	6250	–	12500	–	18750	–	25000	–	27500	–	37500
30H	74⅞	375	4500	6750	9000	11250	13500	15750	18000	20250	22500	24750	27000
		500	6000	9000	12000	15000	18000	21000	24000	27000	30000	33000	36000
		625	7500	11250	15000	18750	22500	26250	30000	33750	43750	41250	45000
35H	86⅞	375	5250	–	10500	–	15750	–	21000	–	26250	–	31500
		500	7000	–	14000	–	21000	–	28000	–	35000	–	42000
		625	8750	–	17500	–	26250	–	35000	–	43750	–	52500
40H	98⅞	375	6000	9000	12000	15000	18000	21000	24000	27000	30000	33000	36000
		500	8000	12000	16000	20000	24000	28000	32000	36000	40000	44000	48000
		625	10000	15000	20000	25000	30000	35000	40000	45000	50000	55000	60000





Typical Extruded Aluminum Filter Track with Polypropylene Seal Gasket

Notes: *1. Dimensions are based on using nominal size 24″ x 24″ and 24″ x 12″ filters. See applicable capacity chart for the desired 2″, 4″, or 6″ filter to determine compatibility.*

2. For capacities other than those shown, ratio the face velocities.

3. Maximum recommended velocities: 2″ pleated filters: 500 FPM; 4″ pleated filters: 625 FPM; 4″ or 6″ VariCel® & PrecisionCell® filters: see applicable capacity chart.

**Allow 27″ minimum clearance on one or preferably both sides for filter installations.*

***Intermediate supports furnished on housings over 4 ft. wide.*

HVAC

Magnehelic® Gages

Product Overview

- The Magnehelic gage is the industry standard to measure fan and blower pressures, filter resistance, air velocity, furnace draft, and pressure drop across orifice plates
- Clear plastic face is highly resistant to breakage, and designed for undistorted viewing of pointer and scale from far away
- Guaranteed accuracy within 2% of full scale
- Features Dwyer's simple, frictionless Magnehelic movement
- Conveniently located zero adjustment screw for easy maintenance
- Shock, vibration resistant

Product Information

Part Number	Description	Std. Pkg. Qty.	Shipping Wt. Lbs. per Box (± 10%)
Dwyer Magnehelic Dial Gages			
391-002-006	2001-AF (0″ – 1.0″ W.G.)	1	2.0
391-002-004	2002-AF (0″ – 2.0″ W.G.)	1	2.0
391-002-017	2003-AF (0″ – 3.0″ W.G.)	1	2.0
391-002-018	2004-AF (0″ – 4.0″ W.G.)	1	2.0
Dwyer Inclined Type Gages			
391-002-001	250-AF (-.1″ – 1.0″ W.G.)	1	3.0
391-003-012	Mark II #25 (0″ – 3.0″ W.G.)	1	2.0

Gages include tubing, static tips or fittings, mounting hardware, and replacement fluid as required.

High Purity Products

High Purity

HEPA/ULPA Filter Construction and Testing Options

This table provides a thorough overview of the options available for each of our HEPA and ULPA filters, allowing you to make informed decisions for a given application and configuration. Each feature is denoted as standard (•), optional (Option), or not available ( ).

	MEGAcel® I ePTFE*	MEGAcel® II ePTFE*	MEGAcel® III ePTFE*	MEGAcel® I eFRM	MEGAcel® II eFRM	MEGAcel® III eFRM	AstroCel® I	AstroCel® II	AstroCel® III
Expanded PTFE Membrane (ePTFE)	•	•	•						
Expanded Fluororesin Membrane (eFRM)				•	•	•			
Glass Fiber Media							•	•	•
Hot Melt Separators		•	•		•	•		Option	Option
Ribbon Pleat								•	
Dimple Pleat								Option	
String Pleat								Option	Option
Embossed/Close Pleat	Option			Option			Option		
Aluminum Separator	•			•			•		
Vinyl Coated Aluminum Separator	Option			Option			Option		
Plastic Separator	Option			Option			Option		
Stainless Steel Separator	Option			Option			Option		
Urethane Pack to Frame Sealant	•	•	•	•	•	•	•	•	•
Silicone Sealant							Option		
64 mm to 149 mm Frame Depths		•			•			•	
V-Style Packs			•			•			•
Gel Seal Filter & Knife Edge	Option	Option	Option	Option	Option	Option	Option	Option	Option
PU-EPDM-Neoprene Gasket	Option	Option	Option	Option	Option	Option	Option	Option	Option
Silicone Gasket							Option		
Painted/Stainless Steel Faceguard	Option	Option		Option	Option		Option	Option	
Fabricated Aluminum Frame	Option		Option	Option		Option	Option		Option
Extruded Aluminum Frame	Option	•	Option	Option	•	Option	Option	•	Option
Stainless Steel Frame	Option	Option	Option	Option	Option	Option	Option	Option	Option
Galvaneal/Galvanized Frame	Option		Option	Option		Option	Option		Option
Particleboard/Plywood Frame	Option			Option			Option		
Plastic Frame	Option			Option			Option		
High Temperature (≥65°C / 149°F)							Option		
Factory Testing - Suitable for Common Test Aerosols (Concentration & Equipment Specific) *DOP*, PAO, PSL, DEHS *Nuclear Market Only*	•	•	•	•	•	•	•	•	•
Field Testing - Suitable for Common Test Aerosols (Concentration & Equipment Specific) PAO, PSL	•	•	•	•	•	•	•	•	•
EN1822: E10 to U17 (ePTFE H13 to U17 only, eFRM H13 and H14 only)	•	•	•	•	•	•	•	•	•
IEST-RP-CC001: Type A-E, H-K	•	•	•	•	•	•	•	•	•
IEST-RP-CC001: Type F-G		•						•	
UL-900/ULC-S111	Option	Option	Option	Option	Option	Option	Option	Option	Option
UL-586							Option	Option	
FM 4920								Option	
Centerboard for PD or Upstream Concentration Measurement		Option			Option			Option	

High Purity

MEGAcel® I eFRM

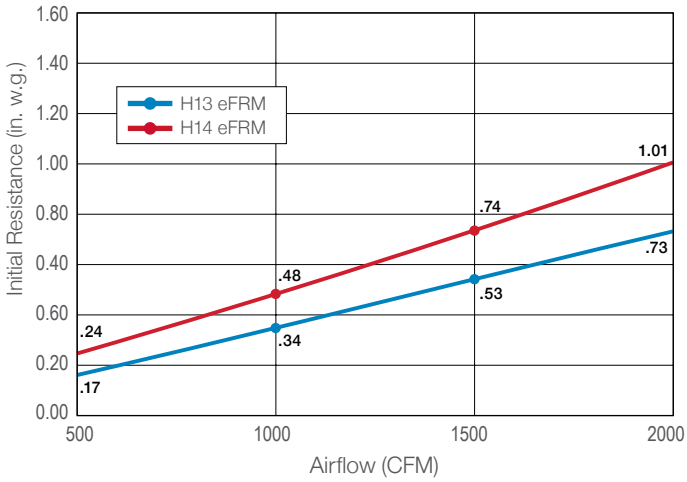
Product Overview

- Lower energy consumption – greater than 30%-50% lower resistance as compared to 12″ deep high capacity HEPA filters
- AAF Flanders eFRM media combines ultra-high efficiency with lowest pressure drop
- Complete compatibility with photometric test aerosols (e.g. PAO, DOP, etc.)
- Highly resistant to corrosive environments (acids, alkalis, and organic substances)
- Negligible offgassing properties (boron, sodium, potassium, silicon)
- High tensile strength media, more resistant to rough handling in transportation and installation
- Withstands pressure up to 20 in. w.g. (5,000 Pa)
- 99.99% to 99.999% minimum efficiency @ 0.3 µm (H13-H14)

Specifications

Efficiency	HEPA
Filter Depth	12″
Frame Material	Galvanized Steel, Aluminum, or Stainless Steel
Separator Style	Corrugated Aluminum
Max Operating Temperature	150°F (66°C)
Special Size Available	Yes
Frame Style	Gel Seal, Gasket Seal
Antimicrobial Available	No
Media Type	eFRM
Air Filtration Certification	UL 900, ULC-S111

Initial Resistance vs. Airflow Capacity



Performance data based on a 24″x 24″ x 11½″ filter

Product Information

Style Code	Actual Size Inches (H x W x D)	Rated Airflow (SCFM)	Std. Pkg. Qty. Per Carton	Shipping Wt. Lbs. per Box (± 7%)	Cubic Ft.
Gasket Seal (99.99%) – Gasket on Air Leaving Side Only					
E24A24AA1P13E2T0BA	24 x 24 x 11½	2,000	1	46.0	4.5
E24A12AA1P13E2T0BA	24 x 12 x 11½	925	2	64.0	2.4
E12A24AA1P13E2T0BA	12 x 24 x 11½	825	1	36.0	2.4
E23D23DA1P13E2T0BA	23⅜ x 23⅜ x 11½	1,900	1	45.0	4.3
E11D23DA1P13E2T0BA	11⅜ x 23⅜ x 11½	750	1	36.0	2.2
Gasket Seal (99.99%) – Gaskets on Both Air Entering and Air Leaving Sides					
E24A24AA1P13E3T0BA	24 x 24 x 11½	2,000	1	46.0	4.3
E24A12AA1P13E3T0BA	24 x 12 x 11½	925	1	36.0	2.2
E12A24AA1P13E3T0BA	12 x 24 x 11½	825	1	36.0	2.2
E23D23DA1P13E3T0BA	23⅜ x 23⅜ x 11½	1,900	1	45.0	4.3
E11D23DA1P13E3T0BA	11⅜ x 23⅜ x 11½	750	1	36.0	2.2
Gel Seal Filters (99.99%)					
E24A24AA1P13F2T0AA	24 x 24 x 11½	2,000	1	46.0	4.3

Additional sizes and configurations available upon request – see following page.

High Purity

MEGAcel® I eFRM Style Code

E24A24A A 1 P 13 F 2 T 0 AA

(1) (2) (3) (4) (5) (6) (7) (8) (9) (10)

(1) SIZE	(2) DEPTH	(3) SEALANT	(4) MEDIA	(5) ACCEPTANCE LEVEL	(6) GASKET MATERIAL	(7) GASKET LOCATION	(8) SEPARATOR	(9) FACEGUARD	(10) FRAME & CONFIGURATION

1. SIZE

E 24 A 24 A

- **E** — Designates Imperial Measurement
- **24** — Filter Height in Whole Inches
- **A** — Filter Height in Additional Fractions of an Inch (see chart below)
- **24** — Filter Width in Whole Numbers
- **A** — Filter Width in Additional Fractions of an Inch (see chart below)

Fractional Notation for Imperial Sizes:

A = 0	B = 1/8	C = 1/4	D = 3/8
E = 1/2	F = 5/8	G = 3/4	H = 7/8

Example: E23D11G

23⅜″ High x 11¾″ Wide

2. DEPTH

Code	Type
A	11½″

3. BOND

1	Polyurethane

4. MEDIA

P	eFRM (99.99% on 0.3 micron or H13)
T	eFRM (99.999% on 0.3 micron or H14)

5. ACCEPTANCE LEVEL

13	99.99% on 0.3 micron, scanned
14	99.999% on 0.3 micron, scanned
21	99.95% on MPPS (H13)
22	99.995% on MPPS (H13)

6. GASKET/GEL MATERIAL

B	Polyurethane Gel
E	EPDM
F	Silicone Gel
P	None
T	Neoprene
U	Poron

*Gaskets are ¼″ thick x ¾″ wide

7. GASKET/GEL LOCATION

Code	Type
0	None
1	Air Entering SIde
2	Air Leaving Side
3	Both Sides
5	Extractor Clips

8. SEPARATOR

T	Aluminum
W	Vinyl Coated Aluminum

9. FACEGUARD

0	None
1	Air Entering SIde
2	Air Leaving Side
3	Both Sides

10. FRAME AND CONFIGURATION:

AA	Galvanized Steel - Gel Seal
AB	304 Stainless Steel - Gel Seal
AC	409 Stainless Steel - Gel Seal
AD	Aluminum - Gel Seal
BA	Galvanized Steel - Gasket Seal
BB	304 Stainless Steel - Gasket Seal
BC	409 Stainless Steel - Gasket Seal
BD	Aluminum - Gasket Seal

High Purity

AstroCel® III

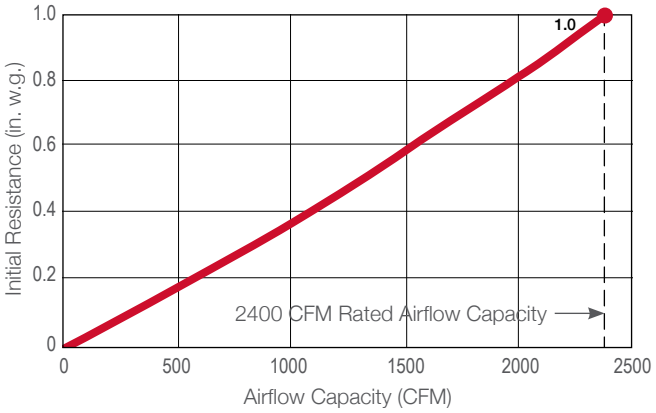
Product Overview

- Ideal for demanding operating conditions in critical applications
- Double the media area typically found in standard HEPA filters for longer filter life and fewer changeouts
- V-bank design for maximum effective media area and minimal resistance to airflow
- Extremely low resistance and long filter life means a much lower Total Cost of Ownership
- Chemical-resistant anodized aluminum frame provides superior strength
- One-piece polyurethane gasket seal and gel seal designs available
- 436 sq. ft. of media, 99.99% efficiency, and 1.0″ w.g. pressure drop at 2400 CFM (24 x 24 x11½ gasket seal configuration)

Specifications

Efficiency	HEPA
Filter Depth	12″
Media Type	Microglass
Frame Material	Anodized Aluminum
Special Size Available	No
Antimicrobial Available	No
Frame Style	Gel Seal, Gasket Seal
Separator Style	Glass Filament
Max Operating Temperature	200°F (93°C)
Air Filter Certification	UL 900, ULC-S111, UL 586

Initial Resistance vs. Airflow Capacity



Performance data is based on AstroCel III 24″ x 24″ x 11½″ gasket seal filter.

Product Information

Part Number	Actual Size Inches (H x W x D)	Rated Airflow SCFM @ 1.0″ w.g.	Std. Pkg. Qty. Per Carton	Shipping Wt. Lbs. per Box (± 7%)	Cubic Ft.
Gasket Seal Filters					
3015302-001	24 x 24 x 11½	2400	1	42.0	4.5
3015302-002	24 x 12 x 11½	900	1	30.0	2.8
3015302-003	23⅜ x 23⅜ x 11½	2325	1	41.0	5.0
3015302-004	23⅜ x 11⅜ x 11½	875	1	29.0	2.7
Gel Seal Filters, without Extractor Clips					
3047388-005	24 x 24 x 11½	2150	1	42.0	5.3
3047388-006	24 x 12 x 11½	800	1	30.0	2.8
3047388-007	23⅜ x 23⅜ x 11½	2075	1	41.0	5.0
3047388-008	23⅜ x 11⅜x 11½	775	1	29.0	2.7
Gel Seal Filters, with Extractor Clips					
3047388-001	24 x 24 x 11½	2150	1	42.0	5.3
3047388-002	24 x 12 x 11½	800	1	30.0	2.8
3047388-003	23⅜ x 23⅜ x 11½	2075	1	41.0	5.0
3047388-004	23⅜ x 11⅜ x 11½	775	1	29.0	2.7

Additional sizes available upon request.

High Purity

SuperFlow® 24

Product Overview

- Specifically designed for high airflow applications requiring HEPA efficiency at an ultra-low pressure drop
- Longer life – gasket seal SuperFlow® 24 filters have 400 sq. ft. of media compared to 240 sq. ft. for traditional HEPA filters
- V-bank design for maximum effective media area and minimal resistance to airflow
- Extremely low resistance and long filter life means a much lower Total Cost of Ownership
- 24 x 24 x11½ gasket seal configuration has 400 sq. ft. of media, and 1.0″ w.g. pressure drop at 2400 CFM

Specifications

Efficiency	HEPA
Filter Depth	12″
Media Type	Microglass
Frame Material	Galvanneal, Anodized Aluminum, Stainless Steel
Special Size Available	No
Antimicrobial Available	No
Frame Style	Gel Seal, Gasket Seal
Separator Style	Gluebead
Max Operating Temperature	175°F (79°C)
Air Filter Certification	UL 900, ULC-S111

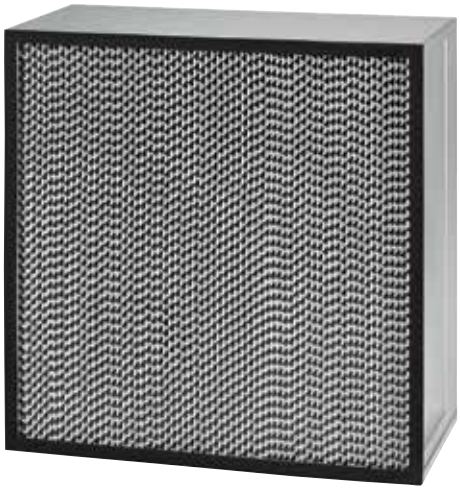
Product Information

Part Number	Actual Size Inches (H x W x D)	Rated Airflow SCFM @ 1.0″ w.g.	Std. Pkg. Qty. Per Carton	Shipping Wt. Lbs. per Box (± 7%)
Gasket Seal (downstream), Aluminum Frame				
SF24-5-G2-GG	24 x 24 x 11½	2400	1	45
SF24-5-G2-CG	12 x 24 x 11½	1200	1	27
SF24-5-G2-YY	23⅜ x 23⅜ x 11½	2270	1	45
SF24-5-G2-UY	11⅜ x 23⅜ x 11½	1100	1	27
Fluid Seal (downstream), Aluminum Frame				
SF24-5-F2-GG	24 x 24 x 11½	2400	1	45
SF24-5-F2-CG	12 x 24 x 11½	1200	1	27
SF24-5-F2-YY	23⅜ x 23⅜ x 11½	2270	1	45
SF24-5-F2-UY	11⅜ x 23⅜ x 11½	1100	1	27

Additional sizes available upon request.

High Purity

AstroCel® I HCX



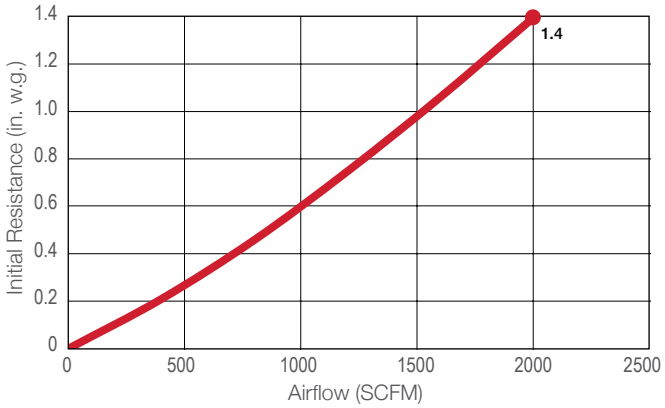
Product Overview

- Double the airflow capacity of a standard AstroCel® I
- Lower resistance, lower energy costs, and longer filter life if running at same speed as a standard capacity HEPA filter
- Rated for continuous operation at 500 FPM (initial resistance of 1.4″ w.g.)
- Individually tested and certified to perform in the most critical applications
- Designed for environments requiring the very highest levels of contamination control
- Custom sizes and a wide variety of construction options, including various cell side materials, efficiencies, and more are available upon request – see page 167 for details

Specifications

Efficiency	HEPA, ULPA
Filter Depth	11½″, 5⅞″
Media Type	Microglass
Frame Material	Wood, Metal
Separator Style	Tapered Corrugated Aluminum
Special Size Available	Yes
Antimicrobial Available	Yes
Frame Style	Gel Seal, Gasket Seal
Max Operating Temperature	175°–500°F (79°–260°C)
Air Filtration Certification	UL 900, ULC S111, UL 586

Initial Resistance vs. Airflow Capacity



Product Information

Part Number	Style Code	Actual Size Inches (H x W x D)	Rated Airflow (SCFM) 1.4″ w.g.	Std. Pkg. Qty. Per Box	Ship. Wt. Lbs/Box (± 7%)	Cubic Ft.	Efficiency
304 Stainless Steel							
550-265-005	15A26H1T2A0	24 x 24 x 11½	2000	1	42.0	4.5	99.97%
550-265-004	44A26H1T2A0	24 x 12 x 11½	1000	1	23.0	2.3	99.97%
557-265-305	15A26H1T2H0	24 x 24 x 11½	2000	1	42.0	4.5	99.99%
557-265-304	44A26H1T2H0	24 x 12 x 11½	1000	1	23.0	2.3	99.99%
Mill Finish Aluminum							
550-295-005	15A29H1T2A0	24 x 24 x 11½	2000	1	42.0	4.5	99.97%
550-295-004	44A29H1T2A0	24 x 12 x 11½	1000	1	23.0	2.3	99.97%
557-295-305	15A29H1T2H0	24 x 24 x 11½	2000	1	42.0	4.5	99.99%
557-295-304	44A29H1T2H0	24 x 12 x 11½	1000	1	23.0	2.3	99.99%
Galvanized Steel							
550-205-005	15A20H1T2A0	24 x 24 x 11½	2000	1	42.0	4.5	99.97%
550-205-004	44A20H1T2A0	24 x 12 x 11½	1000	1	23.0	2.3	99.97%
557-205-305	15A20H1T2H0	24 x 24 x 11½	2000	1	42.0	4.5	99.99%
557-205-304	44A20H1T2H0	24 x 12 x 11½	1000	1	23.0	2.3	99.99%
Fire-Retardant Particle Board							
550-745-005	15A74H1T2A0	24 x 24 x 11½	2000	1	42.0	4.5	99.97%
550-745-004	44A74H1T2A0	24 x 12 x 11½	1000	1	23.0	2.3	99.97%
557-745-005	15A74H1T2H0	24 x 24 x 11½	2000	1	42.0	4.5	99.99%
557-745-004	44A74H1T2H0	24 x 12 x 11½	1000	1	23.0	2.3	99.99%

Additional sizes, efficiencies, and construction options available upon request.

High Purity

AstroCel® I

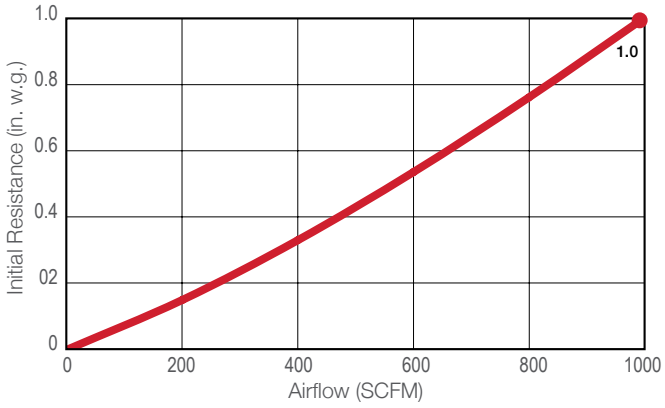
Product Overview

- Designed for environments requiring the very highest levels of contamination control
- Individually tested and certified to perform in the most critical applications
- Custom sizes and a wide variety of construction options, including various cell side materials, efficiencies, and more are available upon request – see page 167 for details

Specifications

Efficiency	HEPA, ULPA
Filter Depth	11½″, 5⅞″
Media Type	Microglass
Frame Material	Wood, Metal
Separator Style	Corrugated Aluminum
Special Size Available	Yes
Antimicrobial Available	Yes
Frame Style	Gel Seal, Gasket Seal
Max Operating Temperature	175°–500°F (79°–260°C)
Air Filtration Certification	UL 900, ULC S111, UL 586

Initial Resistance vs. Airflow Capacity



Product Information

Part Number	Style Code	Actual Size Inches (H x W x D)	Rated Airflow (SCFM) 1.0″ w.g.	Std. Pkg. Qty. Per Box	Ship. Wt. Lbs/Box (± 7%)	Cubic Ft.	Efficiency
Galvanized Steel							
560-205-105	15A20J1T2A5	24 x 24 x 11½	1050	1	40.0	4.5	99.97%
560-205-104	44A20J1T2A5	24 x 12 x 11½	500	1	23.0	2.3	99.97%
560-205-103	42A20J1T2A5	23⅜ x 23⅜ x 11½	1000	1	40.0	4.3	99.97%
560-205-106	16A20J1T2A5	24 x 30 x 11½	1350	1	45.0	5.6	99.97%
567-205-005	16A20J1T2H5	24 x 24 x 11½	1050	1	40.0	4.5	99.99%
567-205-003	42A20J1T2H5	23⅜ x 23⅜ x 11½	1000	1	40.0	4.3	99.99%
Mill Finish Aluminum							
560-295-105	15A29J1T2A5	24 x 24 x 11½	1050	1	40.0	4.5	99.97%
560-295-103	42A29J1T2A5	23⅜ x 23⅜ x 11½	1000	1	40.0	4.3	99.97%
567-295-005	15A29H1T2H5	24 x 24 x 11½	1050	1	40.0	4.5	99.99%
567-295-003	44A29H1T2H5	23⅜ x 23⅜ x 11½	1000	1	40.0	4.3	99.99%
Fire-Retardant Particle Board							
560-745-005	15A74J1T2A5	24 x 24 x 11½	1050	1	42.0	4.5	99.97%
560-745-004	44A74J1T2A5	24 x 12 x 11½	500	1	23.0	2.3	99.97%
567-745-005	15A74J1T2H5	24 x 24 x 11½	1050	1	42.0	4.5	99.99%

Additional sizes, efficiencies, and construction options available upon request.

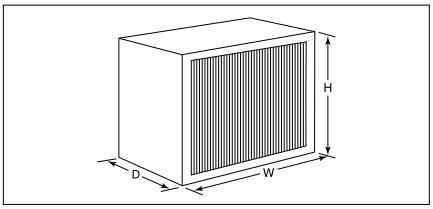
High Purity

AstroCel® I Style Code

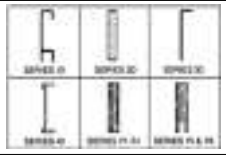
15 A 74 J 1 T 2 A 0

- Size
- Media
- Cell Sides
- Separator Pack/Depth
- Bond Material
- Gasket/Seal Material
- Gasket Location
- Acceptance Level
- Faceguard Location & UL 586 Label

1. FACE SIZE (Inches) H x W x D	
12	8 x 8 x 5⅞
13	12 x 12 x 5⅞
14	24 x 24 x 5⅞
15	24 x 24 x 11½
16	24 x 30 x 11½
17	24 x 48 x 5 ⅞
18	24 x 72 x 5⅞
19	SPECIAL SIZE
31	12 x 12 x 11½
32	12 x 24 x 11½
33	15⅜ x 19⅜ x 5⅞
34	15⅜ x 19⅜ x 11½
35	20⅞ x 20⅞ x 5⅞
36	20⅞ x 20⅞ x 11½
37	20⅞ x 44⅞ x 5⅞
38	23¼ x 23¼ x 5⅞
41	23⅜ x 23⅜ x 5⅞
42	23⅜ x 23⅜ x 11½
43	24 x 12 x 5⅞
44	24 x 12 x 11½
45	24 x 30 x 5⅞
46	24 x 36 x 5⅞
47	24 x 60 x 5⅞
48	24⅜ x 19⅜ x 11½
51	30 x 30 x 5⅞
52	30 x 36 x 5⅞
53	30 x 48 x 5⅞
54	30 x 60 x 5⅞
55	30 x 72 x 5⅞
56	36 x 24 x 5⅞
57	36 x 30 x 5⅞
58	36 x 36 x 5⅞
61	36 x 60 x 5⅞
62	36 x 72 x 5⅞
63	23¼ x 47¼ x 5⅞
64	30 x 24 x 5⅞
65	36 x 48 x 5⅞
66	12 x 24 x 5⅞
67	23¼ x 41¼ x 5⅞
68	23¼ x 29¼ x 5⅞
69	23¼ x 35¼ x 5⅞
91	11⅜ x 23⅜ x 11½
92	23⅜ x 11⅜ x 11½
92	23⅜ x 11⅜ x 11½



2. Media (MICROGLASS) FIBER		
Code	**Type**	**°T Limit**
A	99.97% or 99.99%	1000°F
D	BioCel 95%	1000°F
E	99.999%	1000°F
N	Radiation resistant 99.97%	1000°F
Z	SPECIAL MEDIA	–
I	Antimicrobial Treated	
3. CELL SIDES		
METAL GEL SEAL		
10	Galvanized Steel	
16	304 Stainless Steel	
19	Anodized Extruded Aluminum	
METAL PAN STYLE BOX		
20	Galvanized Steel	
26	304 Stainless Steel	
29	Mill Finish Aluminum	
EXTRUDED ALUMINUM BOX STYLE		
40	Alum “C” Channel 5⅞” Deep	
WOOD		
71	Plywood	200°F
72	Fire Retardant Plywood	200°F
73	Particle Board	200°F
74	Fire Retardant Particle Board	200°F
75	Plywood, w/groove for Gel Seal	200°F
76	Fire Retardant Plywood, w/groove for Gel Seal	200°F
99	SPECIAL CELL SIDES	
4. SEPARATORS		
H	High Capacity Aluminum	600°F
J	Aluminum	600°F
V	Vinyl Coated Aluminum	250°F
W	High Capacity Vinyl Coated Aluminum	250°F
Z	SPECIAL SEPARATORS	
5. BOND MATERIAL		
1	Fire Retardant Polyurethane	200°F
2	Polyurethane (40 Series only)	200°F
4	White Silicone	400°F
5	Red Silicone	500°F
9	SPECIAL BOND	



6. GASKET/SEAL MATERIAL		
Code	**Type**	**°T Limit**
F	Fluid Seal trough @ ¾″ deep, includes Silicone Sealant	175°F
L	Aluminum Skirt @ .063″ thick	175°F
P	None	
R	Dovetail Neoprene	175°F
T	Neoprene Sponge, RE-43-E1	175°F
	Grade (¼″ x ¾″ w/butt joints)	175°F
U	Poron (¼″ x ¾″ w/dovetail joints)	175°F
V	Poron (¼″ x ¾″ w/butt joints)	175°F
Y	Silicone (¼″ x ¾″ w/butt joints)	500°F
Z	SPECIAL GASKET MATERIAL	
7. GASKET LOCATION		
0	No Gaskets	
1	Gasket – Air Entering Side	
2	Gasket – Air Leaving Side (or skirt one face, or gel sealant installed in trough)	
3	Gasket Both Faces	
4	SPECIAL REQUIREMENTS	
5	Extractor Clips (Gel sealant installed in trough)	
8. ACCEPTANCE LEVEL		
A	99.97% on PAO (A)	
B	99.97% PAO – Shroud tested at 100% and 20% flow – no media patching is permitted (military) (A,N)	
E	SPECIAL INSPECTION REQUIRED	
F	BioCel only – 95% on 0.3 mm (D)	
G	99.99% on 0.3 mm PSL (A)	
H	Scan Tested (99.99%) (A)	
J	99.999% on 0.3 mm PSL (E)	
K	Scan Tested (99.999%) (E)	
M	Scan Tested @ 99.9995% on .10 to .20 mm ambient particles + scan tested (E)	
R	99.99% PAO (A)	
S	Cold PAO hand scan (99.99%) (A)	

NOTE: Letter in parentheses above indicates the media type identified in Section 2.

9. FACEGUARD LOCATION & UL 586 LABEL	
0	No Faceguard, no UL Label
1	Faceguard upstream side only
2	Faceguard downstream side only
3	Faceguard both sides, no UL Label
4	SPECIAL (e.g. faceguard must be located with respect to gasket)
5	No faceguard, UL Label
8	Faceguards both sides, UL Label

NOTE: Standard faceguards are flattened expanded galvanized metal for Std-cap filters and 4x4 mesh galv. hardware cloth for Hi-cap filters.

General Notes: The purpose of this style code is for identification of components used in standard AstroCel® I HEPA filters. Because of inherent compatibility limitations, the style code should not be used to arbitrarily “build” a filter with random components. First dimension of filter is height, or direction of separators.

High Purity

Alpha™ 2000

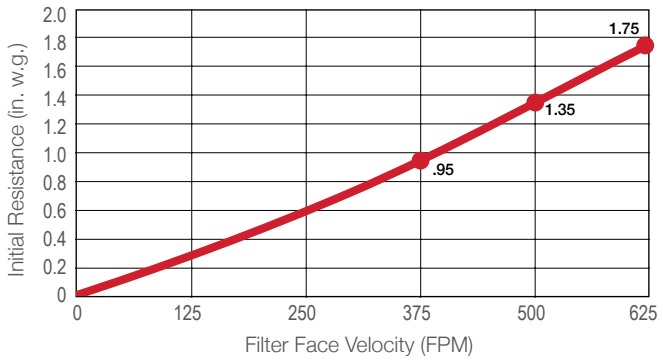
Product Overview

- Double the airflow capacity of a standard Alpha Cell®
- Lower resistance, lower energy costs, and longer filter life if running at same speed as a standard capacity HEPA filter
- Pureform® separatorless media pack for more usable media area and longer service life
- Pureform® media withstands harsh environments that could damage standard aluminum separators
- 40% more media area than the standard capacity Alpha Cell® filter
- Rated for continuous operation at 500 FPM (initial resistance of 1.35″ w.g.)
- Custom sizes and a wide variety of construction options, including various cell side materials, efficiencies, and more are available upon request – see page 170 for details

Specifications

Efficiency	HEPA, ULPA
Filter Depth	11½″
Media Type	Microglass
Frame Material	Wood, Metal
Special Size Available	Yes
Construction Style	Box, Double-Turn Flange, Single Flange
Antimicrobial Available	No
Frame Style	Gel Seal, Gasket Seal
Separator Style	Self-Supporting
Max Operating Temperature	175°F (79°C)
Air Filtration Certification	UL 900, ULC S111, UL 586

Initial Resistance vs. Filter Face Velocity



Product Information

Model Number	Actual Size Inches (H x W x D)	Rated Airflow SCFM @ 1.4″ w.g.	Std. Pkg. Qty.	Shipping Wt. Lbs. per Box (± 7%)	Cubic Ft.	Efficiency
304 Stainless Steel, Double-Turn Flange						
0-007-W-03-03-IU-12-00-GG-F	24 x 24 x 11½	2000	1	38.0	4.5	99.97%
0-007-W-03-03-IU-12-00-GC-F	24 x 12 x 11½	1000	1	26.0	2.3	99.97%
0-007-W-03-03-SU-12-00-GG-F	24 x 24 x 11½	2000	1	38.0	4.5	99.99%
0-007-W-03-03-SU-12-00-GC-F	24 x 12 x 11½	1000	1	26.0	2.3	99.99%
Galvanneal, Box Style						
0-007-W-08-00-IU-12-00-GG-F	24 x 24 x 11½	2000	1	38.0	4.5	99.97%
0-007-W-08-00-IU-12-00-GC-F	24 x 12 x 11½	1000	1	26.0	2.3	99.97%
0-007-W-08-00-SU-12-00-GG-F	24 x 24 x 11½	2000	1	38.0	4.5	99.99%
0-007-W-08-00-SU-12-00-GC-F	24 x 12 x 11½	1000	1	26.0	2.3	99.99%
Fire-Retardant Particle Board, Box Style						
0-007-W-07-00-IU-12-00-GG-F	24 x 24 x 11½	2000	1	38.0	4.5	99.97%
0-007-W-07-00-IU-12-00-GC-F	24 x 12 x 11½	1000	1	26.0	2.3	99.97%

Additional sizes, efficiencies, and construction options available upon request.

High Purity

Alpha Cell®

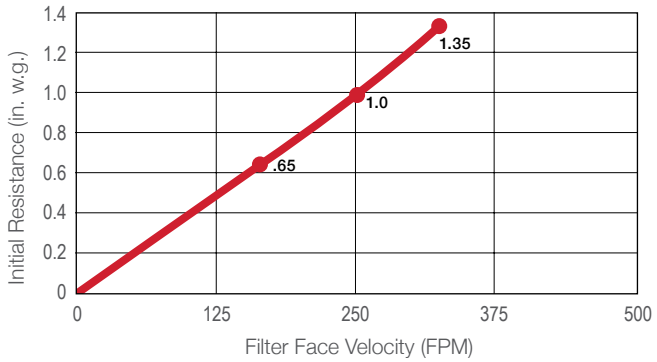
Product Overview

- Designed for environments requiring the very highest levels of contamination control
- Individually tested and certified to perform in the most critical applications
- Pureform® separatorless style media pack
- Rated for continuous operation at 250 FPM (initial resistance of 1.0″ w.g.)
- Custom sizes and a wide variety of construction options, including various cell side materials, efficiencies, and more are available upon request – see page 170 for details

Specifications

Efficiency	HEPA, ULPA
Filter Depth	11½″, 5⅞″
Media Type	Microglass
Frame Material	Wood, Metal
Special Size Available	Yes
Construction Style	Box, Double-Turn Flange, Single Flange
Antimicrobial Available	No
Frame Style	Gel Seal, Gasket Seal
Separator Style	Self-Supporting
Max Operating Temperature	175°F (79°C)
Air Filtration Certification	UL 900, ULC S111, UL 586

Initial Resistance vs. Filter Face Velocity



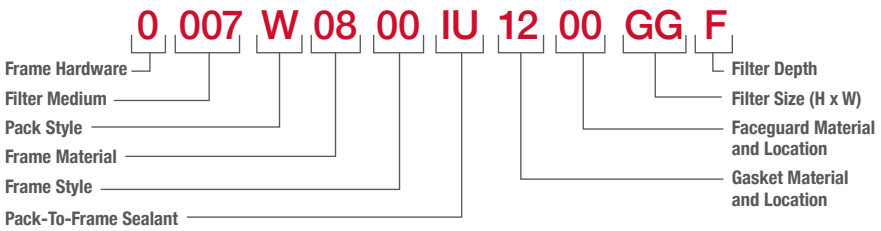
Product Information

Model Number	Actual Size Inches (H x W x D)	Rated Airflow SCFM @ 1.0″ w.g.	Std. Pkg. Qty.	Shipping Wt. Lbs. per Box (± 7%)	Cubic Ft.	Efficiency
Galvanneal, Box Style						
0-007-F-08-00-IU-12-00-GG-F	24 x 24 x 11½	1000	1	38.0	4.5	99.97%
0-007-F-08-00-IU-12-00-GC-F	24 x 12 x 11½	500	1	26.0	2.3	99.97%
0-007-F-08-00-IU-12-00-YY-F	23⅜ x 23⅜ x 11½	1000	1	38.0	4.5	99.97%
0-007-F-08-00-IU-12-00-YU-F	23⅜ x 11⅜ x 11½	500	1	26.0	2.3	99.97%
0-007-F-08-00-SU-12-00-GG-F	24 x 24 x 11½	1000	1	38.0	4.5	99.99%
0-007-F-08-00-SU-12-00-GC-F	24 x 12 x 11½	500	1	26.0	2.3	99.99%
0-007-F-08-00-SU-12-00-YY-F	23⅜ x 23⅜ x 11½	1000	1	38.0	4.5	99.99%
0-007-F-08-00-SU-12-00-YU-F	23⅜ x 11⅜ x 11½	500	1	26.0	2.3	99.99%
304 Stainless Steel, Double-Turn Flange						
0-007-F-03-03-IU-12-00-GG-F	24 x 24 x 11½	1000	1	38.0	4.5	99.97%
0-007-F-03-03-IU-12-00-GC-F	24 x 12 x 11½	500	1	26.0	2.3	99.97%
0-007-F-03-03-SU-12-00-GG-F	24 x 24 x 11½	1000	1	38.0	4.5	99.99%
0-007-F-03-03-SU-12-00-GC-F	24 x 12 x 11½	500	1	26.0	2.3	99.99%
304 Stainless Steel, Fluid Seal						
T-007-F-03-05-IU-52-00-GG-F	24 x 24 x 11½	1000	1	38.0	4.5	99.97%
T-007-F-03-05-IU-52-00-GC-F	24 x 12 x 11½	500	1	26.0	2.3	99.97%
Fire-Retardant Particle Board, Box Style						
0-007-F-07-00-IU-12-00-GG-F	24 x 24 x 11½	1000	1	38.0	4.5	99.97%
0-007-F-07-00-IU-12-00-GC-F	24 x 12 x 11½	500	1	26.0	2.3	99.97%

Additional sizes, efficiencies, and construction options available upon request.

High Purity

Alpha®/Alpha™ 2000 Style Code



1. FRAME HARDWARE

Code	Type
0	None
A	Drilled Flange for PureFrame Clips
E	Extruded Alum. CB w/1 Port
H	Bearing Plates on Filter Frame for A-2, A-4 and B-1 Frames
P	2" Extended Frame with Prefilter Roughing Pad (Dual-Pac)
S	Bearing Plates on Filter Frame for C-Series Housings
T	Extractor Clips (on filters for C-4 and Bag-In/Bag-Out Housings
U	U-Shaped Handle
X	SPECIAL

2. FILTER MEDIUM

007	99.97% W/R Glass (Standard)
008	99.999% Efficient on 0.3µm Particles, ULPA Grade with W/R Glass
00J	95% Efficient on 0.3µm Particles, All W/R Glass DOP Test
A**	Media Treated with an Antimicrobial Agent

***If using special media designation, replace the first "0" with the letter indicated.*

3. PACK STYLE

Code	Type
6	6″ DimplePleat® Element
D	4″ Pureform® Element
F	8″ Pureform® Element
W	11″ Pureform® Element

4. FRAME MATERIAL

01	¾″ Thick Exterior Plywood Non-F.R.
02	16-Gauge Type 409 Stainless Steel Riveted
03	16-Gauge Type 304 Stainless Steel Riveted
04	¾″ Thick F.R. Exterior Plywood
05	.063″ Thick Fabricated Aluminum
07	¾″ Thick Particleboard
08	16-Gauge Galvanneal
11	¾″ Thick Non-F.R. Particleboard
12	14-Gauge Type 304L Stainless Steel
13	14-Gauge Type 316 Stainless Steel
14	P.V.C. (Chlorine Resistant)
15	14-Gauge Type 316L Stainless Steel
42	14-Gauge Type 409 Stainless Steel, Bolted
43	14-Gauge Type 304 Stainless Steel, Bolted

5. FRAME STYLE

Code	Type
00	Box Type Design, Wood Frame, Stapled Metal Frame, No Fasteners (F.R. Urethane)
01	Single Header, Flat Flange
02	Double Header, Flat Flange
03	Two Double-Turn Flanges
05	¾″-Deep Channel (or Groove) Filled with Fluid Sealant
06	Single Header Filled with Fluid Sealant (Back of Header)
08	One Double-Turn Flange
N1	(1) Nipple
N2	(2) Nipples

6. PACK-TO-FRAME SEALANT

INDUSTRIAL GRADE FILTERS	
IE	High Temp Silicone 99.97%
IG	Ceramic and Glass Mat. 99.97%
IU	F.R. Urethane 99.97%
LAMINAR FLOW GRADE FILTERS	
SE	High Temp Silicone 99.99%
SU	F.R. Urethane 99.99%
PHARMACEUTICAL GRADE FILTERS	
PG	F.R. Urethane PAO Test 99.99% Autoscan, No Patches
PA	F.R. Urethane PAO Test 99.99%
PE	High Temp, No Patch
PT	High Temp Thermal PAO Test

Continued on next page.

High Purity

Alpha®/Alpha™ 2000 Style Code

7. GASKET/SEAL MATERIAL	
Code	**Type**
0	None
1	Neoprene
3	Cohrlastic Sponge
4	Woven Glass
5	BluJel®
6	Urethane Jel
7	Glass Packing
8	Polyurethane Ether Foam
B	Black Poly – B
F	FDA-Approved White Silicone
P	Poron
R	Braided Rope
W	White Poly – B
V	Viton
X	Special

8. GASKET LOCATION	
0	None
1	Upstream
2	Downstream
3	Both
4	Back of Header
X	SPECIAL

9. FACEGUARD MATERIAL	
0	None
1	Galvanized (4 x 4 Mesh)
2	Stainless Steel (4 x 4 Mesh)
3	PVC (24″ x 24″) (4 x 4 Mesh)
4	Scrim (6 x 6 Mesh)
A	Anodized Alum. Perf. 40% Open
B	Alum. Perf. (White Paint)
C	CRS Perf. (White Paint) 40% Open
D	Expanded Alum. (White Paint)
E	Expanded S/S
F	Expanded CRS (White Paint)
G	Expanded Aluminized Steel
S	Stainless Steel Perf. 40% Open
X	SPECIAL

10. FACEGUARD LOCATION	
0	None
1	Upstream
2	Downstream
3	Both

STANDARD SIZE DESIGNATIONS*			
Code	**Type**	**Code**	**Type**
B	8″	R	60″
C	12″	S	72″
E	18″	U	11⅜″
G	24″	V	15⅜″
N	30″	W	17⅜″
P	36″	X	29⅜″
H	42″	Y	23⅜″
Q	48″	Z	24⅜″

**Height x Width x Depth.*

ODD SIZE DESIGNATIONS**			
A	0″	J	½″
B	1/16″	K	9/16″
C	⅛″	L	⅝″
D	3/16″	M	11/16″
E	¼″	N	¾″
F	5/16″	P	13/16″
G	⅜″	Q	⅞″
H	7/16″	R	15/16″

***Odd size designation is an alphanumeric description. The first two numbers and letter specify the height and the second two numbers and letter specify the width. Then add the final character as per the below to specify the depth.*

FILTER FRAME DEPTH			
A	3 1/16	2	2⅞
D	5⅞	3	3⅞
D2	7⅞	4	4⅞
F	11½	6	6⅞
F2	13½	8	8⅞
T	6⅜		

FILTER SIZE CODE EXAMPLES	UL CODE**
A (Round Filter Size)	US – UL 586***
M–GQ	U9 – UL 900***
GG–F	
GG-F2	
E1386*	
Z90127*	
YY-D	
17E21A	

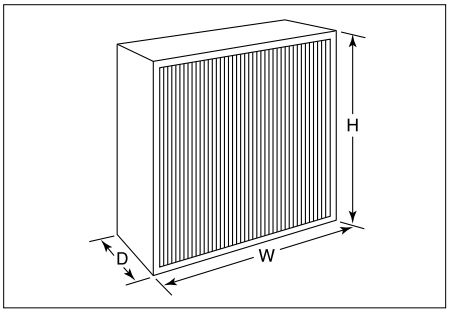
**Indicates special extrusion/engineering drawing.*

***Optional*

****See Engineering Form numbers ENGR-018 & ENGR-021 to determine if a filter meets UL 900 or UL 586.*

Notes:

1. *All combinations are not available as standards – check catalog for standards. Because of inherent compatibility limitations, the style code should not be used to arbitrarily "build" a filter.*
2. *Round HEPAs and nuclear-grade filters are also available. Contact aafforemarket@aafintl.com for more information.*



High Purity

AstroCel® I HTP

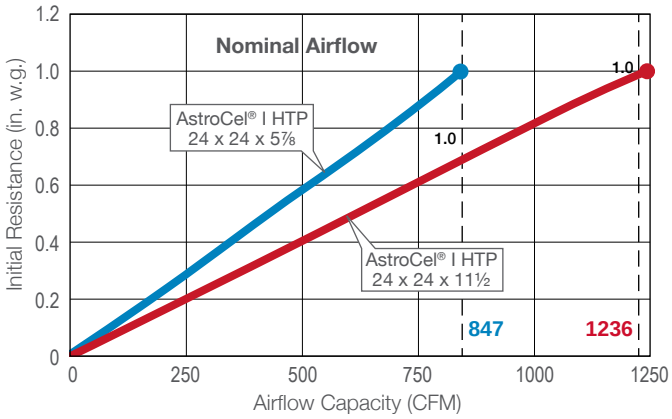
Product Overview

- Designed to withstand the intense thermal stress of repeated heating and cooling
- Elastic fiberglass sealant eliminates cracking, shedding, and leaking seen in competitive filters with ceramic sealant
- Stainless steel separators reduce particle shedding and add strength, as compared to filters made with aluminum separators
- Maximum continuous operating temperature of 662°F (350°C); Up to 752°F (400°C) for up to one hour
- Robust design leads to better durability and longer life
- Excellent choice for pharmaceutical dehydrogenation operations, LCD/TFT manufacturing, or other high temperature applications

Specifications

Efficiency	HEPA
Filter Depth	11½″, 5⅞″
Media Type	Microglass
Frame Material	Stainless Steel
Separator Style	Stainless Steel
Special Size Available	Yes
Antimicrobial Available	No
Construction Style	Box
Max Operating Temperature	752°F (400°C)

Initial Resistance vs. Airflow Capacity



Tests performed at ambient temperatures (68°F).

Product Information

Actual Size Inches (W x H x D)	Rated Airflow (SCFM) 1.0″ w.g.	Std. Pkg. Qty.	Shipping Wt. Lbs. per Box (± 7%)	Cubic Ft.
24 x 24 x 5⅞	847	1	29	2.4
24 x 24 x 11½	1236	1	48	4.5

Additional sizes and part number information available upon request.

High Purity

AstroCel® I HT (750º)

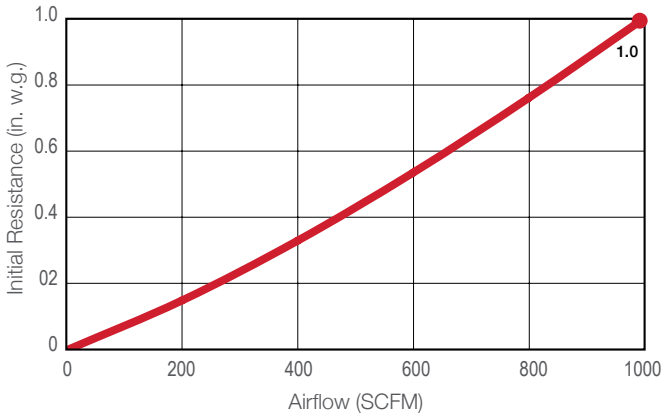
Product Overview

- Designed for environments requiring the very highest levels of contamination control at high temperatures
- Special bond material allows for continuous operation at temperatures as high as 750°F (399°C)
- Stainless steel frame with ceramic gasket
- Individually tested and certified to perform in the most critical applications

Specifications

Efficiency	HEPA
Filter Depth	11½″, 5⅞″
Media Type	Microglass
Frame Material	Stainless Steel
Separator Style	Aluminum
Special Size Available	Yes
Antimicrobial Available	No
Construction Style	Box
Max Operating Temperature	750°F (399°C)
Air Filtration Certification	UL 900

Initial Resistance vs. Airflow Capacity



Product Information

Part Number	Reference Drawing	Actual Size Inches (H x W x D)	Rated Airflow (SCFM) 1.0″ w.g.	Std. Pkg. Qty. Per Box	Ship. Wt. Lbs/Box (± 7%)	Cubic Ft.	Efficiency
GALVANIZED STEEL – ONE GASKET Rated Filter Face Velocity: 260 FPM							
560-614-001	1602614-1	24 x 24 x 11½	1,050	1	40.0	5.3	99.97%

**The HT-750 AstroCel I is constructed with box type stainless steel cell sides.*
Additional sizes available upon request.

High Purity

AstroCel® I HT (400º, 500º)

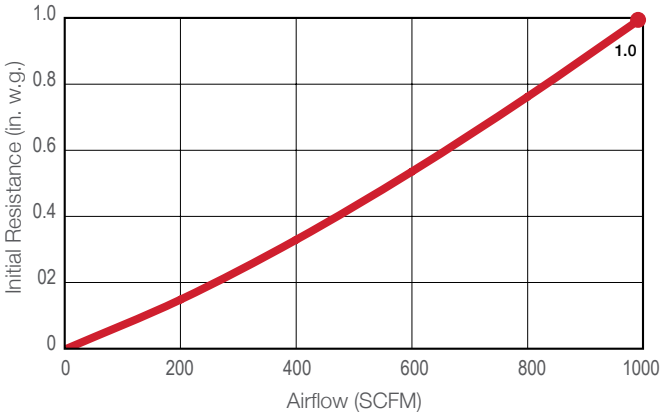
Product Overview

- Designed for environments requiring the very highest levels of contamination control at temperatures up to 500°F (260°C)
- Individually tested and certified to perform in the most critical applications
- High capacity option available for airflows up to 500 FPM
- Custom sizes and a wide variety of construction options, including various cell side materials, efficiencies, and more are all available upon request – see page 167 for details

Specifications

Efficiency	HEPA
Filter Depth	11½″, 5⅞″
Media Type	Microglass
Frame Material	Aluminum, Stainless Steel
Separator Style	Aluminum
Special Size Available	Yes
Antimicrobial Available	No
Construction Style	Box
Max Operating Temperature	500°F (260°C)
Air Filtration Certification	UL 900, UL 586

Initial Resistance vs. Airflow Capacity



Product Information

Part Number	Style Code	Actual Size Inches (H x W x D)	Rated Airflow (SCFM) 1.0″ w.g.	Std. Pkg. Qty. Per Box	Ship. Wt. Lbs/Box (± 7%)	Cubic Ft.	Max. Temp Rating	Efficiency
Stainless Steel								
560-264-005	15A26J4Y2A0	24 x 24 x 11½	1,050	1	40.0	5.3	HT-400	99.97%
560-266-005	15A26J5Y2A0	24 x 24 x 11½	1,050	1	40.0	5.3	HT-500	99.97%
567-264-005	15A26J4Y2H0	24 x 24 x 11½	1,050	1	40.0	5.3	HT-400	99.99%
567-266-005	15A26J5Y2H0	24 x 24 x 11½	1,050	1	40.0	5.3	HT-500	99.99%
Aluminum								
560-294-005	15A29J4Y2A0	24 x 24 x 11½	1,050	1	40.0	5.3	HT-400	99.97%
560-296-005	15A29J5Y2A0	24 x 24 x 11½	1,050	1	40.0	5.3	HT-500	99.97%
567-294-005	15A29J4Y2H0	24 x 24 x 11½	1,050	1	40.0	5.3	HT-400	99.99%
567-296-005	15A29J5Y2H0	24 x 24 x 11½	1,050	1	40.0	5.3	HT-500	99.99%

Additional sizes available upon request.

High Purity

Alpha™ HT

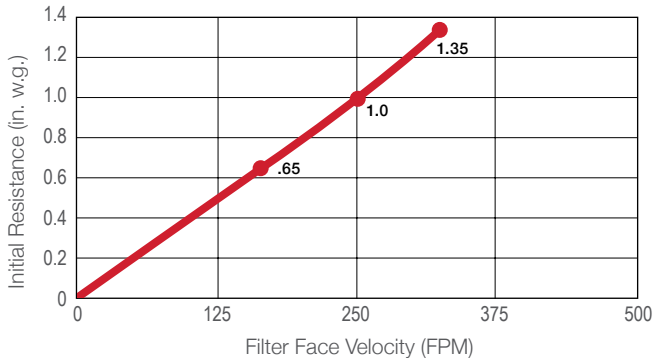
Product Overview

- Designed for environments requiring the very highest levels of contamination control at temperatures up to 500°F (260°C)
- Can be used at temperatures up to 1000° in exhaust air applications
- Gasket or fluid seal available; Fluid seal has a max. temp. of 390°F (199°C)
- Individually tested and certified to perform in the most critical applications
- Available with Pureform® separatorless media pack for more usable media area and longer service life
- Pureform® media withstands harsh environments that could damage standard aluminum separators
- High capacity option available for airflows up to 500 FPM

Specifications

Efficiency	HEPA
Filter Depth	11½″, 5⅞″
Media Type	Microglass
Frame Material	Aluminum, Stainless Steel
Special Size Available	Yes
Antimicrobial Available	No
Frame Style	Gel Seal, Gasket Seal
Construction Style	Box, Double-Turn Flange
Separator Style	Self-Supporting or Aluminum
Max Operating Temperature (538°C) for exhaust only	500°F (260°C) or 1000°F
Air Filtration Certification	UL 900, UL 586

Initial Resistance vs. Filter Face Velocity



Product Information

Part Number	Actual Size Inches (H x W x D)	Rated Airflow SCFM @ 1.0″ w.g.	Media Pack Style	Max. Temp Rating	Std. Pkg. Qty. Per Box	Shipping Wt. Lbs. (± 7%)	Cubic Ft.	Efficiency
304 Stainless Steel Frame; Double-Turn Flange Style								
0-007-F-02-03-IE-32-00-GG-F	24 x 24 x 11½	1000	Pureform®	500°F	1	38	4.5	99.97%
0-007-F-02-03-IE-32-00-GC-F	24 x 12 x 11½	450	Pureform®	500°F	1	26	2.3	99.97%
0-007-F-02-03-IE-32-00-YY-F	23⅜ x 23⅜ x 11½	950	Pureform®	500°F	1	37	4.5	99.97%
0-007-F-02-03-IE-32-00-YU-F	23⅜ x 11⅜ x 11½	425	Pureform®	500°F	1	25	2.3	99.97%
0-011-H-03-03-SE-32-00-GG-F	24 x 24 x 11½	2000	Separator	500°F	1	38	4.5	99.99%
0-011-H-03-03-SE-32-00-YY-F	23⅜ x 23⅜ x 11½	2000	Separator	500°F	1	37	4.5	99.99%
409 Stainless Steel Frame; Double-Turn Flange Style								
0-007-W-02-03-SE-32-23-GG-F	24 x 24 x 11½	2000	Pureform®	500°F	1	38	4.5	99.99%
Aluminum Frame; Fluid Seal Frame Style; Extractor Clips								
T-007-W-05-05-IE-52-00-GG-F	24 x 24 x 11½	1000	Pureform®	500°F	1	38	4.5	99.97%
T-007-W-05-05-IE-52-00-YY-F	23⅜ x 23⅜ x 11½	950	Pureform®	500°F	1	37	4.5	99.97%

Additional sizes available upon request.

High Purity

AstroPak®

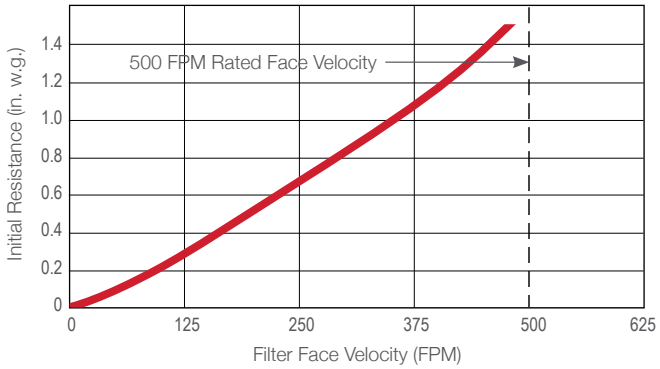
Product Overview

- Designed for use in negative air machines and for asbestos abatement
- Rated for airflow up to 2000 CFM (Model 2000)
- Uses hot melt separators rather than aluminum, eliminating any possibility of metal in the airstream
- Individually tested to ensure high performance

Specifications

Efficiency	HEPA
Filter Depth	12″
Media Type	Fiberglass
Frame Material	Particle Board
Separator Style	Hot Melt
Special Size Available	No
Antimicrobial Available	No
Construction Style	Box
Max Operating Temperature	175°F (79°C)

Initial Resistance vs. Filter Face Velocity



Performance data is based on Model 2000 AstroPak®

Product Information

Part Number	Actual Size Inches (H x W x D)	Rated Airflow (SCFM)	Std. Pkg. Qty.	Shipping Wt. Lbs. per Box (± 7%)	Cubic Ft.
Model 1000 (Standard Capacity), Gasket on Air Leaving Side					
3024635-001	24 x 24 x 11½	1000 @ 1.1″ w.g.	1	30.0	4.5
Model 1000 (Standard Capacity), Gasket on Air Entering Side					
3024635-002	24 x 24 x 11½	1000 @ 1.1″ w.g.	1	30.0	4.5
Model 2000 (High Capacity), Gasket on Air Leaving Side					
3024619-001	24 x 24 x 11½	2000 @ 1.5″ w.g.	1	35.0	4.5
Model 2000 (High Capacity), Gasket on Air Entering Side					
3024619-002	24 x 24 x 11½	2000 @ 1.5″ w.g.	1	35.0	4.5

High Purity

MEGAcel® II eFRM

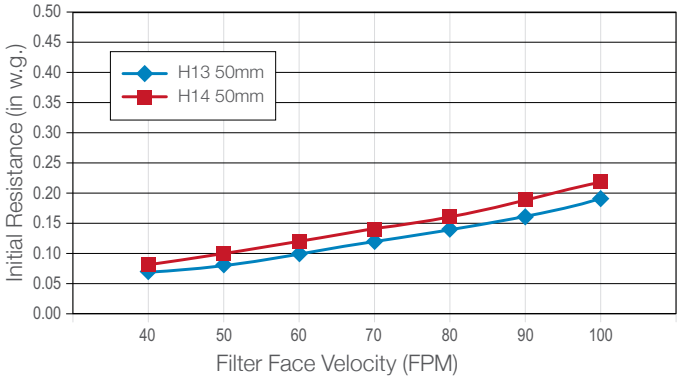
Product Overview

- Pharmaceutical grade eFRM media is proven to be more durable than microglass, delivering superior performance
- Industry's first and only membrane media to be Polyalphaolefin (PAO) compatible, with a higher PAO holding capacity compared to microglass media
- Superior durability and tensile strength, 84 times the pleated strength of microglass
- Chemical-resistant capabilities reduce media degradation in highly corrosive environments
- Exceptional water resistance compared to ultrafine microglass

Specifications

Efficiency	HEPA
Filter Depth	50 mm
Frame Material	Aluminum
Separator Style	Hot Melt
Max Operating Temperature	150°F (66°C)
Special Size Available	Yes
Construction Style	Gel, Gasket, or Knife-Edge Seal
Antimicrobial Available	No
Media Type	eFRM
Air Filtration Certification	UL 900, ULC-S111

Initial Resistance vs. Filter Face Velocity



Filter Face Velocity (FPM)	40	50	60	70	80	90	100
H13 50mm (in w.g.)	0.07	0.08	0.10	0.12	0.14	0.16	0.19
H14 50mm (in w.g.)	0.08	0.10	0.12	0.14	0.16	0.19	0.22

Product Information

Style Code	Actual Size Inches (H x W x D)	Rated Airflow (SCFM) @ 0.25" w.g.	Std. Pkg. Qty. Per Carton	Shipping Wt. Lbs. per Box (± 7%)	Cubic Ft.
Replacement Panels for AAF Flanders and Competitive Modules					
E21F19HB85K2F1SA0A	21⅝ x 19⅞ x 2⅞	235	1	15.0	1.1
E21F43HB85K2F1SA0A	21⅝ x 43⅞ x 2⅞	550	1	28.0	2.3
E21G20AB85K2F1SA0A	21¾ x 20 x 2⅞	235	1	15.0	1.1
E21G44AB85K2F1SA0A	21¾ x 44 x 2⅞	550	1	28.0	2.3

Additional sizes, media pack depths, and gasket configurations available upon request.

High Purity

MEGAcel® II eFRM Style Code

(1)	(2)	(3)	(4)	(5)	(6a)	(6b)	(7)	(8)	(9)	(9)
Size	Medium	Cell Construction & Configuration	Medium Pack Depth	Bond/ Patching	Gasket Material	Gasket Location	Acceptance Level	Faceguard Material	Faceguard Location	Center Divider

(1) SIZE: [All Dimensions are in Inches, for filter Depth see (3) below]

Designates Imperial Measurement
Filter Height In Whole Numbers
Filter Height in Additional Fractions of an Inch (See Chart Below)
Filter Height in Additional Fractions of an Inch (See Chart Below)
Filter Width in Whole Numbers

Fractional Notation for Imperial Sizes:

A = 0	B = 1/8	C = 1/4	D = 3/8	E = 1/2	F = 5/8	G = 3/4	H = 7/8
J = 1/16	K = 3/16	L = 5/16	M = 7/16	N = 9/16	P = 11/16	Q = 13/16	R = 15/16

Examples:

E	23	D	35	H

23⅜ High x 35⅞ Wide

E	12	A	24	E

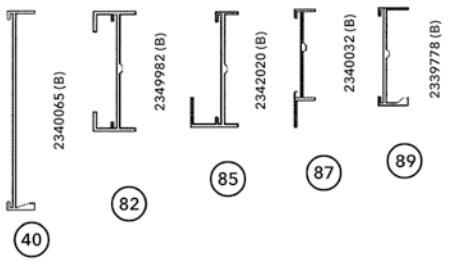
12 High x 24½ Wide

(2) MEDIUM: (Waterproof, Fire-Retardant Glass Fiber)

B – 99.99% HEPA eFRM PAO COMPATIBLE
Z – Special

(3) CELL CONSTRUCTION & CONFIGURATION: (Extruded Anodized Aluminum Unless Otherwise Noted)

40 Series
40 – 'C' Channel (5⅞″ Overall Depth)
80 Series
82 – 'C' Channel (3 1⁄16″ Overall Depth)
85 – 'C' Channel (2⅞″ Overall Depth)(Fluid Seal)
87 – 3/4″ Knife-Edge (3¼″ Overall Depth)
89 – 'C' Channel (2¾″ Overall Depth)
99 – Special Configuration



(4) PACK DEPTH: (Depth/Separators)	(5) BOND/PATCHING:
K – 50mm Hot Melt/Polyolefin	2 – Polyurethane Bond, Patching Per Iest RP-CC 001 with Silicone Caulk
X – Special	4 – Polyurethane Bond, Patching Per Iest RP-CC 001 with Non-Silicone Material
	6 – Polyurethane Bond, No Patching Allowed
	9 – Special Bond And/Or Special Patching

(6a) GASKET MATERIAL: Style - The Standard Style will be ¼″ Thickness, ¾″ Wide w/Butt Joints (Unless Otherwise Noted)

B-Polyurethane Gel Seal, F-Silicone Gel Seal, P-Non, R-Neoprene (Dovetail), T-Neoprene, U-Poron (Dovetail), V-Poron, Y-Silicone, Z-Special

(6b) GASKET LOCATION:	(7) ACCEPTANCE LEVEL:	(8) FACEGUARD MATERIAL:
0 – No Gasket	H – 99.99% Scanned Tested	A – None
1 – Air Entering Side	S – 99.99% Cold PAO Scan	B – White Painted Expanded Steel
2 – Air Leaving Side	Z – Special	C – Expanded 304 Stainless Steel
3 – Both Faces		D – Perforated 304 Stainless Steel
4 – Special		E – Perforated Anodized Aluminum
		Z – Special

(9) FACEGUARD LOCATION:	(10) CENTER DIVIDER:
0 – No Gasket	A – No Center Divider or Test Port
1 – Air Entering Side	B – Center Divider
2 – Air Leaving Side	C – Center Divider and 1 Test Port
3 – Both Faces	D – Center Divider and 2 Test Ports
4 – Special	Z – Special

High Purity

MEGAcel® II ePTFE

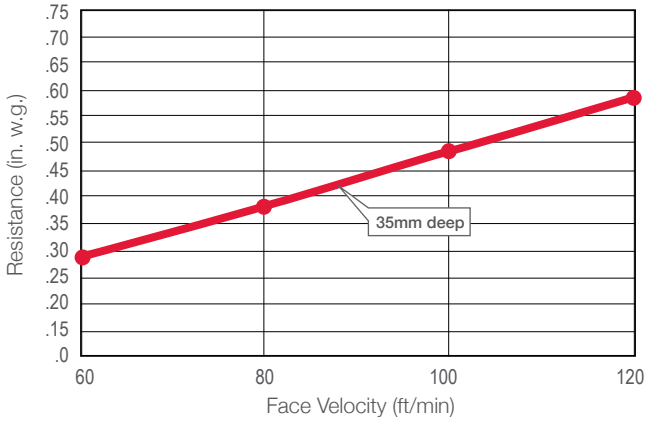
Product Overview

- AAF Flanders ePTFE Filtration Technology media combines ultra-high efficiency with negligible pressure drop
- Lower energy consumption adds up to savings of more than 30% versus fiberglass ULPA panel filters
- High resistance to corrosive environments
- Negligible offgassing properties (boron, sodium, potassium, silicon)
- High tensile strength media, more resistant to rough handling in transportation and installation
- Meets I300I specifications and is UL 900 and ULC S111 Classified
- Lower profile, reducing space and weight

Specifications

Efficiency	ULPA
Media Type	ePTFE
Frame Material	Aluminum
Separator Style	Hot Melt
Special Size Available	Yes
Antimicrobial Available	No
Single Header	No
Max Operating Temperature	150°F (66°C)
Filter Depth	Various
Air Filtration Certification	UL 900, ULC S111

Resistance vs Velocity Typical Performance



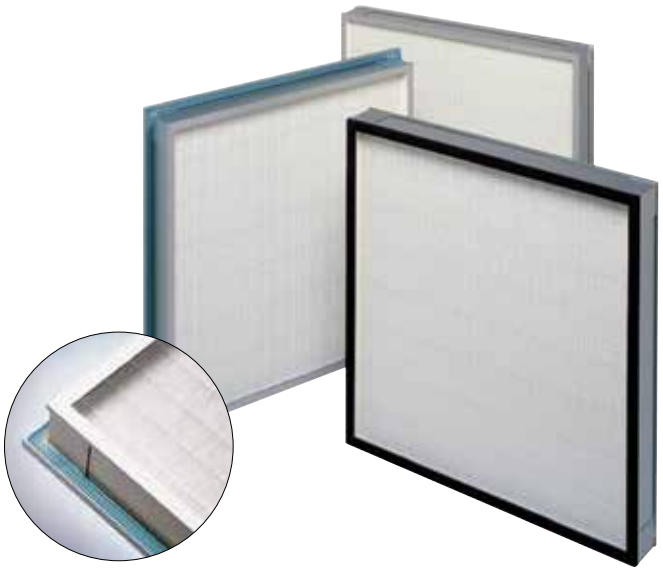
Product Information

Actual Size Inches (H x W x D)	Rated Airflow (SCFM) 1.0″ w.g.	Std. Pkg. Qty.	Shipping Wt. Lbs. per Box (± 7%)	Cubic Ft.
24 x 24 x 2¾	350	1	21	1.4
24 x 48 x 2¾	720	1	28	2.7

Additional sizes and part number information available upon request.

High Purity

AstroCel® II (Gel Seal)



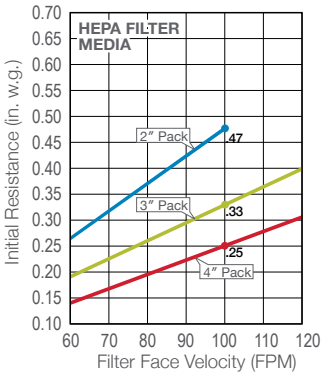
Product Overview

- Highest efficiency and lowest possible pressure drop
- Gel seal design allows for a long lasting airtight seal in ceiling grids or hoods
- Eight (8) pleats per inch allow for the greatest amount of media in the shallowest depth
- Pleat straightness to +/-¼″ – unmatched by competitors
- Designed for environments requiring the very highest levels of contamination control
- Each filter undergoes state-of-the-art testing, tailored to meet your performance requirements
- Media is water-resistant and fire-retardant
- Custom sizes and a wide variety of construction options available upon request – see page 183 for details

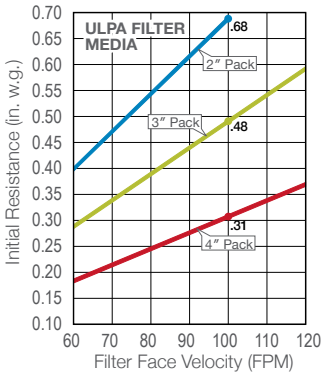
Specifications

Efficiency	HEPA, ULPA
Media Type	Microglass
Frame Material	Aluminum
Separator Style	Media Ribbon
Special Size Available	Yes
Antimicrobial Available	No
Frame Style	Gel Seal
Max Operating Temperature	150°F (66°C)
Filter Depth	Various
Air Filtration Certification	UL 90, ULC S111, UL 586

Initial Resistance vs. Filter Face Velocity



99.99% Minimum Efficiency on 0.30 Micrometer Particles



99.9995% Minimum Efficiency on 0.10 to 0.20 Micrometer Particles

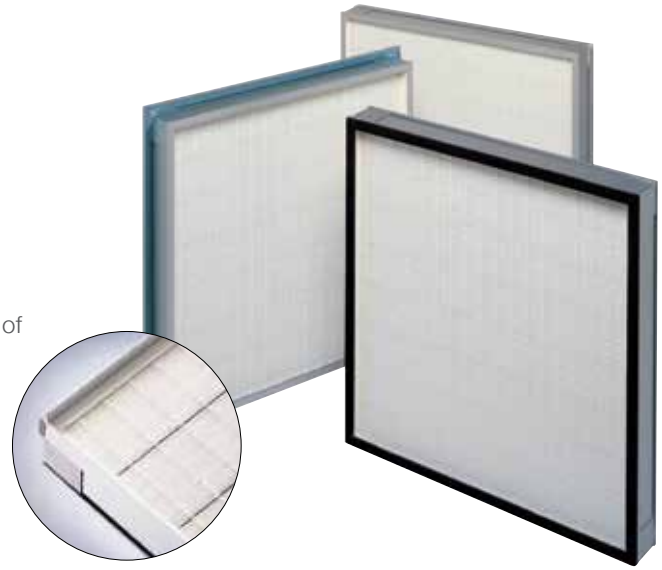
Product Information

Part Number	Style Code	Nominal Size (Feet)	Actual Size Inches (H x W x D)	Media Pack Depth	Rated Airflow (SCFM) 100 FPM	Std. Pkg. Qty.	Ship. Wt. Lbs/Box (± 7%)	Cubic Ft.
HEPA Efficiency – 99.99% on 0.3 micron (Scan Tested)								
577-850-027	27A85A2P0H0	2 x 2	21⅝ x 19⅞ x 2⅞	2″	235	1	15.0	1.1
577-850-028	28A85A2P0H0	2 x 4	21⅝ x 43⅞ x 2⅞	2″	550	1	20.0	2.3
577-550-027	27A55B2P0H0	2 x 2	21⅝ x 19⅞ x 3⅞	3″	235	1	18.0	1.3
577-550-028	28A55B2P0H0	2 x 4	21⅝ x 43⅞ x 3⅞	3″	550	1	23.0	2.9
577-650-027	27A65F2P0H0	2 x 2	21⅝ x 19⅞ x 4⅞	4″	235	1	20.0	1.6
577-650-028	28A65F2P0H0	2 x 4	21⅝ x 43⅞ x 4⅞	4″	550	1	25.0	3.5
ULPA Efficiency – 99.9995% on 0.1–0.2 micron (Laser and Scan Tested)								
579-850-027	27E85A2P0M0	2 x 2	21⅝ x 19⅞ x 2⅞	2″	235	1	15.0	1.0
579-850-028	28E85A2P0M0	2 x 4	21⅝ x 43⅞ x 2⅞	2″	550	1	20.0	6.4
579-550-027	27E55B2P0M0	2 x 2	21⅝ x 19⅞ x 3⅞	3″	235	1	18.0	#N/A
579-550-028	28E55B2P0M0	2 x 4	21⅝ x 43⅞ x 3 ⅞	3″	550	1	23.0	2.9
579-650-027	27E65F2P0M0	2 x 2	21⅝ x 19⅞ x 4⅞	4″	235	1	20.0	0.6
579-650-028	28E65F2P0M0	2 x 4	21⅝ x 43⅞ x 4⅞	4″	550	1	25.0	3.5

Additional sizes available upon request.

High Purity

AstroCel® II (Knife-Edge)



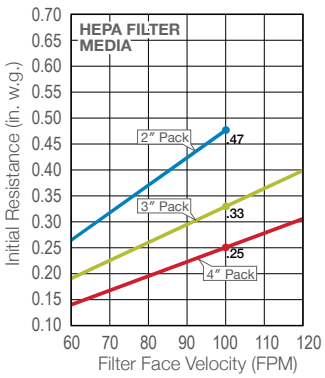
Product Overview

- Highest efficiency and lowest possible pressure drop
- Knife-edge design allows for long-lasting airtight seal in existing gel seal grid systems
- Eight (8) pleats per inch allow for the greatest amount of media in the shallowest depth
- Pleat straightness to +/-¼″ – unmatched by competitors
- Designed for environments requiring the very highest levels of contamination control
- Each filter undergoes state-of-the-art testing, tailored to meet your performance requirements
- Media is water-resistant and fire-retardant
- Custom sizes and a wide variety of construction options available upon request – see page 183 for details

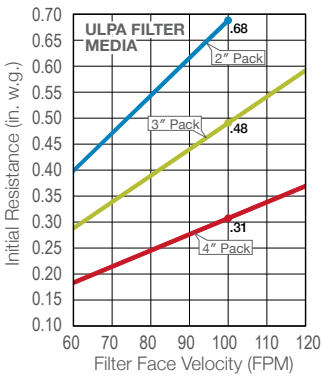
Specifications

Efficiency	HEPA, ULPA
Media Type	Microglass
Frame Material	Aluminum
Separator Style	Media Ribbon
Special Size Available	Yes
Antimicrobial Available	No
Frame Style	Knife-Edge
Max Operating Temperature	150°F (66°C)
Filter Depth	Various
Air Filtration Certification	UL 90, ULC S111, UL 586

Initial Resistance vs. Filter Face Velocity



99.99% Minimum Efficiency on 0.30 Micrometer Particles



99.9995% Minimum Efficiency on 0.10 to 0.20 Micrometer Particles

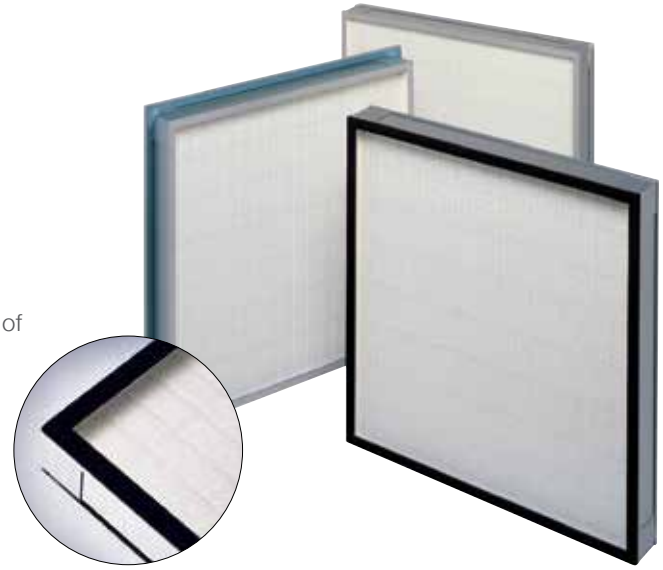
Product Information

Part Number	Style Code	Nominal Size (Feet)	Actual Size Inches (H x W x D)	Rated Airflow (SCFM) 100 FPM	Std. Pkg. Qty.	Ship. Wt. Lbs/Box (± 7%)	Cell Sides	Media Pack Depth
HEPA Efficiency – 99.99% on 0.3 micron (Scan Tested)								
577-870-023	23A87A2P0H0	2 x 2	23 x 23 x 3¼	320	1	16.0	3¼″	2″
577-870-022	22A87A2P0H0	2 x 3.5	23 x 41 x 3¼	600	1	26.0	3¼″	2″
577-870-021	21A87A2P0H0	2 x 4	23 x 47 x 3¼	695	1	30.0	3¼″	2″
577-570-023	23A57B2P0H0	2 x 2	23 x 23 x 4¼	320	1	18.0	4¼″	3″
577-570-022	22A57B2P0H0	2 x 3.5	23 x 41 x 4¼	600	1	30.0	4¼″	3″
577-570-021	21A57B2P0H0	2 x 4	23 x 47 x 4¼	695	1	32.0	4¼″	3″
577-670-023	23A67F2P0H0	2 x 2	23 x 23 x 5¼	320	1	20.0	5¼″	4″
577-670-022	22A67F2P0H0	2 x 3.5	23 x 41 x 5¼	600	1	32.0	5¼″	4″
577-670-021	21A67F2P0H0	2 x 4	23 x 47 x 5¼	695	1	36.0	5¼″	4″
ULPA Efficiency – 99.9995% on 0.1–0.2 micron (Laser and Scan Tested)								
579-870-023	23E87A2P0M0	2 x 2	23 x 23 x 3¼	320	1	16.0	3¼″	2″
579-870-022	22E87A2P0M0	2 x 3.5	23 x 41 x 3¼	600	1	26.0	3¼″	2″
579-870-021	21E87A2P0M0	2 x 4	23 x 47 x 3¼	695	1	30.0	3¼″	2″
579-570-023	23E57B2P0M0	2 x 2	23 x 23 x 4¼	320	1	18.0	4¼″	3″
579-570-022	22E57B2P0M0	2 x 3.5	23 x 41 x 4¼	600	1	30.0	4¼″	3″
579-570-021	21E57B2P0M0	2 x 4	23 x 47 x 4¼	695	1	32.0	4¼″	3″
579-670-023	23E67F2P0M0	2 x 2	23 x 23 x 5¼	320	1	20.0	5¼″	4″
579-670-022	22E67F2P0M0	2 x 3.5	23 x 41 x 5¼	600	1	32.0	5¼″	4″
579-670-021	21E67F2P0M0	2 x 4	23 x 47 x 5¼	695	1	36.0	5¼″	4″

Additional sizes available upon request.

High Purity

AstroCel® II (Gasket Seal)



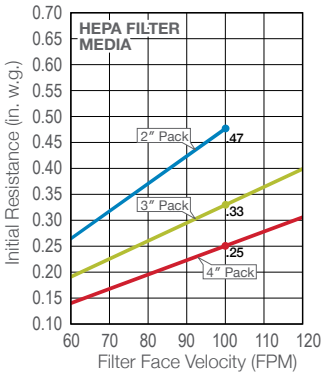
Product Overview

- Highest efficiency and lowest possible pressure drop
- Gasket Seal design allows for long lasting airtight seal in existing gel seal grid systems
- Eight (8) pleats per inch allow for the greatest amount of media in the shallowest depth
- Pleat straightness to +/-¼″ – unmatched by competitors
- Designed for environments requiring the very highest levels of contamination control
- Each filter undergoes state-of-the-art testing, tailored to meet your performance requirements
- Media is water-resistant and fire-retardant
- Custom sizes and a wide variety of construction options available upon request – see page 183 for details

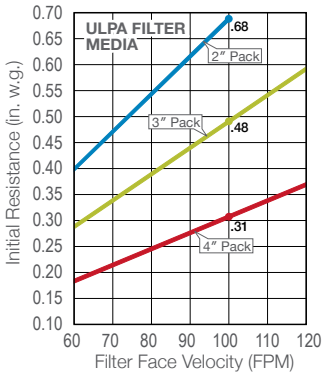
Specifications

Efficiency	HEPA, ULPA
Media Type	Microglass
Frame Material	Aluminum
Separator Style	Media Ribbon
Special Size Available	Yes
Antimicrobial Available	No
Frame Style	Gasket Seal
Max Operating Temperature	150°F (66°C)
Filter Depth	Various
Air Filtration Certification	UL 90, ULC S111, UL 586

Initial Resistance vs. Filter Face Velocity



99.99% Minimum Efficiency on 0.30 Micrometer Particles



99.9995% Minimum Efficiency on 0.10 to 0.20 Micrometer Particles

Product Information

Part Number	Style Code	Nominal Size (Feet)	Actual Size Inches (H x W x D)	Rated Airflow (SCFM) 100 FPM	Std. Pkg. Qty.	Ship. Wt. Lbs/Box (± 7%)	Cubic Ft.	Cell Sides	Media Pack Depth
HEPA Efficiency – 99.99% on 0.3 micron (Scan Tested)									
577-890-004	43A89A2T2H0	2 x 1	24 x 12 x 2¾	165	1	18.0	0.7	2¾	2″
577-890-005	14A89A2T2H0	2 x 2	24 x 24 x 2¾	350	1	21.0	1.4	2¾	2″
577-890-007	46A89A2T2H0	2 x 3	24 x 36 x 2¾	540	1	24.0	2.0	2¾	2″
577-890-008	17A89A2T2H0	2 x 4	24 x 48 x 2¾	725	1	28.0	2.7	2¾	2″
577-590-004	43A59B2T2H0	2 x 1	24 x 12 x 3¾	165	1	19.0	0.9	3¾	3″
577-590-005	14A59B2T2H0	2 x 2	24 x 24 x 3¾	350	1	24.0	1.7	3¾	3″
577-590-007	46A59B2T2H0	2 x 3	24 x 36 x 3¾	540	1	26.0	1.7	3¾	3″
577-590-008	17A59B2T2H0	2 x 4	24 x 48 x 3¾	725	1	31.0	3.4	3¾	3″
579-890-004	43E89A2T2M0	2 x 1	24 x 12 x 2¾	165	1	18.0	#N/A	2¾	2″
577-690-004	43A69F2T2H0	2 x 1	24 x 12 x 4¾	165	1	20.0	1.2	4¾	4″
577-690-005	14A69F2T2H0	2 x 2	24 x 24 x 4¾	350	1	26.0	2.1	4¾	4″
577-690-007	46A69F2T2H0	2 x 3	24 x 36 x 4¾	540	1	30.0	3.1	4¾	4″
577-690-008	17A69F2T2H0	2 x 4	24 x 48 x 4¾	725	1	36.0	4.1	4¾	4″
ULPA Efficiency – 99.9995% on 0.1–0.2 micron (Laser and Scan Tested)									
579-890-005	14E89A2T2M0	2 x 2	24 x 24 x 2¾	350	1	21.0	1.4	2¾	2″
579-890-007	46E89A2T2M0	2 x 3	24 x 36 x 2¾	540	1	24.0	3.3	2¾	2″
579-890-008	17E89A2T2M0	2 x 4	24 x 48 x 2¾	725	1	28.0	2.7	2¾	2″
579-590-004	43E59B2T2M0	2 x 1	24 x 12 x 3¾	165	1	19.0	#N/A	3¾	3″
579-590-005	14E59B2T2M0	2 x 2	24 x 24 x 3¾	350	1	24.0	1.7	3¾	3″
579-590-007	46E59B2T2M0	2 x 3	24 x 36 x 3¾	540	1	26.0	#N/A	3¾	3″
579-590-008	17E59B2T2M0	2 x 4	24 x 48 x 3¾	725	1	31.0	3.4	3¾	3″
579-690-004	43E69F2T2M0	2 x 1	24 x 12 x 4¾	165	1	20.0	#N/A	4¾	4″
579-690-005	14E69F2T2M0	2 x 2	24 x 24 x 4¾	350	1	26.0	2.1	4¾	4″
579-690-007	46E69F2T2M0	2 x 3	24 x 36 x 4¾	540	1	30.0	#N/A	4¾	4″
579-690-008	17E69F2T2M0	2 x 4	24 x 48 x 4¾	725	1	36.0	4.1	4¾	4″

Additional sizes available upon request.

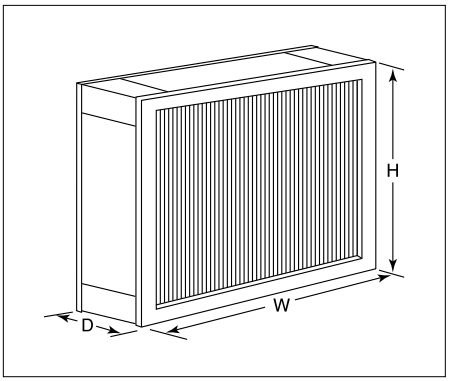
High Purity

AstroCel® II Style Code

1. FACE SIZE (Inches) H x W x D			
12	8 x 8	43	24 x 12
13	12 x 12	45	24 x 30
14	24 x 24	46	24 x 36
17	24 x 48	47	24 x 60
18	24 x 72	51	30 x 30
21	23 x 47	52	30 x 36
22	23 x 41	53	30 x 48
23	23 x 23	54	30 x 60
24	23⅝ x 47⅝	55	30 x 72
26	23⅝ x 23⅝	58	36 x 36
27	21⅝ x 19⅞	61	36 x 60
28	21⅝ x 43⅞	62	36 x 72
29	SPECIAL SIZE	63	23¼ x 47¼
33	15⅜ x 19⅜	65	36 x 48
35	20⅞ x 20⅞	67	23¼ x 41¼
37	20⅞ x 44⅞	68	23¼ x 29¼
38	23¼ x 23¼	69	23¼ x 35¼
41	23⅜ x 23⅜		

2. MEDIA (WATERPROOF MICROGLASS FIBER		
		°T Limit
A	99.97% or 99.99%	1000°F
D	BioCel 95%	1000°F
E	ULPA 99.999% or 99.9995%	1000°F
Z	SPECIAL MEDIA	–

3. CELL SIDES	
40 Series (2″, 3″, 4″ Deep Media Pack)	
40	"C" Channel (5⅞″ overall depth)
50 Series (2″, 3″ Deep Media Pack)	
55	Gel Seal (3⅞″ overall depth with Gel Seal) (PharmaGel)
57	¾″ Knife edge (4¼″ overall depth)
59	Gasket Seal (3¾″ overall depth)
60 Series (2″, 3″, 4″ Deep Media Pack)	
65	Gel Seal (4⅞″ overall depth) with Gel Seal - PharmaGel)
67	¾″ Knife edge (5¼″ overall depth)
68	2¼″ Knife edge (6¾″ overall depth)
69	Gasket Seal (4¾″ overall depth)



3. CELL SIDES	
80 Series (2″ Deep Media Pack)	
85	Gel Seal (2⅞″ overall depth) with Gel Seal - PharmaGel)
86	304 Stainless Steel (2¾″ overall depth)
87	¾″ Knife Edge (3¼″ overall depth)
89	Gasket Seal (2¾″ overall depth)
99	SPECIAL

NOTE: All cell sides are extruded anodizedaluminum unless otherwise noted.

4. PACK DEPTH (Ribbon Separators)	
A	2″ Media Pack
G	2½″ Media Pack
B	3″ Media Pack
C	3¼″ Media Pack
D	3½″ Media Pack
E	3¾″ Media Pack
F	4″ Media Pack
X	SPECIAL DEPTH

5. BOND MATERIAL		
		°T Limit
2	Polyurethane Elastomer	200°F
9	SPECIAL BOND	

6. GASKET MATERIAL		
P	None	
T	Neoprene sponge, SCE-43 Grade	225°F
U	Poron (¼″ x ¾″ w/dovetail joints)	
V	Poron (¼″ x ¾″ w/butt joints)	
Z	SPECIAL GASKET MATERIAL	

Note: Standard gasket is ¼″ x ¾″ with butt joints

7. GASKET LOCATION	
0	No gaskets required
1	Upstream only
2	Downstream only
3	Both faces
4	SPECIAL REQUIREMENT

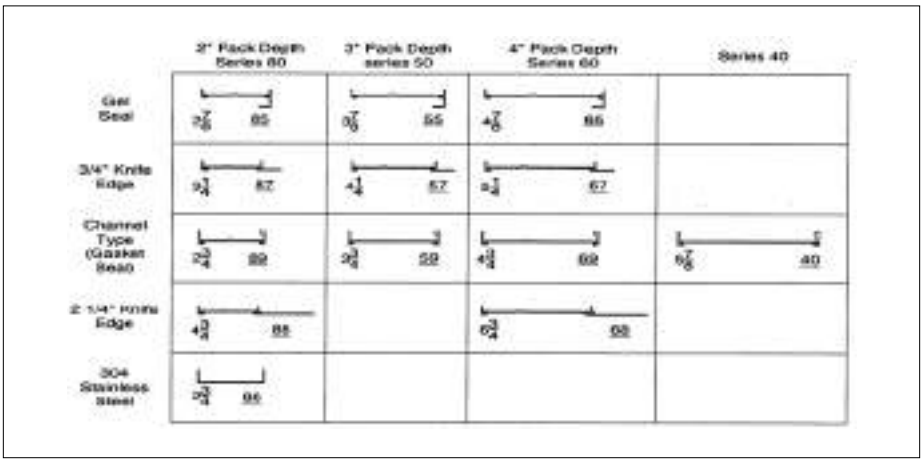
8. ACCEPTANCE LEVEL		
A	99.97% on PAO	(A)
E	SPECIAL INSPECTION REQUIRED	
F	BioCel only - 95% on 0.3 mm	(D)
G	99.99% on 0.3 mm PSL	(A)
H	Scan Tested (99.99%)	(A)
J	99.999% on 0.3 mm PSL	(E)
K	Scan Tested (99.999%)	(E)
M	Scan Tested @ 99.9995% on .10 to .20 mm ambient particles + scan tested Tested at 100 FPM	(E)
P	Autoscan (99.9995 on MPPS, PSL)	
R	99.99% PAO	(A)
S	Cold PAO hand scan (99.99%)	(A)

Note: Letter in parentheses indicates the media type identified in Section 2.

9. FACEGUARD LOCATION & UL 586 LABEL	
0	No Faceguard, no UL Label
1	Faceguard upstream side only
2	Faceguard downstream side only
3	Faceguard both sides, no UL Label
4	SPECIAL FACEGUARDS
5	UL Label no faceguard
6	UL Label w/upstream faceguard
7	UL Label w/downstream faceguard
8	UL Label w/two faceguards

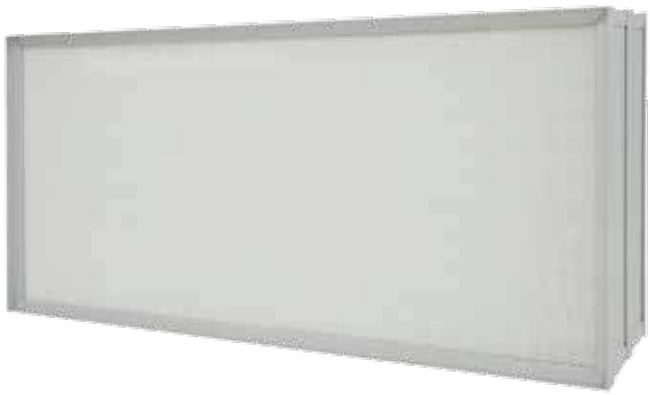
Note: Standard faceguard is flattened expanded metal painted white.

General Notes: The purpose of this style code is for identification of components used in standard catalogued AstroCel® II HEPA filters. Because of inherent compatibility limitations, the style code should not be used to arbitrarily "build" a filter incorporating random components. First dimension of filter is height, or direction of separators.



High Purity

DimplePleat®



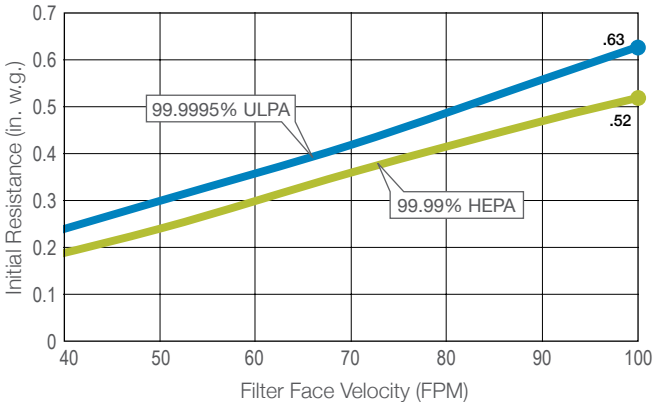
Product Overview

- Maximum utilization of media for long life
- Completely separatorless media pack
- Minimal offgassing due to elimination of glue, and no particle generation or fraying due to elimination of strings and strips
- Lightweight and easy to handle with a superior appearance
- State-of-the-art testing with low offgassing urethane to seal media pack to the frame

Specifications

Efficiency	HEPA, ULPA
Media Type	Microglass
Frame Material	Aluminum, Stainless Steel
Special Size Available	Yes
Antimicrobial Available	No
Frame Style	Gel, Gasket, or Knife-Edge Seal
Separator Style	Self-Supporting
Max Operating Temperature	212°F (100°C)
Filter Depth	Various
Air Filter Certification	UL 900

Initial Resistance vs. Filter Face Velocity



Based on 2″ media pack

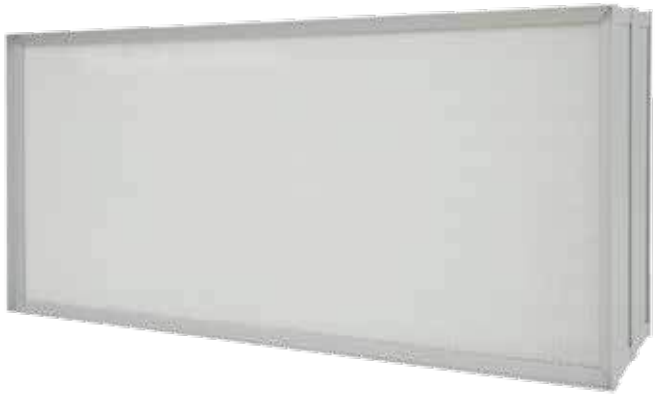
Product Information

Part Number	Actual Size Inches (H x W x D)	Rated Airflow CFM @ 100 FPM	Media Pack Depth	Shipping Wt. Lbs.	Std. Pkg. Qty.
HEPA Efficiency – 99.99% on 0.3 micron (Scan Tested)					
0-007-2-19-03-SU-12-00-GG-2	24 x 24 x 2 11/16	350	2″	10	1
0-007-2-19-03-SU-12-00-GQ-2	24 x 48 x 2 11/16	725	2″	20	1
0-007-4-19-03-SU-12-00-GG-4	24 x 24 x 4 11/16	350	4″	10	1
0-007-4-19-03-SU-12-00-GQ-4	24 x 48 x 4 11/16	725	4″	20	1
0-007-2-19-06-SU-52-00-GG-2	24 x 24 x 2 11/16	330	2″	10	1
0-007-2-19-06-SU-52-00-GQ-2	24 x 48 x 2 11/16	680	2″	20	1
0-007-4-19-06-SU-52-00-GG-4	24 x 24 x 4 11/16	330	4″	10	1
0-007-2-19-33-SU-00-00-K-GG	23 x 23 x 3 7/16	325	2″	10	1
0-007-2-19-33-SU-00-00-K-GQ	23 x 47 x 3 7/16	685	2″	20	1
0-007-4-19-33-SU-00-00-K-GG	23 x 23 x 5 3/8	325	4″	16	1
0-007-4-19-33-SU-00-00-K-GQ	23 x 47 x 5 3/8	685	4″	31	1
ULPA Efficiency – 99.9995% on 0.1–0.2 micron (Laser and Scan Tested)					
0-009-2-19-03-SU-12-00-GG-2	24 x 24 x 2 11/16	350	2″	10	1
0-009-2-19-03-SU-12-00-GQ-2	24 x 48 x 2 11/16	725	2″	20	1
0-009-4-19-03-SU-12-00-GG-4	24 x 24 x 4 11/16	350	4″	10	1
0-009-4-19-03-SU-12-00-GQ-4	24 x 48 x 4 11/16	725	4″	20	1
0-009-2-19-06-SU-52-00-GG-2	24 x 24 x 2 11/16	330	2″	10	1
0-009-2-19-06-SU-52-00-GQ-2	24 x 48 x 2 11/16	680	2″	20	1
0-009-4-19-06-SU-52-00-GG-4	24 x 24 x 4 11/16	330	4″	10	1
0-009-2-19-33-SU-00-00-K-GG	23 x 23 x 3 7/16	325	2″	10	1
0-009-2-19-33-SU-00-00-K-GQ	23 x 47 x 3 7/16	685	2″	20	1
0-009-4-19-33-SU-00-00-K-GG	23 x 23 x 5 3/8	325	4″	16	1
0-009-4-19-33-SU-00-00-K-GQ	23 x 47 x 5 3/8	685	4″	31	1

Additional sizes available upon request.

High Purity

DimplePleat® LB



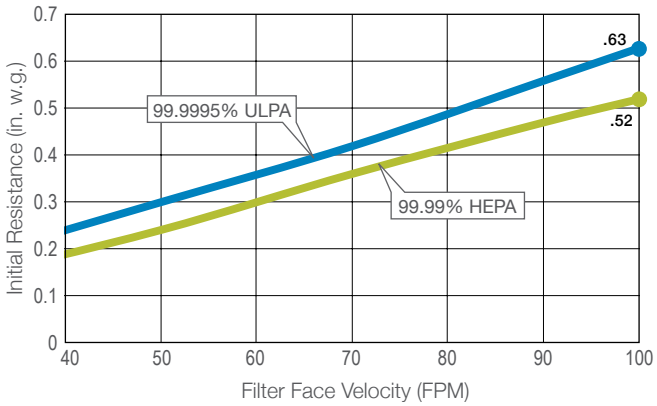
Product Overview

- Less than 10 PPM of boron, as compared to 20,000 to 30,000 in traditional microglass HEPA media
- Economical alternative to ePTFE media when low boron is required
- Completely separatorless media pack design for maximum airflow and media utilization
- Elimination of separators minimizes offgassing and particle generation

Specifications

Efficiency	HEPA, ULPA
Media Type	Low-Boron Microglass
Frame Material	Aluminum, Stainless Steel
Special Size Available	Yes
Antimicrobial Available	No
Frame Style	Gel, Gasket, or Knife-Edge Seal
Separator Style	Self-Supporting
Max Operating Temperature	212°F (100°C)
Filter Depth	Various
Air Filter Certification	UL 900

Initial Resistance vs. Filter Face Velocity



Based on 2″ media pack

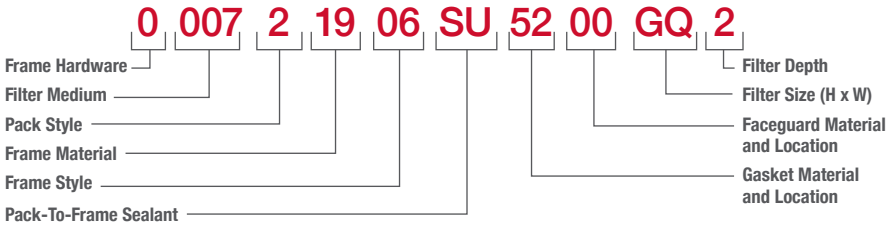
Product Information

Part Number	Actual Size Inches (W x H x D)	Rated Airflow CFM @ 100 FPM	Media Pack Depth	Shipping Wt. Lbs.	Std. Pkg. Qty.
HEPA Efficiency – 99.99% on 0.3 micron (Scan Tested)					
0-B07-2-19-03-SU-12-00-GG-2	24 x 24 x 2 11/16	350	2″	10	1
0-B07-2-19-03-SU-12-00-GQ-2	24 x 48 x 2 11/16	725	2″	20	1
0-B07-4-19-03-SU-12-00-GG-4	24 x 24 x 4 11/16	350	4″	10	1
0-B07-4-19-03-SU-12-00-GQ-4	24 x 48 x 4 11/16	725	4″	20	1
0-B07-2-19-06-SU-52-00-GG-2	24 x 24 x 2 11/16	285	2″	10	1
0-B07-2-19-06-SU-52-00-GQ-2	24 x 48 x 2 11/16	625	2″	20	1
0-B07-4-19-06-SU-52-00-GG-4	24 x 24 x 4 11/16	285	4″	10	1
0-B07-2-19-33-SU-00-00-K-GG	23 x 23 x 3 7/16	625	2″	10	1
0-B07-2-19-33-SU-00-00-K-GQ	23 x 47 x 3 7/16	685	2″	20	1
0-B07-4-19-33-SU-00-00-K-GG	23 x 23 x 5 3/8	325	4″	16	1
0-B07-4-19-33-SU-00-00-K-GQ	23 x 47 x 5 3/8	685	4″	31	1
ULPA Efficiency – 99.9995% on 0.1–0.2 micron (Laser and Scan Tested)					
0-B09-2-19-03-SU-12-00-GG-2	24 x 24 x 2 11/16	350	2″	10	1
0-B09-2-19-03-SU-12-00-GQ-2	24 x 48 x 2 11/16	725	2″	20	1
0-B09-4-19-03-SU-12-00-GG-4	24 x 24 x 4 11/16	350	4″	10	1
0-B09-4-19-03-SU-12-00-GQ-4	24 x 48 x 4 11/16	725	4″	20	1
0-B09-2-19-06-SU-52-00-GG-2	24 x 24 x 2 11/16	285	2″	10	1
0-B09-2-19-06-SU-52-00-GQ-2	24 x 48 x 2 11/16	625	2″	20	1
0-B09-4-19-06-SU-52-00-GG-4	24 x 24 x 4 11/16	285	4″	10	1
0-B09-2-19-33-SU-00-00-K-GG	23 x 23 x 3 7/16	325	2″	10	1
0-B09-2-19-33-SU-00-00-K-GQ	23 x 47 x 3 7/16	685	2″	20	1
0-B09-4-19-33-SU-00-00-K-GG	23 x 23 x 5 3/8	325	4″	16	1
0-B09-4-19-33-SU-00-00-K-GQ	23 x 47 x 5 3/8	685	4″	31	1

Additional sizes available upon request.

High Purity

DimplePleat® Style Code



1. FRAME HARDWARE

Code	Type
0	None
E	Extruded Alum. CB w/1 Port
X	SPECIAL

2. FILTER MEDIUM

007	99.97% W/R Glass (Standard)
008	99.999% Efficient on 0.3µm Particles, ULPA Grade with W/R Glass
009	99.9995% Efficient on 0.12µm Particles, ULPA Grade with W/R Glass
012	99.99999% Efficient on 0.12µm Particles, VLSI Grade with W/R Glass
A**	Media Treated with an Antimicrobial Agent

***If using special media designation, replace the first "0" with the letter indicated.*

3. PACK STYLE

Code	Type
1	1″ DimplePleat® Element
2	2″ DimplePleat® Element
3	3″ DimplePleat® Element
4	4″ DimplePleat® Element
6	6″ DimplePleat® Element
Q	1″ Hot Element
R	2″ Hot Element
S	3″ Hot Element
T	4″ Hot Element
U	1″ Hot Melt Element

4. FRAME MATERIAL

02	16-Gauge Type 409 Stainless Steel Riveted
03	16-Gauge Type 304 Stainless Steel Riveted
05	.063″ Thick Fabricated Aluminum
08	16-Gauge Galvanneal
14	P.V.C. (Chlorine Resistant)
19	Extruded Aluminum (Clear Anodized)

5. FRAME STYLE

Code	Type
03	Two Double-Turn Flanges
04	Skirted Filter for Channel-Ceil System
05	¾″-Deep Channel (or Groove) Filled with Fluid Sealant
06	Single Header Filled with Fluid Sealant (Back of Header)
32	1″ Skirted Filter for Fluid Seal Grid System
33	¾″ Skirted Filter for Fluid Seal Grid System
74	Skirted Filter for Fluid Channel Ceil System

6. PACK-TO-FRAME SEALANT

LAMINAR FLOW GRADE FILTERS	
SE	High Temp Silicone 99.99%
SU	F.R. Urethane 99.99%
PHARMACEUTICAL GRADE FILTERS	
PG	F.R. Urethane PAO Test 99.99% Autoscan, No Patches
PA	F.R. Urethane PAO Test 99.99%
PE	High Temp, No Patch
PT	High Temp Thermal PAO Test

Continued on next page.

High Purity

DimplePleat® Style Code

7. GASKET/SEAL MATERIAL	
Code	**Type**
0	None
1	Neoprene
3	Cohrlastic Sponge
4	Woven Glass
5	BluJel®
6	Urethane Jel
7	Glass Packing
8	Polyurethane Ether Foam
B	Black Poly – B
F	FDA-Approved White Silicone
P	Poron
R	Braided Rope
W	White Poly – B
V	Viton
X	Special

8. GASKET LOCATION	
0	None
1	Upstream
2	Downstream
3	Both
4	Back of Header
X	SPECIAL

9. FACEGUARD MATERIAL	
0	None
1	Galvanized (4 x 4 Mesh)
2	Stainless Steel (4 x 4 Mesh)
3	PVC (24″ x 24″) (4 x 4 Mesh)
4	Scrim (6 x 6 Mesh)
A	Anodized Alum. Perf. 40% Open
B	Alum. Perf. (White Paint)
C	CRS Perf. (White Paint) 40% Open
D	Expanded Alum. (White Paint)
E	Expanded S/S
F	Expanded CRS (White Paint)
G	Expanded Aluminized Steel
S	Stainless Steel Perf. 40% Open
X	SPECIAL

10. FACEGUARD LOCATION	
0	None
1	Upstream
2	Downstream
3	Both

STANDARD SIZE DESIGNATIONS*			
Code	**Type**	**Code**	**Type**
B	8″	R	60″
C	12″	S	72″
E	18″	U	11⅜″
G	24″	V	15⅜″
N	30″	W	17⅜″
P	36″	X	29⅜″
H	42″	Y	23⅜″
Q	48″	Z	24⅜″

**Height x Width x Depth.*

ODD SIZE DESIGNATIONS**			
A	0″	J	½″
B	1/16″	K	9/16″
C	⅛″	L	⅝″
D	3/16″	M	11/16″
E	¼″	N	¾″
F	5/16″	P	13/16″
G	⅜″	Q	⅞″
H	7/16″	R	15/16″

***Odd size designation is an alphanumeric description. The first two numbers and letter specify the height and the second two numbers and letter specify the width. Then add the final character as per the below to specify the depth.*

FILTER FRAME DEPTH			
A	3 1/16	2	2⅞
D	5⅞	3	3⅞
D2	7⅞	4	4⅞
F	11½	6	6⅞
F2	13½	8	8⅞
T	6⅜		

FILTER SIZE CODE EXAMPLES	UL CODE**
A (Round Filter Size)	US – UL 586***
M–GQ	U9 – UL 900***
GG–F	
GG-F2	
E1386*	
Z90127*	
YY-D	
17E21A	

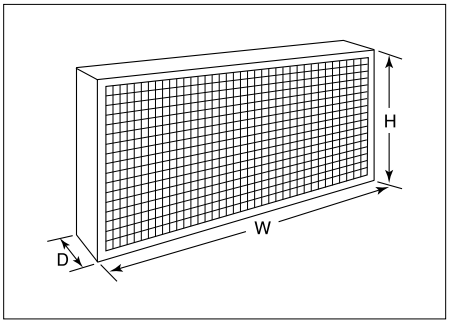
**Indicates special extrusion/engineering drawing.*

***Optional*

****See Engineering Form numbers ENGR-018 & ENGR-021 to determine if a filter meets UL 900 or UL 586.*

Notes:

1. All combinations are not available as standards – check catalog for standards. Because of inherent compatibility limitations, the style code should not be used to arbitrarily "build" a filter.



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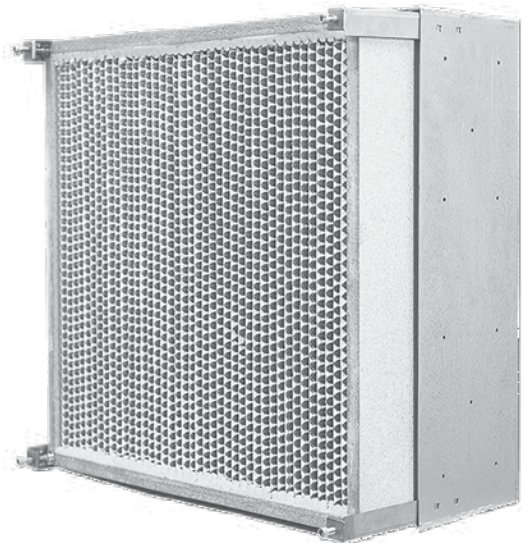
B-1 Frame



Product Overview

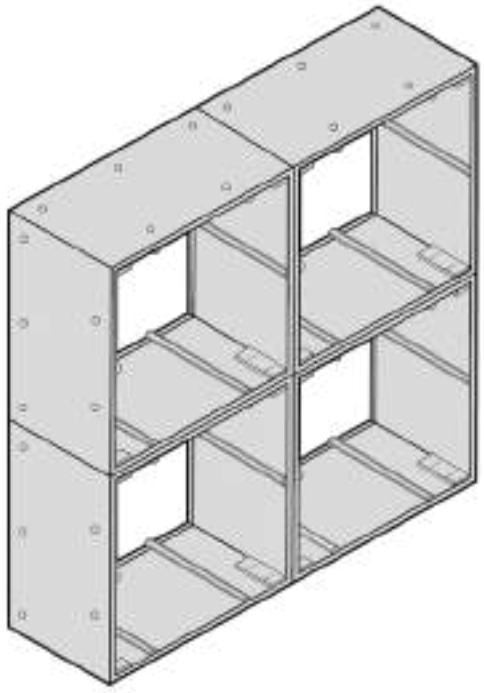
- All-welded 14-gauge galvanneal steel construction for corrosion resistance and rigidity
- Stainless steel locking arm and screw assemblies secure and seal the HEPA filter
- Factory-drilled alignment holes facilitate field assembly of built-up filter banks
- Optional prefilter assembly is available for direct attachment to the frame

Product Information

Model Number	Fits HEPA Filter Size (Inches)	Shipping Wt. Lbs. per Box
Galvanized		
B1-GLV-GG-F	24 x 24 x 11½	14
B1-GLV-GG-D	24 x 24 x 5⅞	14
B1-GLV-GC-F	24 x 12 x 11½	9
B1-GLV-GC-D	24 x 12 x 5⅞	9
B1-GLV-YY-F	23⅜ x 23⅜ x 11½	13
B1-GLV-YY-D	23⅜ x 23⅜ x 5⅞	13
B1-GLV-YU-F	23⅜ x 11⅜ x 11½	9
B1-GLV-YU-D	23⅜ x 11⅜ x 5⅞	9
Aluminum		
B1-ALUM-GG-F	24 x 24 x 11½	14
B1-ALUM-GG-D	24 x 24 x 5⅞	14
B1-ALUM-GC-F	24 x 12 x 11½	9
B1-ALUM-GC-D	24 x 12 x 5⅞	9
B1-ALUM-YY-F	23⅜ x 23⅜ x 11½	13
B1-ALUM-YY-D	23⅜ x 23⅜ x 5⅞	13
B1-ALUM-YU-F	23⅜ x 11⅜ x 11½	9
B1-ALUM-YU-D	23⅜ x 11⅜ x 5⅞	9
304 Stainless Steel		
B1-34-GG-F	24 x 24 x 11½	28
B1-34-GG-D	24 x 24 x 5⅞	28
B1-34-GC-F	24 x 12 x 11½	18
B1-34-GC-D	24 x 12 x 5⅞	18
B1-34-YY-F	23⅜ x 23⅜ x 11½	27
B1-34-YY-D	23⅜ x 23⅜ x 5⅞	27
B1-34-YU-F	23⅜ x 11⅜ x 11½	18
B1-34-YU-D	23⅜ x 11⅜ x 5⅞	18

High Purity

AstroFrame™



Product Overview

- 14-gauge all-welded construction to deliver maximum enclosure integrity
- Galvanized steel or type 304 stainless steel
- Predrilled for ease of field assembly
- Pressure bolt latches for positive seal
- Gasket seal or gel seal
- Designed to ensure installed filters achieve at least 99.97% efficiency on 0.3µm

Product Information

Galvanized Part Number	Cubic Ft.	304 Stainless Steel Part Number	Cubic Ft.	AstroCel® Size Inches (W x H x D)	Actual Frame Size
Gel Seal AstroCel® Filters					
329-526-006	5.2	329-526-014	5.2	24 x 24 x 11½	24¾ x 24¾ x 13½
329-526-005	2.7	329-526-013	2.7	12 x 24 x 11½	12¾ x 24¾ x 13½
329-526-019	2.7	329-526-023	2.7	24 x 12 x 11½	24¾ x 12¾ x 13½
Gasket Seal AstroCel® Filters					
329-526-002	5.2	329-526-010	5.2	24 x 24 x 11½	24¾ x 24¾ x 13½
329-526-001	2.7	329-526-009	2.7	12 x 24 x 11½	12¾ x 24¾ x 13½
329-526-017	2.7	329-526-021	2.7	24 x 12 x 11½	24¾ x 12¾ x 13½

Additional sizes and configurations available upon request.

High Purity

A-4 Frame

Product Overview

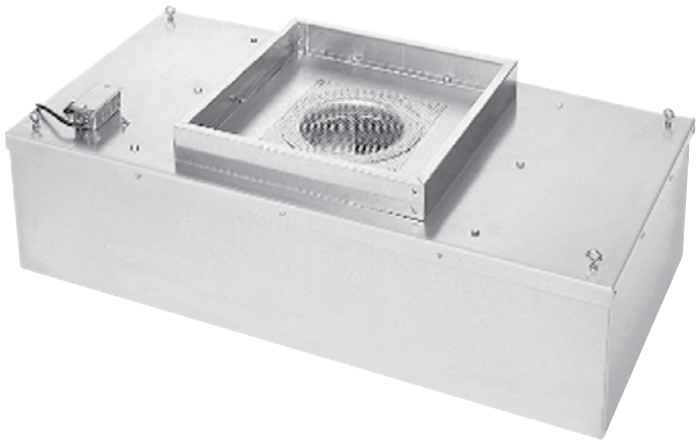
- All-welded construction for corrosion resistance and rigidity
- Gel seal for the best protection against bypass leakage
- Stainless steel locking arm and screw assemblies secure and seal the HEPA filter
- Factory drilled alignment holes facilitate field assembly of built-up filter banks

Product Information

Model Number	Fits HEPA Filter Size (Inches)	Shipping Wt. Lbs. per Box
Galvanized		
A4-GLV-GG-F	24 x 24 x 11½	14
A4-GLV-GG-D	24 x 24 x 5⅞	14
A4-GLV-GC-F	24 x 12 x 11½	10
A4-GLV-GC-D	24 x 12 x 5⅞	10
A4-GLV-YY-F	23⅜ x 23⅜ x 11½	13
A4-GLV-YY-D	23⅜ x 23⅜ x 5⅞	13
A4-GLV-YU-F	23⅜ x 11⅜ x 11½	9
A4-GLV-YU-D	23⅜ x 11⅜ x 5⅞	9
Aluminum		
A4-ALUM-GG-F	24 x 24 x 11½	14
A4-ALUM-GG-D	24 x 24 x 5⅞	14
A4-ALUM-GC-F	24 x 12 x 11½	10
A4-ALUM-GC-D	24 x 12 x 5⅞	10
A4-ALUM-YY-F	23⅜ x 23⅜ x 11½	13
A4-ALUM-YY-D	23⅜ x 23⅜ x 5⅞	13
A4-ALUM-YU-F	23⅜ x 11⅜ x 11½	9
A4-ALUM-YU-D	23⅜ x 11⅜ x 5⅞	9
304 Stainless Steel		
A4-34-GG-F	24 x 24 x 11½	28
A4-34-GG-D	24 x 24 x 5⅞	28
A4-34-GC-F	24 x 12 x 11½	20
A4-34-GC-D	24 x 12 x 5⅞	20
A4-34-YY-F	23⅜ x 23⅜ x 11½	27
A4-34-YY-D	23⅜ x 23⅜ x 5⅞	27
A4-34-YU-F	23⅜ x 11⅜ x 11½	19
A4-34-YU-D	23⅜ x 11⅜ x 5⅞	19

High Purity

Pureflo™ FPM



Product Overview

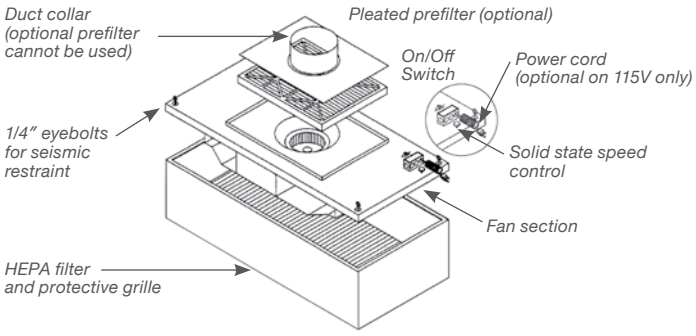
- Extremely quiet fan/motor assembly
- HEPA/ULPA filters are replaceable
- Filters are scan tested after assembly to meet or exceed IEST RP-1 requirements for Type C and F filters
- DimplePleat® separatorless filter pack for a lightweight and low-profile design
- Recommended for cleanrooms in fabrication of microelectronics, semiconductors, and medical devices
- All electrical components UL Classified
- Lightweight and corrosion resistant housing

Specifications

Available Styles	Prefilter, Duct Collar
Housing Material	Mill Finish Aluminum
Available Efficiencies	HEPA, ULPA
Module Type	Fan Unit, Replaceable Filter
Protective Grill	Expanded Steel, White Powder Coated
Fan/Motor Assembly	1/3 HP Backward-Curved Fan
Max Operating Temperature	212°F (100°C)

Product Information

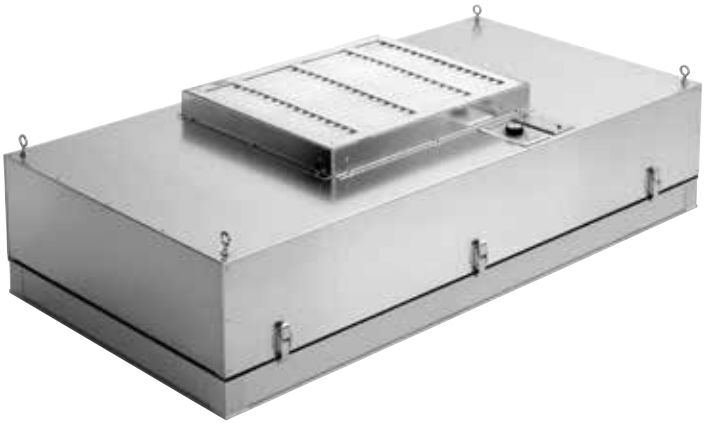
Model Number	Nominal Size Inches	Actual Size (Top) Inches	Actual Size (Bottom) Inches	Particle Efficiency	Typical Running Amps (115V)	Sensible Heat Output (BtuH)	Rated SCFM @ 90 FPM	Ship. Wt. (Lbs.)
PF-FPM-493-2424-STD	24 x 24	23.87 x 23.87	23.63 x 23.63	99.99% (0.3µm)	1.68	659	360	44
PF-FPM-493-2448-STD	24 x 48	23.87 x 47.87	23.63 x 47.63	99.99% (0.3µm)	2.04	800	720	66
PF-FPM-591-2424-STD	24 x 24	23.87 x 23.87	23.63 x 23.63	99.9995 (0.12µm)	1.89	724	360	44
PF-FPM-591-2448-STD	24 x 48	23.87 x 47.87	23.63 x 47.63	99.9995 (0.12µm)	2.11	828	720	66



Motor Options (all motors are 1/3 HP single phase)			
Volts	Hertz	Amps (full load)	RPM
115	60	2.4	1570
230	60	0.94	1570
277	60	0.94	1570
230	50	0.94	1310

High Purity

FM2-LE™

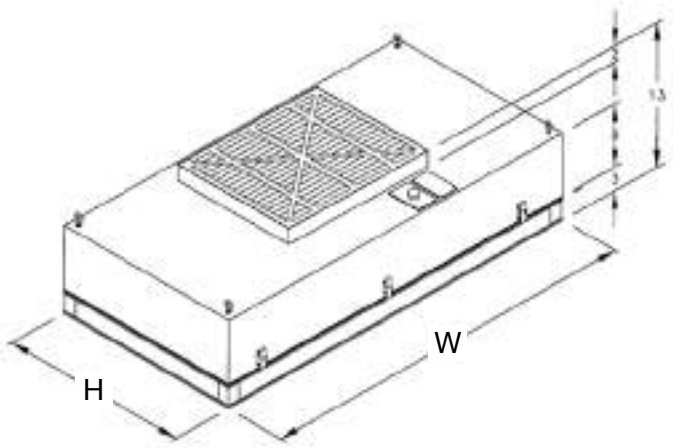


Product Overview

- Can upgrade existing cleanrooms or convert existing space into a cleanroom
- HEPA/ULPA filters are replaceable
- Energy efficient backward-curved motorized impeller
- Includes low pressure drop AstroCel® II, can be upgraded to MEGAcel® II
- Supplied with either a MERV 8 pleated prefilter to extend HEPA life, or duct connections for ease of installation
- All motors dynamically balanced and 100% inspected
- All electrical components UL Classified
- Lightweight and corrosion resistant housing

Specifications

Available Styles	Prefilter, Duct Collar
Housing Material	Mill Finish Aluminum
Available Efficiencies	HEPA, ULPA
Module Type	Fan Unit, Replaceable Filter
Protective Grill	Expanded Steel, White Powder Coated
Fan/Motor Assembly	1/3 HP Backward-Curved Fan
Max Operating Temperature	150°F (68°C)



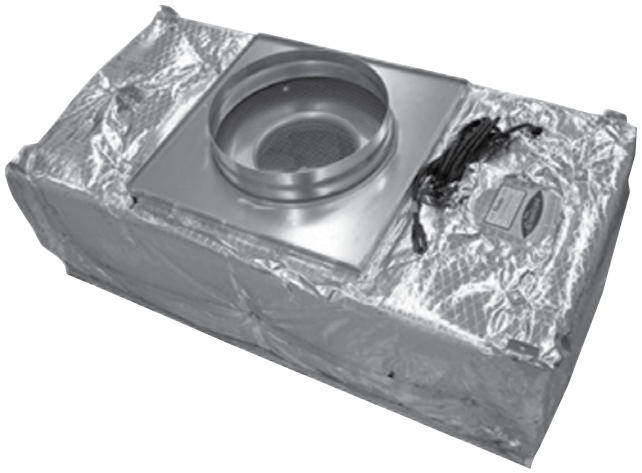
Product Information

Part Number	Nominal Size Inches (Feet)	Actual Size Inches (H x W x D)	Dust Collar Size (Inches)	Rated SCFM @ 100 FPM	Std. Pkg. Qty. Per Box	Shipping Wt. Lbs. per Box (± 7%)	Cubic Ft.
Aluminum Housing w/Steel Faceguard; 99.99% scan-tested HEPA filter, 115v, 60Hz Motor							
3010352-002	2 x 2	23⅝ x 23⅝ x 13	NA	340	1	30.0	1.0
3010352-006	2 x 2	23⅝ x 23⅝ x 13	10	340	1	30.0	0.0
3010352-010	2 x 2	23⅝ x 23⅝ x 13	12	340	1	30.0	0.0
3010345-002	2 x 3	23⅝ x 35⅝ x 13	NA	525	1	50.0	1.6
3010345-006	2 x 3	23⅝ x 35⅝ x 13	10	525	1	50.0	4.6
3010345-010	2 x 3	23⅝ x 35⅝ x 13	12	525	1	50.0	0.0
3010337-002	2 x 4	23⅝ x 47⅝ x 13	NA	710	1	60.0	6.2
3010337-006	2 x 4	23⅝ x 47⅝ x 13	10	710	1	60.0	0.0
3010337-010	2 x 4	23⅝ x 47⅝ x 13	12	710	1	60.0	0.0
Aluminum Housing w/Steel Faceguard; 99.99% scan-tested HEPA filter, 115v, 60Hz Motor, Power Cord Included							
3010352-001	2 x 2	23⅝ x 23⅝ x 13	NA	340	1	30.0	1.0
3010352-005	2 x 2	23⅝ x 23⅝ x 13	10	340	1	30.0	3.1
3010352-009	2 x 2	23⅝ x 23⅝ x 13	12	340	1	30.0	0.0
3010345-001	2 x 3	23⅝ x 35⅝ x 13	NA	525	1	50.0	1.6
3010345-005	2 x 3	23⅝ x 35⅝ x 13	10	525	1	50.0	1.6
3010345-009	2 x 3	23⅝ x 35⅝ x 13	12	525	1	50.0	0.0
3010337-001	2 x 4	23⅝ x 47⅝ x 13	NA	710	1	60.0	2.1
3010337-005	2 x 4	23⅝ x 47⅝ x 13	10	710	1	60.0	0.0
3010337-009	2 x 4	23⅝ x 47⅝ x 13	12	710	1	60.0	6.2

Additional options available on request include: 3″ and 4″ filter depths, 230v/60Hz motor, stainless steel faceguard, center divider with test port on filter, and filter efficiencies up to 99.9995% on 0.1 – 0.2µm particles. Contact your local AAF Flanders representative for details.

High Purity

Model 39 Airvelope®

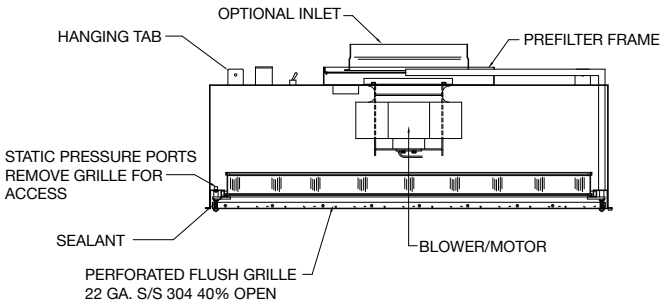


Product Overview

- Roomside replaceable HEPA filter for quick and easy maintenance
- Upgrade existing cleanrooms or convert existing space into a cleanroom
- Motor assembly also roomside removable for easy service
- Extremely quiet operation
- ISO Class 5 or better airflow
- Variable speed control
- Washable foam prefilter
- Lightweight and corrosion resistant housing

Specifications

Available Styles	Prefilter, Duct Collar
Housing Material	Mill Finish Aluminum or Stainless Steel
Available Efficiencies	HEPA, ULPA
Module Type	Fan Unit, Roomside Replaceable Filter
Protective Grill	Expanded Steel, White Powder Coated
Fan/Motor Assembly	1/3 HP Backward-Curved Fan
Max Operating Temperature	212°F (100°C)



Product Information

Modules – Filter Not Included

Model Number	Nominal Size Inches	Actual Size Inches	Frame Material	Shipping Wt. Lbs. per Box	CFM Capacity (Max/Min)
A39-E1286-ACF00000D0000	24 x 24	22 11/16 x 22 11/16 x 16 5/8	Aluminum	40	400/225
A39-E1386-ACF00000D0000	24 x 48	22 11/16 x 46 11/16 x 16 5/8	Aluminum	60	800/415
A39-E1286-SSF00000D0000	24 x 24	22 11/16 x 22 11/16 x 16 5/8	Stainless Steel	50	400/225
A39-E1386-SSF00000D0000	24 x 48	22 11/16 x 46 11/16 x 16 5/8	Stainless Steel	75	800/415

Dimensions listed do not include trim for installation in ceiling grids or optional duct inlet.

Motor Specs: 1.9-2.3 Amps @ 115 Volts (Low – High); 64 dBa (as measured 30″ from filter at 90 FPM).

Filters

Part Number	Nominal Size Inches (H x W x D)	Frame Material	Shipping Wt. Lbs.
HEPA Filters – 99.99% on 0.3µm, 2″ Deep DimplePleat® Media Pack, Scan Tested			
0-007-2-19-06-SU-52-00-E1286	24 x 24 x 2	Extruded Aluminum	10
0-007-2-19-06-SU-52-00-E1386	24 x 48 x 2	Extruded Aluminum	20
0-007-2-03-06-SU-52-00-E1286	24 x 24 x 2	Stainless Steel	12
0-007-2-03-06-SU-52-00-E1386	24 x 48 x 2	Stainless Steel	24
ULPA Filters – 99.9995% on 0.12µm, DimplePleat® Media Pack, Scan Tested			
0-009-2-19-06-SU-52-00-E1286	24 x 24 x 2	Extruded Aluminum	10
0-009-2-19-06-SU-52-00-E1386	24 x 48 x 2	Extruded Aluminum	20
0-009-2-03-06-SU-52-00-E1286	24 x 24 x 2	Stainless Steel	12
0-009-2-03-06-SU-52-00-E1386	24 x 48 x 2	Stainless Steel	24

High Purity

Airvelope® PCR

Product Overview

- Self-contained module that can create a stand alone ISO 5 cleanroom
- Can be suspended from ceiling, or mounted on legs and casters
- Filters are conveniently installed, changed, or tested from roomside
- Direct drive centrifugal blowers with variable frequency drives for speed control
- Retrofit or upgrade existing cleanrooms and fill lines
- Guaranteed to meet or exceed cleanliness requirements of ISO 14644-1
- Stainless steel plenum for easy cleaning and sterilization
- 480V single point connection for easy electrical hookup

Specifications

Available Styles	Prefilter, Duct Collar
Housing Material	Mill Finish Aluminum or Stainless Steel
Available Efficiencies	HEPA, ULPA
Module Type	Fan Unit, Roomside Replaceable Filter
Protective Grill	Expanded Steel, White Powder Coated
Fan/Motor Assembly	1/3 HP Backward-Curved Fan
Max Operating Temperature	212°F (100°C)

PCR - 480 - 4X8 - B - E - 304#4

- **PCR** — Portable Cleanroom
- **480** — **Voltage**: 480 = 480V; 230 = 230V
- **4X8** — **Nominal Size**
- **B** — **Prefilter Location**: B = Bottom; E = End
- **E** — **Blower Location**: E = End; T - Top
- **304#4** — **Housing Material**: 304#4 = Stainless steel #4 brush finish; 316L = Stainless steel #4 brush finish; ALU-P = Aluminum, painted finish

Product Information

Available Filter Efficiencies		
Laminar Flow Grade	**Minimum Efficiency (%)**	**Micron Particle Size**
HEPA	99.99	0.30
ULPA	99.9995	0.12
SULPA	99.999999	0.12

Self-Contained Laminar Flow Module								
Nominal Clean Area (ft.)	**1 HP Motors (Number)**	**A**	**B**	**C**	**Light Fixtures**		**Weight**	**Cubic Feet**
					No.	**Size (ft.)**		
4 x 4	1	48½	48¾	72¾	1	4	588	49
4 x 6	1	48½	74⅛	98⅛	2	4	660	65
4 x 8	2	48½	99½	123½	3	4	750	83
4 x 10	2	48½	124⅞	148⅞	4	4	896	110
4 x 12	2	48½	150¼	174¼	5	4	1350	116
6 x 6	2	72½	74⅛	98⅛	2	6	876	97
6 x 8	2	72½	99½	123½	3	6	954	124
6 x 10	3	72½	124⅞	148⅞	4	6	1440	149
6 x 12	3	72½	150¼	174¼	5	6	1560	173
8 x 8	3	96½	99½	123½	3	8	1490	166

Available Options

- Teardrop lighting (120V) (277V)
- Photohelic gage
- Aerosol injection port
- Audible alarm (with silence button)
- Visual alarm
- 316 L stainless steel construction
- Vinyl curtains
- Adjustable legs/casters
- Prefilters/polypad
- Sprinkler connection

High Purity

AstroHood® S-I

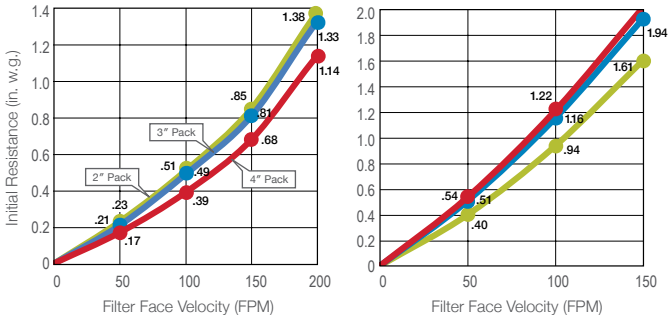
Product Overview

- Slide damper design allows for superior airflow distribution and fine adjustment
- Roomside replaceable HEPA filter for quick and easy maintenance
- Airflow adjustment and testing also available from roomside
- Continuous seal welding eliminates leak paths and adds strength
- Easy lay-in installation in a standard tee-bar ceiling
- Adaptable for horizontal or exhaust applications
- Gel seal design prevents bypass/leakage
- Lightweight and corrosion resistant housing

Specifications

Available Styles	Duct Collar
Housing Material	Mill Finish Aluminum or Stainless Steel
Available Efficiencies	HEPA, ULPA
Module Type	Hood, Roomside Replaceable Filter
Protective Grill	Expanded Steel, White Powder Coated

Initial Resistance vs. Filter Face Velocity



Product Information

Modules – Filter Not Included

Model Number	Nominal Size Inches	Actual Size Inches	Frame Material	Shipping Wt. Lbs. per Box
ESD0881-AL22-CF0000000T1	24 x 24	22 11/16 x 22 11/16 x 11	Aluminum	25
ESD0781-AL22-CF0000000T1	24 x 48	22 11/16 x 46 11/16 x 11	Aluminum	35
ESD0881-SS22-SF0000000T1	24 x 24	22 11/16 x 22 11/16 x 11	Stainless Steel	25
ESD0781-SS22-SF0000000T1	24 x 48	22 11/16 x 46 11/16 x 11	Stainless Steel	35

Dimensions listed do not include trim for installation in ceiling grids. Depths include duct collar. Filters with 3″ or 4″ media packs will require module depths up to 21″ overall.

Filters

Part Number	Nominal Size Inches (D x W x H)	Frame Material	Shipping Wt. Lbs.
HEPA Filters – 99.99% on 0.3µm, 2″ Deep DimplePleat® Media Pack, Scan Tested			
0-007-2-19-06-SU-52-00-E1286	24 x 24 x 2	Extruded Aluminum	10
0-007-2-19-06-SU-52-00-E1386	24 x 48 x 2	Extruded Aluminum	20
0-007-2-03-06-SU-52-00-E1286	24 x 24 x 2	Stainless Steel	12
0-007-2-03-06-SU-52-00-E1386	24 x 48 x 2	Stainless Steel	24
ULPA Filters – 99.9995% on 0.12µm, DimplePleat® Media Pack, Scan Tested			
0-009-2-19-06-SU-52-00-E1286	24 x 24 x 2	Extruded Aluminum	10
0-009-2-19-06-SU-52-00-E1386	24 x 48 x 2	Extruded Aluminum	20
0-009-2-03-06-SU-52-00-E1286	24 x 24 x 2	Stainless Steel	12
0-009-2-03-06-SU-52-00-E1386	24 x 48 x 2	Stainless Steel	24

High Purity

AstroHood® S-I Style Code

AS1A	–	E	F	22	10R	–	PS	1	0	–	3	0	0	1
(1)		(2)	(3)	(4)	(5)		(6)	(7)	(8)		(9)	(10)	(11)	(12)

(1) PRODUCT TYPE	(2) DAMPER TYPE	(3) SEAL TYPE	(4) HOOD SIZE	(5) INLET SIZE	(6) GRILLE TYPE	(7) GRILLE OPTIONS	(8) MOUNTING TYPE	(9) TRIM TYPE	(10) INSULATION	(11) FINISH	(12) FITTINGS

1. PRODUCT TYPE

Code	Type
AS1A	AstroHood SI Aluminum
AS1S	AstroHood SI Stainless Steal

2. DAMPER TYPE

E	ESD (STD)

3. SEAL TYPE

F	Fluid
G	Gasket

4. HOOD SIZE

14	1 x 4 (10-11/16″ x 46-11/16″)
22	2 x 2 (22-11/16″ x 22-11/16″)
23	2 x 3 (22-11/16″ x 34-11/16″)
24	2 x 4 (22-11/16″ x 46-11/16″)

5. INLET SIZE

08R	8″ Round
10R	10″ Round
12R	12″ Round
14R	14″ Round
08S	8″ x 8″ Square
10S	10″ x 10″ Square
12S	12″ x 12″ Square
14S	14″ x 14″ Square
08R_S	8″ Round ___ Side
08S_S	8″ Square ___ Side
Ex. 08RSS	8″ Round Side (8″ round inlet on short side of housing)
	*Long Side is ALWAYS on Hanging Side

6. GRILLE TYPE

PS	Perf SST (STD)
PP	Perf Painted
SS	Swirl SST
SP	Swirl Painted

7. GRILLE OPTIONS

0	Acorn Nuts (STD)
1	Hinged w/ 1/4 Turn Fasteners and Safety Cables

8. MOUNTING TYPE

0	Hanging Tabs
1	Mounting Pads
2	Clean Ceiling Angles 2″
3	Clean Ceiling Angles 3″

9. TRIM TYPE

Code	Type
1	1/2″ Permanent Flange
2	1/2″ Field Installed SST Flange
3	1-1/2″ Field Installed SST Flange
4	1/2″ Permanent Flange (316L)
5	1/2″ Field Installed SST Flange (316L)
6	1-1/2″ Field Installed SST Flange (316L)

10. INSULATION

0	None
1	2″ Foilback
2	1″ Armaflex

11. FINISH

0	No Finish
1	Power Coated

12. FITTINGS

0	3/8″ Female NPT
1	3/8″ Colder Fitting Quick Disconnects

APPLICABLE DUCT SIZES

	Hood Size	Duct Size
14	1 x 4	08R/S
22	2 x 2	08R/S 10R/S
23	2 x 3	10R/S 12R/S
24	2 x 4	10R/S 12R/S 14R/S

Example:

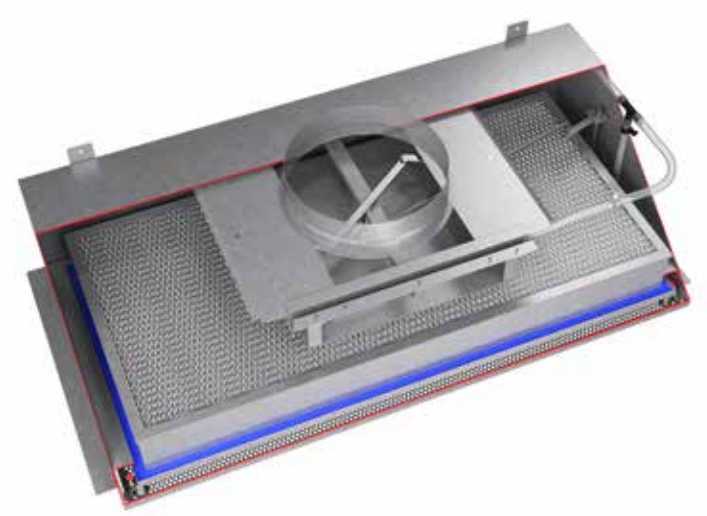
AS1A-EF2210R-PS10-3001

High Purity

AstroHood® S-II

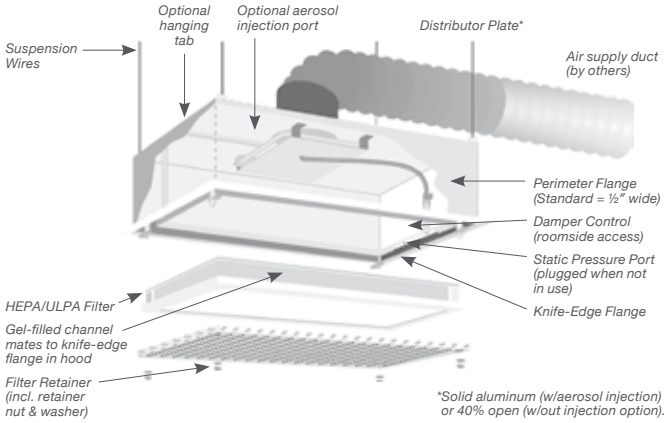
Product Overview

- Roomside replaceable HEPA filter for quick and easy maintenance
- Ideal for pharmaceutical and biotech cleanrooms
- Airflow adjustment and testing also available from roomside
- Easy lay-in installation in a standard tee-bar ceiling
- Continuous seal welding eliminates leak paths and adds strength
- Adaptable for horizontal or exhaust applications
- Gel seal design prevents bypass/leakage
- Lightweight and corrosion resistant housing



Specifications

Available Styles	Duct Collar
Housing Material	Mill Finish Aluminum or Stainless Steel
Available Efficiencies	HEPA, ULPA
Module Type	Hood, Roomside Replaceable Filter
Protective Grill	Expanded Steel, White Powder Coated



Product Information

Modules – Filter Not Included

Model Number	Nominal Size Inches	Actual Size Inches	Module Material	Trim Frame Material	Shipping Wt. Lbs. per Box
AS2A-GF2210R-PS00-3001	24 x 24	22 11/16 x 22 11/16 x 10	Aluminum	Stainless Steel	25
AS2A-GF2410R-PS00-3001	24 x 48	22 11/16 x 46 11/16 x 10	Aluminum	Stainless Steel	35
AS2S-GF2210R-PS00-3001	24 x 24	22 11/16 x 22 11/16 x 10	Stainless Steel	Stainless Steel	25
AS2S-GF2410R-PS00-3001	24 x 48	22 11/16 x 46 11/16 x 10	Stainless Steel	Stainless Steel	35

Dimensions listed do not include trim for installation in ceiling grids. Depths do not include duct collar. Filters with 3″or 4″ media packs will require increased depths.

Filters

Part Number	Nominal Size Inches (D x W x H)	Frame Material	Shipping Wt. Lbs.
HEPA Filters – 99.99% on 0.3µm, 2″ Deep DimplePleat® Media Pack, Scan Tested			
0-007-2-19-06-SU-52-00-E1286	24 x 24 x 2	Extruded Aluminum	10
0-007-2-19-06-SU-52-00-E1386	24 x 48 x 2	Extruded Aluminum	20
0-007-2-03-06-SU-52-00-E1286	24 x 24 x 2	Stainless Steel	12
0-007-2-03-06-SU-52-00-E1386	24 x 48 x 2	Stainless Steel	24
ULPA Filters – 99.9995% on 0.12µm, DimplePleat® Media Pack, Scan Tested			
0-009-2-19-06-SU-52-00-E1286	24 x 24 x 2	Extruded Aluminum	10
0-009-2-19-06-SU-52-00-E1386	24 x 48 x 2	Extruded Aluminum	20
0-009-2-03-06-SU-52-00-E1286	24 x 24 x 2	Stainless Steel	12
0-009-2-03-06-SU-52-00-E1386	24 x 48 x 2	Stainless Steel	24

High Purity

AstroHood® S-II Style Code

AS2A	–	E	F	22	10R	–	PS	1	0	–	3	0	0	1
(1)		(2)	(3)	(4)	(5)		(6)	(7)	(8)		(9)	(10)	(11)	(12)

(1) PRODUCT TYPE	(2) DAMPER TYPE	(3) SEAL TYPE	(4) HOOD SIZE	(5) INLET SIZE	(6) GRILLE TYPE	(7) GRILLE OPTIONS	(8) MOUNTING TYPE	(9) TRIM TYPE	(10) INSULATION	(11) FINISH	(12) FITTINGS

1. PRODUCT TYPE	
Code	**Type**
AS2A	AstroHood S-II Aluminum
AS2S	AstroHood S-II Stainless Steal

2. DAMPER TYPE	
G	Guillotine (STD)
E	ESD
B	Butterfly

3. SEAL TYPE	
F	Fluid
G	Gasket

4. HOOD SIZE	
14	1 x 4 (10-11/16″ x 46-11/16″)
22	2 x 2 (22-11/16″ x 22-11/16″)
23	2 x 3 (22-11/16″ x 34-11/16″)
24	2 x 4 (22-11/16″ x 46-11/16″)

5. INLET SIZE	
08R	8″ Round
10R	10″ Round
12R	12″ Round
14R	14″ Round
08S	8″ x 8″ Square
10S	10″ x 10″ Square
12S	12″ x 12″ Square
14S	14″ x 14″ Square
08R_S	8″ Round ___ Side
08S_S	8″ Square ___ Side
Ex. 08RSS	8″ Round Side (8″ round inlet on short side of housing)
*Long Side is ALWAYS on Hanging Side	

6. GRILLE TYPE	
PS	Perf SST (STD)
PP	Perf Painted
SS	Swirl SST
SP	Swirl Painted

7. GRILLE OPTIONS	
0	Acorn Nuts (STD)
1	Hinged w/ 1/4 Turn Fasteners and Safety Cables

8. MOUNTING TYPE	
0	Hanging Tabs
1	Mounting Pads
2	Clean Ceiling Angles 2″
3	Clean Ceiling Angles 3″

9. TRIM TYPE	
Code	**Type**
1	1/2″ Permanent Flange
2	1/2″ Field Installed SST Flange
3	1-1/2″ Field Installed SST Flange
4	1/2″ Permanent Flange (316L)
5	1/2″ Field Installed SST Flange (316L)
6	1-1/2″ Field Installed SST Flange (316L)

10. INSULATION	
0	None
1	2″ Foilback
2	1″ Armaflex

11. FINISH	
0	No Finish
1	Power Coated

12. FITTINGS	
0	3/8″ Female NPT
1	3/8″ Colder Fitting Quick Disconnects

APPLICABLE DUCT SIZES		
	Hood Size	**Duct Size**
14	1 x 4	08R/S
22	2 x 2	08R/S 10R/S
23	2 x 3	10R/S 12R/S
24	2 x 4	10R/S 12R/S 14R/S

Example:

AS2A-EF2210R-PS10-3001

High Purity

ESD RetroFit Kit

Product Overview

- Specifically designed to allow facility maintenance personnel to adapt existing roomside replaceable units with the ESD damper
- Easy installation using hand tools, no extended downtime
- Each kit comes complete with the ESD damper, retrofit jigs and fixtures, hardware, drawings, and a detailed instruction manual
- The ESD damper and adjustment mechanism make it ideal for applications where excellent aerosol and velocity uniformity are required, fine adjustment is desired, and when extremely low static pressure values are sought

Specifications

Available Styles	Duct Collar
Housing Material	Mill Finish Aluminum or Stainless Steel

Product Information

Modules – Filter Not Included

Model Number	Part Number	Nominal Size Inches	Frame Material	Shipping Wt. Lbs. per Box
ESD-RETRO-2x2 AL	E0707266	24 x 24	Aluminum	20
ESD-RETRO-2x4 AL	E0707267	24 x 48	Aluminum	25
ESD-RETRO-2x2 SS	E0707308	24 x 24	Stainless Steel	30
ESD-RETRO-2x4 SS	E0707309	24 x 48	Stainless Steel	35

Filters

Part Number	Nominal Size Inches (H x W x D)	Frame Material	Shipping Wt. Lbs.
HEPA Filters – 99.99% on 0.3µm, 2″ Deep DimplePleat® Media Pack, Scan Tested			
0-007-2-19-06-SU-52-00-E1286	24 x 24 x 2	Extruded Aluminum	10
0-007-2-19-06-SU-52-00-E1386	24 x 48 x 2	Extruded Aluminum	20
0-007-2-03-06-SU-52-00-E1286	24 x 24 x 2	Stainless Steel	12
0-007-2-03-06-SU-52-00-E1386	24 x 48 x 2	Stainless Steel	24
ULPA Filters – 99.9995% on 0.12µm, DimplePleat® Media Pack, Scan Tested			
0-009-2-19-06-SU-52-00-E1286	24 x 24 x 2	Extruded Aluminum	10
0-009-2-19-06-SU-52-00-E1386	24 x 48 x 2	Extruded Aluminum	20
0-009-2-03-06-SU-52-00-E1286	24 x 24 x 2	Stainless Steel	12
0-009-2-03-06-SU-52-00-E1386	24 x 48 x 2	Stainless Steel	24

High Purity

AstroHood® S-III

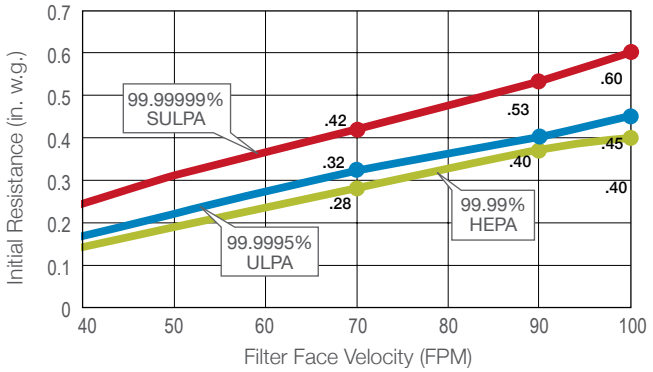
Product Overview

- Disposable HEPA module for a variety of cleanroom applications
- Low-profile and lightweight for easy installation
- Available with up to a 4″ media pack for maximum airflow
- Entire unit is factory sealed and individually scan tested to ensure leak-free performance
- Both HEPA and ULPA efficiencies available
- Can be supplied with AstroCel® II or DimplePleat® media packs
- Wide range of additional options available including lighting, insulation, and many more

Specifications

Available Styles	Duct Collar
Housing Material	Anodized Aluminum
Available Efficiencies	HEPA, ULPA
Module Type	Hood, Disposable
Max Operating Temperature	250˚F (121˚C)
Filter Type	Minipleat; Separatorless or Ribbon Separators

Initial Resistance vs. Filter Face Velocity



Values based on 4″ pack depth

Product Information

Model Number	Nominal Size (Inches)	Dimensions (Inches)	Media Pack Depth (Inches)	Damper Type	Rated CFM @ 100 FPM	Initial Resistance at 100 FPM
HEPA - 99.99% Efficient on 0.3um, 1-1/2 T-Bar, Scan Tested, White Painted CRS Faceguard, No Insulation						
AS3G-2-007-B22**-P0	2 x 2	23⅝ x 23⅝ x 5$^{17}/_{32}$	2	Butterfly	300	0.57
AS3G-2-007-B23**-P0	2 x 3	23⅝ x 35⅝ x 5$^{17}/_{32}$	2	Butterfly	480	0.57
AS3G-2-007-B24**-P0	2 x 4	23⅝ x 47⅝ x 5$^{17}/_{32}$	2	Butterfly	660	0.57
AS3G-4-007-B22**-P0	2 x 2	23⅝ x 23⅝ x 8$^{29}/_{32}$	4	Butterfly	300	0.40
AS3G-4-007-B23**-P0	2 x 3	23⅝ x 35⅝ x 8$^{29}/_{32}$	4	Butterfly	480	0.40
AS3G-4-007-B24**-P0	2 x 4	23⅝ x 47⅝ x 8$^{29}/_{32}$	4	Butterfly	660	0.40
ULPA - 99.9995% Efficient on 0.12um, 1-1/2 T-Bar, Scan Tested, White Painted CRS Faceguard, No Insulation						
AS3G-2-009-B22**-P0	2 x 2	23⅝ x 23⅝ x 5$^{17}/_{32}$	2	Butterfly	300	0.68
AS3G-2-009-B23**-P0	2 x 3	23⅝ x 35⅝ x 5$^{17}/_{32}$	2	Butterfly	480	0.68
AS3G-2-009-B24**-P0	2 x 4	23⅝ x 47⅝ x 5$^{17}/_{32}$	2	Butterfly	660	0.68
AS3G-4-009-B22**-P0	2 x 2	23⅝ x 23⅝ x 8$^{29}/_{32}$	4	Butterfly	300	0.45
AS3G-4-009-B23**-P0	2 x 3	23⅝ x 35⅝ x 8$^{29}/_{32}$	4	Butterfly	480	0.45
AS3G-4-009-B24**-P0	2 x 4	23⅝ x 47⅝ x 8$^{29}/_{32}$	4	Butterfly	660	0.45

Replace (**) with inlet size, for example, '12' for the 12″ inlet collar.
Additional damper types and knife-edge configuration available as standard offering.
Additional sizes available upon request.

High Purity

AstroHood® S-III Style Code

AS3G – 2 – 007 – B 24 10 – P 0

(1) (2) (3) (4) (5) (6) (7) (8)

(1) PRODUCT TYPE	(2) PACK HEIGHT	(3) FILTER EFFICIENCY	(4) DAMPER TYPE	(5) HOOD SIZE	(6) INLET SIZE	(7) GRILLE TYPE	(8) INSULATION

1. PRODUCT TYPE	
Code	**Type**
AS3G	AstroHood S-III for Gasket Grid
AS3K	AstroHood S-III with 3/4″ Knife-Edge for Gel Grid

2. PACK HEIGHT	
2	2″ Pack Height
4	4″ Pack Height

3. FILTER EFFICIENCY	
007	99.99% on 0.3 µm
008	99.999% on 0.3 µm
009	99.9995% on 0.12 µm
012	99.99999% on 0.12 µm

4. DAMPER TYPE	
B	Butterfly
T	Telescoping Disc
N	None

5. HOOD SIZE	
22	2 x 2 (23-5/8″ x 23-5/8″)
23	2 x 3 (23-5/8″ x 35-5/8″)
24	2 x 4 (23-5/8″ x 47-5/8″)

6. INLET SIZE	
Code	**Type**
08	8″ Round – 2 x 2 only
10	10″ Round – 2 x 2, 2 x 3, 2 x 4
12	12″ Round – 2 x 3 and 2 x 4 only
14	14″ Round – 2 x 4 only

7. GRILLE TYPE	
P	Painted Expanded CRS
S	40% Perf. Stainless Steel (316L)
A	40% Anodized Aluminum

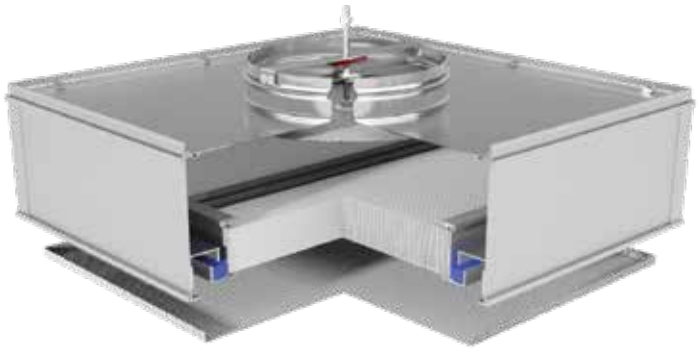
8. INSULATION	
0	None
1	2″ Foil Back Glass (Top & Sides)
2	2″ Foil Back Glass (Top Only)

Example:

AS3G-2-007-B2410-P0

High Purity

AstroHood® S-III (RSR)

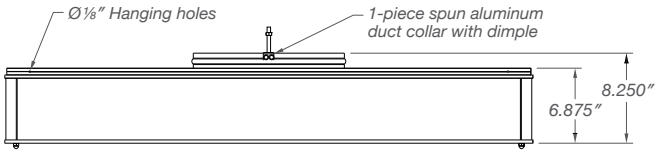


Product Overview

- Roomside replaceable HEPA filter for quick and easy maintenance
- Lightweight, low profile design
- Airflow adjustment and testing also available from roomside
- Gel and knife-edge construction styles available to ensure leak-free operation

Specifications

Available Styles	Duct Collar
Housing Material	Anodized Aluminum
Available Efficiencies	HEPA, ULPA
Module Type	Hood, Roomside Replaceable Filter
Protective Grill	Expanded Steel, White Powder Coated



Product Information

Model Number	Overall Size Inches	T-Bar Type Inches	Weight Lbs.	Baffle Type	Design Airflow (CFM)	Unit Resistance (w.g.)	
						HEPA	ULPA
AS3R-BF2210-P00	23⅝ x 23⅝ x 8¼	1½	25	Butterfly	400	0.67	0.78
AS3R-BF2310-P00	23⅝ x 35⅝ x 8¼	1½	30	Butterfly	600	0.67	0.78
AS3R-BF2410-P00	23⅝ x 47⅝ x 8¼	1½	40	Butterfly	800	0.67	0.78
AS3R-TF2210-P00	23⅝ x 23⅝ x 8¼	1½	25	Adjustable Perf. Disk	400	0.67	0.78
AS3R-TF2310-P00	23⅝ x 35⅝ x 8¼	1½	30	Adjustable Perf. Disk	600	0.67	0.78
AS3R-TF2410-P00	23⅝ x 47⅝ x 8¼	1½	40	Adjustable Perf. Disk	800	0.67	0.78
AS3R-NF2210-P00	23⅝ x 23⅝ x 8¼	1½	25	Fixed Perf. Disk	400	0.67	0.78
AS3R-NF2310-P00	23⅝ x 35⅝ x 8¼	1½	30	Fixed Perf. Disk	600	0.67	0.78
AS3R-NF2410-P00	23⅝ x 47⅝ x 8¼	1½	40	Fixed Perf. Disk	800	0.67	0.78

Replacement Filters

Model Number	Overall Size Inches	Efficiency	Baffle Type
0-007-2-19-06-SU-52-00-21A21A	21 x 21 x 2 17/32	HEPA	Fixed
0-007-2-19-06-SU-52-00-21A33A	21 x 33 x 2 17/32	HEPA	Fixed
0-007-2-19-06-SU-52-00-21A45A	21 x 45 x 2 17/32	HEPA	Fixed
0-007-2-19-06-SU-52-00-20J20J	20½ x 20½ x 2 17/32	HEPA	Fixed
0-009-2-19-06-SU-52-00-21A21A	21 x 21 x 2 17/32	ULPA	Fixed
0-009-2-19-06-SU-52-00-20J20J	20½ x 20½ x 2 17/32	ULPA	Fixed
E-007-2-19-06-SU-52-00-21A21A	21 x 21 x 2 17/32	HEPA	Adj./Butterfly
E-007-2-19-06-SU-52-00-20J20J	20½ x 20½ x 2 17/32	HEPA	Adj./Butterfly
E-009-2-19-06-SU-52-00-21A21A	21 x 21 x 2 17/32	ULPA	Adj./Butterfly
E-009-2-19-06-SU-52-00-20J20J	20½ x 20½ x 2 17/32	ULPA	Adj./Butterfly

High Purity

AstroHood® S-III (RSR) Style Code

AS3R	–	B	F	22	10	–	S	0	0
(1)		(2)	(3)	(4)	(5)		(6)	(7)	(8)

(1) PRODUCT TYPE	(2) DAMPER TYPE	(3) SEAL TYPE	(4) HOOD SIZE	(5) INLET SIZE	(6) GRILLE TYPE	(7) INSULATION	(8) FINISH

Example:
AS3R-BF2210-S00

1. PRODUCT TYPE	
Code	**Type**
AS3R	AstroHood S-III Extruded Aluminum

2. DAMPER TYPE	
B	Butterfly
T	Telescoping Perforated Disk
N	None

3. SEAL TYPE	
F	Fluid

4. HOOD SIZE	
22	2 x 2 (23-5/8″ x 23-5/8″)
23	2 x 3 (23-5/8″ x 35-5/8″)
24	2 x 4 (23-5/8″ x 47-5/8″)

5. INLET SIZE	
08	8″ Round
10	10″ Round
12	12″ Round
14	14″ Round

6. GRILLE TYPE	
S	40% Perf Stainless Steel (316L)
P	40% Perf Painted CRS

7. INSULATION	
0	None
1	2″ Foil back glass (Top & Sides)
2	2″ Foil back glass (Top Only)

8. FINISH	
0	No Finish
1	Powder paint coated (white)

APPLICABLE DUCT SIZE		
	Hood Size	**Duct Size**
22	2 x 2	08″, 10″
23	2 x 3	10″, 12″
24	2 x 4	10″ ,12″, 14″

High Purity

PermaFrame™

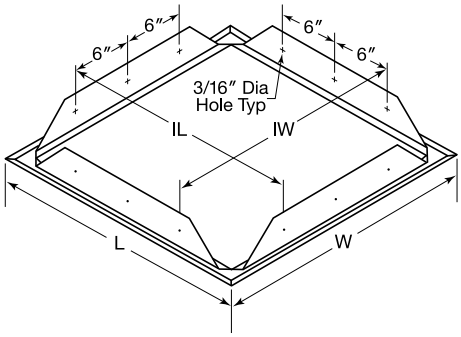
Product Overview

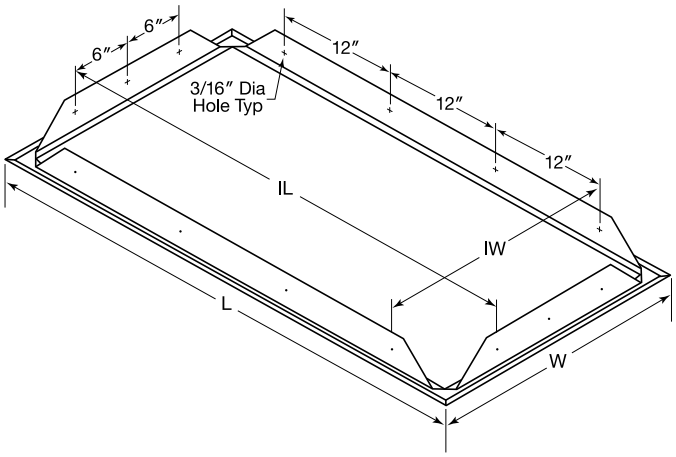
- Used to mount ducted or fan-powered terminal modules in a hard ceiling application, such as sheet rock or plasterboard
- Ideal for biotech facilities that require frequent wash-down of the cleanroom, as well as isolation hospital rooms where HEPA-type filtration is frequently required
- Heavy-duty construction
- Powder coated washable surface
- Welded corners
- Requires no gasketing

Product Information

Model Number	Actual Dimensions (inches)				Weight (lbs.)
	L	W	Inside Length	Inside Width	
HCFA 2424	26	26	24	24	4
HCFA 2448	50	26	48	24	6

Construction – 18-gauge cold rolled steel or 304 stainless steel





High Purity

AstroSafe® BF-Series Gel Seal Bag-In/Bag-Out Housings

Product Overview

- Designed to accommodate both standard gel seal HEPA filters and carbon adsorbers
- Guaranteed to pass DOP and Freon in-place tests
- Side access bag-in/bag-out port that allows contaminated filters and carbon adsorbers to be removed without direct contact

BF1 - 1H 2W - 2 GGF - 304 - D1

Housing Series
BF1 = Bag-Out Type for Gel Seal Filters

Number of Filters High

Number of Filters Wide

Size Designator of Primary Filter
(see chart below)

Nominal Depth of Prefilter
2 = 2 inch deep Prefilter
4 = 4 inch deep Prefilter
6 = 6 inch deep Prefilter
Blank = No Prefilter

Housing Material Type
304 = Type 304 Stainless Steel (Standard)
304L = Type 304L Stainless Steel
316 = Type 316 Stainless Steel
316L = Type 316L Stainless Steel

Access Door Arrangement
D1 = One Access Door
D2 = Two Access Doors, One per Side
D3 = Two Access Doors on One Side (one for primary filter, one for prefilter)
D4 = Four Access Doors, Two on Each Side (one for primary filter, one for prefilter)

Product Information

Part Number	Height (in.)	Width (in.)	Depth (in.)	Weight (Lbs.)
BF1-1H1W-2/4/6CC-304-D1*	18	15	14	60
BF1-1H1W-2/4/6CG-304-D1*	18	27	14	70
BF1-1H1W-2/4/6GC-304-D1*	30	15	14	80
BF1-1H1W-2/4/6GG-304-D1*	30	27	14	90
BF1-1H2W-GGF/12-304-D1	30	51	25	205
BF1-1H2W-GG16-304-D1	30	51	32⅝	225
BF1-1H2W-GG18-304-D1	30	51	32⅝	235
BF1-1H2W-2/4/6GGF/12-304-D1	30	51	33¼	220
BF1-1H2W-2/4/6GG16-304-D1	30	51	41	240
BF1-1H2W-2/4/6GG18-304-D1	30	51	41	250
BF1-1H2W-2/4/6GGF/12-304-D3	30	51	37½	275
BF1-1H2W-2/4/6GG16-304-D3	30	51	45¼	295
BF1-1H2W-2/4/6GG18-304-D3	30	51	45¼	300
BF1-1H2W-2/4/6GG-304-D1*	30	51	14	120
BF1-1H3W-GGF/12-304-D1	30	75	25	265
BF1-1H3W-GG16-304-D1	30	75	32⅝	290
BF1-1H3W-GG18-304-D1	30	75	32⅝	300
BF1-1H3W-2/4/6GGF/12-304-D1	30	75	33¼	280
BF1-1H3W-2/4/6GG16-304-D1	30	75	41	305
BF1-1H3W-2GG18-304-D1	30	75	41	320
BF1-1H3W-2/4/6GGF/12-304-D3	30	75	37½	350
BF1-1H3W-2/4/6GG16-304-D3	30	75	45¼	375
BF1-1H3W-2/4/6GG18-304-D3	30	75	45¼	390
BF1-1H3W-2/4/6GG-304-D1*	30	75	14	150

*These housings are designed to accommodate prefilters only.

Filter Size Designator (HEPA Filters and Carbon Adsorbers) **Actual Filter Dimensions are Listed**
HEPA Filters
†CCD 12 x 12 x 5⅞
†CCF 12 x 12 x 11½
†CGF 12 x 24 x 11½
†GCF 24 x 12 x 11½
†GGF 24 x 24 x 11½
Carbon Adsorbers
†CC6 12 x 12 x 5⅞
†CC12 12 x 12 x 11½
†CG12 12 x 24 x 11½
†GC12 24 x 12 x 11½
†GG12 24 x 24 x 11½
†CG16 12 x 24 x 16
†GC16 24 x 12 x 16
†GG16 24 x 24 x 16
†GG18 24 x 24 x 18

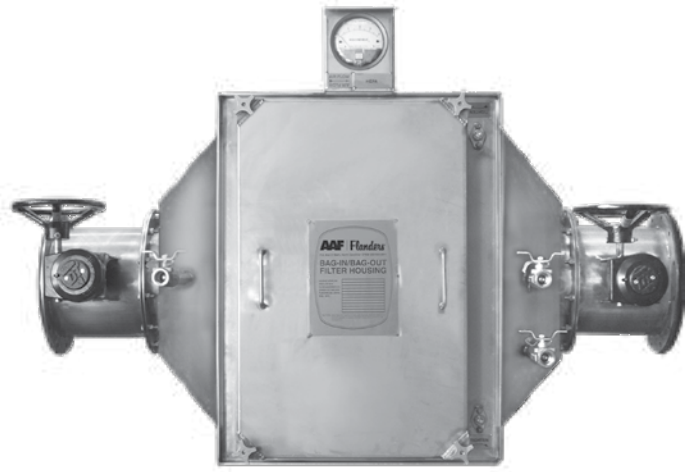
†Insert 2, 4, or 6 to indicate 2", 4", or 6" prefilter track.

High Purity

AstroSafe® BG-Series Gasket Seal Bag-In/Bag-Out Housings

Product Overview

- Side servicing filter housing designed for gasket seal filters
- Minimizing exposure to harmful contamination, this housing incorporates a ribbed bagging ring behind the access door, over which a PVC bag is attached
- Manufactured under stringent quality assurance controls



BG1 - 1H 2W - 2 GGF - 304 - D1

Housing Series
BG1 = Bag-Out Type for Gasket Seal Filters

Number of Filters High

Number of Filters Wide

Nominal Depth of Prefilter
2 = 2 inch deep Prefilter
4 = 4 inch deep Prefilter
6 = 6 inch deep Prefilter
Blank = No Prefilter

Size Designator of Primary Filter
(see chart below)

Housing Material Type
304 = Type 304 Stainless Steel (Standard)
304L = Type 304L Stainless Steel
316 = Type 316 Stainless Steel
316L = Type 316L Stainless Steel

Access Door Arrangement
D1 = One Access Door
D2 = Two Access Doors, One per Side
D3 = Two Access Doors on One Side (one for primary filter, one for prefilter)
D4 = Four Access Doors, Two on Each Side (one for primary filter, one for prefilter)

Product Information

Part Number	Height (in.)	Width (in.)	Depth (in.)	Weight (Lbs.)
BG1-1H1W-2/4/6CC-304-D1*	18	15	14	60
BG1-1H1W-2/4/6CG-304-D1*	18	27	14	70
BG1-1H1W-2/4/6GC-304-D1*	30	15	14	80
BG1-1H1W-2/4/6GG-304-D1*	30	27	14	90
BG1-1H2W-GGF/12-304-D1	30	51	23	205
BG1-1H2W-GG16-304-D1	30	51	27½	225
BG1-1H2W-GG18-304-D1	30	51	29½	235
BG1-1H2W-2GGF/12-304-D1	30	51	26	220
BG1-1H2W-2GG16-304-D1	30	51	20½	240
BG1-1H2W-2GG18-304-D1	30	51	32½	250
BG1-1H2W-2/4/6GGF/12-304-D3	30	51	35¾	275
BG1-1H2W-2/4/6GG16-304-D3	30	51	40¼	295
BG1-1H2W-2/4/6GG18-304-D3	30	51	42¼	300
BG1-1H2W-2/4/6GG-304-D1*	30	51	14	120
BG1-1H3W-GGF/12-304-D1	30	75	23	265
BG1-1H3W-GG16-304-D1	30	75	27½	290
BG1-1H3W-GG18-304-D1	30	75	29½	300
BG1-1H3W-2GGF/12-304-D1	30	75	26	280
BG1-1H3W-2GG16-304-D1	30	75	30½	305
BG1-1H3W-2GG18-304-D1	30	75	32½	320
BG1-1H3W-2/4/6GGF/12-304-D3	30	75	35¾	350
BG1-1H3W-2/4/6GG16-304-D3	30	75	40¼	375
BG1-1H3W-2/4/6GG18-304-D3	30	75	42¼	390
BG1-1H3W-2/4/6GG-304-D1*	30	75	14	150

**These housings are designed to accommodate prefilters only.*

Part Number	Height (in.)	Width (in.)	Depth (in.)	Weight (Lbs.)
BG1-1H1W-CCD/6-304-D1**	18	15	17⅜	75
BG1-1H1W-CCF/12-304-D1	18	15	23	85
BG1-1H1W-CGF/12-304-D1	18	27	23	100
BG1-1H1W-CG16-304-D1	18	27	27½	115
BG1-1H1W-GCF/12-304-D1	30	15	23	120
BG1-1H1W-GC16-304-D1	30	15	27½	140
BG1-1H1W-GGF/12-304-D1***	30	27	23	145
BG1-1H1W-GG16-304-D1	30	27	27½	160
BG1-1H1W-GG18-304-D1	30	27	29½	165
BG1-1H1W-2CCF/12-304-D1	18	15	26	90
BG1-1H1W-2CGF/12-304-D1	18	27	26	115
BG1-1H1W-2CG16-304-D1	18	27	30½	125
BG1-1H1W-2GCF/12-304-D1	30	15	26	130
BG1-1H1W-2GC16-304-D1	30	15	30½	145
BG1-1H1W-2GGF/12-304-D1	30	27	26	155
BG1-1H1W-2GG16-304-D1	30	27	30½	170
BG1-1H1W-2GG18-304-D1	30	27	32½	175
BG1-1H1W-2/4/6CCF/12-304-D3	18	15	35¾	115
BG1-1H1W-2/4/6CGF/12-304-D3	18	27	35¾	145
BG1-1H1W-2/4/6CG16-304-D3	18	27	40¼	155
BG1-1H1W-2/4/6GCF/12-304-D3	30	15	35¾	160
BG1-1H1W-2/4/6GC16-304-D3	30	15	40¼	170
BG1-1H1W-2/4/6GGF/12-304-D3	30	27	35¾	185
BG1-1H1W-2/4/6GG16-304-D3	30	27	40¼	205
BG1-1H1W-2/4/6GG18-304-D3	30	27	42¼	210

***The D/6 in this model number represents the following model numbers:*
BG1-1H1W-CCD-304-D1 *to contain a HEPA filter*
BG1-1H1W-CC6-304-D1 *to contain a Carbon Adsorber*

****The F/12 in this model number represents the following model numbers:*
BG1-1H1W-GGF-304-D1 *to contain a HEPA filter*
BG1-1H1W-GG12-304-D1 *to contain a Carbon Adsorber*

Note: *For multi-high housings, just add the height dimension as needed.*

Filter Size Designator
(HEPA Filters and Carbon Adsorbers)
Actual Filter Dimensions are Listed

HEPA Filters
†CCD 12 x 12 x 5⅞
†CCF 12 x 12 x 11½
†CGF 12 x 24 x 11½
†GCF 24 x 12 x 11½
†GGF 24 x 24 x 11½
Carbon Adsorbers
†CC6 12 x 12 x 5⅞
†CC12 12 x 12 x 11½
†CG12 12 x 24 x 11½
†GC12 24 x 12 x 11½
†GG12 24 x 24 x 11½
†CG16 12 x 24 x 16
†GC16 24 x 12 x 16
†GG16 24 x 24 x 16
†GG18 24 x 24 x 18

†Insert 2, 4, or 6 to indicate 2", 4", or 6" prefilter track.

High Purity

AstroSafe® G-Series Single Filter Housings

Product Overview

- Allows a single filter element (prefilter, HEPA filter, or gas adsorber) to be installed in a low CFM ventilation system
- Designed so that housing can be tested in place
- Accommodates various arrangements of inlet and outlet ports
- Filter-to-housing fluid seal is created by means of a continuous knife-edge in the housing

G1F - GGF - 304

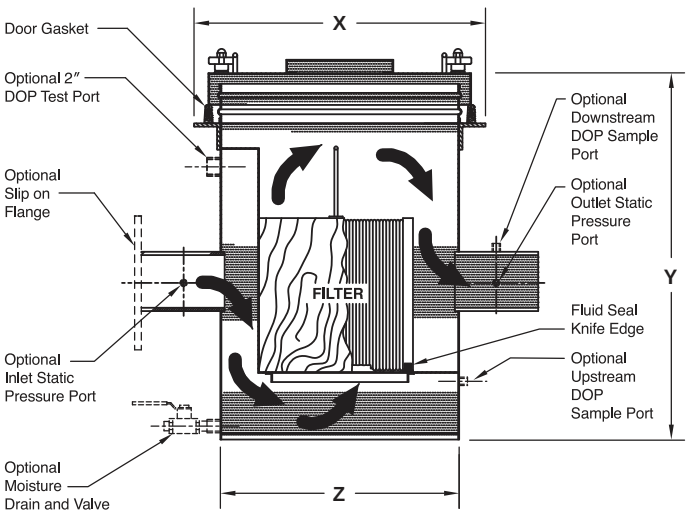
Housing Series/Type
G1F = Bag-Out Gel Seal
G1G = Bag-Out Gasket Seal
(for non-bag-out applications, delete bags and straps)

Filter Size
(see chart below)

Housing Material Type
304 = Type 304 Stainless Steel (Standard)
304L = Type 304L Stainless Steel
316 = Type 316 Stainless Steel
316L = Type 316L Stainless Steel

Product Information

Part Number	Filter Size	Housing Dimensions (Inches) X	Y	Z	Filter Dimensions Inches (H x W x D)	Rated Capacity (CFM)
Filters						
G1F-CCD-304	CCD	22⅛	24	18⅛	12 x 12 x 5⅞	105
G1F-CCF-304	CCF	22⅛	24	18⅛	12 x 12 x 11½	160
G1F-GGD-304	GGD	40⅛	24	36⅛	24 x 24 x 5⅞	500
G1F-GGF-304	GGF	40⅛	24	36⅛	24 x 24 x 11½	1000
Adsorbers						
G1F-CC12-304	CC12	22⅛	24	18⅛	12 x 12 x 12¼	165
G1F-GG12-304	GG12	40⅛	24	36⅛	24 x 24 x 12¼	1000
G1F-GG16-304	GG16	40⅛	28	36⅛	24 x 24 x 16¾	1000
G1F-GG18-304	GG18	40⅛	28	36⅛	24 x 24 x 18¾	1250



AstroSafe® is a registered trademark of AAF International in the U.S. and other countries.

High Purity

AstroSafe® Isolation Dampers

Product Overview

- Effective shut off and isolation of one or more tiers of filters
- Cost effective isolation of filter banks
- Special requirements may be satisfied through custom design

DBT - * - FB - 304 - 18

Damper Series
DBT = Damper, Bubble Tight

Actuator Options
M = Manual
P= Pneumatic
E = Electric

Blade
FB = Flat Blade

Housing Material Type
304 = Type 304 Stainless Steel (Standard)
304L = Type 304L Stainless Steel
316 = Type 316 Stainless Steel
316L = Type 316L Stainless Steel

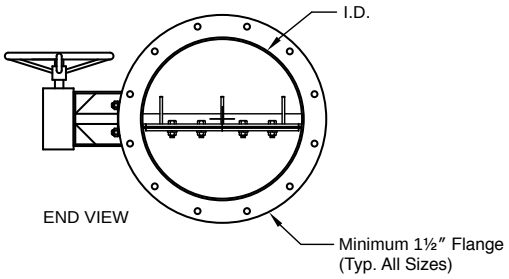
Damper Size
(see chart below)

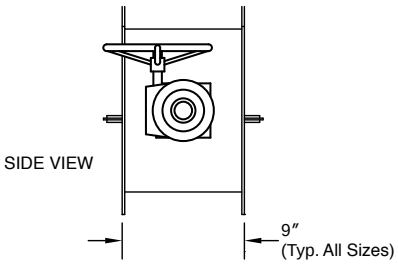
Product Information

Part Number	ID (Inches)	Diameter of Bolt Circle (Inches)	Number of Bolt Holes
DBT*-FB-304-6	5¾	8 1/16	8
DBT*-FB-304-8	7¾	10 1/16	8
DBT*-FB-304-10	9¾	12 1/16	12
DBT*-FB-304-12	11¾	14 1/16	12
DBT*-FB-304-14	13¾	16 1/16	16
DBT*-FB-304-16	15¾	18 1/16	16
DBT*-FB-304-18	17¾	20 1/16	16
DBT*-FB-304-20	19¾	22 1/16	20
DBT*-FB-304-22	21¾	24 1/16	20
DBT*-FB-304-24	23¾	26 1/16	24
DBT*-FB-304-26	25¾	28 1/16	24
DBT*-FB-304-28	27¾	30 1/16	24
DBT*-FB-304-30	29¾	32 1/16	28
DBT*-FB-304-32	31¾	34 1/16	28
DBT*-FB-304-34	33¾	36 1/16	32
DBT*-FB-304-36	35¾	38 1/16	32

**Type of Actuator.*

Note: *Dimensions shown are AAF Flanders standard.*
AAF Flanders can manufacture dampers to custom fit any existing ductwork.
Static pressure through open dampers is negligible with reasonable velocities.





High Purity

AstroSafe® KF-Series Gel Seal Non-Bag-In/Bag-Out Housings

Product Overview

- High efficiency filtration, side servicing filter housing
- Designed to give user maximum quality and performance in a non-bag-in/bag-out configuration
- Guaranteed to pass DOP and Freon in-place tests

KF1 - 1H 2W - 2 GGF - 304 - D1

Housing Series
KF1 = Non-Bag-Out Type for Gasket Seal Filters

Number of Filters High

Number of Filters Wide

Nominal Depth of Prefilter
2 = 2 inch deep Prefilter
4 = 4 inch deep Prefilter
6 = 6 inch deep Prefilter
Blank = No Prefilter

Size Designator of Primary Filter
(see chart below)

Housing Material Type
304 = Type 304 Stainless Steel (Standard)
304L = Type 304L Stainless Steel
316 = Type 316 Stainless Steel
316L = Type 316L Stainless Steel

Access Door Arrangement
D1 = One Access Door
D2 = Two Access Doors, One per Side
D3 = Two Access Doors on One Side (one for primary filter, one for prefilter)
D4 = Four Access Doors, Two on Each Side (one for primary filter, one for prefilter)

Product Information

Part Number	Height (in.)	Width (in.)	Depth (in.)	Weight (Lbs.)
KF1-1H1W-2/4/6CC-304-D1*	18	15	14	50
KF1-1H1W-2/4/6CG-304-D1*	18	27	14	60
KF1-1H1W-2/4/6GC-304-D1*	30	15	14	70
KF1-1H1W-2/4/6GG-304-D1*	30	27	14	80
KF1-1H2W-GGF/12-304-D1	30	51	25	200
KF1-1H2W-GG16-304-D1	30	51	32⅝	220
KF1-1H2W-GG18-304-D1	30	51	32⅝	225
KF1-1H2W-2/4/6GGF/12-304-D1	30	51	33¼	255
KF1-1H2W-2/4/6GG16-304-D1	30	51	41	275
KF1-1H2W-2/4/6GG18-304-D1	30	51	41	285
KF1-1H2W-2/4/6GGF/12-304-D3	30	51	37½	275
KF1-1H2W-2/4/6GG16-304-D3	30	51	45¼	295
KF1-1H2W-2/4/6GG18-304-D3	30	51	45¼	305
KF1-1H2W-2/4/6GG-304-D1*	30	51	14	100
KF1-1H3W-GGF/12-304-D1	30	75	25	265
KF1-1H3W-GG16-304-D1	30	75	32⅝	290
KF1-1H3W-GG18-304-D1	30	75	32⅝	300
KF1-1H3W-2/4/6GGF/12-304-D1	30	75	33¼	325
KF1-1H3W-2/4/6GG16-304-D1	30	75	41	350
KF1-1H3W-2/4/6GG18-304-D1	30	75	41	365
KF1-1H3W-2/4/6GG/12-304-D3	30	75	37½	360
KF1-1H3W-2/4/6GG16-304-D3	30	75	45¼	385
KF1-1H3W-2/4/6GG18-304-D3	30	75	45¼	395
KF1-1H3W-2/4/6GG-304-D1*	30	75	14	120

**These housings are designed to accommodate prefilters only.*

Part Number	Height (in.)	Width (in.)	Depth (in.)	Weight (Lbs.)
KF1-1H1W-CCD/6-304-D1**	18	15	19⅜	60
KF1-1H1W-CCF/12-304-D1	18	15	25	75
KF1-1H1W-CGF/12-304-D1	18	27	25	100
KF1-1H1W-CG16-304-D1	18	27	32⅝	110
KF1-1H1W-GCF/12-304-D1	30	15	25	105
KF1-1H1W-GC16-304-D1	30	15	32⅝	115
KF1-1H1W-GGF/12-304-D1***	30	27	25	135
KF1-1H1W-GG16-304-D1	30	27	32⅝	150
KF1-1H1W-GG18-304-D1	30	27	32⅝	155
KF1-1H1W-2/4/6CCF/12-304-D1	18	15	33¼	105
KF1-1H1W-2/4/6CGF/12-304-D1	18	27	33¼	140
KF1-1H1W-2/4/6CG16-304-D1	18	27	41	150
KF1-1H1W-2/4/6GCF/12-304-D1	30	15	33¼	140
KF1-1H1W-2/4/6GC16-304-D1	30	15	41	155
KF1-1H1W-2/4/6GGF/12-304-D1	30	27	33¼	175
KF1-1H1W-2/4/6GG16-304-D1	30	27	41	195
KF1-1H1W-2/4/6GG18-304-D1	30	27	41	200
KF1-1H1W-2/4/6CCF/12-304-D3	18	15	37½	110
KF1-1H1W-2/4/6CGF/12-304-D3	18	27	37½	150
KF1-1H1W-2/4/6CG16-304-D3	18	27	45¼	165
KF1-1H1W-2/4/6GCF/12-304-D3	30	15	37½	150
KF1-1H1W-2/4/6GC16-304-D3	30	15	45¼	265
KF1-1H1W-2/4/6GGF/12-304-D3	30	27	37½	190
KF1-1H1W-2/4/6GG16-304-D3	30	27	45¼	205
KF1-1H1W-2/4/6GG18-304-D3	30	27	45¼	210

***The D/6 in this model number represents the following model numbers:*
KF1-1H1W-CCD-304-D1 *to contain a HEPA filter*
KF1-1H1W-CC6-304-D1 *to contain a Carbon Adsorber*

****The F/12 in this model number represents the following model numbers:*
KF1-1H1W-GGF-304-D1 *to contain a HEPA filter*
KF1-1H1W-GG12-304-D1 *to contain a Carbon Adsorber*

Note: *For multi-high housings, just add the height dimension as needed.*

Filter Size Designator (HEPA Filters and Carbon Adsorbers)
Actual Filter Dimensions are Listed

HEPA Filters
†CCD 12 x 12 x 5⅞
†CCF 12 x 12 x 11½
†CGF 12 x 24 x 11½
†GCF 24 x 12 x 11½
†GGF 24 x 24 x 11½
Carbon Adsorbers
†CC6 12 x 12 x 5⅞
†CC12 12 x 12 x 11½
†CG12 12 x 24 x 11½
†GC12 24 x 12 x 11½
†GG12 24 x 24 x 11½
†CG16 12 x 24 x 16
†GC16 24 x 12 x 16
†GG16 24 x 24 x 16
†GG18 24 x 24 x 18

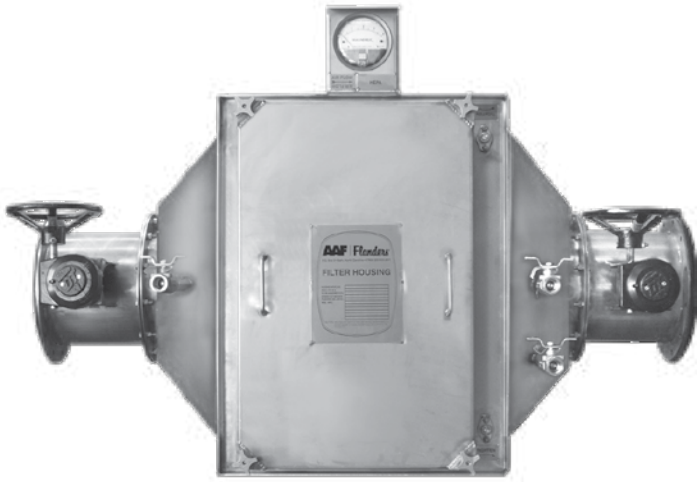
†Insert 2, 4, or 6 to indicate 2″, 4″, or 6″ prefilter track.

High Purity

AstroSafe® KG-Series Gasket Seal Non-Bag-In/Bag-Out Housings

Product Overview

- High efficiency side servicing filter housing
- Non-bag-in/bag-out configuration
- Designed for gasket seal primary filters



KG1 - 1H 2W - 2 GGF - 304 - D1

Housing Series
KF1 = Non-Bag-Out Type for Gasket Seal Filters

Number of Filters High

Number of Filters Wide

Nominal Depth of Prefilter
2 = 2 inch deep Prefilter
4 = 4 inch deep Prefilter
6 = 6 inch deep Prefilter
Blank = No Prefilter

Size Designator of Primary Filter
(see chart below)

Housing Material Type
304 = Type 304 Stainless Steel (Standard)
304L = Type 304L Stainless Steel
316 = Type 316 Stainless Steel
316L = Type 316L Stainless Steel

Access Door Arrangement
D1 = One Access Door
D2 = Two Access Doors, One per Side
D3 = Two Access Doors on One Side (one for primary filter, one for prefilter)
D4 = Four Access Doors, Two on Each Side (one for primary filter, one for prefilter)

Product Information

Part Number	Height (in.)	Width (in.)	Depth (in.)	Weight (Lbs.)
KG1-1H1W-2/4/6CC-304-D1*	18	15	14	50
KG1-1H1W-2/4/6CG-304-D1*	18	27	14	60
KG1-1H1W-2/4/6GC-304-D1*	30	15	14	70
KG1-1H1W-2/4/6GG-304-D1*	30	27	14	80
KG1-1H2W-GGF/12-304-D1	30	51	23	200
KG1-1H2W-GG16-304-D1	30	51	27½	220
KG1-1H2W-GG18-304-D1	30	51	29½	225
KG1-1H2W-2/4/6GGF/12-304-D1	30	51	31	255
KG1-1H2W-2/4/6GG16-304-D1	30	51	35½	275
KG1-1H2W-2/4/6GG18-304-D1	30	51	37½	285
KG1-1H2W-2/4/6GGF/12-304-D3	30	51	36¼	275
KG1-1H2W-2/4/6GG16-304-D3	30	51	40¾	295
KG1-1H2W-2/4/6GG18-304-D3	30	51	42¾	305
KG1-1H2W-2/4/6GG-304-D1*	30	51	14	100
KG1-1H3W-GGF/12-304-D1	30	75	23	265
KG1-1H3W-GG16-304-D1	30	75	27½	290
KG1-1H3W-GG18-304-D1	30	75	29½	300
KG1-1H3W-2/4/6GGF/12-304-D1	30	75	31	325
KG1-1H3W-2/4/6GG16-304-D1	30	75	35½	350
KG1-1H3W-2/4/6GG18-304-D1	30	75	37½	365
KG1-1H3W-2/4/6GG/12-304-D3	30	75	36½	360
KG1-1H3W-2/4/6GG16-304-D3	30	75	40¾	385
KG1-1H3W-2/4/6GG18-304-D3	30	75	42¾	395
KG1-1H3W-2/4/6GG-304-D1*	30	75	14	120

**These housings are designed to accommodate prefilters only.*

Part Number	Height (in.)	Width (in.)	Depth (in.)	Weight (Lbs.)
KG1-1H1W-CCD/6-304-D1**	18	15	17⅞	60
KG1-1H1W-CCF/12-304-D1	18	15	23	75
KG1-1H1W-CGF/12-304-D1	18	27	23	100
KG1-1H1W-CG16-304-D1	18	27	27½	110
KG1-1H1W-GCF/12-304-D1	30	15	23	105
KG1-1H1W-GC16-304-D1	30	15	27½	115
KG1-1H1W-GGF/12-304-D1***	30	27	23	135
KG1-1H1W-GG16-304-D1	30	27	27½	150
KG1-1H1W-GG18-304-D1	30	27	29½	155
KG1-1H1W-2/4/6CCF/12-304-D1	18	15	31	105
KG1-1H1W-2/4/6CGF/12-304-D1	18	27	31	140
KG1-1H1W-2/4/6CG16-304-D1	18	27	35½	150
KG1-1H1W-2/4/6GCF/12-304-D1	30	15	31	140
KG1-1H1W-2/4/6GC16-304-D1	30	15	35½	155
KG1-1H1W-2/4/6GGF/12-304-D1	30	27	31	175
KG1-1H1W-2/4/6GG16-304-D1	30	27	35½	195
KG1-1H1W-2/4/6GG18-304-D1	30	27	37½	200
KG1-1H1W-2/4/6CCF/12-304-D3	18	15	36¼	110
KG1-1H1W-2/4/6CGF/12-304-D3	18	27	36¼	150
KG1-1H1W-2/4/6CG16-304-D3	18	27	40¾	165
KG1-1H1W-2/4/6GCF/12-304-D3	30	15	36¼	150
KG1-1H1W-2/4/6GC16-304-D3	30	15	40¾	265
KG1-1H1W-2/4/6GGF/12-304-D3	30	27	36¼	190
KG1-1H1W-2/4/6GG16-304-D3	30	27	40¾	205
KG1-1H1W-2/4/6GG18-304-D3	30	27	42¾	210

***The D/6 in this model number represents the following model numbers:*
KG1-1H1W-CCD-304-D1 *to contain a HEPA filter*
KG1-1H1W-CC6-304-D1 *to contain a Carbon Adsorber*

****The F/12 in this model number represents the following model numbers:*
KG1-1H1W-GGF-304-D1 *to contain a HEPA filter*
KG1-1H1W-GG12-304-D1 *to contain a Carbon Adsorber*

Note: *For multi-high housings, just add the height dimension as needed.*

Filter Size Designator (HEPA Filters and Carbon Adsorbers) Actual Filter Dimensions are Listed
HEPA Filters
†CCD 12 x 12 x 5⅞
†CCF 12 x 12 x 11½
†CGF 12 x 24 x 11½
†GCF 24 x 12 x 11½
†GGF 24 x 24 x 11½
Carbon Adsorbers
†CC6 12 x 12 x 5⅞
†CC12 12 x 12 x 11½
†CG12 12 x 24 x 11½
†GC12 24 x 12 x 11½
†GG12 24 x 24 x 11½
†CG16 12 x 24 x 16
†GC16 24 x 12 x 16
†GG16 24 x 24 x 16
†GG18 24 x 24 x 18

†Insert 2, 4, or 6 to indicate 2″, 4″, or 6″ prefilter track.

Gas-Phase Products

Gas-Phase

SAAF™ Cassette Cleanroom Grade

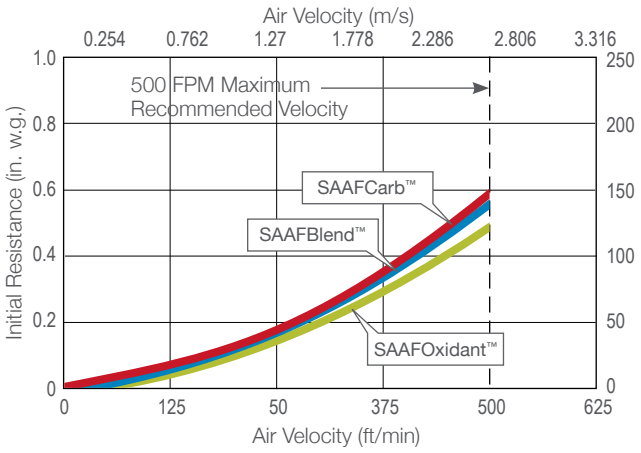
Product Overview

- One-piece construction reduces bypass
- Form and fit unlike any other 12″-deep, 1″ gas filtration cassette
- Improved fit and sealing, even when deployed in older cassette holding systems
- Designed to enhance media utilization
- Constructed without glue to eliminate problems from spills, offgassing, bypass, and leakage
- Patented cassette design and manufacturing process patents covered under US 7,588,629 B2
- Filled cassettes UL Classified

Specifications

Filter Depth	12″
Media Type	Chemical
Frame Material	High Impact Polystyrene (HIPS)
Special Size Available	No

Initial Resistance vs. Airflow Capacity



Product Information

Part Number	Nominal Size Inches (W x H x D)	Media Type	Std. Pkg. Qty. per Box	Shipping Wt. Lbs. per Box (± 12%)
3024155-002	12 x 24 x 12	SAAFOxidant	1	28.0
3024155-003	12 x 24 x 12	SAAFCarb	1	30.0
3024155-004	12 x 24 x 12	SAAFCarb MA	1	30.0
3024155-005	12 x 24 x 12	SAAFCarb MB	1	30.0
3024155-007	12 x 24 x 12	SAAFBlend GP	1	30.0
3024155-008	12 x 24 x 12	SAAFBlend WS	1	29.0
3024155-009	12 x 24 x 12	SAAFCarb MA.HT	1	30.0
3024155-012	12 x 24 x 12	SAAFOxidant SC	1	28.0
3024155-013	12 x 24 x 12	SAAFBlend GP SC	1	30.0

Gasket kits for installation into side access housings also available upon request.

Gas-Phase

SAAF™ Cassette Heavy Duty

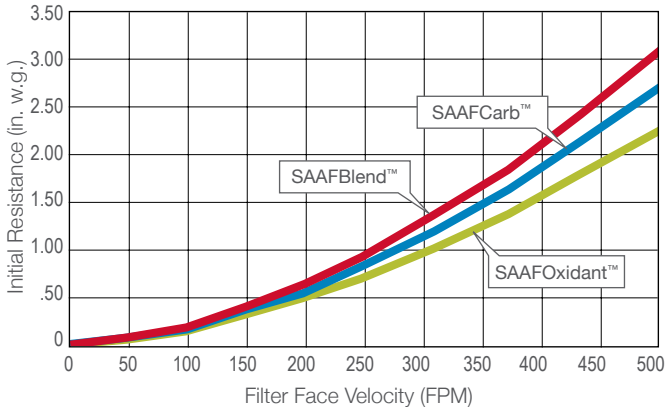
Product Overview

- Form and fit unlike any other 12″-deep, 3″ gas filtration cassette
- Improved fit and sealing, even when deployed in older cassette holding systems
- Designed to enhance media utilization
- Constructed without glue to eliminate problems from spills, offgassing, bypass, and leakage
- Patented cassette design and manufacturing process patents covered under US 7,588,629 B2
- Filled cassettes are UL Classified

Specifications

Filter Depth	12″
Media Type	Chemical
Frame Material	High impact polystyrene (HIPS)
Special Size Available	No

Initial Resistance vs. Filter Face Velocity



Product Information

Part Number	Nominal Size Inches (W x H x D)	Media Type	Std. Pkg. Qty. per Box	Shipping Wt. Lbs. per Box (± 12%)
3024130-002	12 x 24 x 12	SAAFOxidant	1 set	42.0
3024130-003	12 x 24 x 12	SAAFCarb	1 set	47.0
3024130-004	12 x 24 x 12	SAAFCarb MA	1 set	47.0
3024130-005	12 x 24 x 12	SAAFCarb MB	1 set	47.0
3024130-007	12 x 24 x 12	SAAFBlend GP	1 set	47.0
3024130-008	12 x 24 x 12	SAAFBlend WS	1 set	45.0
3024130-009	12 x 24 x 12	SAAFCarb MA.HT	1 set	47.0
3024130-012	24 x 12 x 12	SAAFOxidant SC	1 set	42.0
3024130-013	24 x 12 x 12	SAAFBlend GP SC	1 set	47.0

Gasket kits for installation into side access housings also available upon request.

Gas-Phase

SAAF™ Cassette Medium Duty

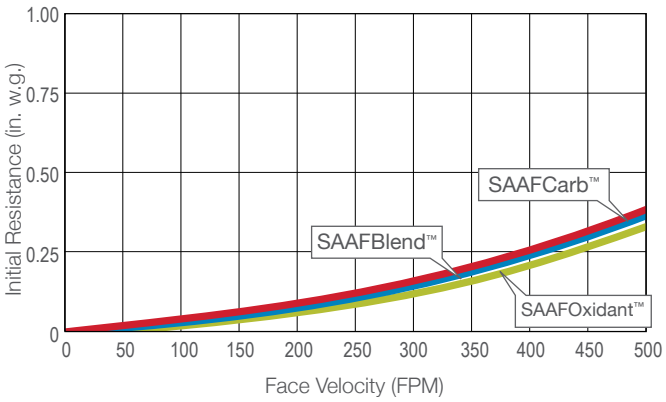
Product Overview

- Form and fit unlike any other 18″-deep, 1″ gas filtration cassette
- Improved fit and sealing, even when deployed in older cassette holding systems
- Designed to enhance media utilization
- Constructed without glue to eliminate problems from spills, offgassing, bypass, and leakage
- Patented cassette design and manufacturing process patents covered under US 7,588,629 B2
- Filled cassettes are UL Classified

Specifications

Filter Depth	18″
Media Type	Chemical
Frame Material	High impact polystyrene (HIPS)
Special Size Available	No

Initial Resistance vs. Face Velocity



Product Information

Part Number	Nominal Size Inches (W x H x D)	Media Type	Std. Pkg. Qty. per Box	Shipping Wt. Lbs. per Box (± 12%)
3024148-002	6 x 24 x 18	SAAFOxidant	1 set	25.0
3024148-003	6 x 24 x 18	SAAFCarb	1 set	27.0
3024148-004	6 x 24 x 18	SAAFCarb MA	1 set	27.0
3024148-005	6 x 24 x 18	SAAFCarb MB	1 set	27.0
3024148-007	6 x 24 x 18	SAAFBlend GP	1 set	27.0
3024148-008	6 x 24 x 18	SAAFBlend WS	1 set	26.0
3024148-009	6 x 24 x 18	SAAFCarb MA.HT	1 set	27.0
3024148-012	6 x 24 x 18	SAAFOxidant SC	1 set	25.0
3024148-013	6 x 24 x 18	SAAFBlend GP SC	1 set	27.0

Gasket kits for installation into side access housings also available upon request.

Gas-Phase

SAAFBlend™ GP

Product Overview

- Targets reactive compounds and volatile organic compounds
- Removes toxic and impure gases by physical adsorption
- Equal volumetric mix of SAAFOxidant™ and SAAFCarb™ media
- Suitable for use in commercial and industrial applications
- Accurate service life testing
- Target contaminants include:
  - Formaldehyde
  - Hydrocarbons (VOCs)
  - Hydrogen sulfide
  - Lower molecular weight aldehydes and organic acids
  - Nitric oxide
  - Nitrogen dioxide
  - Sulfur dioxide

Specifications

SAAFOxidant™ Media Fraction	
Apparent Density	0.8 g/cc +/- 10%
Crush Strength	25 N minimum
$KMnO_4$ Content	8 wt % minimum
Nominal Diameter	4 mm
Shape	Sphere

SAAFCarb™ Media Fraction	
Apparent Density	0.8 g/cc +/- 10%
Carbon Description	Virgin
Raw Material	Coal
CTC	60 wt % minimum
Hardness	95% minimum
Nominal Diameter	4 mm
Shape	Cylindrical pellet

Product Information

Part Number	Media Type	Media Wgt. per Container (Lbs.)	Shipping Container Volume (Cubic Feet)
Cubic Foot Containers			
395-914-001	SAAFBlend GP (50/50 Mix)	43	1.2
NOTE: All media packaged in Cubic Foot Containers is sold per container. Containers cannot be broken.			
Large Super Sack Containers			
395-913-001	SAAFBlend GP (50/50 Mix)	1100	27.5
NOTE: All media packaged in Large Super Sack Containers is sold per pound. The weights should be sold in multiples of the container weight.			

Gas-Phase

SAAFBlend™ GP SC

Product Overview

- Targets reactive compounds and volatile organic compounds
- Accurate service life testing
- Equal volumetric mix of SAAFOxidant™ SC and SAAFCarb™ media
- Suited for use in commercial and industrial applications
- Target contaminants include:
  - Formaldehyde
  - Hydrocarbons (VOCs)
  - Hydrogen sulfide
  - Lower molecular weight aldehydes and organic acids
  - Nitric oxide
  - Nitrogen dioxide
  - Sulfur dioxide

Specifications

SAAFOxidant™ Media Fraction	
Apparent Density	0.8 g/cc +/- 10%
Crush Strength	25 N minimum
$KMnO_4$ Content	4 wt % minimum
Nominal Diameter	4 mm
Shape	Sphere

SAAFCarb™ Media Fraction	
Apparent Density	0.5 g/cc +/- 10%
Carbon Description	Virgin
Raw Material	Coal
CTC	60 wt % minimum
Hardness	95% minimum
Nominal Diameter	4 mm
Shape	Cylindrical pellet

Product Information

Part Number	Media Type	Media Wgt. per Container (Lbs.)	Shipping Container Volume (Cubic Feet)
Cubic Foot Containers			
395-914-003	SAAFBlend GP SC (50/50 Mix)	43	1.2
NOTE: All media packaged in Cubic Foot Containers is sold per container. Containers cannot be broken.			
Large Super Sack Containers			
395-913-003	SAAFBlend GP SC (50/50 Mix)	1100	27.5
NOTE: All media packaged in Large Super Sack Containers is sold per pound. The weights should be sold in multiples of the container weight.			

Gas-Phase

SAAFOxidant™

Product Overview

- Removes and holds contaminants by chemical conversion
- Non-flammable and non-toxic
- Accurate service life testing
- Does not support bacterial and fungal growth
- Patented high capacity formulation
- UL Classified

Specifications

Apparent Density	0.8 g/cc +/- 10%
Crush Strength	25 N minimum
$KMnO_4$ Content	8 wt % minimum
Nominal Diameter	4 mm
Shape	Sphere

Product Information

Part Number	Media Type	Media Wgt. per Container (Lbs.)	Shipping Container Volume (Cubic Feet)
Cubic Foot Containers			
395-914-100	SAAFOxidant	50	1.2
NOTE: All media packaged in Cubic Foot Containers is sold per container. Containers cannot be broken.			
Large Super Sack Containers			
033-050-021	SAAFOxidant	1100	22.0
NOTE: All media packaged in Large Super Sack Containers is sold per pound. The weights should be sold in multiples of the container weight.			

Gas-Phase

SAAFOxidant™ SC

Product Overview

- Removes and holds contaminants by chemical conversion
- Non-flammable and non-toxic
- Accurate service life testing
- Does not support bacterial and fungal growth
- Easy disposal by landfill
- Patented formulation
- UL Classified

Specifications

Apparent Density	0.8 g/cc +/- 10%
Crush Strength	25 N minimum
$KMnO_4$ Content	4 wt % minimum
Nominal Diameter	4 mm
Shape	Sphere

Product Information

Part Number	Media Type	Media Wgt. per Container (Lbs.)	Shipping Container Volume (Cubic Feet)
Cubic Foot Containers			
395-914-110	SAAFOxidant SC	50	1.2
NOTE: All media packaged in Cubic Foot Containers is sold per container. Containers cannot be broken.			
Large Super Sack Containers			
033-050-022	SAAFOxidant SC	1100	22.0
NOTE: All media packaged in Large Super Sack Containers is sold per pound. The weights should be sold in multiples of the container weight.			

Gas-Phase

SAAFCarb™

Product Overview

- Pelletized activated carbon media that removes toxic and impure contaminants from the atmosphere
- Quick and easy media changeovers
- Resists a wide range of impure gases
- Low pressure drop and high adsorptive capacity

Specifications

Apparent Density	0.5 g/cc +/- 10%
Carbon Description	Virgin
Raw Material	Coal
CTC	60 wt % minimum
Hardness	95% minimum
Nominal Diameter	4 mm
Shape	Cylindrical pellet

Product Information

Part Number	Media Type	Media Wgt. per Container (Lbs.)	Shipping Container Volume (Cubic Feet)
Cubic Foot Containers			
395-914-200	SAAFCarb	30	1.2
NOTE: All media packaged in Cubic Foot Containers is sold per container. Containers cannot be broken.			
Large Super Sack Containers			
395-913-200	SAAFCarb	1100	36.7
NOTE: All media packaged in Large Super Sack Containers is sold per pound. The weights should be sold in multiples of the container weight.			
Special Containers			
395-919-200	SAAFCarb (50-lb bag)	50	1.7
NOTE: All media packaged in Special Containers is sold per pound. Containers cannot be broken.			

Gas-Phase

SAAFCarb™ MA

Product Overview

- Manufactured exclusively for acidic corrosive environments
- Targeted contaminant removal capacity for acid gases
- Provides extended equipment protection with infrequent media changeovers
- Compatible for use in all carbon-based air filtration systems
- Low pressure drop and high adsorptive capacity

Specifications

Apparent Density	0.6 g/cc (~37 lb/ft^3) +/- 10%
Carbon Description	Impregnated
Raw Material	Coal
CTC	60 wt % minimum
H_2S gas capacity	0.12-0.15 g H_2S/cc media
Hardness	95% minimum
Nominal Diameter	4 mm
Shape	Cylindrical pellet

Product Information

Part Number	Media Type	Media Wgt. per Container (Lbs.)	Shipping Container Volume (Cubic Feet)
Cubic Foot Containers			
395-914-300	SAAFCarb MA	34	1.2
NOTE: All media packaged in Cubic Foot Containers is sold per container. Containers cannot be broken.			
Large Super Sack Containers			
395-913-300	SAAFCarb MA	1100	31.5
NOTE: All media packaged in Large Super Sack Containers is sold per pound. The weights should be sold in multiples of the container weight.			
Special Containers			
395-919-300	SAAFCarb MA (50-lb bag)	50	1.5
NOTE: All media packaged in Special Containers is sold per pound. Containers cannot be broken.			

Gas-Phase

SAAFCarb™ MC

Product Overview

- Targeted contaminant removal for chlorine
- Provides extended equipment protection with infrequent media changeovers
- Compatible for use in all carbon-based air filtration systems
- Low pressure drop and high adsorptive capacity

Specifications

Apparent Density	0.6 g/cc (~37 lb/ft^3) +/- 10%
Carbon Description	Impregnated
Cl2 Gas Capacity	0.04 g Cl_2 / cc Carbon +/- 10%
CTC	60 wt % minimum
Hardness	95% minimum
Nominal Diameter	4 mm
Shape	Cylindrical pellet

Product Information

Part Number	Media Type	Media Wgt. per Container (Lbs.)	Shipping Container Volume (Cubic Feet)
Cubic Foot Containers			
395-914-500	SAAFCarb MC	34	1.2
NOTE: All media packaged in Cubic Foot Containers is sold per container. Containers cannot be broken.			
Large Super Sack Containers			
395-913-500	SAAFCarb MC	1100	31.5
NOTE: All media packaged in Large Super Sack Containers is sold per pound. The weights should be sold in multiples of the container weight.			

Gas-Phase

SAAFCarb™ MB

Product Overview

- Provides effective removal of ammonia gas
- Effective removal of Volatile Organic Compounds (VOCs)
- Low pressure drop
- Specifically impregnated media

Specifications

Apparent Density	0.6 g/cc (~37 lb/ft^3) +/- 15%
Carbon Description	Impregnated
Cl2 Gas Capacity	Coal
CTC	60 wt % minimum
Hardness	95% minimum
Nominal Diameter	4 mm
Shape	Cylindrical pellet

Product Information

Part Number	Media Type	Media Wgt. per Container (Lbs.)	Shipping Container Volume (Cubic Feet)
Cubic Foot Containers			
395-914-400	SAAFCarb MB	34	1.2
NOTE: All media packaged in Cubic Foot Containers is sold per container. Containers cannot be broken.			
Large Super Sack Containers			
395-913-400	SAAFCarb MB	1100	31.5
NOTE: All media packaged in Large Super Sack Containers is sold per pound. The weights should be sold in multiples of the container weight.			

Gas-Phase

SAAFCarb™ MA.HT

Product Overview

- High capacity, chemical media targeted for H_2S removal
- Provides extended equipment protection with infrequent media changeovers
- Compatible for use in all carbon-based air filtration systems
- Low pressure drop and high adsorptive capacity

Specifications

Apparent Density	0.42 g/cc (~26 lb/ft^3) +/- 10%
Carbon Description	Non-Impregnated
CTC	60 wt % minimum
H_2S Gas Capacity	0.28 g H_2S/cc media +/- 10%
Hardness	95% minimum
Nominal Diameter	4 mm
Shape	Cylindrical pellet

Product Information

Part Number	Media Type	Media Wgt. per Container (Lbs.)	Shipping Container Volume (Cubic Feet)
Cubic Foot Containers			
395-914-800	SAAFCarb MA.HT	28	1.2
NOTE: All media packaged in Cubic Foot Containers is sold per container. Containers cannot be broken.			
Large Super Sack Containers			
395-913-800	SAAFCarb MA.HT	1100	39.3
NOTE: All media packaged in Large Super Sack Containers is sold per pound. The weights should be sold in multiples of the container weight.			

Gas-Phase

SAAFBlend™ WS

Product Overview

- Targets acidic gases, volatile organic compounds, reactive molecular weight organics
- Accurate service life testing
- Equal volumetric mix of SAAFOxidant,™ SAAFCarb,™ and SAAFCarb™ MA media
- Target contaminants include:
  - Formaldehyde
  - Hydrocarbons (VOCs)
  - Hydrogen sulfide
  - Lower molecular weight aldehydes and organic acids
  - Nitric oxide
  - Nitrogen dioxide
  - Sulfur dioxide

Specifications

SAAFOxidant™ Media Fraction	
Apparent Density	0.8 g/cc +/- 10%
Crush Strength	25 N minimum
$KMnO_4$ Content	8 wt % minimum
Nominal Diameter	4 mm
Shape	Sphere

SAAFCarb™ MA Media Fraction	
Apparent Density	0.6 g/cc +/- 10%
Carbon Description	Impregnated
Raw Material	Coal
CTC	60 wt % minimum
H_2S Gas Capacity	0.12-0.15 g H_2S/cc media
Hardness	95% minimum
Nominal Diameter	4 mm
Shape	Cylindrical pellet

SAAFCarb™ Media Fraction	
Apparent Density	0.5 g/cc +/- 10%
Carbon Description	Virgin
Raw Material	Coal
CTC	60 wt % minimum
Hardness	95% minimum
Nominal Diameter	4 mm
Shape	Cylindrical pellet

Product Information

Part Number	Media Type	Media Wgt. per Container (Lbs.)	Shipping Container Volume (Cubic Feet)
Cubic Foot Containers			
395-914-002	SAAFBlend WS (33/33/33 Mix)	40	1.2
NOTE: All media packaged in Cubic Foot Containers is sold per container. Containers cannot be broken.			
Large Super Sack Containers			
395-913-002	SAAFBlend WS (33/33/33 Mix)	1100	29.7
NOTE: All media packaged in Large Super Sack Containers is sold per pound. The weights should be sold in multiples of the container weight.			

Gas-Phase

VariSorb® XL15

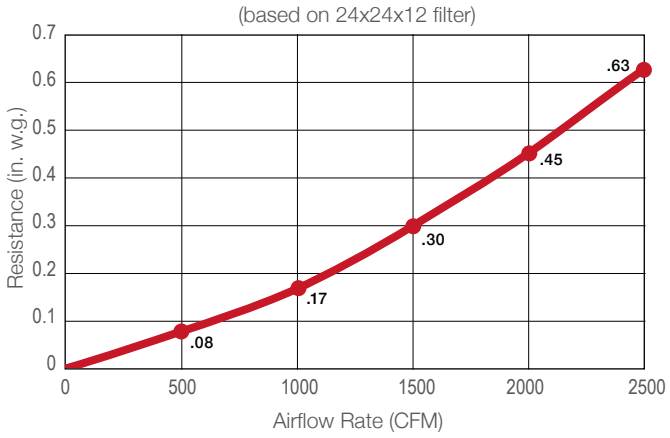
Product Overview

- A complete solution to Indoor Air Quality (IAQ) by providing high level filtration of both odors and particulates
- Directly replaces existing 12″ deep single header filters, adding odor control and/or upgrading particulate filtration without requiring new hardware
- Highest activity carbon for most odor/contaminant adsorption
- Minipleat design for low resistance and energy savings, allows for upgrade to chemical filtration without adding resistance
- Higher Dust Holding Capacity (DHC) and higher molecular contaminant efficiency than any similar dual purpose filter produced today
- Lighter weight than any competitive dual purpose filter, for additional savings on operating costs
- Completely incinerable, no metal components
- MERV 15 particulate efficiency

Specifications

Efficiency	MERV 15
Filter Depth	12″
Media Type	Synthetic w Embedded Carbon
Frame Material	HIPS & ABS Plastic
Special Size Available	No
Header Style	Single
Max Operating Temperature	130˚F (54˚C)

Initial Resistance vs. Airflow



Product Information

Part Number	Nominal Size Inches (W x H x D)	Actual Size Inches (W x H x D)	Std. Pkg. Qty. per Box	Shipping Wt. Lbs. per Box (± 12%)	Cubic Ft.
Ungasketed					
3100465-001	24 x 12 x 12	23⅜ x 11⅜ x 11½	1	9.1	2.2
3100465-002	24 x 20 x 12	23⅜ x 19⅜ x 11½	1	14.9	3.6
3100465-003	24 x 24 x 12	23⅜ x 23⅜ x 11½	1	17.8	4.3
3100465-008	20 x 20 x 12	19⅜ x 19⅜ x 11½	1	12.5	3.6
Gasket on Air Leaving Side					
3100465-004	24 x 12 x 12	23⅜ x 11⅜ x 11½	1	9.2	2.2
3100465-005	24 x 20 x 12	23⅜ x 19⅜ x 11½	1	15.0	3.6
3100465-006	24 x 24 x 12	23⅜ x 23⅜ x 11½	1	17.9	4.3
3100465-007	20 x 20 x 12	19⅜ x 19⅜ x 11½	1	12.5	3.6

Gas-Phase

VariSorb® XL

Product Overview

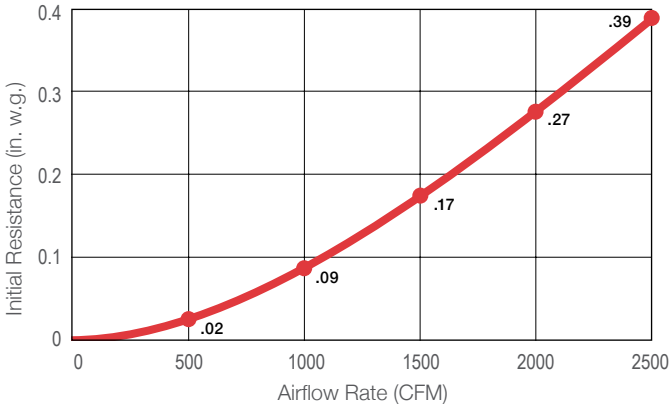
- Highest activity carbon media for superior Indoor Air Quality (IAQ)
- Effective removal of most common urban contaminants, including So_x, No_x, Ozone, and Volatile Organic Compounds (VOCs)
- Small granule carbon ensures a much higher efficiency per pound than media used in deep bed adsorbers
- Carbon media is securely bonded to synthetic fibers, nearly eliminating dusting
- Designed to minimize pressure drop
- Metal free design will not rust or corrode, and is fully incinerable

Specifications

Filter Depth	12″
Media Type	Synthetic w/ Carbon Embedded
Frame Material	HIPS & ABS Plastic
Special Size Available	No
Header Style	Single
Max Operating Temperature	130˚F (54˚C)

Initial Resistance vs. Airflow

(based on 24 x 24 x 12 filter)



Product Information

Part Number	Nominal Size Inches (W x H x D)	Actual Size Inches (W x H x D)	Std. Pkg. Qty. per Box	Shipping Wt. Lbs. per Box (± 12%)	Cubic Ft.
Ungasketed					
3039567-001	24 x 12 x 12	23⅜ x 11⅜ x 11½	1	11.0	2.2
3039567-002	24 x 20 x 12	23⅜ x 19⅜ x 11½	1	17.0	3.6
3039567-003	24 x 24 x 12	23⅜ x 23⅜ x 11½	1	20.0	4.3
3039567-008	20 x 20 x 12	19⅜ x 19⅜ x 11½	1	12.5	3.6
Gasket on Air Leaving Side					
3039567-004	24 x 12 x 12	23⅜ x 11⅜ x 11½	1	11.0	2.2
3039567-005	24 x 20 x 12	23⅜ x 19⅜ x 11½	1	17.0	3.6
3039567-006	24 x 24 x 12	23⅜ x 23⅜ x 11½	1	20.0	4.3
3039567-007	20 x 20 x 12	19⅜ x 19⅜ x 11½	1	12.5	3.6

Gas-Phase

VariSorb® HC

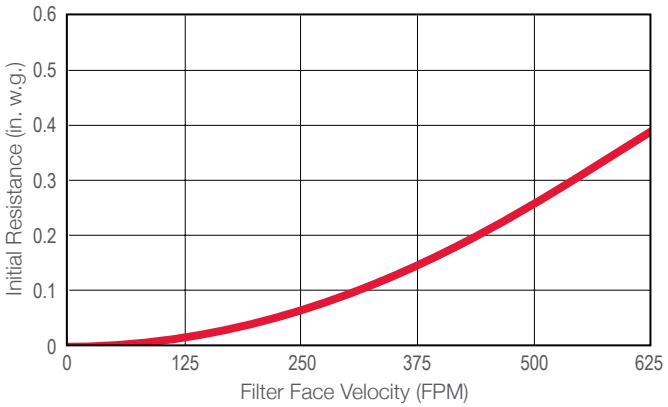
Product Overview

- High chemical media content for superior Indoor Air Quality (IAQ)
- Three types of carbon media available to specifically target contaminants and odors:
  - SAAFCarb: removes Volatile Organic Compounds (VOCs), hydrocarbons, and diesel/jet fuel fumes
  - SAAFOxidant: removes H_2S, SO_x, NO_x, and formaldehyde
  - SAAFBlend GP: a 50/50 blend of the above for wide spectrum air quality control
- V-bank design minimizes pressure drop
- Honeycomb design with fine mesh to retain the media
- Metal free design will not rust or corrode, and is fully incinerable

Specifications

Filter Depth	12″
Media Type	Chemical
Frame Material	HIPS & ABS Plastic
Special Size Available	No
Header Style	Single
Max Operating Temperature	125°F (52°C)

Initial Resistance vs. Filter Face Velocity



Product Information

Part Number	Nominal Size Inches (W x H x D)	Actual Size Inches (W x H x D)	Std. Pkg. Qty. per Box	Shipping Wt. Lbs. per Box (± 12%)	Cubic Ft.
with SAAFCarb™					
411-500-319	24 x 12 x 12	23⅜ x 11⅜ x 11½	1	14.0	2.2
411-500-859	24 x 20 x 12	23⅜ x 19⅜ x 11½	1	24.0	3.6
411-500-863	24 x 24 x 12	23⅜ x 23⅜ x 11½	1	28.0	4.3
with SAAFOxidant™					
411-501-319	24 x 12 x 12	23⅜ x 11⅜ x 11½	1	18.0	2.2
411-501-859	24 x 20 x 12	23⅜ x 19⅜ x 11½	1	31.0	3.6
411-501-863	24 x 24 x 12	23⅜ x 23⅜ x 11½	1	37.0	4.3
with SAAFBlend GP™ (50/50 Mix)					
411-502-319	24 x 12 x 12	23⅜ x 11⅜ x 11½	1	16.0	2.2
411-502-859	24 x 20 x 12	23⅜ x 19⅜ x 11½	1	27.0	3.6
411-502-863	24 x 24 x 12	23⅜ x 23⅜ x 11½	1	32.0	4.3

Gas-Phase

SuperFlow® VC

Product Overview

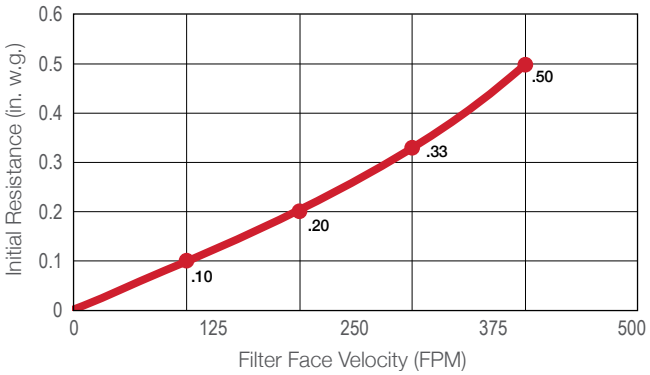
- V-bank multi panel design allows for high efficiency against odors and low pressure drop
- Five impregnated carbon blends available for targeted control of difficult contaminants
- 8-panel configuration for maximum airflow exposure to media without bypass
- Suitable for initial construction but also designed for retrofit of most existing HVAC systems, in front or side-access configurations
- Contaminants that can be adsorbed include: H_2S, acid gasses, formaldehyde, ammonia, aldehydes, amines, and more
- Easy installation and disposal, especially compared to systems with multiple separate media trays

Specifications

Filter Depth	12″
Media Type	Chemical
Frame Material	ABS Plastic w/Metal Supports
Special Size Available	No
Header Style	Single*
Max Operating Temperature	150°F (65°C)

**Double Header or Box Style (full wrap) available upon request.*

Initial Resistance vs. Filter Face Velocity



Product Information

Part Number	Nominal Size Inches (W x H x D)	Actual Size Inches (W x H x D)	Std. Pkg. Qty. per Box	Shipping Wt. Lbs. per Box (± 12%)
SFVC-*-242412	24 x 24 x 12	23⅜ x 23⅜ x 11½	1	34.0
SFVC-*-122412	12 x 24 x 12	11⅜ x 23⅜ x 11½	1	17.0
SFVC-*-202412	20 x 24 x 12	19⅜ x 23⅜ x 11½	1	25.0

*To develop a complete model number, replace the * in the above with the corresponding gas-phase media blend desired from the below table:*

Media Type	Description	Media Weight (per each 24 x 24 filter)
TS201	For adsorption of VOCs (Volatile Organic Compounds); Media produced from virgin coconut shell.	25
TS202	For control of acid and malodorous gasses	29
TS204	For control of ammonia and light organic amines	28
TS205	For control of aldehydes	29
TS209	Blended media for universal adsorption of both acid and alkaline gasses/vapors.	32

For example: Model number SFVC-TS201-242412 would be a 24x24x12 filter with media for control of VOCs.

Polyfoam gasketing material shipped loose with each filter, standard. Additional available options include: "SuperFlow VC Light" with 75% media fill, Preinstalled gasketing (upstream or on both sides), Box style full metal wrap, double header frame style, or downstream media wrap (dusting sack). Contact your local AAF Flanders representative for details.

Gas-Phase

VaporClean®

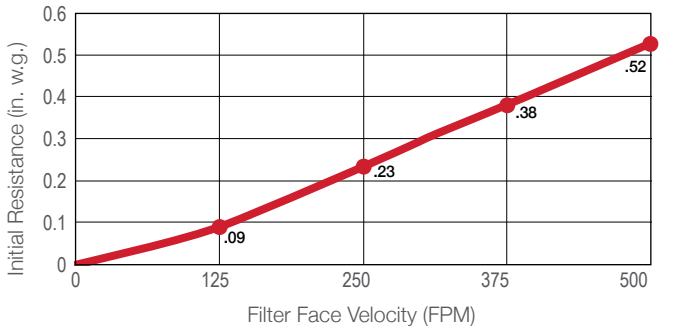
Product Overview

- Designed for removal of molecular contaminants at low concentration levels
- Utilizes Dry Processed Carbon Composite media (DPCC) for high efficiency removal of multiple contaminants
- Five impregnated carbon blends available for targeted control of difficult contaminants
- Maximized chemical media surface area and consistent distribution
- Non-dusting design with carbon media granules bonded to polyester fibers
- Low initial pressure drop

Specifications

Filter Depth	12″
Media Type	Chemical
Frame Material	Galvanized Steel
Special Size Available	No
Header Style	Single, Box Style
Max Operating Temperature	120°F (49°C)

Initial Resistance vs. Filter Face Velocity



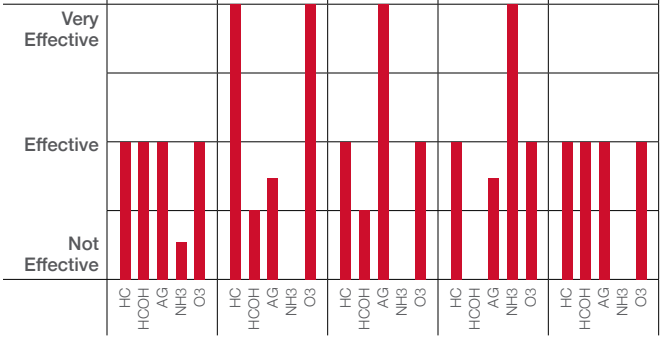
Product Information

Part Number	Nominal Size Inches (W x H x D)	Actual Size Inches (W x H x D)	Std. Pkg. Qty. per Box
Box Style Frame			
VC-*-16-00-2424-00	24 x 24 x 12	23⅜ x 23⅜ x 11½	1
VC-*-16-00-1224-00	12 x 24 x 12	11⅜ x 23⅜ x 11½	1
VC-*-16-00-2024-00	20 x 24 x 12	19⅜ x 23⅜ x 11½	1
Single Header Style			
VC-*-16-01-2424-00	24 x 24 x 12	23⅜ x 23⅜ x 11½	1
VC-*-16-01-1224-00	12 x 24 x 12	11⅜ x 23⅜ x 11½	1
VC-*-16-01-2024-00	20 x 24 x 12	19⅜ x 23⅜ x 11½	1

Available options include gasketing (upstream, downstream or both sides), and alternate frame materials. Contact your local AAF Flanders representative for details.

*To develop a complete model number, replace the * in the above with the corresponding gas-phase media blend desired from the below table:*

Available VaporClean media blends and effectiveness vs. various contaminants



Contaminant Matching
Match the VaporClean media type to the contaminant of concern

HC	Hydrocarbons
HCOH	Formaldehyde
AG	Acid Gases
NH_3	Ammonia
O_3	Ozone

Media Type	Effective Against	Typical Application
1501	VOCs, Acid and Alkaline Gasses	Diesel Exhaust, Cooking Odors
1073	Acid Gasses	Museums, Document Storage
1075	Wide-Spectrum of VOCs and acids	Sewer Odors
1076	Hydrocarbons, Ozone	Corrosive Environments
1090	Alkaline Gasses	Animal Odors

VaporClean® is a registered trademark of Flanders Corporation in the U.S.

Gas-Phase

VariCel® RF/C & RF/C+SAAFOxi

Product Overview

- Offers both particulate and gaseous contaminant removal
- Two types available:
  - Varicel RF/C: removes Volatile Organic Compounds (VOCs), hydrocarbons, and diesel/jet fuel fumes
  - Varicel RF/C+SAAFOxi: removes the above along with H_2S, SO_x, NO_x, and formaldehyde
- Galvanized steel construction withstands the most demanding conditions
- Media pack designed to maximize effectiveness and service life
- Directly replaces existing 12″ deep single header filters, adding odor control without requiring new hardware

Specifications

Efficiency	MERV 8
Filter Depth	12″
Media Type	Chemical
Frame Material	Galvanized Steel
Special Size Available	No
Header Style	Single, Box Style
Max Operating Temperature	125°F (52°C)
Air Filtration Certification	UL 900, ULC-S111

Product Information

Part Number	Nominal Size Inches (W x H x D)	Actual Size Inches (W x H x D)	Std. Pkg. Qty. per Box	Shipping Wt. Lbs. per Box (± 12%)	Media Area (Sq. Ft.)	Media Weight (Lbs. per Filter)
VariCel® RF/C – No Header with Carbon						
185-100-319	12 x 24 x 12	11⅞ x 23⅜ x 11½	2	24.0	29.0	3.8
185-100-700	20 x 20 x 12	19⅜ x 19⅜ x 11½	1	13.7	39.9	5.3
185-100-782	20 x 24 x 12	19⅜ x 23⅜ x 11½	1	15.3	48.3	6.4
185-100-863	24 x 24 x 12	23⅜ x 23⅜ x 11½	1	17.5	58.7	7.8
VariCel® RF/C Type SH – Single Header with Carbon						
185-101-319	12 x 24 x 12	11⅞ x 23⅜ x 11½	2	23.2	26.0	3.4
185-101-700	20 x 20 x 12	19⅜ x 19⅜ x 11½	1	13.9	35.4	4.7
185-101-782	20 x 24 x 12	19⅜ x 23⅜ x 11½	1	15.8	43.4	5.7
185-101-863	24 x 24 x 12	23⅜ x 23⅜ x 11½	1	18.0	52.6	7.0
VariCel® RF/C+SAAFOxi - No Header with 50/50 Blend						
185-110-319	12 x 24 x 12	11⅞ x 23⅜ x 11½	2	26.4	26.0	4.8
185-110-700	20 x 20 x 12	19⅜ x 19⅜ x 11½	1	15.2	39.9	6.6
185-110-782	20 x 24 x 12	19⅜ x 23⅜ x 11½	1	17.1	48.3	8.0
185-110-863	24 x 24 x 12	23⅜ x 23⅜ x 11½	1	19.8	58.7	9.7
VariCel® RF/C+SAAFOxi Type SH - Single Header with 50/50 Blend						
185-111-319	12 x 24 x 12	11⅞ x 23⅜ x 11½	2	23.4	26.0	4.3
185-111-700	20 x 20 x 12	19⅜ x 19⅜ x 11½	1	15.2	35.4	5.9
185-111-782	20 x 24 x 12	19⅜ x 23⅜ x 11½	1	17.3	43.4	7.2
185-111-863	24 x 24 x 12	23⅜ x 23⅜ x 11½	1	19.7	52.0	8.6

Gas-Phase

AmAir®/C Family of Filters

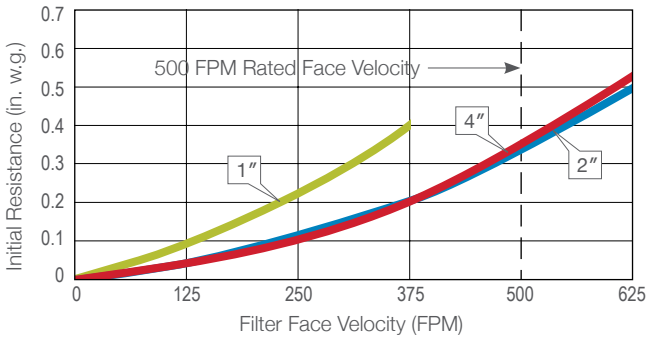
Product Overview

- Easy and economical solution to many gaseous contaminant problems
- High chemical media density yields superior odor control
- MERV 7 particulate efficiency
- Directly replaces existing 1″, 2″, or 4″ filters, adding odor control without requiring new hardware
- Controls odors and removes corrosive elements from the airstream
- Three types of carbon media available to specifically target certain contaminants and odors

Specifications

Efficiency	MERV 7
Filter Depth	1″, 2″, 4″
Media Type	Chemical
Frame Material	Beverage Board
Special Size Available	Yes
Max Operating Temperature	120˚F (49˚C)
Air Filtration Certification	UL 900

Initial Resistance vs. Filter Face Velocity



Product Information

Part Number	Nominal Size Inches (W x H x D)	Actual Size Inches (W x H x D)	Rated Airflow Capacity (CFM)	Std. Pkg. Qty. per Carton	Shipping Wt. Lbs. per Box (± 7%)	Cubic Ft.	Carbon Density
C-1 Pleated Carbon Filters (1″) – 100 Carbon Density							
182-111-319	12 x 24 x 1	11⅜ x 23⅜ x ⅞	1,000	12	8.5	2.0	100
182-111-500	16 x 20 x 1	15½ x 19½ x ⅞	1,100	12	9.5	2.2	100
182-111-600	16 x 25 x 1	15½ x 24½ x ⅞	1,400	12	11.0	2.8	100
182-111-700	20 x 20 x 1	19½ x 19½ x ⅞	1,400	12	11.5	2.8	100
182-111-782	20 x 24 x 1	19⅜ x 23⅜ x ⅞	1,650	12	12.0	3.3	100
182-111-800	20 x 25 x 1	19½ x 24½ x ⅞	1,750	12	12.5	3.5	100
182-111-863	24 x 24 x 1	23⅜ x 23⅜ x ⅞	2,000	12	14.0	4.0	100
C-2 Pleated Carbon Filters (2″) – 200 Carbon Density							
182-122-319	12 x 24 x 2	11⅜ x 23⅜ x 1¾	1,000	6	9.9	2.0	200
182-122-500	16 x 20 x 2	15½ x 19½ x 1¾	1,100	6	11.0	2.2	200
182-122-600	16 x 25 x 2	15½ x 24½ x 1¾	1,400	6	14.5	2.8	200
182-122-700	20 x 20 x 2	19½ x 19½ x 1¾	1,400	6	13.9	2.8	200
182-122-782	20 x 24 x 2	19⅜ x 23⅜ x 1¾	1,650	6	15.6	3.3	200
182-122-800	20 x 25 x 2	19½ x 24½ x 1¾	1,750	6	16.3	3.5	200
182-122-863	24 x 24 x 2	23⅜ x 23⅜ x 1¾	2,000	6	18.5	8.0	200
C-3 Pleated Carbon Filters (4″) – 300 Carbon Density							
182-134-319	12 x 24 x 4	11⅜ x 23⅜ x 3⅝	1,000	3	7.9	2.0	300
182-134-500	16 x 20 x 4	15⅜ x 19⅜ x 3⅝	1,100	3	8.5	2.2	300
182-134-600	16 x 25 x 4	15⅜ x 24⅜ x 3⅝	1,400	3	10.0	2.8	300
182-134-700	20 x 20 x 4	19⅜ x 19⅜ x 3⅝	1,400	3	12.2	2.8	300
182-134-800	20 x 25 x 4	19⅜ x 24⅜ x 3⅝	1,750	3	16.5	3.3	300
182-134-859	24 x 20 x 4	23⅜ x 19⅜ x 3⅝	1,650	3	15.5	3.5	300
182-134-863	24 x 24 x 4	23⅜ x 23⅜ x 3⅝	2,000	3	19.0	4.0	300
C-3 Panel Fillers (2″) – 300 Carbon Density							
182-032-319	12 x 24 x 2	11⅜ x 23⅜ x 1¾	1,000	6	12.0	2.0	300
182-032-500	16 x 20 x 2	15½ x 19½ x 1¾	1,100	6	13.4	2.2	300
182-032-600	16 x 25 x 2	15½ x 24½ x 1¾	1,400	6	15.7	2.8	300
182-032-700	20 x 20 x 2	19½ x 19½ x 1¾	1,400	6	15.7	0.8	300
182-032-782	20 x 24 x 2	19⅜ x 23⅜ x 1¾	1,650	6	18.2	3.3	300
182-032-800	20 x 25 x 2	19½ x 24½ x 1¾	1,750	6	18.7	3.5	300
182-032-863	24 x 24 x 2	23⅜ x 23⅜ x 1¾	2,000	6	21.4	4.0	300

AmAir/C media also available in media pads and ring panels. Pleated filters may also be ordered with Activated Alumina (AmAir/SAAFOxi) or 50/50 blended (AmAir/C+SAAFOxi) media. Special sizes available upon request. Contact your local AAF Flanders representative for more information.

Gas-Phase

FCP Carbon Pleat

Product Overview

- Maximum carbon surface area to optimize efficiency and available capacity
- Media with exceptional adhesion of carbon granules to preclude dusting
- Far superior performance to filters made with carbon slurry media
- Directly replaces existing 2″ or 4″ filters, adding odor control without requiring new hardware
- Three types of carbon media available to specifically target certain contaminants and odors
- High capacity option available in each type

Specifications

Filter Depth	2″, 4″
Media Type	Chemical
Frame Material	Beverage Board
Special Size Available	No
Max Operating Temperature	120°F (49°C)

Product Information

Part Number	Nominal Size Inches (W x H x D)	Actual Size Inches (W x H x D)	Std. Pkg. Qty. per Carton	Media Area (sq. ft.)	Rated Airflow Capacity (CFM)
201 Media – Standard Capacity (200 Gram) Carbon					
FCP201-24242	24 x 24 x 2	23⅜ x 23⅜ x 1¾	12	20	2000
FCP201-12242	12 x 24 x 2	11⅜ x 23⅜ x 1¾	6	10	1000
FCP201-24244	24 x 24 x 4	23⅜ x 23⅜ x 3¾	3	44	2000
FCP201-12244	12 x 24 x 4	11⅜ x 23⅜ x 3¾	3	21	1000
301 Media – High Capacity (300 Gram) Carbon					
FCP301-24242	24 x 24 x 2	23⅜ x 23⅜ x 1¾	6	20	2000
FCP301-12242	12 x 24 x 2	11⅜ x 23⅜ x 1¾	3	10	1000
FCP301-24244	24 x 24 x 4	23⅜ x 23⅜ x 3¾	3	44	2000
FCP301-12244	12 x 24 x 4	11⅜ x 23⅜ x 3¾	3	21	1000

Also available with 202 or 302 media for removal of acid gasses, and 204 or 304 media for removal of alkaline gasses. Additional sizes also available. Contact your local AAF Flanders representative for more information.

Gas-Phase

AmAir®/CE Pleated Carbon Filters

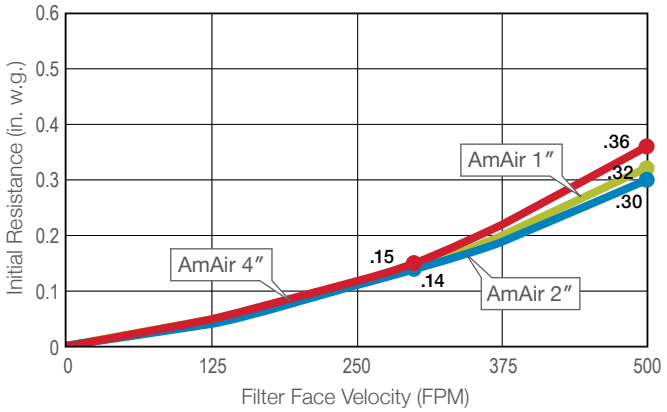
Product Overview

- Economical solution to many odor problems, from light to moderate
- Directly replaces existing 1″, 2″, or 4″ filters, adding odor control without requiring new hardware
- Fast, easy remediation of minor odor problems
- High wet strength beverage board frame
- MERV 6 particulate efficiency

Specifications

Efficiency	MERV 6
Filter Depth	1″, 2″, 4″
Media Type	Chemical
Frame Material	Beverage Board
Special Size Available	Yes
Max Operating Temperature	120˚F (49˚C)
Air Filtration Certification	UL 900

Initial Resistance vs. Filter Face Velocity



Filters are rated at 500 FPM filter face velocity. Recommended final resistance for all AmAir/CE filters is 1″ w.g.

Product Information

Part Number	Nominal Size Inches (W x H x D)	Actual Size Inches (W x H x D)	Rated Airflow Capacity(CFM) (Mid/High)	Std. Pkg. Qty. per Carton	Shipping Wt. Lbs. per Box (± 7%)	Cubic Ft.
1″						
411-301-319	12 x 24 x 1	11⅜ x 23⅜ x ⅞	750 / 1000	12	7.9	4.0
411-301-500	16 x 20 x 1	15½ x 19½ x ⅞	830 / 1110	12	8.8	4.4
411-301-600	16 x 25 x 1	15½ x 24½ x ⅞	1050 / 1400	12	11.0	5.6
411-301-700	20 x 20 x 1	19½ x 19½ x ⅞	1050 / 1400	12	11.0	5.6
411-301-782	20 x 24 x 1	19⅜ x 23⅜ x ⅞	1250 / 1675	12	13.2	6.7
411-301-800	20 x 25 x 1	19½ x 24½ x ⅞	1300 / 1750	12	13.8	6.9
411-301-863	24 x 24 x 1	23⅜ x 23⅜ x ⅞	1500 / 2000	12	15.9	8.0
2″						
411-302-319	12 x 24 x 2	11⅜ x 23⅜ x 1¾	750 / 1000	12	11.3	4.0
411-302-500	16 x 20 x 2	15½ x 19½ x 1¾	830 / 1110	12	12.6	4.4
411-302-600	16 x 25 x 2	15½ x 24½ x 1¾	1050 / 1400	12	15.7	5.6
411-302-700	20 x 20 x 2	19½ x 19½ x 1¾	1050 / 1400	12	15.7	5.6
411-302-782	20 x 24 x 2	19⅜ x 23⅜ x 1¾	1250 / 1680	12	18.9	6.7
411-302-800	20 x 25 x 2	19½ x 24½ x 1¾	1300 / 1750	12	19.7	6.9
411-302-863	24 x 24 x 2	23⅜ x 23⅜ x 1¾	1500 / 2000	12	22.6	20.8
4″						
411-304-319	12 x 24 x 4	11½ x 23½ x 3⅝	1000 / 1250	6	9.4	2.0
411-304-500	16 x 20 x 4	15½ x 19½ x 3⅝	1100 / 1400	6	10.4	2.2
411-304-600	16 x 25 x 4	15½ x 24½ x 3⅝	1400 / 1750	6	13.0	2.8
411-304-700	20 x 20 x 4	19½ x 19½ x 3⅝	1400 / 1750	6	13.0	2.8
411-304-782	20 x 24 x 4	19½ x 23½ x 3⅝	1680 / 2100	6	15.6	1.1
411-304-800	20 x 25 x 4	19½ x 24½ x 3⅝	1750 / 2200	6	16.3	1.2
411-304-863	24 x 24 x 4	23½ x 23½ x 3⅝	2000 / 2500	6	18.7	4.0

Additional sizes available upon request.

Gas-Phase

PREpleat® AC

Product Overview

- Combines the low resistance and high Dust Holding Capacity (DHC) of a pleated filter with the odor removing abilities of activated carbon
- Fast, easy remediation of minor odor problems
- 100% add-on of activated carbon by weight (carbon weight equivalent to media weight)
- Directly replaces existing 1″, 2″, or 4″ filters, adding odor control without requiring new hardware

Specifications

Efficiency	MERV 6
Filter Depth	1″, 2″, or 4″
Media Type	Synthetic w/Activated Carbon
Frame Material	Beverage Board
Special Size Available	Yes
Max Operating Temperature	120°F (49°C)

Product Information

Part Number	Nominal Size Inches (W x H x D)	Actual Size Inches (W x H x D)	Std. Pkg. Qty. per Box	Shipping Wt. Lbs. per Box (± 12%)	Cubic Ft.
1″					
81255.011224	12 x 24 x 1	11½ x 23½ x ¾	12	7.0	1.9
81255.011620	16 x 20 x 1	15½ x 19½ x ¾	12	8.0	2.0
81255.011625	16 x 25 x 1	15½ x 24½ x ¾	12	9.5	2.4
81255.012020	20 x 20 x 1	19½ x 19½ x ¾	12	9.5	2.4
81255.012024	20 x 24 x 1	19½ x 23½ x ¾	12	11.0	3.0
81255.012025	20 x 25 x 1	19½ x 24½ x ¾	12	11.0	3.0
81255.012424	24 x 24 x 1	23⅜ x 23⅜ x ¾	12	12.3	3.5
2″					
81255.021224	12 x 24 x 2	11⅜ x 23⅜ x 1¾	12	11.5	3.9
81255.021620	16 x 20 x 2	15½ x 19½ x 1¾	12	12.2	4.4
81255.021625	16 x 25 x 2	15½ x 24½ x 1¾	12	14.4	5.6
81255.022020	20 x 20 x 2	17½ x 24½ x 1¾	12	14.3	5.6
81255.022024	20 x 24 x 2	19½ x 19½ x 1¾	12	16.5	6.9
81255.022025	20 x 25 x 2	19⅜ x 23⅜ x 1¾	12	15.8	6.9
81255.022424	24 x 24 x 2	19½ x 24½ x 1¾	12	19.5	8.7
4″					
81255.041224	12 x 24 x 4	11⅜ x 23⅜ x 3¾	6	12.0	3.9
81255.041620	16 x 20 x 4	15½ x 19½ x 3¾	6	11.5	4.4
81255.041625	16 x 25 x 4	15½ x 24½ x 3¾	6	13.6	5.6
81255.042020	20 x 20 x 4	19½ x 19½ x 3¾	6	12.8	5.6
81255.042024	20 x 24 x 4	19⅜ x 23⅜ x 3¾	6	16.0	6.9
81255.042025	20 x 25 x 4	19½ x 24½ x 3¾	6	15.0	6.9
81255.042424	24 x 24 x 4	23⅜ x 23⅜ x 3¾	6	18.4	8.7

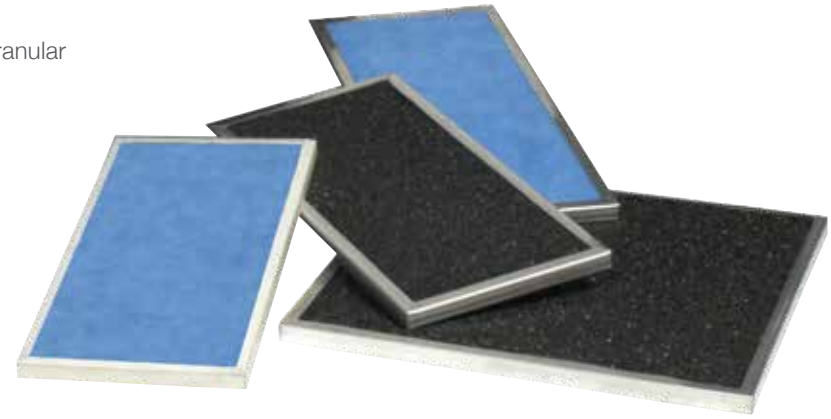
Additional sizes available upon request.

Gas-Phase

AmerSorb® BP Carbon Bonded Panel Filters

Product Overview

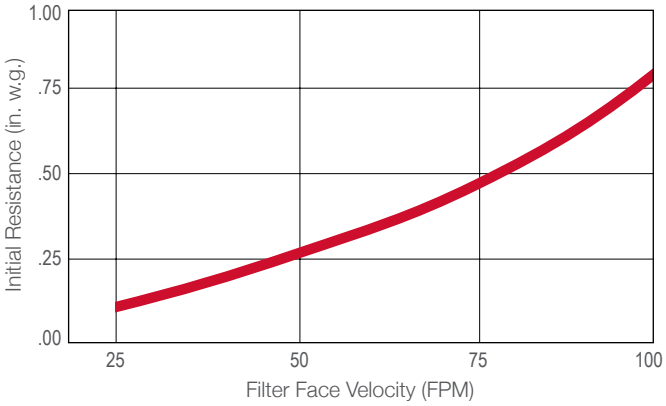
- An economical alternative to refillable trays used in granular media housings
- Easier to handle, reduces maintenance costs versus refillable trays
- Direct replacement for 1″ panels used in most manufacturers' side and front access housings
- No carbon dusting – no settling
- No enclosure required, allowing for more carbon by weight than comparable loose fill panel filter
- High first-pass removal efficiency and low resistance to airflow
- 60% CTC activity carbon



Specifications

Filter Depth	⅞″–2″ (in ⅛″ increments)
Media Type	Chemical (Bonded)
Frame Material	Galvannealed Steel or Aluminized Steel
Special Size Available	Yes

Initial Resistance vs. Filter Face Velocity



Product Information

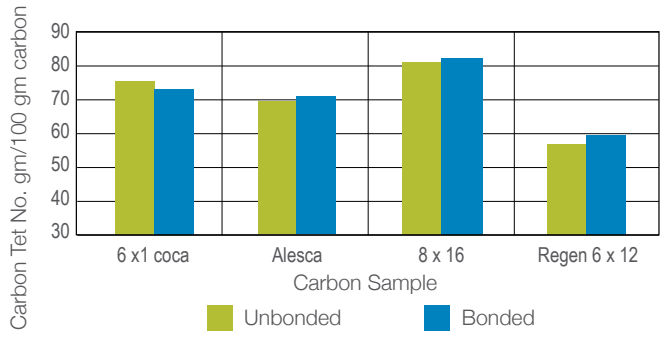
Part Number	Nominal Size Inches (W x H x D)	Actual Size Inches (W x H x D)
186-000-11D23DA	12 x 24 x 1	11⅜ x 23⅜ x ⅞
186-000-23D23DA	24 x 24 x 1	23⅜ x 23⅜ x ⅞
186-000-11D23DH	12 x 24 x 2	11⅜ x 23⅜ x 1¾
186-000-23D23DH	24 x 24 x 2	23⅜ x 23⅜ x 1¾

Above filters include galvannealed steel frame, no gasketing, and bonded carbon media derived from virgin coconut shell. Aluminized steel frames, gasketing, and additional media options, along with a wide range of sizes, also available upon request. Contact your local AAF Flanders representative for details.

Static Adsorption Capacity

Carbon Tetrachloride (CCl_4) adsorption capacity is virtually unaffected by bonding. Several carbon samples in the 60-80% CCl_4 activity range are shown in the graph at right. As indicated, there is little impact on the activated carbon by the bonding process.

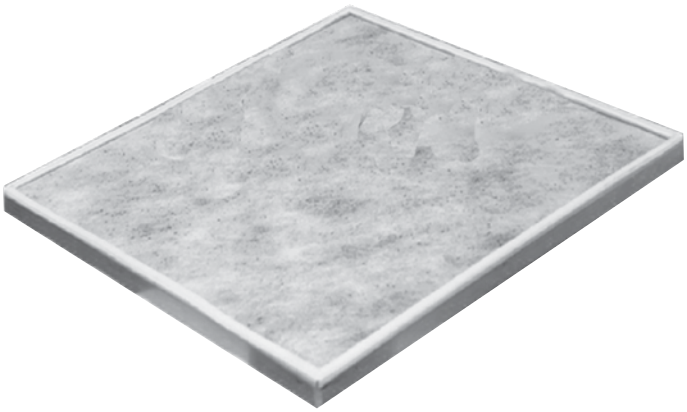
Static Adsorption, CCl_4 Bonded vs. Unbonded Carbon



AmerSorb® is a registered trademark of AAF International in the U.S.

Gas-Phase

High Mass Zero Dust (HMZD)



Product Overview

- Better performance than loose filled trays due to increased carbon density and elimination of bypass
- High Mass refers to a high density of activated carbon installed
- Zero Dust means that the filters will not release carbon dust into the air stream
- Fabricated from 100% virgin coconut shell activated carbon, with a minimum 60% CTC activity
- Six media types available to ensure targeted contaminant removal for every application
- Easy installation and disposal, with no need to refill trays
- Can be used in V-bank housings for minimal pressure drop

Specifications

Filter Depth	7⁄16″, 5⁄8″, 3⁄4″, 1″
Media Type	Chemical (Bonded)
Frame Material	Galvanized or Stainless Steel
Special Size Available	Yes
Max Operating Temperature	120° (49°C)

HMZD Carbon Types and Applications*

201 – Impregnate is virgin coconut shell carbon for general removal of Volatile Organic Chemicals (VOCs)

202 – Caustic impregnated for removal of acid gases

204 – Acid impregnated for removal of alkaline gases

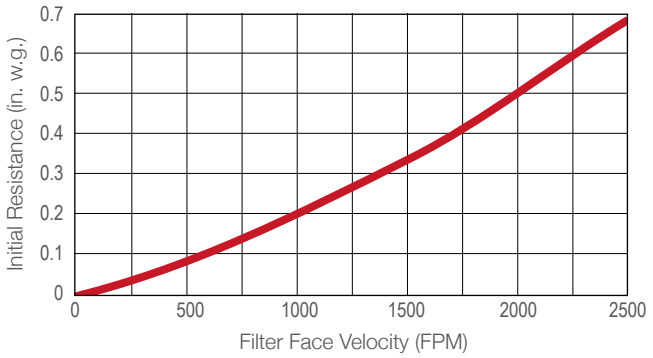
205 – Chromate impregnated for removal of amines

209 – Universal impregnate for removal of acid and alkaline gases

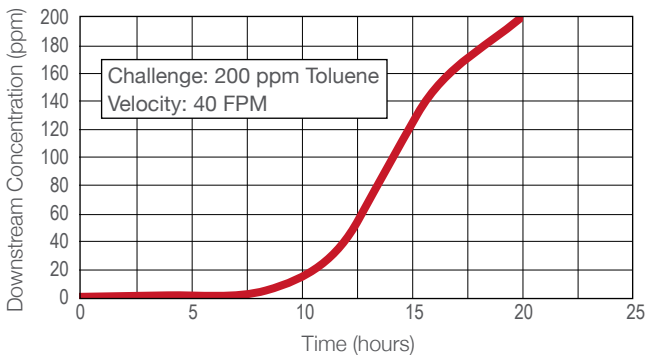
225 – Proprietary blend for airports and helipads

***Carbon Selection** – In general, contaminants with a boiling point greater than 212°F (160°C) can be effectively removed with carbon type 201. Contaminants with a boiling point below 212°F (160°C) require other available types of impregnated carbon, such as type 202, 204, 205, or 209.*

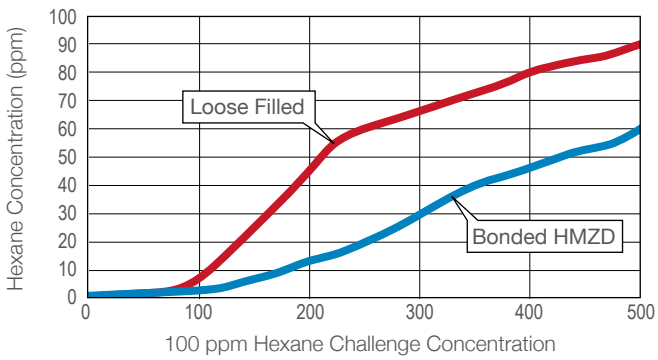
Initial Resistance vs. Filter Face Velocity



TS 201 Toluene Time to Breakthrough



Service Life Comparison



The breakthrough test was based on continuous 100 ppm Hexane challenge concentration. Testing conducted at an independent lab on virgin coconut shell carbon.

Gas-Phase

HEGA Filter Type IV – Stainless Steel

Product Overview

- 99.9% mechanical efficiency when tested in accordance with IES-RP-CC-008-84
- Common application is for high efficiency removal of gaseous contaminants from nuclear, biological, and/or chemical process exhaust air
- V-bank configuration allows high airflow at low pressure drop
- Designed, manufactured, and tested under a Quality Assurance program meeting the requirements of ASME NQA-1
- Test reports accompany the filter (copies available on request)
- Activated impregnated carbon media meets requirements of Article FF-5000 or ASME/ANSI AG-1-1997

Specifications

Mechanical Efficiency	99.9%
Bed Depth	1″, 1⅜″, 2″
Frame Style	Gel Seal, Gasket Seal
Frame Material	Stainless Steel
Max. Operating Temperature	200°F (93°C)

A G - GG16 - 6 2 - W S

Adsorber

Seal Type
G = Gasket Seal
F = Gel Seal

Adsorber Size (Nominal) H x W x D

Number of Beds per Cell

Bed Thickness (Inches)

Frame Material
S = Stainless Steel

Adsorbent Material
A = Activated Carbon (8 x 16 Mesh)
N = Nuclear Grade Carbon (8 x 16 Mesh)
W = Whetlerized Carbon (12 x 30 Mesh)
T = ASZM-TEDA Carbon (12 x 30 Mesh)

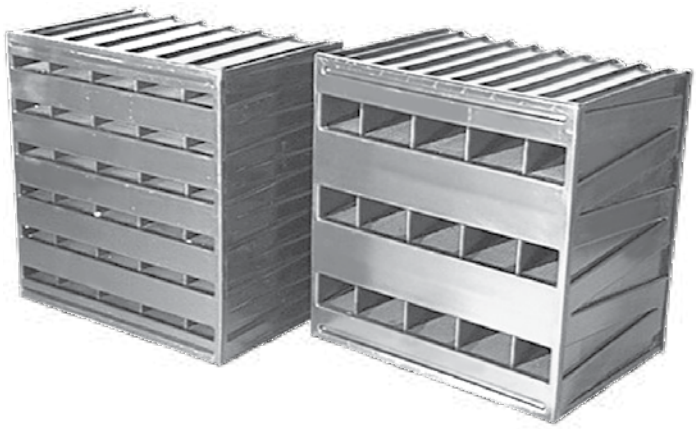
Product Information

Part Number	Nominal Size Inches (H x W x D) w/Gel Seal Channel	Rated Airflow Capacity (CFM)	Approx. ΔP (in. w.g.)	Res. Time (sec.)	No. of Beds	Bed Depth (Inches)	Max. Temp.	Approx. Carbon Net Wt. (Lbs.)	Approx. Shipping Wt. (Lbs.)
Gel Seal									
AF-GC12-101-AS	24 x 12 x 12¼	500	0.90	0.083	10	1	200°F	29	92
AF-GC12-101-NS	24 x 12 x 12¼	500	0.90	0.083	10	1	200°F	32	95
AF-GC12-101-WS	24 x 12 x 12¼	500	2.00	0.083	10	1	200°F	35	98
AF-GG12-101-AS	24 x 24 x 12¼	1000	0.90	0.083	10	1	200°F	58	153
AF-GG12-101-NS	24 x 24 x 12¼	1000	0.90	0.083	10	1	200°F	64	159
AF-GG12-101-WS	24 x 24 x 12¼	1000	2.00	0.083	10	1	200°F	70	165
AF-GG16-81⅜-AS	24 x 24 x 16¾	1000	0.85	0.125	8	1⅜	200°F	75	210
AF-GG16-81⅜-NS	24 x 24 x 16¾	1000	0.85	0.125	8	1⅜	200°F	80	215
AF-GG16-81⅜-WS	24 x 24 x 16¾	1000	2.10	0.125	8	1⅜	200°F	90	225
AF-GG12-62-AS	24 x 24 x 12¼	700	1.75	0.125	6	2	200°F	59	162
AF-GG12-62-NS	24 x 24 x 12¼	700	1.75	0.125	6	2	200°F	62	165
AF-GG12-62-WS	24 x 24 x 12¼	700	3.90	0.125	6	2	200°F	70	173
Gasket Seal									
AG-GG12-101-AS	24 x 24 x 11½	1000	0.90	0.083	10	1	200°F	58	148
AG-GG12-101-NS	24 x 24 x 11½	1000	0.90	0.083	10	1	200°F	64	154
AG-GG12-101-WS	24 x 24 x 11½	1000	2.00	0.083	10	1	200°F	70	160
AG-GG16-81⅜-AS	24 x 24 x 16	1000	0.85	0.125	8	1⅜	200°F	75	205
AG-GG16-81⅜-NS	24 x 24 x 16	1000	0.85	0.125	8	1⅜	200°F	80	210
AG-GG16-81⅜-WS	24 x 24 x 16	1000	2.10	0.125	8	1⅜	200°F	90	220
AG-GG18-62-AS	24 x 24 x 18	1250	1.75	0.125	6	2	200°F	90	220
AG-GG18-62-NS	24 x 24 x 18	1250	1.75	0.125	6	2	200°F	96	226
AG-GG18-62-WS	24 x 24 x 18	1250	4.10	0.125	6	2	200°F	105	235

Not all model number combinations available. Small size adsorbers also available. Contact your local AAF Flanders representative for details.

Gas-Phase

HEGA Filter Type IV – Cinersorb

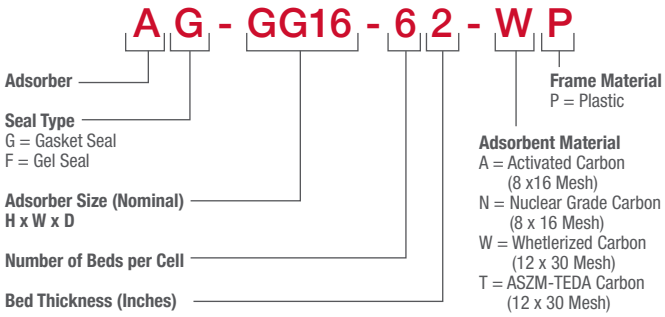


Product Overview

- Polystyrene frame allows for disposal by incineration
- 99.9% mechanical efficiency when tested in accordance with IES-RP-CC-008-84
- Weighs 40-50% less than metal framed adsorbers
- Common application is for high efficiency removal of gaseous contaminants from nuclear, biological, and/or chemical process exhaust air
- Designed, manufactured, and tested under a Quality Assurance program meeting the requirements of ASME NQA-1
- Test reports accompany the filter (copies available on request)
- Activated impregnated carbon media meets requirements of Article FF-5000 or ASME/ANSI AG-1-1997

Specifications

Mechanical Efficiency	99.9%
Bed Depth	1″, 1⅜″, 2″
Frame Style	Gel Seal, Gasket Seal
Frame Material	Polystyrene (HIPS)
Max. Operating Temperature	120°F (49°C)



Product Information

Part Number	Nominal Size Inches (H x W x D) w/Gel Seal Channel	Rated Airflow Capacity (CFM)	Approx. ΔP (in. w.g.)	Res. Time (sec.)	No. of Beds	Bed Depth (Inches)	Max. Temp.	Approx. Carbon Net Wt. (Lbs.)	Approx. Shipping Wt. (Lbs.)
Gel Seal									
AF-GC12-101-AP	24 x 12 x 12¼	500	0.90	0.083	10	1	120°F	23	92
AF-GC12-101-NP	24 x 12 x 12¼	500	0.90	0.083	10	1	120°F	25	95
AF-GC12-101-WP	24 x 12 x 12¼	500	2.00	0.083	10	1	120°F	26	98
AF-GG12-101-AP	24 x 24 x 12¼	1000	0.90	0.083	10	1	120°F	43	153
AF-GG12-101-NP	24 x 24 x 12¼	1000	0.90	0.083	10	1	120°F	49	159
AF-GG12-101-WP	24 x 24 x 12¼	1000	2.00	0.083	10	1	120°F	52	165
AF-GG16-81⅜-AP	24 x 24 x 16¾	1000	0.85	0.125	8	1⅜	120°F	74	113
AF-GG16-81⅜-NP	24 x 24 x 16¾	1000	0.85	0.125	8	1⅜	120°F	79	118
AF-GG16-81⅜-WP	24 x 24 x 16¾	1000	2.10	0.125	8	1⅜	120°F	88	127
AF-GG16-62-AP	24 x 24 x 16¾	1000	1.75	0.125	6	2	120°F	80	115
AF-GG16-62-NP	24 x 24 x 16¾	1000	1.75	0.125	6	2	120°F	84	119
AF-GG16-62-WP	24 x 24 x 16¾	1000	3.90	0.125	6	2	120°F	96	131
Gasket Seal									
AG-GC12-101-AP	24 x 12 x 11½	500	0.90	0.083	10	1	120°F	23	42
AG-GC12-101-NP	24 x 12 x 11½	500	0.90	0.083	10	1	120°F	25	44
AG-GC12-101-WP	24 x 12 x 11½	500	2.00	0.083	10	1	120°F	26	45
AG-GG16-81⅜-AP	24 x 24 x 16	1000	0.85	0.125	8	1⅜	120°F	74	113
AG-GG16-81⅜-NP	24 x 24 x 16	1000	0.85	0.125	8	1⅜	120°F	79	118
AG-GG16-81⅜-WP	24 x 24 x 16	1000	2.10	0.125	8	1⅜	120°F	88	127
AG-GG16-62-AP	24 x 24 x 16	1000	1.75	0.125	6	2	120°F	80	115
AG-GG16-62-NP	24 x 24 x 16	1000	1.75	0.125	6	2	120°F	84	119
AG-GG16-62-WP	24 x 24 x 16	1000	3.90	0.125	6	2	120°F	96	131

Not all model number combinations available. Contact your local AAF Flanders representative for details.

Gas-Phase

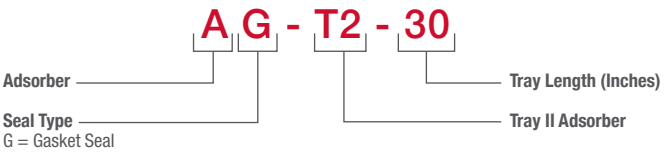
HEGA Filter Type II

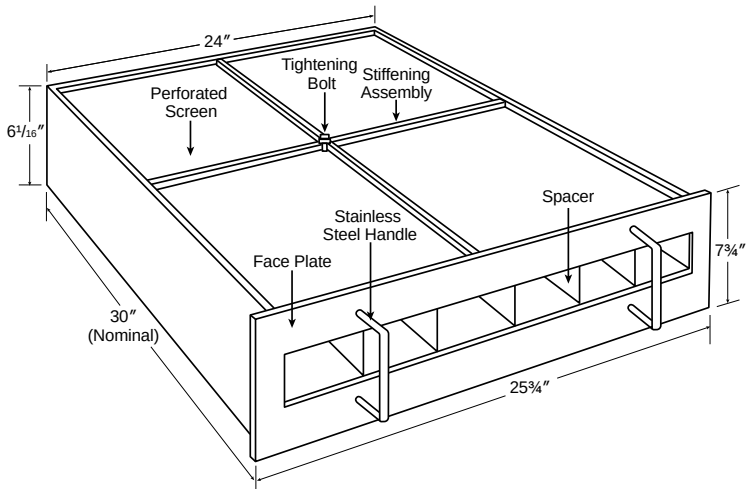
Product Overview

- 99.9% mechanical efficiency when tested in accordance with IES-RP-CC-008-84
- Common application is for high efficiency removal of gaseous contaminants from nuclear, biological, and/or chemical process exhaust air
- Designed, manufactured, and tested under a Quality Assurance program meeting the requirements of ASME NQA-1
- Test reports accompany the filter (copies available on request)
- Designed to be modular with a 1000 CFM HEPA filter in both flow rate and size by using multiple cells
- Activated impregnated carbon media meets requirements of Article FF-5000 or ASME/ANSI AG-1-1997

Specifications

Rated Flow	333 CFM
Velocity	40 FPM
Mechanical Efficiency	99.9%
Bed Depth	2″
Pressure Drop	1.10″
Residence Time	0.25 seconds
Approx. Filled Weight	96 lbs.
Max. Operating Temperature	200°F (93°C)
Frame Material	Stainless Steel





Standard options include: various cell lengths and custom sizing; different frame materials, different chemical media/adsorbents, special faceplate/labeling, and more.

Contact your local AAF Flanders representative for details.

Gas-Phase

SAAF™ Front Access Housings (FAH)

Product Overview

- Combines particulate filters and gas-phase cassettes to create a total clean air solution
- Stand-alone system can be easily incorporated into new and existing air handling units
- Patented SAAF™ Seal sealing system design and manufacturing process patents covered under US 7,588,629 B2

Product Information

Part Number	Nominal Size Inches (W x H x D)	Model Number	Std. Pkg. Qty. per Box	Shipping Wt. Lbs. per Box (± 12%)	Cubic Ft.
SAAF™ FAH – Medium Duty (for use with MD Cassettes only)					
3026705-001	24 x 24 x 21½	FAH 202-2P-MD	1	70.0	8.0
3028404-001	24 x 12 x 21½	FAH 201-2P-MD	1	50.0	4.0
3028172-001	12 x 24 x 21½	FAH 102-2P-MD	1	50.0	4.0
SAAF™ FAH – Heavy Duty (for use with HD Cassettes only)					
3028438-001	24 x 24 x 15¾	FAH 202-2P-HD	1	70.0	6.0
3028487-001	24 x 12 x 15¾	FAH 201-2P-HD	1	50.0	3.0
3028412-001	12 x 24 x 15¾	FAH 102-2P-HD	1	50.0	3.0
SAAF™ FAH – Cleanroom Grade (for use with CG Cassettes only)					
3028552-001	24 x 24 x 15¾	FAH 202-2P-CG	1	70.0	6.0
3028503-001	24 x 12 x 15¾	FAH 201-2P-CG	1	50.0	3.0

Gas-Phase

SAAF™ Air Purification Systems: Pressurization and Recirculation Unit (PRU) and Recirculation Unit (RU)

Product Overview

- Pressurize, recirculate, and clean the air in a controlled environment
- Easy installation, operation, and maintenance in a self-contained system
- Combines gas-phase and high efficiency air filters to create total clean air solutions
- Patented SAAF™ Seal sealing system design and manufacturing process patents covered under US 7,588,629 B2
- Designed with internal variable speed fan (electronically commutated)
- Customizable media combinations to meet your specific requirements
- Whisper-quiet operation

Product Information

Description	Product & Size					
	RU500V	RU1000V	RU2000V	RU500H	RU1000H	RU2000H
SAAF™ Air Purification Systems: Pressurization and Recirculation Unit (PRU)						
Fan style	ebm	ebm	ebm	ebm	ebm	ebm
Height (inches)	78½	85	85	29	29	29
Width (inches)	31	31	60	26	26	50
Depth (inches)	26	26	26	89	93	93
SAAF™ Air Purification Systems: Recirculation Unit (RU)						
Fan style	ebm	ebm	ebm	ebm	ebm	ebm
Height (inches)	73⅜	80	80	29	29	29
Width (inches)	31	31	60	26	26	50
Depth (inches)	26	26	26	77	77	77

Gas-Phase

SAAF™ PORTA-Scrubber

Product Overview

- Units available as Powered and Non-Powered
- Ideal for a wide variety of applications
- Suitable for outdoor installation
- Compact design is space-efficient while reducing capital and installation costs
- Quick, easy installation and operation in a self-contained system—virtually maintenance free
- Corrosion-resistant, cast aluminum fan
- Designed to remove gaseous and particulate contaminants from the airstream in the most demanding applications
- Ultra-high capacity SAAFCarb™ MA.HT chemical media provides complete contaminant removal and longer service life than conventional scrubber media currently available

Product Information

Style	Non-Powered		Powered		
Model Number & Nominal Airflow (SCFM)	**200NP**	**500NP**	**200**	**500**	**1000**
Dimensions Nominal (in.)	49H x 24D	65H x 39D	51H x 24D	65H x 39D	83H x 58D
Inlet Diameter (in.)	4	6	4	6	10
Part Number	3040821-001E	3040839-001	3052941-001	3040789-001	3064441-001
Particulate Filters Required (PolyKlean™ Media Pads)	24″ Round PN 358-012-024	37″ Round PN 358-012-037	24″ Round PN 358-012-024	37″ Round PN 358-012-037	59″ Round PN 358-012-058
Gas-Phase Chemical Media Options (Sold in 1 ft³ boxes)	**Media Volume Required**				
SAAFOxidant™ (395-914-100)	5 ft³	17 ft³	5 ft³	17 ft³	39 ft³
SAAFCarb™ (395-914-200)	5 ft³	17 ft³	5 ft³	17 ft³	39 ft³
SAAFCarb™ MA (395-914-300)	5 ft³	17 ft³	5 ft³	17 ft³	39 ft³
SAAFCarb™ MB (395-914-400)	5 ft³	17 ft³	5 ft³	17 ft³	39 ft³
SAAFCarb™ MA.HT (395-914-800)	5 ft³	17 ft³	5 ft³	17 ft³	39 ft³
SAAFBlend™ GP (395-914-001)	5 ft³	17 ft³	5 ft³	17 ft³	39 ft³

Additional Options
Motor Rain Cover (123A-3061942)
115V, 10 foot Power Cord (5246707)

Gas-Phase

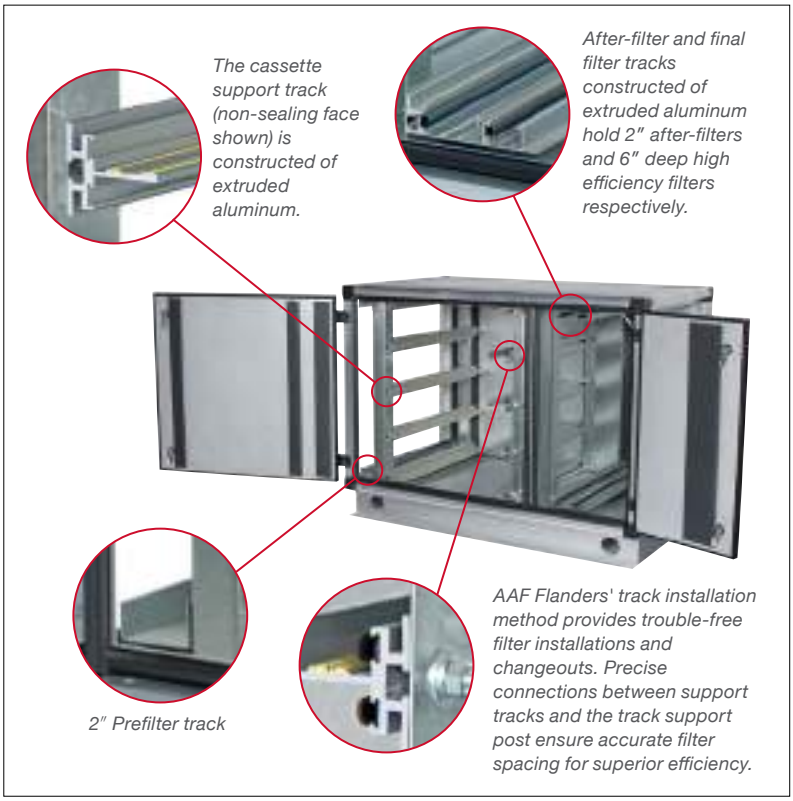
SAAF™ Side Access Housings (SAH)

Product Overview

- Combines particulate filters, gas-phase cassettes, and high efficiency filters to create a total clean air solution (removing both airborne particulate and gaseous contaminants)
- Patented SAAF™ Seal sealing system design and manufacturing process patents covered under US 7,588,629 B2
- Wide range of sizes and combinations of filter banks
- Available with internal fan
- Insulated double-walled construction
- Allows for easy installation, operation, and maintenance in a totally self-contained system

Product Information

Model	Nominal Dimensions		Cassette Selection		
	H Ft	W Ft	SAAF HD Airflow @ 250 FPM Velocity	SAAF MD Airflow @ 500 FPM Velocity	SAAF CG Airflow @ 500 FPM Velocity
102	1	2	500	1,000	1,000
104	1	4	1,000	2,000	2,000
202	2	2	1,000	2,000	2,000
204	2	4	2,000	4,000	4,000
206	2	6	3,000	6,000	6,000
302	3	2	1,500	3,000	3,000
304	3	4	3,000	6,000	6,000
306	3	6	4,500	9,000	9,000
402	4	2	2,000	4,000	4,000
404	4	4	4,000	8,000	8,000
406	4	6	6,000	12,000	12,000
408	4	8	8,000	16,000	16,000
410	4	10	10,000	20,000	20,000
504	5	4	5,000	10,000	10,000
506	5	6	7,500	15,000	15,000
508	5	8	10,000	20,000	20,000
510	5	10	12,500	25,000	25,000
604	6	4	6,000	12,000	12,000
606	6	6	9,000	18,000	18,000
608	6	8	12,000	24,000	24,000
610	6	10	15,000	30,000	30,000



Gas-Phase

SAAF™ Machine Intake Filter (MIF)

Product Overview

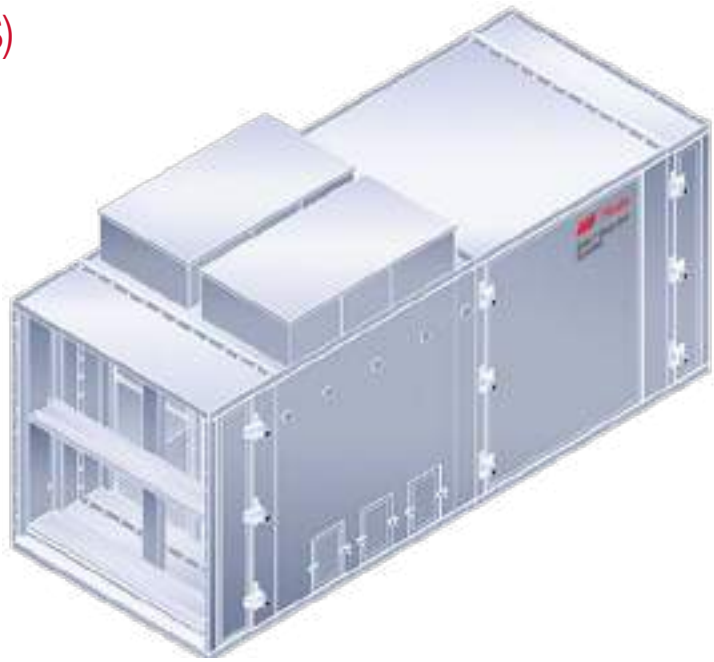
- Specifically designed for machine air intakes within hostile air quality environments, such as industrial manufacturing facilities, mining, smelting, petrochemical, and pulp and paper processing
- Combines decades of AAF Flanders air filtration expertise in gas turbine and complex machine air intakes
- Incorporates AAF Flanders low pressure drop, enhanced performance air filtration technologies for high efficiency, high capacity, maintenance-effective solutions
- Patented SAAF™ Seal sealing system design and manufacturing process patents covered under US 7,588,629 B2

Product Information

Inches (W x H)	Depth (Inches)
6 x 4	12

Gas-Phase

SAAF™ Deep Bed Scrubber (DBS)



Product Overview

- Combines AAF Flanders' particulate and gas-phase technologies for an AAF Flanders Total Filtration Solution
- Provides highest chemical media-to-air ratio for heavily polluted environments that require air quality guarantees and optimal cost of ownership
- Available with internal fan: wide range of sizes and combination of AAF Flanders Filtration technologies
- Offers the best flexibility and control to adapt to changes in the environment

Product Information

DBS	Velocity		Airflow	
Housing Size	Ft/Min	M/Sec	Ft^3/Min	M^3/H
202	100	0.5	400	680
302	100	0.5	600	1,020
402	100	0.5	800	1,360
403	100	0.5	1,200	2,040
404	100	0.5	1,600	2,720
406	100	0.5	2,400	4,080
408	100	0.5	3,200	5,440
504	100	0.5	2,000	3,400
506	100	0.5	3,000	5,100
508	100	0.5	4,000	6,800
604	100	0.5	2,400	4,080
606	100	0.5	3,600	6,120
608	100	0.5	4,800	8,160
708	100	0.5	5,600	9,520
808	100	0.5	6,400	10,870
810	100	0.5	8,000	13,600

Gas-Phase

SAAF™ Reactivity Monitoring Coupons (RMCs)

Product Overview

- Investigative tool to gauge gas-phase filter performance
- Ideal for site assessment reports related to air reactivity
- Qualifies the presence or absences of gas types (sulfur compounds, chlorine compounds, compounds that form oxide films, and unknowns)
- Quantifies reactivity of environment per ISA-71.04-2013 and related coupon standards
- Available in light-duty and heavy-duty versions to suit the application contamination severity

Product Information

Part Number	Description	Std. Pkg. Qty. per Box	Shipping Wt. Lbs. per Box (± 7%)	Cubic Ft.
392-801-000	Glass Coupon – Reactivity Monitor	1	1.0	0.0
392-801-001	Metal Coupon – Reactivity Monitor	1	1.0	0.0

Part Number	Description	Shipping Wt. (lbs.)	Cubic Ft.
392-801-000	Glass Coupon – Reactivity Monitor	1	1.0
392-801-001	Metal Coupon – Reactivity Monitor	1	1.0
1 oz. SAAF Media Samples			
395-920-100	SAAFOxidant™	1	0.1
395-920-200	SAAFCarb™	1	0.1
395-920-300	SAAFCarb™ MA	1	0.1
395-920-400	SAAFCarb™ MB	1	0.1
395-920-800	SAAFCarb™ MA.HT	1	0.1
395-920-001	SAAFBlend™ GP (50/50 Mix)	1	0.1
395-920-002	SAAFBlend™ WS (33/33/33 Mix)	1	0.1
NOTE: All media samples are placed in glass bottles with screw top lids.			
5 lb. SAAF Media Samples			
395-921-100	SAAFOxidant™	5	0.5
395-921-200	SAAFCarb™	5	0.5
395-921-300	SAAFCarb™ MA	5	0.5
395-921-400	SAAFCarb™ MB	5	0.5
395-921-800	SAAFCarb™ MA.HT	5	0.5
395-921-001	SAAFBlend™ GP (50/50 Mix)	5	0.5
NOTE: All media samples are placed in glass bottles with screw top lids.			

Power & Industrial

Power & Industrial Division

AAF clean air products and systems offer the most comprehensive clean air solutions available in the world. With global manufacturing capabilities, each AAF facility is specifically designed to manufacture and test the most complex clean air solutions. However, you may not be aware that since 1932, AAF has offered solutions to clean exhaust air from industrial applications, nor that filtration systems for nuclear power, diesel engines, and gas turbines have been available from AAF for over 50 years.

Environmental Products

Dry Dust Collectors

Our Power & Industrial division offers a complete range of high-efficiency pleated media collectors. Complementing these collectors are a range of specialized filtration elements focused on higher efficiency, lower pressure, and longer life. Utilizing high-efficiency reverse cleaning technology, the AAF International® FabriPulse®, OptiFlo® and ArrestAll® ranges ensure optimum cleaning and utilization of the filtration media for lower emissions and longer life.

PulsePak® Prime

PulsePak® Prime

The PulsePak Prime combines true downflow of the incoming dust-laden air with the unobstructed “free-fall” of the dislodged dust to the hopper. As a result, the PulsePak Prime operates with less internal turbulence and, therefore, a lower differential pressure than competitive designs. The unique filter cartridge arrangement provides a more compact design, which allows for maximum flexibility while meeting space requirements. Large hinged access doors allow for minimized inspection and cartridge change-out time, since multiple filter cartridges can be externally accessed through one door. By using a venturi design, the PulsePak Prime cleans more efficiently. The PulsePak Prime is equipped with REDClean® Media, allowing it to offer best-in-class filtration. Many different media options are also available.

OptiFlo RC

OptiFlo RC

The OptiFlo RC cartridge collector is a completely modular design that allows an unlimited range of sizes. Modules can be interconnected to accommodate the largest air cleaning task. The compact modules conserve valuable space and have the lowest flange-to-flange differential pressure, allowing up to 10% greater airflow with lower fan power requirements than competitive models.

The internal construction of the OptiFlo RC prevents direct impingement of entering particulate on the cartridges, minimizing abrasion and dust build-up. The top entry, “down flow” design eliminates “can velocity” concerns. A wide selection of cartridge types, options, and accessories enable the collector to be tailored to suit specific application requirements.

Wet Dust Collectors

AAF International pioneered the development of wet collectors and devices designed to remove particulate matter from the air by passing through a liquid medium. The AAF International RotoClone® and Kinpactor ranges allow dust and fume to be collected in hot, humid, and sticky environments.

RotoClone W

RotoClone W

The RotoClone W is designed to combine the scrubbing effect of water with the principle of dynamic precipitation. This highly-effective wet-type collector discharges collected materials as a slurry. The RotoClone W collector is effective in applications such as chemical processing, mining, coal processing, food, and pharmaceutical dust capture.

RotoClone N

RotoClone N

The RotoClone N cleans the air by the combined action of centrifugal force and a thorough intermixing of water and dust-laden air. It has no moving parts, pumps, or other auxiliary equipment, requires minimum space, and is easy to install.

Power & Industrial

Power & Industrial Division

Gas Turbine Products

With an extensive gas turbine filter range, innovative products that push the boundaries of filtration technology, and reliable and trusted service, AAF International is the supplier of choice for many of the world's leading operators and OEMs in the gas turbine sector.

Moisture Removal and Pre-filtration

Final filters can only achieve their full potential with the protection of well-designed moisture removal stages, including pre-filtration. This removal of moisture and larger particles from airstreams allows the final filters to trap smaller submicron particles more effectively, providing maximum protection to gas turbines. AAF's AmerShield is the class-leading pre-filter designed for the rigorous environments of gas turbine inlet applications. AmerShield, with integrated Impress® technology, offers an unmatched combination of advanced filtration technology and coalescing performance. Thermal embossed-pleat technology and intermittent beads of adhesive create the ideal surface geometry for smooth, even airflow. Optimized pleat spacing allows even loading throughout the depth of the filter media, introduces minimal resistance to airflow, and maximizes filter life.

AmerShield

Static Filters

AAF maintains a complete range of static filters for applications in which pulse cleaning is not required or possible. This line includes V-Bank filters, box filters, and static cartridges. The static final filter plays a pivotal role in ensuring the safe operation of the gas turbine. AAF's latest product, the HydroGT V450+, boasts a greater filter depth and quantity of filter media, providing the ultimate protection for your gas turbine, which ensures reliable performance and power output in the most demanding environments. The HydroGT high efficiency filter range delivers class-leading protection for your gas turbine, helping to extend component life and reduce maintenance costs. In addition, EPA efficiency grades significantly reduce compressor fouling and the need for offline water washing, resulting in increased machine availability and reduced operational costs.

HydroGT V450+

Pulse Filters

Pulse filters typically take the form of cartridges or canisters and panel pak filters in environments in which dust represents a significant challenge. Pulse cleaning removes larger dust particles from the outer layer of the filter media, extending the life of the filter that protects the gas turbine. The HydroPak is a direct replacement to existing ASC filter houses. The ASC's Integral Secondary Air System achieves optimum performance over a maximized lifetime. The HydroPak delivers an outstanding combination of filtration efficiency, low cost of operation, and lengthy filter life. The design of the HydroPak eliminates compressor fouling and frequent water washing, resulting in improved power output and engine reliability.

HydroPak

Pulse filters cartridges or canisters and panel pak filters

Nuclear Products

AAF International, a world leader in clean air solutions, was there with the right products when the nuclear industry first began. Today we continue to help you meet the ongoing demand for qualified and dependable solutions that support operating license renewals, power uprates, and new construction.

- Bag In/Bag Out
- Side Access TSC
- Replacement Filters
- Air Handling Units
- Walk-In Housings
- Cooling Coils
- Fans/Dampers
- Commercial Grade Dedication

For more information on **Power & Industrial products** from AAF International, visit our site at www.aafintl.com/en/power-and-industrial or **call 1-800-477-1214**.

Nuclear Products

Daikin

Daikin Products

AAF Flanders is proud to be part of the Daikin Group, the global leader in air comfort. Our parent company Daikin offers solutions across three primary areas – HVAC equipment, chemicals and coolants, and air filtration. Our sister companies in the Daikin Group include U.S.-based HVAC manufacturers Goodman, Amana, and Daikin Applied, all of whom help power Daikin to the forefront of the air conditioning industry in the U.S. and worldwide.

The company recently celebrated its 90th anniversary and continues to lead the way in the development of clean air and comfort solutions, thanks in large part to its Texas Technology Park in Houston and the Technology and Innovation Center in Osaka, Japan.

Innovative products developed by Daikin include:

- Rooftop Units
- Split Systems
- Air Handlers
- Variable Refrigerant Volume (VRV) Systems
- Smart Thermostats

Texas Technology Park in Houston.

Technology and Innovation Center in Osaka, Japan.

Rooftop Units

Daikin's rooftop product line combines the availability of units tailored to a multitude of applications with industry-leading efficiency. From residences to every size of commercial building, Daikin offers easily installed systems that minimize operating costs.

Rooftop Unit

Split Systems

Every Daikin commercial air conditioner features high-performance, high-efficiency compressors that operate in tandem with a high-efficiency coil design. This innovative system offers stellar levels of reliability, durability, and efficiency.

Split System Air Conditioner

Air Handlers

Air handlers are the indoor portion of your heating and cooling systems. These units help circulate temperature-regulated air throughout your building quietly and efficiently, making them ideal for use in light commercial applications.

Air Handlers

Variable Refrigerant Volume (VRV) Systems

A VRV system is a modular, commercially applied air conditioning and heating system that distributes refrigerant as opposed to water. Daikin's industry-leading variable speed inverter compressors ensure comfort and energy efficiency by providing only the necessary heating or cooling from the outdoor unit to each individual indoor unit.

Variable Refrigerant Volume (VRV) System

Smart Thermostats

Daikin One+ is the first intelligent home air controller from one of the world's leading heating, ventilating, and air conditioning manufacturers. It serves as the cloud-connected hub of a sophisticated, integrated solution for management of temperature, humidity, and air quality.

Glossary of Terms

Filtration Glossary of Terms

Organizations

ABNT Brazilian Association of Technical Standards
ABSA Animal Biological Safety Association
ACS American College of Surgeons
AFNOR French Standardization Association
AIA American Institute of Architects
ANSI American National Standards Institute
ANVISA Brazilian Health Regulatory Agency
APHIS Animal & Plant Health Inspection Services
ARS Agricultural Research Service
AS/NZS Australian New Zealand Standards
ASHP Pharmaceutical Compounding Sterile Preparations
ASHRAE American Society of Heating, Refrigerating, and Air Conditioning Engineers, Inc.
ASTM American Society for Testing and Materials

BMBL Biosafety in Microbiological and Biomedical Laboratories
BSI British Standards Institute
BSL Biological Safety Association

Cal/OSHA California Division of Occupational Safety and Health (California OSHA)
CDC Centers for Disease Control and Prevention (a Federal agency)
CDER Center for Drug Evaluation and Research
CFDA China Food and Drug Administration
CITC Curry International Tuberculosis Center
CMC California Mechanical Code

EMA European Medicines Agency
EPA Environmental Protection Agency

FDA US Food and Drug Administration (a Federal agency)

HPRA Health Products Regulatory Authority

ICC International Code Council
ISO International Standards Organization (29463,14644 filter & cleanroom norms)
ISPE International Society of Pharmaceutical Engineers
ITRS International Technology Roadmap for Semiconductors

JACA Japan Air Cleaning Association
JCAHO Joint Commission on Accreditation of Healthcare Organizations
JCI Joint Commission International (accreditation)
JSA Japanese Standards Association

MHRA Medicines and Healthcare Products Regulatory Agency (UK)
MMWR Morbidity and Mortality Weekly Report

NACMCF National Advisory Committee on Microbiological Criteria for Foods
NEBB National Environmental Balancing Bureau
NFPA National Fire Protection Association
NIH National Institute of Health
NIOSH National Institute for Occupational Safety and Health (a Federal agency)
NOM Official Mexican Standards
NSF National Sanitation Foundation

OECA Office of Enforcement and Compliance Assurance (EPA)
OSHA Occupational Safety and Health Administration (a Federal agency)
OSHPD Office of Statewide Health Planning and Development (a California agency)

PDA Parental Drug Association
PHSS Pharmaceutical & Healthcare Sciences Society
PICS Pharmaceutical Inspection Convention & Co-operation Scheme

SEMI Semiconductor Equipment and Materials International

TGA Therapeutic Goods Administration (Australia)
TPD Therapeutic Products Directorate (Canada)

US DOD Department of Defense
US DOE Department of Energy
US DOH Department of Health
USDA United States Department of Agriculture
USP United States Pharmacopeial Convention

VDI Association of German Engineers

WHO World Health Organization

Filtration Glossary of Terms

Terms

ACH	Air Changes per Hour
AFB	Acid-Fast Bacilli
AHJ	Authority Having Jurisdiction
AHU	Air Handling Unit
AIDS	Acquired Immunodeficiency Syndrome
AIIR	Airborne Infection Isolation Room
AMC	Airborne Molecular Contamination
AMHSs	Automated Material Handling Systems
APC	Aerodynamic Particle Counter
API	Active Pharmaceutical Ingredient
aRABs	Active Restricted Access Barrier System
BACnet	Building Automation Control networking protocol
BAMT	Blood Assay for Mycobacterium Tuberculosis
BAS	Building Automation System
BCG	Bacille Calmette-Guérin (vaccine)
BI	Biological Indicators
BIBO	Bag In Bag Out
BMS	Building Management System
BOD	Basis of Design
BSC	Biological Safety Cabinet
C&Q	Commissioning & Qualification
CAV	Constant Air Volume
CFD	Computational Fluid Dynamics
CFM	Cubic Feet per Minute
CFR	Code of Federal Regulation
CFUs	Colony Forming Units
CGMP	Current Good Manufacturing Practice
CHW	Chilled water
CIP	Clean In Place
CMD	Count Mean Diameter
CMMS	Computerized Maintenance Management System
CNC	Controlled Not Classified
COSHH	Control of Substances Hazardous to Health
CPC	Condensation Particle Counter
CPU	Central Processing Unit
cRABs	Closed Restricted Access Barrier System
CRR	Contamination Recovery Rates
CVCM	Collected Volatile Condensable Material
DFW	Downflow Booth
DIW	Deionized Water
DOT	Directly Observed Therapy
DPC	Discrete Particle Counter
DQ	Design Qualification
DRAM	Dynamic Random Access Memory
DUV	Deep Ultraviolet
ECM	Engineering Change Management
EM	Environmental Monitoring
EMI	Electromagnetic Interference
EMS	Energy Management System
EN	1822 European Norm for Air Filter Testing Parts 1-5
ESD	Energy Saving Damper
ESD	Electrostatic Discharge
FAMU	Fresh Air Make Up
FAT	Factory Acceptance Test
FFU	Fan Filter Unit
FOUP	Front Opening Unified Pod
FPD	Flat Panel Display
FPM	Feet Per Minute
FRM	Fluoro-Resin-Media
FRS	Functional Requirement Specification
GCHW	Glycol Chilled Water
GEP	Good Engineering Practice
GIP	Gassing In Place
GLP	Good Laboratory Practice
GMP	Good Manufacturing Practice
HACCP	Hazard Analysis and Critical Control Points
HCW	Healthcare Worker
HEPA	High Efficiency Particulate Air
HIV	Human Immunodeficiency Virus
HMI	Human Machine Interface
HPC	Highly Potent Compound
HSC	Health & Safety Commission (UK)
HSE	Health & Safety Executive (UK)
HVAC	Heating, Ventilating, and Air Conditioning
IAQ	Indoor Air Quality
ICP	Infection Control Plan
IDLH	Immediately Danger to Life and Health
IGRA	Interferon Gamma Release Assay
IIoT	Industrial Internet of Things
INH	Isoniazid
IoT	Internet of Things
IQ	Installation Qualification
LAF	Laminar Flow
LCC	Life Cycle Cost
LCD	Liquid Crystal Display
LED	Light Emitting Diode
LEV	Local Exhaust Ventilation
LLF	Light Loss Factor
LTBI	Latent Tuberculosis Infection
LUX	Light (Latin)

Filtration Glossary of Terms

Terms

M.tb	Mycobacterium Tuberculosis
MA	Molecular Acids
MALs	Material Air Locks
MB	Molecular Bases
MC	Molecular Condensable (Organic Compounds)
MCP	Microbial Carrying Particles
MD	Molecular Dopants
MDR	Multidrug-Resistant
MPPS	Most Penetrating Particle Size
MTBF	Mean Time Between Failures
MTP	Material Transfer Port
MUA	Make Up Air
NAAT	Nucleic Acid Amplification Test
NTM	Nontuberculous Mycobacteria
NTT	No Touch Transfer
NVR	Non Volatile Residue
OAQ	Outdoor Air Quality
OEB	Occupational Exposure Bands
OEL	Occupational Exposure Limit
OPC	Optical Particle Counter
OPS	Operations Performance Systems
OQ	Operational Qualification
OSD	Oral Solid Dosage
PALs	Personnel Air Locks
PCW	Process Chilled Water
PE	Particle Exhaust
PEH	Heat Exhaust
PEV	VOC Exhaust
PFC	Power Factor Correction
PIN	Policy Intent Notice
PLC	Programmable Logic Control
POG	Point of Generation
POU	Point of Use
PPD	Purified Protein Derivative
PPE	Personal Protection Equipment
PQ	Performance Qualification
PTFE	Poly-Tetra-Fuoro-Ethylene
PUPSIT	Preuse Post Sterilization Integrity Testing
QFT-G	QuantiFERON®-TB Gold blood test
QRM	Quality Risk Management
RABs	Restricted Access Barrier System
RAH	Recirc Air Handling Unit
REL	Recommended Exposure Limits
RFU	Recirc Fan Unit
RIPT	Respiratory Isolation of Pulmonary Tuberculosis
RTMCC	Regional Training and Medical Consultation Center
RTP's	Rapid Transfer Ports
SAL	Sterility Assurance Level
SAT	Site Acceptance Test
SBV's	Split Butterfly Valves
SEM	Scanning Electron Microscope
Sensor360®	IAQ sensor technology that measures PM and PD levels to optimize filter life and performance.
SIP	Sterilize In Place
SME	Subject Matter Expert
STEL	Short Term Exposure Limit
SUP	Supply Air Categories
TB	Tuberculosis
TCOD	Total Cost of Ownership Diagnostic® Software
TFT	Thin Film Transistor
TLV	Threshold Limit Values
TOC	Total Organic Compound
TST	Tuberculin Skin Test
TVOCs	Total Volatile Organic Compounds
UDF	Unidirectional Down-Flow Hood
UPS	Uninterrupted Power Supply
UPW	Ultrapure Water
URS	User Requirement Specification
UV	Ultraviolet
UVGI	Ultraviolet Germicidal Irradiation
VAV	Variable Air Volume
VCM	Volatile Condensable Material
VFD	Variable Frequency Drive
VHP	Vaporized Hydrogen Peroxide (H_2O_2)
VLF	Vertical Laminar Flow
VMP	Validation Master Plan VO-Voltage Optimization
VOC	Volatile Organic Compound
VO	Voltage Optimization
VSD	Variable Speed Drives
VUs	Viable Units
"W.G."	Inches of Water Gauge
XDR	Extensively Drug-Resistant

Filtration Industry Definitions

ABSOLUTE – An arbitrary term once used to describe high efficiency particulate air filters, based on minimal penetration of 0.3 micron particles. In air filtration, there are no absolutes.

ABSOLUTE FILTER – This term has been applied to air filters of high efficiency—greater than 95% against submicron particles—but is now less frequently used. Modern terminology prefers the term HEPA filter (High Efficiency Particulate Air).

ABSORB – To intercept, or drink in, as a sponge sucks in water.

ABSORPTION – A physio-chemical process in which one substance associates with another to form a homogeneous mixture that presents the characteristics of a solution.

ACFM – Actual Cubic Feet Per Minute. Airflow measured at operating temperature and pressure.

ACID – Any of a class of substances whose aqueous solutions are characterized by a sour taste, the ability to turn blue litmus to red, and the ability to react with bases and certain metals to form salts. Acids will yield hydrogen ions when dissolved in water.

ACTIVATED ALUMINA – A highly porous and granular form of aluminum oxide having preferential adsorptive capacity for moisture from gases, vapors, and some liquids.

ACTIVATED CARBON – Any form of carbon characterized by high adsorptive capacity for gases, vapors, or colloidal solids. The carbon or charcoal is produced by destructive distillation of wood, peat, lignite, nut shells, bones, vegetable, or other carbonaceous matter, but must be activated by high temperature steam or carbon dioxide, which creates a porous particle structure.

ACTIVATED CHARCOAL – See activated carbon.

ADHESION – Intermolecular forces which hold matter together. Also applied to the sticking together of a particle to a surface, a fiber or another particle. The main factors affecting adhesion of particles are 1) London-van der Waals forces, which are electrical in origin, 2) electrostatic forces, and 3) surface tension, due to films of moisture on particles or on the surface. Other factors influencing adhesion are the nature of the surfaces, surface contaminants, particle size, shape and roughness, and time of contact.

ADSORB – The physio-chemical phenomenon involved to attract and hold a gas, vapor, or liquid on the surface of a solid, particularly on a finely divided material.

ADSORBATE – The material which is adsorbed; i.e., the gas, vapor, or liquid which adheres, or is chemically attracted to, the surface of the solid.

ADSORBENT – The material which adsorbs; i.e., the solid which attracts and holds on its surface the gas, vapor, or liquid. Activated carbon and activated alumina are all adsorbents

ADSORPTION – The natural phenomenon of a gas, vapor, or liquid being attracted to, and held on, the surface of a solid. To some extent, adsorption takes place on any solid surface, but certain materials have sufficient adsorbent capacity because they are finely divided and are therefore useful in such industrial applications as the purification and separation of gases and liquids.

AEROSOL – Liquid or solid particles suspended in air, gas, or vapor.

AHRI – Air-Conditioning, Heating, and Refrigeration Institute.

ALKALI – A term that applies to the type of compounds which have basic properties and will neutralize acids. Some alkaline materials are hydroxides, carbonates, or caustics.

AMBIENT – Of the surrounding area or environment.

AMBIENT AIR – The air surrounding a building. The source of outdoor air brought into a building.

AMINE – A class of organic compounds of nitrogen that may be considered to be derived from ammonia. It may be a gas, liquid, or solid. All amines are basic in nature and will usually combine readily with hydrochloric or other strong acids to form salts.

AMMONIA – A colorless gas with a characteristic pungent odor. Used for refrigeration, fertilizer, chemical manufacturing, and many other uses.

ANGSTROM – A unit of length, 10-10 meter, or one ten thousandth of a micron.

ANSI – American National Standards Institute.

ARRESTANCE – A measure of the ability of an air-cleaning device to remove ASHRAE loading dust from test air. Measurements are made of the weight of loading dust fed and the weight of the dust passing the device during loading. The difference between the weight of dust fed and the weight of dust passing the device is calculated as the dust captured by the device. Arrestance is then calculated as the percentage of the dust fed that was captured by the device.

AROMATIC COMPOUNDS – Compounds related to six-carbon membered rings as benzene or its derivatives.

ASHRAE – American Society of Heating, Refrigerating and Air-Conditioning Engineers.

ASHRAE LOADING DUST – Loading dust for testing air filtration devices composed, by weight, of 72% SAE Standard J726 test dust (fine), 23% powdered carbon, and 5% milled cotton linters.

ASME – American Society of Mechanical Engineers.

ATMOSPHERIC PRESSURE – The pressure of approximately 14.7 pounds per square inch exerted at sea level in all directions by the atmosphere.

BIOAEROSOL – A suspension of airborne particles that contain living organisms or were released from living organisms.

BLEEDTHRU – The term bleedthru was a phrase coined by industry professionals when multiple filters (normally installed in a Grade A space) were exposed to a thermal ('hot smoke') challenge aerosol. The filters installed had excessive penetration through the media, hence the term 'bleedthru'.

A lot has been written about this topic including from 'not thick enough media' to 'we must now use ULPA filters' but the issue and 'fix' can be summarized below.

The three main factors to be aware of are:

1. Higher than expected or design velocity (We should look at effective filter area not the nominal frame size)
2. Challenge aerosol type. ('Hot' smoke mean particle size can be close to the MPPS)

Filtration Industry Definitions

3. Filter Specification. (The traditional 99.99 at 0.3 micron can 'fail' a scan test when exposed to a thermally generated aerosol especially at higher than design or factory tested velocity in the field)

How to solve the problem:

1. Understand the actual media face velocity when selecting/specifying filters. A nominal '4x2' or 1200x600 filter can be as high as 20% smaller when installed in a given housing or ceiling grid therefore increasing the actual face velocity which can contribute to higher penetration values. Most filter manufactures test filters at 120 fpm or 0.6 m/s to minimize risk. Some older facilities due to the specific site design have higher than recommended filter face velocities. Filters can be manufactured to perform at elevated velocities if known ahead of time. The only negative of course is the penalty paid in a higher energy cost due to the increased pressure drop. (Membrane eFRM media can reduce DP substantially in these applications)
2. Understand where possible how your filters are being tested. A 'hot smoke' (thermal) has a higher penetration than 'cold smoke' (Laskin Nozzle) in the field as stated above.
3. To minimize risk, specify filters with an efficiency of H14 (99.995) at MPPS in accordance with EN-1822 or Type K (99.995) at 0.1-0.2 micron in accordance with IEST CC001. The leakage factor for the H14 filter should be 1.6 (Type K) instead of 5, therefore giving a maximum penetration of 0.008% assuming a standard velocity of 120 fpm or 0.6 m/s.

It's important all parties involved from the end user, specifier, certifier and filter vendor understand the site specific variables. Again, filter efficiency specified, actual on site HEPA media velocity, and the equipment and specification of how filters are tested both in the factory and field.

BLIND SPOTS – Places in a medium where no filtering occurs. These places are also referred to as dead areas and are the opposite of the effective area.

BREAKTHROUGH – When the downstream concentration exceeds the allowable concentration.

BRIDGING – Where particles being removed from the air form an arch over the individual openings/pleats in an extended surface filter, blocking the narrow air passages between pleats and reducing the service life of the filter.

BROWNIAN MOTION – The random movement of microscopic particles suspended in a liquid or gas, caused by collisions with molecules of the surrounding medium. Also called Brownian Movement.

BTU (BRITISH THERMAL UNIT) – A standard measure of heat content in a substance that can be burned to provide energy.

BYPASS – Condition resulting from the fluid stream flowing through a housing without flowing through the filtering medium. In air filtration, unfiltered air going around the filter.

CAPACITY – Volume of air expressed in cubic feet per minute (CFM), or similar units that a filter is rated to handle.

CFM – Cubic feet per minute.

CHEMISORPTION – The combined process of adsorption, absorption, and oxidation, where gases trapped in chemisorbant media (adsorbent with an impregnant) are changed from gases into harmless solids.

CHIMNEY EFFECT – The tendency of heated air to rise due to lower density in comparison with ambient, also called thermal, updrafts. In cleanroom areas, heat generating equipment may cause severe upward air currents, resulting in unwanted turbulence.

CLEAN PRESSURE DROP – Differential pressure (drop) across a clean filter, typically measured in inches of water column (water gauge) or pascals.

CLEAN SPACE – A term referring to cleanrooms or work stations within a room.

CLEANING – Removal of soil from objects/surfaces.

CLEANROOM – A specially constructed enclosed area environmentally controlled with respect to airborne particulates, temperature, humidity, air pressure, airflow patterns, air motion, and lighting.

COALESCING – Action of uniting of small droplets of one liquid, preparatory to its being separated from another liquid.

COMPOSITE MEDIA – Media made up of more than one material.

CONTACT TIME – The length of time an absorbent is in contact with a liquid or gas prior to being removed by the filter.

CONTAMINANT – Synthetic or naturally occurring chemical, particle, or microorganism in air that could have adverse effects

NON-LAMINAR FLOW CLEANROOM – A cleanroom with no requirements for uniform airflow patterns and air velocities.

CORROSION – Conversion of metals into oxides, hydrated oxides, carbonates, or other compounds, due to the action of air or water, or both. Salts and Sulphur are also important sources of corrosion.

CRITICAL SURFACE – The surface in a cleanroom or work station to be protected from particulate contamination.

DEAD AREAS – Places in a medium where no filtering occurs. Also referred to as blind spots. The opposite of the effective area.

DECONTAMINATION – Removal of all pathogenic microorganisms from objects to ensure they are safe to handle.

DEGRADATION – The wearing down, or reduction in the efficiency of, the medium.

DELTA (Δ) P – A commonly used symbol denoting the difference in pressure between two points, such as the inlet and outlet of a filter. This difference is often referred to as the pressure drop and is typically measured in inches of water column (water gauge) or pascals.

DEPTH FILTRATION – Filtration accomplished by a progressively denser, deep medium, designed to allow finer particles to penetrate further into the medium, while larger particulates are lodged closer to the surface. A progressive density medium has superior dust holding capacity.

DIFFERENTIAL PRESSURE – Difference in pressure between two points, such as the inlet and outlet of a filter. This difference is often referred to as the pressure drop, and is typically measured in inches of water column (water gauge) or pascals.

Filtration Industry Definitions

DIFFERENTIAL PRESSURE INDICATOR – Indicator that signals the difference in pressure at two points.

DIFFERENTIAL PRESSURE SWITCH – Electrical switch operated by the difference between two pressures and often used to give warning of the end of a filtration cycle.

DIFFUSER – An air distribution outlet specifically designed to mix conditioned air with room air by induction. Mixing is accomplished by venture action, as the high velocity airstream leaving the diffuser aspirates ambient air toward the device.

DIFFUSION – A method of filtration that is effective on particles 0.1 micron and smaller, whose direction and velocity are influenced by molecular collisions (called Brownian Motion). Particulates of this size do not follow the airstream, but behave more like gases than particulate. Their dwell time in the media is longer as they are battered across the direction of flow in a random "helter skelter" fashion. When a particle strikes a fiber, it is retained by the inherent adhesive forces between the particle and fiber (van der Waals forces).

DISINFECTION – Elimination of many or all pathogenic organisms with the exception of bacterial spores.

DISPOSABLE – Describes an expendable component which is to be discarded after use and replaced with an identical component. This means that the component is replaceable, not reusable.

D.O.P. (DIOCTYL PHTHALATE) – An oil-like plasticizer which is readily atomized to form the test aerosol which was once used in the overall penetration and scan tests of HEPA filters. This test aerosol is now rarely used and has been replaced with PAO (poly-alpha-olefin).

DOWNSTREAM – Portion of the system located after a filter. Also, the leaving air or the clean air side of a filter.

DUAL LAYER MEDIA – Media in a filter element that has a coarse layer followed by a fine layer, to enhance dust holding capacity.

DUST HOLDING CAPACITY (DHC) – The total weight of ASHRAE test dust a filter can hold before reaching a given final resistance. This amount will vary, depending on the size and design of the filter and airflow rate. Typically reported in grams, DHC is used to provide a relative measure of filter service life.

EFFECTIVE AREA – Area of the medium exposed to flow and usable for its intended purpose (filtering). This term means the opposite of blind spots or dead area.

EFFICIENCY – Degree to which a filter will perform in removing solids, in accordance with the chosen test method.

EFFICIENCY CURVE – Graph showing the performance of a filter when challenged by specified contaminants under controlled conditions. Usually will be plotted against particle size at a given face velocity.

ELECTRET MEDIA – Filter media containing an electrostatic charge.

ELECTROSTATIC PRECIPITATION – A method of filtration that imparts a positive charge to airborne particulate matter and collects the particles on negatively charged collection plates.

EXFILTRATION – Outward air leakage from a space through openings, caused by pressure differences across these openings.

EXTENDED SURFACE FILTER – A category of filter that is designed with pleats or pockets to increase the amount of media exposed to the airstream within a given face dimension. Greater filter surface area reduces media velocity and increases efficiency and dust holding capacity.

FACE AREA – The area of a filter perpendicular to the flow direction.

FACE LOADING – The phenomenon by which contaminants in the air load up on the surface of the filter, causing an abnormal rise in resistance.

FDA – U.S. Food and Drug Administration, which is responsible for protecting and promoting public health through the regulation and supervision of food safety, tobacco products, dietary supplements, prescription and over-the-counter pharmaceutical drugs, vaccines, biopharmaceuticals, blood transfusions, medical devices, electromagnetic radiation emitting devices, cosmetics, animal food and feed, and veterinary products. The FDA enforces Current Good Manufacturing Practices (CGMPs).

FIBER – Fundamental unit comprising a textile raw material such as cotton or wool.

FIBERGLASS – A term used to describe a variety of filter media made with glass fibers.

FILTER – A term generally applied to a device used to remove contaminates from the air. A filter may be one of a number of types, such as panel, automatic self-renewable, extended surface, HEPA, electrostatic, or gas phase. The term filter is sometimes erroneously used to describe the media used inside the device.

FILTER MEDIUM – The porous material mounted in the filter through which air is passed to remove the contaminants.

FILTRATION – The process of removing contaminants from liquid or gas by forcing them through a porous medium.

FINAL FILTER – The last and usually most efficient filter in a multi-stage filtration system.

FPM – Feet Per Minute. This term refers to the speed at which air moves through an area.

FRESH AIR – Term used for outdoor air.

GAS – The state of matter in which molecules move freely, causing matter to expand indefinitely, occupying the total volume available.

GAS-PHASE FILTER – Air cleaning device that uses the adsorption and/or chemisorption removal process. Typical filter mediums are activated carbon, alumina, and zeolite, with and without chemical impregnants.

GASKET – Material inserted between contact surfaces of a joint to ensure a seal.

HEPA FILTER – High Efficiency Particulate Air filter, which is capable of removing a minimum of 99.97% of 0.3 micron particles (typically PAO) of other gases from air.

HYDROCARBON – Any one of a large number of compounds composed primarily of the elements carbon and hydrogen. As they increase in molecular weight and boiling point, these compounds may be respectively gases, liquids, or solids.

HYDROPHILIC – Water accepting, or water wetting. Having an affinity for water, the opposite of hydrophobic.

Filtration Industry Definitions

HYDROPHOBIC – Non-water wetting. Having an antagonism for water, the opposite of hydrophilic.

IEST – Institute of Environmental Sciences and Technology, whose mission is "To globally expand and communicate the knowledge of contamination control, nanotechnology facilities, and test reliability. This is accomplished through the development of Recommended Practices and Standards by a community dedicated to professional collaboration, training, and education."

IMPINGEMENT – A method of filtration that is effective on particles with sufficient inertia to cause them to leave the airstream and collide with a fiber. Often referred to as "viscous impingement," when the fibers are coated with an adhesive.

INCHES W.G. – Abbreviation for "inches water column gauge." This is a method of reporting filter resistance (or pressure drop) across a filter.

INFILTRATION – Inward air leakage from a space through openings, caused by pressure differences across these openings.

INITIAL RESISTANCE – Differential pressure (drop) across a clean filter, typically measured in inches of water column (water gauge) or pascals. Synonymous with initial pressure drop, or clean pressure drop.

INTERCEPTION – A special case of the impingement method of filtration that does not depend on the inertia of the particles to bring them in contact with a fiber. Interception occurs when a particle follows the airstream but touches a fiber as it attempts to flow around it. The particle is held by the inherent adhesive forces between the particle and fiber (van der Waals force).

INTERSTICES – Spaces or openings in a medium, such as the spaces between intersecting fibers. Also referred to as pores or voids.

KNIFE-EDGE SEAL – A narrow, pointed ridge on the peripheral sealing surface of a filter or filter frame, which provides a seal by the impression of a sharp edge into a gasket or gel.

LAMINAR AIRFLOW – Airflow in parallel flow lines with uniform velocity and minimum eddies.

LAMINAR FLOW CLEANROOM – A cleanroom with a requirement for laminar airflow. Airflow velocities are usually not greater than 90 FPM.

LIFE EXPECTANCY – The service life or change-out interval of a filter cartridge. Even with known dust holding capacity, the useful life will vary according to the type and size of contaminants entering the filter, particularly on makeup air or 100% outside air systems.

LIFE CYCLE COSTS (FILTER) – Sum of all costs associated with operating a filter system, including product, energy, labor, transportation, and disposal costs.

MAKEUP AIR – Outside air introduced to the HVAC system for ventilation, pressurization, or to replace exhausted air quantities.

MASS TRANSFER ZONE – Area of the adsorbent bed where contaminants are removed from the airstream. The mass transfer zone will move away from the inlet of the bed to the discharge until breakthrough occurs (end of useful life of the medium).

MAXIMUM DIFFERENTIAL PRESSURE – The highest pressure differential which a filter is required to withstand without structural failure or collapse.

MAXIMUM RECOMMENDED PRESSURE DROP – Published final pressure drop by manufacturer.

MEDIA – Plural of medium. This is the material that performs the actual separation of contaminants from the air stream.

MEDIA VELOCITY – Speed of the air flowing perpendicular to the media, calculated by dividing the total airflow through a filter by the effective media area.

MEDIUM – The porous material through which air is passed to remove contaminants (particulates or gases). It is usually confined within a frame or cell sides and is generally referred to as a filter or filter cartridge.

MERV – Minimum Efficiency Reporting Value is a single number that is used, along with the air velocity at which the test was performed, to simplify the extensive data generated by the ASHRAE Standard 52.2, Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size. MERV is expressed on a 16 point scale (MERV 1 through MERV 16) and is derived from the particle size removal efficiency measured in the test.

MICRON OR MICROMETER – A unit of length in the metric system. This term means one millionth of a meter, 10-4 centimeter, 10-3 millimeter, or 0.000039 of one inch. It is commonly used as a measure of particle size or fiber size in filter media. The naked eye can see a particle approximately 10 microns or larger without magnification.

MICROORGANISMS – Living bodies that can be seen only through a microscope.

MIGRATION – Contaminant captured and subsequently released downstream of a filter.

MILLILITER – One thousandth of a liter, equal to one cubic centimeter.

MOORE'S LAW – The amount of information storable on a given amount of silicone doubles every year. (Gordon Moore, 1964, founded Intel)

NET EFFECTIVE MEDIA AREA – The amount of media area in a filter that is exposed to airflow and usable for collecting airborne contaminants. The opposite of blind spots or dead area, this term is synonymous with net effective filtering area.

NEGATIVE PRESSURE – Vacuum or suction.

NON-LAMINAR – As applied to cleanroom airflow, this is less desirable than laminar flow because the air supply is introduced at random, causing turbulence and induction that stir the airborne dust particles and keep them in suspension.

NONWOVEN – A filter cloth or paper that is formed of synthetic fibers that are randomly oriented in the media. It is usually held together with a binder or binder fibers.

NON-SUPPORTED FILTERS – Extended-area filters which rely on the airflow to support the media in the airstream. Filters will generally sag or collapse under low or no airflow conditions.

Filtration Industry Definitions

NVR – **Non Volatile Residue** - refers to the matter that remains after the solvent containing such matter has been filtered and evaporated at a specified temperature.

OFFGASSING – Term used to express the release of a gas from a material that was previously captured by an adsorbent. Preferential off-gassing occurs when an adsorbent releases a lighter molecular weight gas in order to adsorb a heavier molecular weight gas.

ORGANIC – Describes the vast number of chemical substances containing carbon, hydrogen, and oxygen.

OUTDOOR AIR – Ambient air that enters a building through a ventilation system, through intentional openings for natural ventilation, or by infiltration.

OXIDE – Combination of oxygen with another element.

OXIDATION – Any chemical reaction in which a material gives up electrons, as when the material combines with oxygen. Burning is an example of rapid oxidation, while rusting is an example of slow oxidation.

PANEL FILTER – A low efficiency filter, consisting of a flat sheet of media that is usually contained within a cardboard frame. An alternative design has an internal wire frame. Panel filters are typically made with fiberglass or synthetic media and are often referred to as throw-away filters.

PARTICLE COUNT – In a cleanroom, the particulate concentration expressed as particles per cubic foot or particles per cubic meter, by particle size, is used to express the Airborne Particulate Cleanliness Class in accordance with Federal Standard 209E or ISO Standard 14644-1. Depending on the cleanliness class, particles are simultaneously measured from 0.1 micron to 5 microns in size.

PARTICULATE MATTER (PM) – Also known as particle pollution, PM is a complex mixture of extremely small particles and liquid droplets. Particle pollution is made up of a number of components, including acids (such as nitrates and sulfates), organic chemicals, metals, and soil or dust particles.

PENETRATION – The leak rate through the filter, penetration is expressed as a percentage based upon a specific particle size. The percentage of penetration is the reciprocal of the percentage of the efficiency. HEPA filters, for example, have a 0.03% maximum penetration on 0.3 micron (μ) particles.

PLEATED FILTER – A type of extended surface filter where the media is folded back and forth to increase the amount of media exposed to the airstream within a given face dimension. Greater filter surface area reduces media velocity and increases the efficiency and dust holding capacity.

PLEATING – In filters with a paper medium or other sheet material, pleating means the folding processes which provide a large surface area within a given volume of filter.

PREFILTER – A filter placed in front of another filter to remove larger, heavier particles. The primary purpose of this is to extend the life of the final filters. Prefilters are highly recommended in systems requiring high efficiency filtration, especially where a high concentration of lint and larger particles are present.

PRESSURE DIFFERENTIAL – Difference in pressure between two points.

PRESSURE DROP – Difference in pressure between two points, generally at the inlet and outlet of a filter. Pressure drop is typically measured in inches of water column (water gauge) or pascals.

PRESSURE, STATIC – The fan-induced pressure that tends to burst or collapse a duct, which is required to move air through a system. Fans must push or pull air to deliver against resistance from duct friction, filters, coils, and other airflow obstructions.

PRESSURE, TOTAL – The combination of static pressure and velocity pressure within a duct.

PRESSURE, VELOCITY – The pressure required to maintain movement of air through a duct.

RESIDENCE TIME – The theoretical time that a contaminant is within the confines of a media bed.

RETENTIVITY – The ability of an adsorbent to resist the desorption of an adsorbate.

ROOM CLASSIFICATION

As Built - As built testing is carried out when the cleanroom envelope and all mechanical and electrical systems are complete but no production or process equipment is installed.

At Rest - At rest testing is carried out when all the production and process equipment is installed but has no occupancy of personnel.

Operational - Operational testing is carried out when all the production, process and occupants are in place– full working cleanroom.

SAMPLING

Isokinetic - Isokinetic sampling is when the sampling velocity is equal to the system or approach air velocity. Isokinetic sampling produces the most accurate and quantifiable results while leak scan testing.

Hyperkinetic - Hyperkinetic sampling is when the sampling velocity is greater than the system or approach air velocity. Leak scan testing via hyperkinetic sampling (greater than Isokinetic) produces less conservative readings that add the risk of missing leaks.

Hypokinetic - Hypokinetic sampling is when the sampling velocity is lower than the system or approach air velocity. It has been shown through experiment that the measured concentrations are conservative. In other words, leak scan testing via hypokinetic sampling (lower than Isokinetic) produces readings that may indicate a larger leak.

Note: Hypokinetic sampling method may be used qualitatively (not to quantify the reading at the leak) as a more conservative method than Isokinetic sampling to leak scan filters. In other words, this method increases the chances of finding a leak while leak scan testing.

SCAN TEST – Technique for disclosing leaks in HEPA and ULPA filters. Tests are performed by introducing a challenge aerosol upstream of the filters and passing the inlet of a sampling probe of an aerosol photometer or discrete particle in a series of parallel, slightly overlapping strokes across the downstream face of the filter (scanning), to detect any leaks.

Filtration Industry Definitions

SCFM – Standard Cubic Feet per Minute. This term refers to airflow that has been corrected to "standardized" conditions of temperature and pressure.

SENSOR360® – AAF IAQ sensor technology that measures PM and PD levels to optimize life and performance.

SKIN LOADING – The condition that occurs when collected particles build up on the surface of the media, plugging the spaces between the fibers. This is also known as blocking or surface loading. As a rule, the finer the media, the more susceptible it is to skin loading by "coarse" particles.

SORBENT – A substance that has the property of collecting molecules of another substance by adsorption or absorption.

STATIC TIP – Device used to measure static pressures in ducts or rooms. These devices are frequently installed upstream and downstream of a filter bank and connected to a pressure gauge to measure the pressure differential across the filter bank.

STERILIZATION – Complete elimination, destruction of all microbial life.

STOKES' LAW – A physical law which approximates the velocity of a particle falling under the action of gravity through a fluid. The particle accelerates until the frictional drag of the fluid just balances the gravitational acceleration, after which it will continue to fall at a constant velocity known as the terminal or free-settling velocity.

STRAINING – A method of filtration that removes larger particles. Straining occurs when a particle is larger than the space between fibers and cannot pass through them.

SULPA FILTER – Super Low Penetrating Air filter with a minimum efficiency of 99.9999% on 0.12 micron (μ) particles.

SURFACE AREA – The surface area of an adsorbent is determined by the BET method and is usually expressed in square meters per gram of adsorbent.

TCOD – **Total Cost of Ownership Diagnostics®** – AAF Software designed specifically to optimize LCC of HVAC filters.

TERMINAL HEPA MODULE – A HEPA filter module that is connected to the end of a duct, most often mounted in the ceiling of a cleanroom.

TERMINAL VELOCITY – Steady velocity achieved by a falling particle when gravitational forces are balanced by viscous forces. See Stokes' Law.

TEST AEROSOLS

DEHS: di-2-ethyl-hexyl-sebacate - Frequently used in the factory, occasionally in the field.

DOP: di-octyl-phthalate - Often prohibited, seen as being carcinogenic (Still utilized in Nuclear applications)

PAO: poly-alpha-olefin - Most commonly utilized test aerosol in the field for Life Science applications.

PSL: poly-styrene-latex - mono dispersed spheres, typically used as a challenge aerosol in the HEPA manufacturing facility.

U DESCRIPTOR – method to present the measurement results for ultrafine particle concentration in a cleanroom. The descriptor serves as the upper limit for the location averages or as an Upper Confidence Limit (UCL), or both as appropriate.

UL 586 – Standard for High Efficiency, Particulate Air (HEPA) Filter Units. For this standard, filters are tested for efficiency and penetration and undergo a moisture test, heated air test, a low temperature test, and a spot flame test. A UL 586 label can only be applied to HEPA filters whose designs have been proven to meet the requirements of UL 586 test standard and must be tested for efficiency and resistance.

UL 900 – Standard for Air Filter Units. Filters that are classified to this standard and bear the UL mark meet the requirements of the test for the amount of smoke generated and the combustibility of the air filter unit. Filters meeting the standard are classified as follows: "Air filter units covered by this standard are classified as those that, when clean, burn moderately when attacked by flame or emit moderate amounts of smoke, or both."

ULPA FILTER – Ultra Low Penetrating Air filter with a minimum efficiency of 99.9995% on 0.12 micron (μm) particles.

UNLOADING – Release downstream of trapped contaminate. This can be due to a change in flow rate, mechanical shock, vibration, excessive pressure build-up, or medium failure.

VAPOR – A substance diffused or suspended in the air, especially one that is normally liquid or solid.

VENTILATION – The movement of air to and from a space by mechanical or natural means, including both the exchange of air to the outside, as well as the circulation of air within a building or space.

VISIONAIR™ CLEAN WITH TCO DIAGNOSTIC® SOFTWARE – An AAF software designed specifically to optimize A/C change rates, HEPA and housing selection.

VOLATILE ORGANIC COMPOUNDS (VOCs) – Organic chemicals that have a high vapor pressure/low boiling point at ordinary room temperature, which causes large numbers of molecules to evaporate or sublimate from the liquid or solid form of the compound and enter the surrounding air. The health effects of VOCs in indoor environments vary, depending on the type and concentration of VOCs, along with the length of time a person is exposed.

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