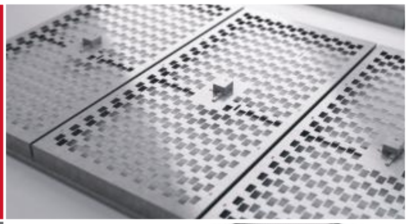
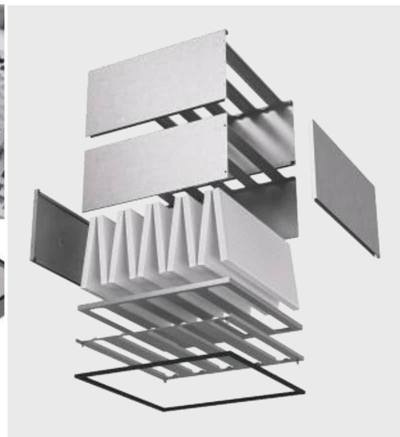
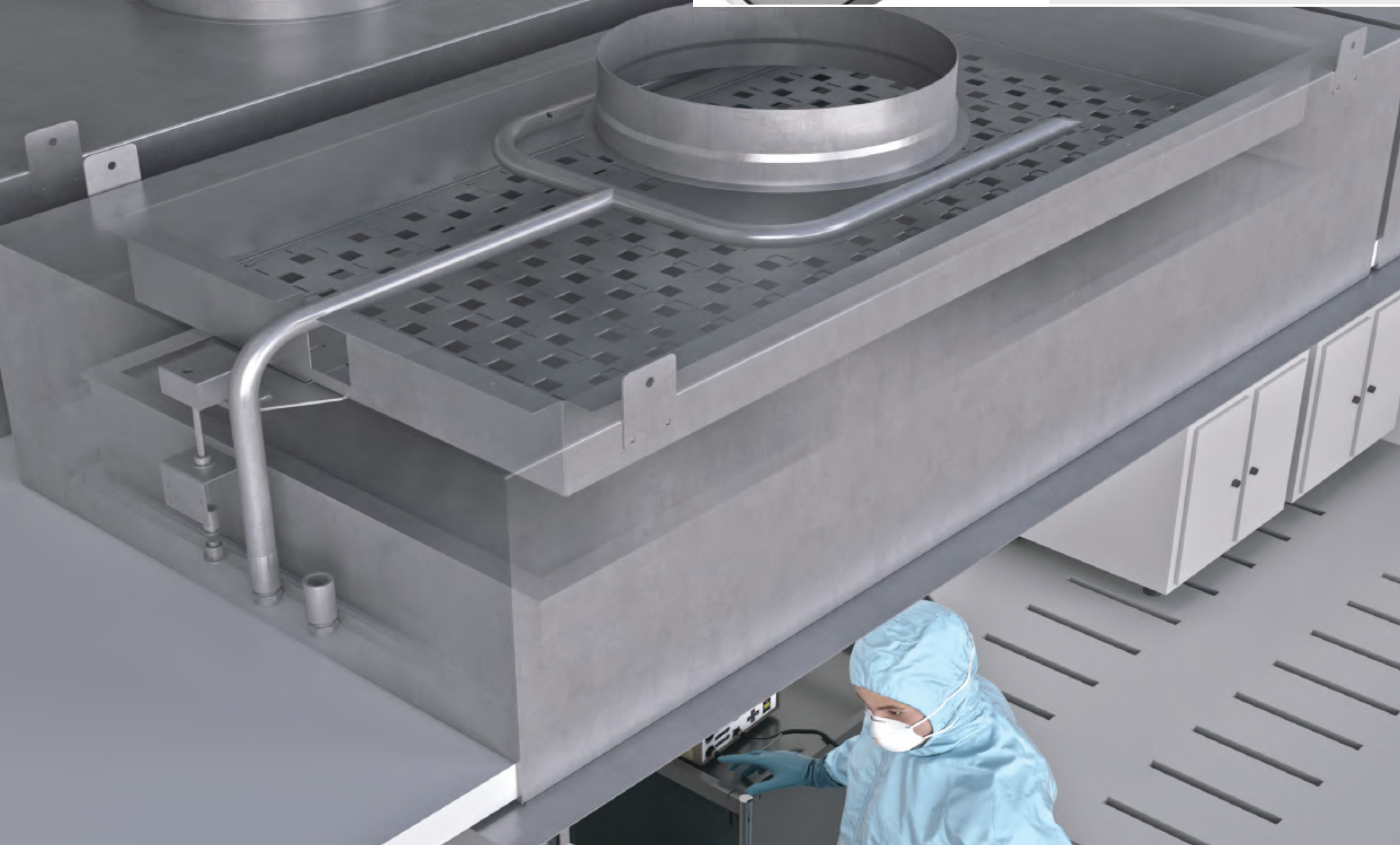
# High Purity Filtration Solutions

## Supply Housings and HEPA/ULPA Filters

**AstroHood® and AstroFan® Housings**
**AstroCel® and MEGAcel® Filters**





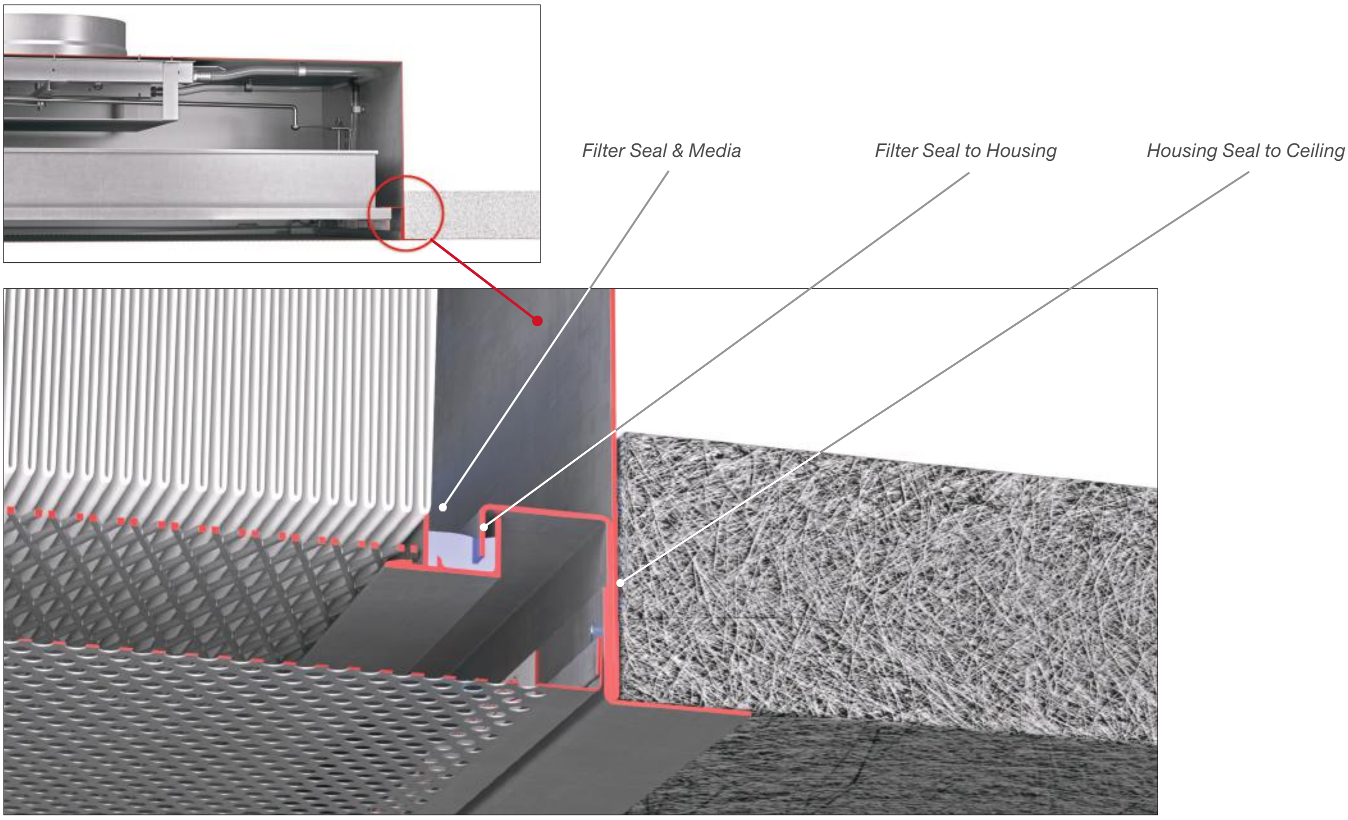


The need to control viable and non-viable particles is crucial for protecting critical processes, equipment and environments. Protection of people from hazardous or potent compounds is also critical. In addition, the reduction of energy consumption and overall operating costs is essential to the efficient operation of a facility. It is therefore important to partner with suppliers who have both the product capabilities and application expertise required to minimize risk and maximize total system economy in critical environments.

# Maximizing System Integrity and System Economy

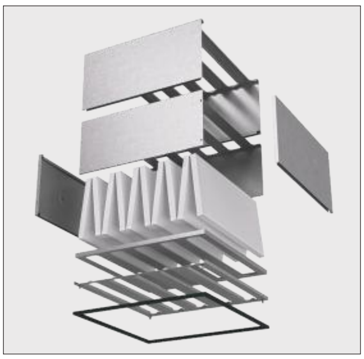
## Media + Seal + Housing = System Integrity

High efficiency filtration media is the heart of the filter and the cleanroom, yet delivering its promised performance is ultimately dependent on the overall integrity of the total filtration system, including the seals between filters and housings, as well as the construction quality of the housing it will be contained in. Achieving maximum protection for critical environments requires a holistic approach to the analysis, design, and implementation of high purity filtration systems. When considering the ideal solution, it is important to account for all potential leak paths and remember that **Media + Seal + Housing = True System Integrity.**

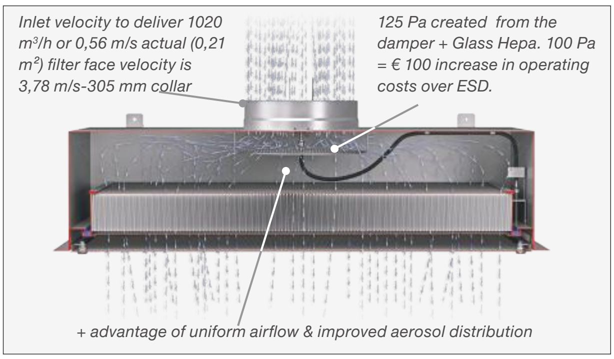



## Housing + Damper + Filter = System Economy

In addition to the contaminant protection of critical environments, the economically efficient operation of those facilities must also be considered and planned for. When it comes to filters, more media does not always mean less resistance. The construction and configuration of filtration media in a finished filter determines up to 65% of its economic efficiency. Furthermore, the housing and damper systems selected to hold a filter can contribute up to 250% more resistance than the resistance of the filter itself. Therefore, as with System Economy, the whole is truly the sum of its parts, and every part must be carefully selected to deliver the lowest possible operating costs – **Hood + Damper + Filter = System Economy.**



*MEGAcel II box filter with 10 Minipleat Packs in V-Style Configuration*




*Combined Resistance of Housing, Butterfly Damper, Swirl Diffuser, and Microfiberglass HEPA Filter*

*Life Science applications utilize AstroHood® and Plenums depending on the room classification requirement*

# Media – The Heart of the Filter and the Cleanroom

## Understanding the Media Options Available to You

HEPA and ULPA filters made with microglass media have stood the test of time for over 75 years. However, aside from the development of “low boron” microglass media for the microelectronics industry, the technology has seen very little innovation since its inception. While its filtration performance has been proven throughout its long history, unfortunately so has its fragility. Despite its well documented filtration performance, the delicate nature of glass fiber media continues to present a potential risk for damage that should be considered when selecting the ideal media for a given application.

Conversely, membrane media technologies have seen and experienced continuous innovation and adoption across many industries and applications over the past 30 years. In the early 1990’s, increased demand from the booming microelectronics industry for HEPA and ULPA grade air filters with reduced offgassing properties and improved energy efficiency created an opportunity for innovation in HEPA and ULPA grade medias. Within that same time period, Daikin Industries discovered an ultrafine fiber structure that would enable a revolutionary change in air filter membrane media development.

## Proven Alternatives to Glass Fiber Media

The development of Daikin’s unique ultrafine fiber ePTFE membrane media offered an alternative option to glass fiber filters for the microelectronics industry that provided the lowest offgassing properties, lowest energy consumption, and far superior tensile strength and durability. This technological advancement enabled the industry to dramatically reduce operating costs, while also improving production yield. Since that time, ePTFE media has become the media of choice for the microelectronics industry.

## Expanded Portfolio of Membrane Technologies

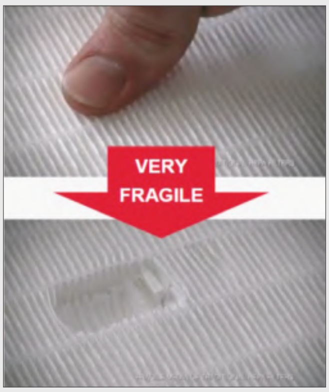
Membrane technologies have evolved since the discovery of the ultrafine fibers by Daikin Industries in 1988. The main benefits remain the same: excellent pressure drop, no boron emissions, and superior durability when compared to glass fiber media. However, the portfolio of available media types for specific applications has expanded.

## Evolution Meets Revolution: Introducing the Fluororesin Membrane

Expanded Fluororesin Membrane, or eFRM, is the next generation of membrane media technology, designed specifically for applications where high concentrations of oil-based test aerosols (i.e. PAO) and fine particulate (i.e. Hydrocarbons) are present. This unique recipe of ultra-fine membrane layers and support structures now enables these demanding environments to take advantage of the same membrane media performance that other applications have enjoyed for decades.

## Media Resilience Comparison

AAF’s HEPA/ULPA filters utilizing Daikin’s ultra-fine fiber membrane media technology are the product of choice in the most demanding environments.

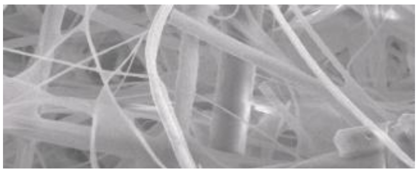



Wet laid glass fiber media is delicate and vulnerable to various levels of degradation, ranging from pinhole leaks to irreparable damage.

### Microglass Media:

Wetlaid media made from borosilicate glass fibers and adhesive binders.

- Available in E10 –U17
- Compatible with Discrete Particle Counters (DPC) testing and photometric test methods

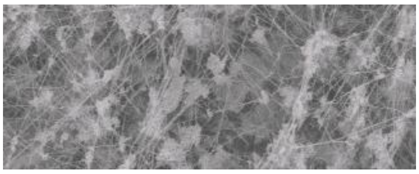


*(10,000x)*

### 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



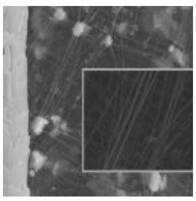
*(10,000x)*

### eFRM Membrane Media:

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

- Available in H13 –H14
- Designed for ultra-high particulate loading, including oil-based test aerosols
- Compatible with photometric test methods

+nm_@LG F[s_l
*(Low Fibril Density)*



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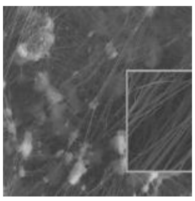
, h^ _@LG F[s_l
*(High Fibril Density)*

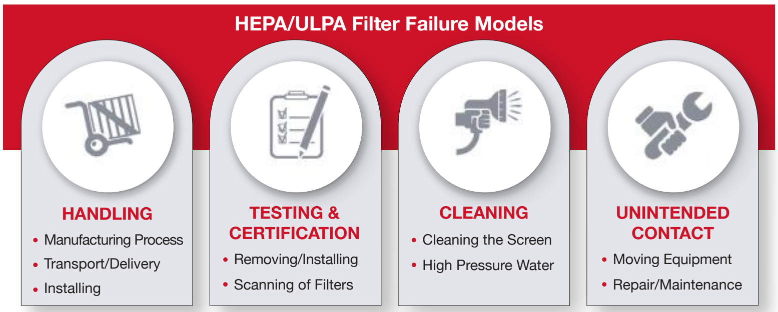


*(10,000x)*

# Selecting the Right HEPA/ULPA Filter

## Key Risk Based Considerations: Modes of HEPA/ULPA Filter Failure

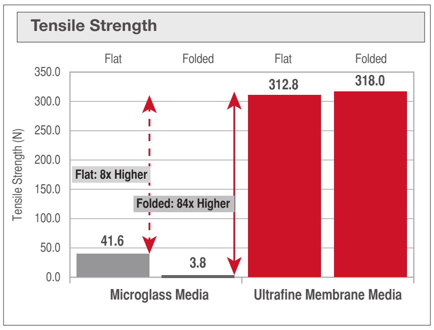
Now that we understand the critical role of media selection in the choice of HEPA/ULPA filters for a given application, it's important to also review some of the in-situ risk that the filter will be confronted with in the clean space.



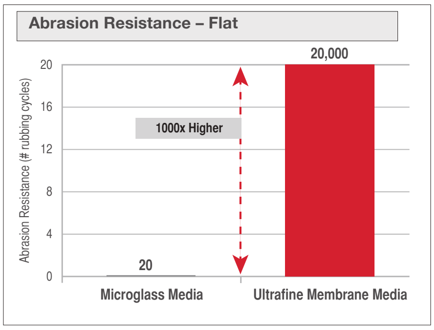

*HEPA Filters typically fail due to some form of contact combined with the poor mechanical strength of the media.*

## Comparing Glass Fiber and Membrane Media Options

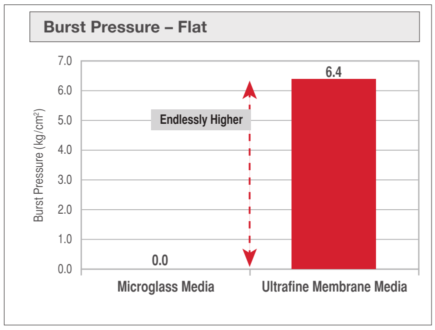
The risks listed above can be mitigated by the use of durable ePTFE or eFRM membrane-based HEPA/ULPA filters. The table below shows a comparison of physical properties of ePTFE, eFRM, and glass fiber HEPA filters for consideration when durability and reliability are key concerns.




*Results based on Test Standard DIN EN 29073-3.*




*Results based on Test Standard DIN EN 12947-2.*




*Results based on Test Standard DIN EN 13938-2.*

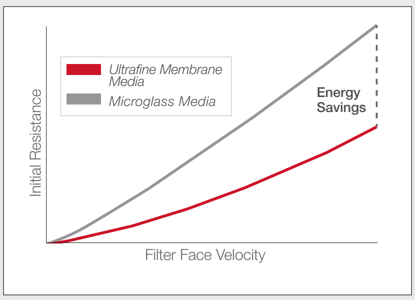
## Summary of Considerations for HEPA/ULPA Filter Selection

This product guide contains multiple product options and configurations for your review and selection. Below is a helpful checklist of items to consider as you make your final selection.

## What to Look for in HEPA/ULPA Filters

### Media Integrity

- Highest level of mechanical strength for resistance to damage, leaking, or failure
- Chemically inert, which reduces media degradation in highly corrosive environments
- Hydrophobic (water resistant)




### Economy and Testing

- Lowest available pressure drop to reduce energy consumption and changeout cycles
- Lowest off-gassing of chemical components to minimize risk of contamination
- Ability to perform local field testing per standards for your environment

### Total Cost of Ownership

- Clearly quantify all potential operational risks associated with your filter selection
- Invest in technology that improves operational performance and reduces the effort required for maintenance and repair
- Partner with a supplier that can provide professional guidance and a fully integrated system solution

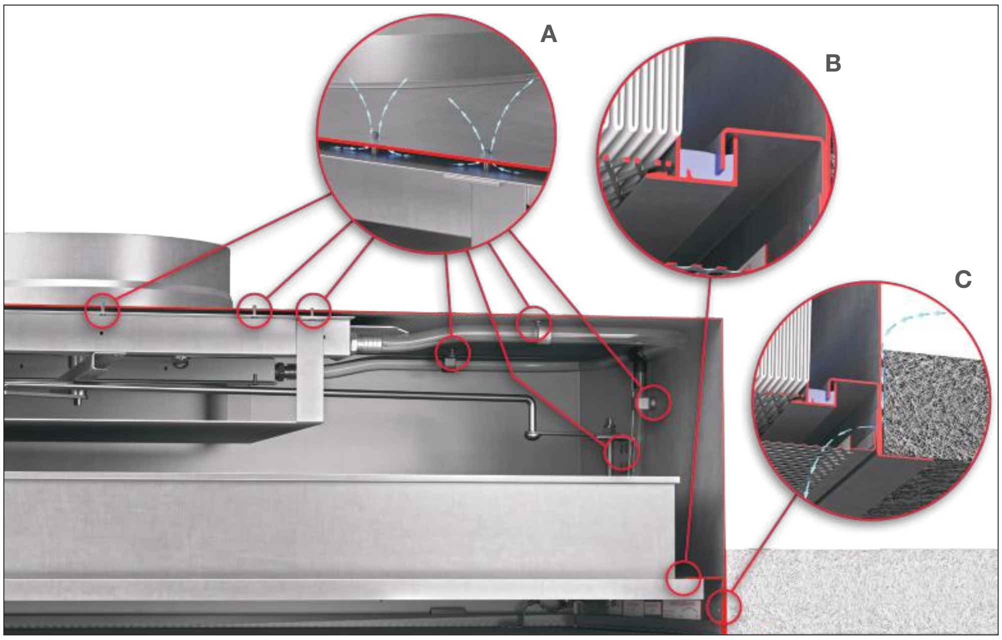
# Ensuring System Integrity

## Media + Seal + Housing = System Integrity

While we now clearly understand why media is the heart of the filter and the cleanroom, its success is still dependent on three other key factors:

1. The seal between the filter and the housing or holding frame
2. The construction of the housing or holding frame it will be contained in
3. The seal between the housing or holding frame and the ceiling or air handling unit it is connected to

Air will always travel the path of least resistance. Therefore, every connection point and construction method used to integrate the media, seal, and housing must be carefully considered and selected to ensure full system integrity.




### Filter Seal to Housing

*A Construction rivets connecting internal housing components represent potential leak paths if not designed correctly*

*B Example of fluid seal and knife-edge connection between filter and housing*

*C Representation of potential leak path between housing, trim, and ceiling*

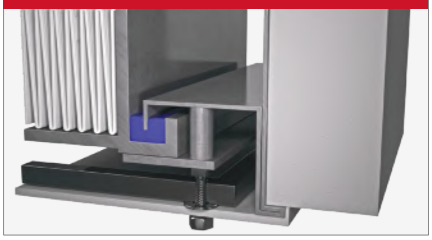
## Seal Type Options for Consideration

The filter seal type selected will provide the critical connection point between the filter frame and the housing or holding frame it is installed in. Therefore, it is important to understand the options available to you, and their corresponding benefits, before making a selection.

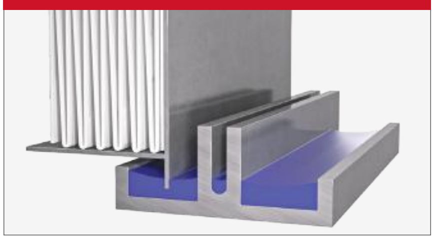
Some of the categories available are pictured below:

**Dry**

**Fluid**



**Knife-Edge**



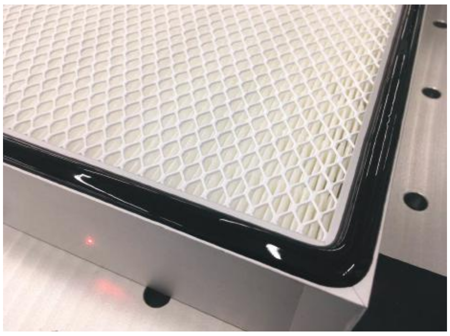
*Within the dry and fluid seal categories, there are various options available to best meet the requirements of your specific application.*

| | MEGAcel® I ePTFE* | MEGAcel® II ePTFE* | MEGAcel® III ePTFE* | MEGAcel® I eFRM | MEGAcel® II eFRM | MEGAcel® III eFRM | AstroCel® I | AstroCel® II | AstroCel® III |
|---|---|---|---|---|---|---|---|---|---|
| Dry (PU-EPDM-Neoprene Gasket) | Option | Option | Option | Option | Option | Option | Option | Option | Option |
| Fluid Seal Filter & Knife Edge | Option | Option | Option | Option | Option | Option | Option | Option | Option |
| Silicone Gasket | | | | | | | Option | | |

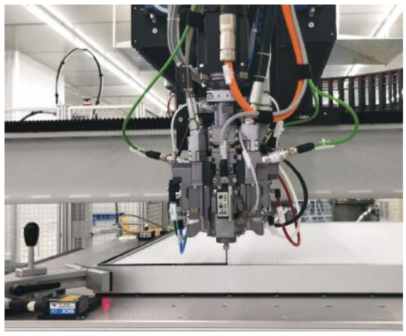
Each of these options can be selected for either the filter or the housing it will be installed in. Each respective seal type must be chosen for compatibility with its matching counterpart on the housing it will be installed in.

# Selecting the Right HEPA Filter Seal Type

*Gasket PU applied in a bottom load extruded channel.*



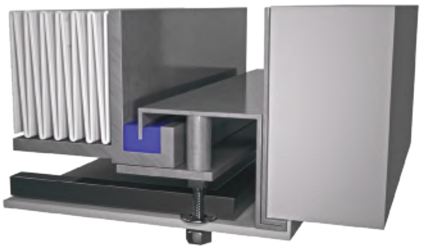
*PU poured gasket on the HEPA sealing surface.*



*Automated PU application during assembly.*

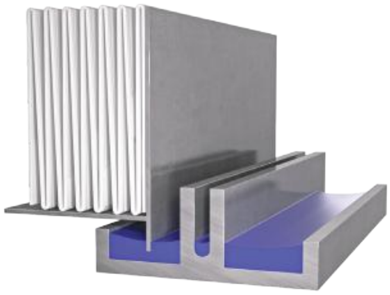
## Dry Seal

The original mechanism utilized to seal a HEPA filter sealing surface to the framework of a housing or holding frame, has been a dry gasket. There are various material and configuration options used today, ranging from a four-piece closed cell neoprene with interlocking corners, to single piece gasket extrusions such as EPDM. Ethylene Propylene Diene Monomer, or more commonly known as EPDM, can be adhered to the HEPA filter surface in a one-piece mold with a double sealing 'U' shape surface thereby improving the overall integrity of the seal. Due to the advancements in robotic gasket applications technology, there is also a growing adoption of polyurethane foam (PU) gaskets. This 'one-piece poured in place' gasket minimizes any potential leak paths, especially at corner locations. The PU gasket is commonly used on Fan Filter Units (FFUs) and is more cost effective than the fluid seal alternatives frequently used in certain cleanroom applications.



*Bottom load fluid seal*

*Top load fluid seal*



*Knife-edge seal*

## Fluid Seal

Fluid or gel seal materials have been used as an easy and reliable method of sealing HEPA filters to housings, holding frames, and ceiling grids for over thirty years. This seal type continues to gain popularity over other sealing methods because fluid seal materials are much softer and more forgiving than dry gasket alternatives, requiring near-zero clamping pressure and minimizing the potential for leak path creation due to user error during installation.

### Fluid Seal Material Types: Polydimethylsiloxane (Silicone) vs. Polyurethane

Both silicone and polyurethane allow for easy, reliable, air-tight sealing of HEPA filters to housings, holding frames, and ceiling grids, creating a leak free connection to supply or exhaust air. Both silicone and polyurethane gels exhibit comparable external properties in hardness/softness, surface tack, and elasticity. However, there are significant differences that should be considered based on the specific application environment being protected.

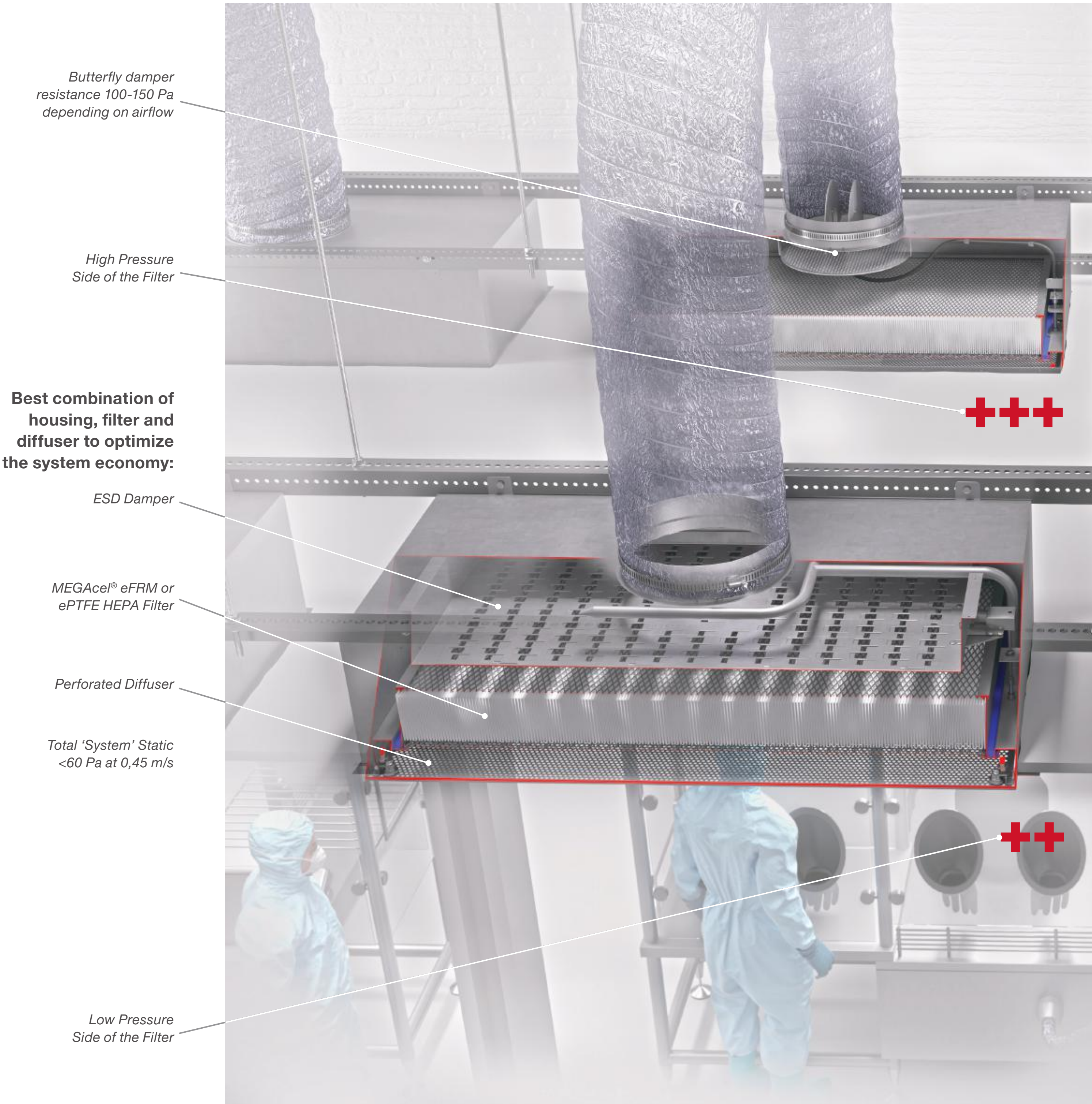
### Fluid Seal Materials, System Integrity Testing, and Environmental Conditions

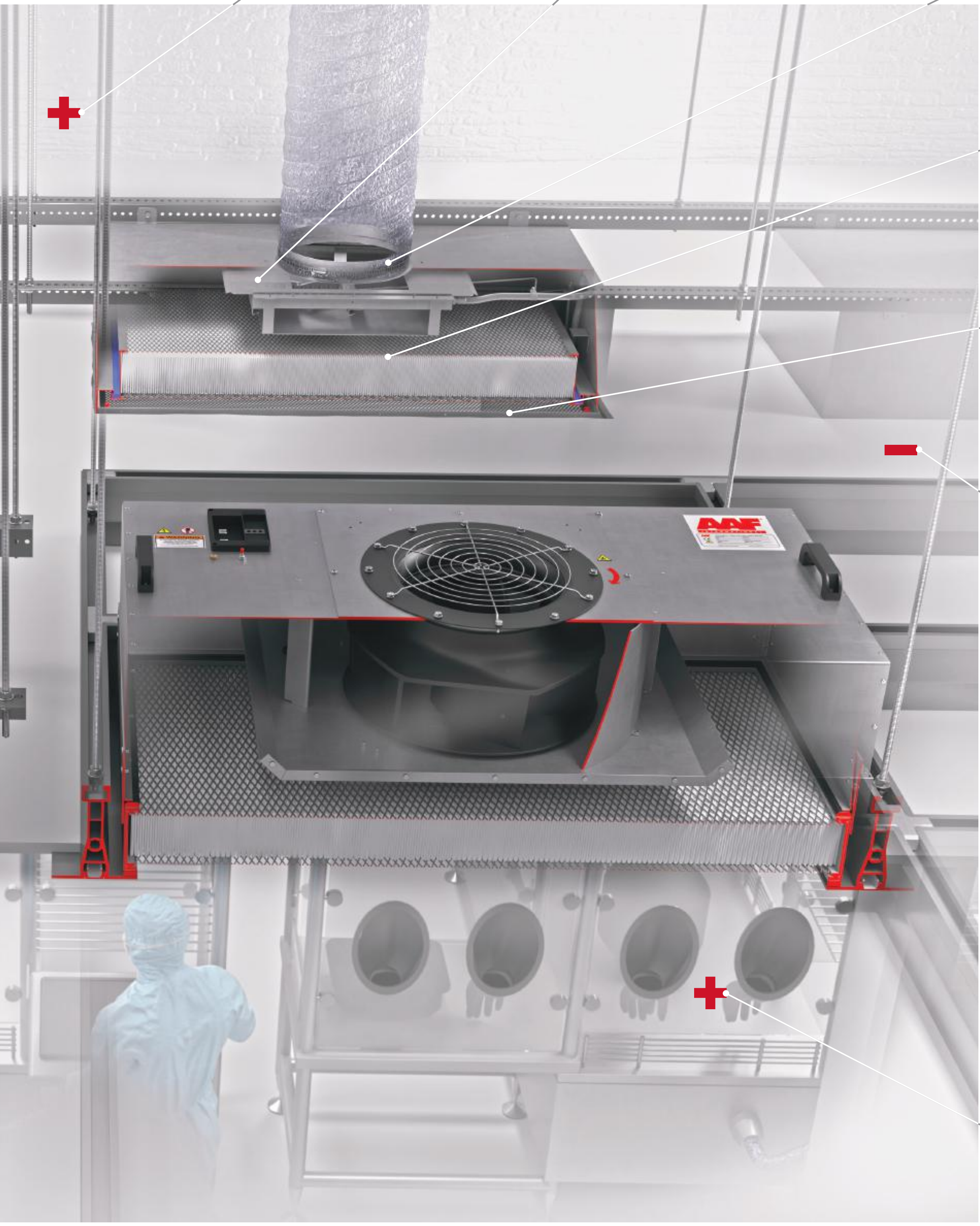
When selecting fluid seal material types for a specific application, it is very important to ensure the filter manufacturer has the necessary understanding and testing capability to verify fluid material compatibility with common cleaning agents, decontamination materials, and field certification test aerosols such as VHP, CL2, CH20, SporKlenz, Vaprox, PAO or others as defined by the end user facility.

# Maximizing System Economy

As with maximizing system integrity, maximizing system economy requires careful consideration of each contributing factor to total system pressure, rather than merely the pressure drop of the filter itself. When it comes to system economy, the whole is truly the sum of its parts, including the housing, damper, media type, media construction, and diffuser.

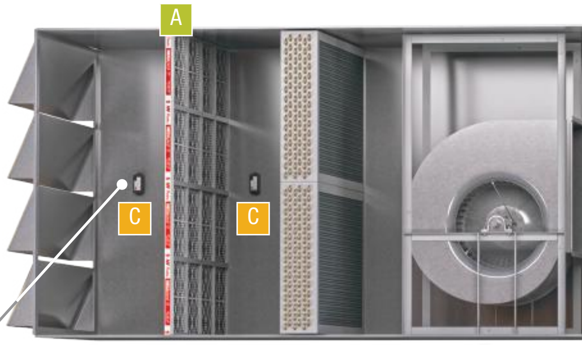
The application and component examples below clearly demonstrate the compound effect of each contributing factor to overall system pressure, and consequently, system economy. In them, one can see the combined pressure effect of a Housing (50-100 Pa) + a Filter (100 Pa) + a Diffuser (30-70 Pa) which could equate to an average clean pressure drop above 250 Pa, more than double the individual filter static that most stakeholders focus on during design discussions.

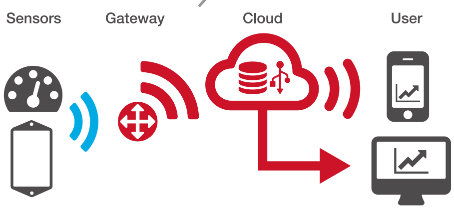



Typically positive in the plenum for direct ducted HEPA housings
Guillotine damper resistance 100-150 Pa depending on airflow
High inlet collar velocity 4,0-6,0 m/s depending on airflow and collar size
HEPA filter initial resistance can vary from 37-125 Pa depending on pack depth and media type (Glass or PTFE/FRM) and efficiency selected.
Diffuser pressure drop can vary from 5 Pa-75 Pa depending of type selected (Perf, 4-Way, Swirl)
Negative Pressure Plenum
Using FFU's in an open negative pressure plenum design helps prevent leakage or by-pass of contaminants into the room.
Another advantage to the FFU design is the reduction in size of the AHU's as the FFU's handle more of the recirculated air requirements that can save space and cost.
Positive Pressure Room

# Life Science Cleanrooms

Control of viable and non-viable particles is crucial in many process applications in the Life Science industry. Protection of people from hazardous or potent compounds is equally important. There is a wide variety of supply, exhaust and recirculated air housings and filter types to address each application. It is important to utilize a manufacturer who can offer a fully integrated solution in order to minimize risk and points of potential failure.



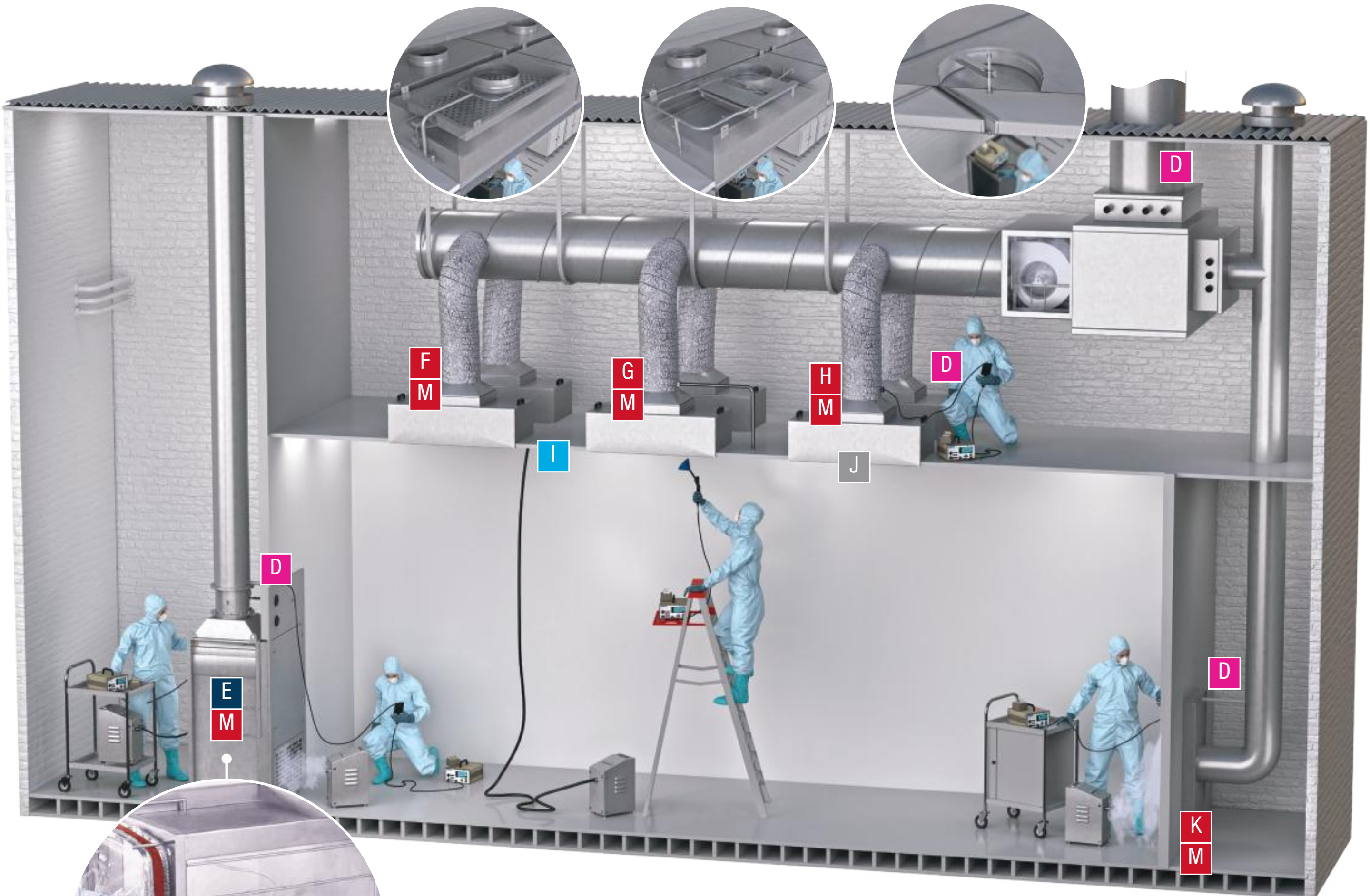




**Sensor³60®**
Cloud-based air quality and pressure drop measurement technology.

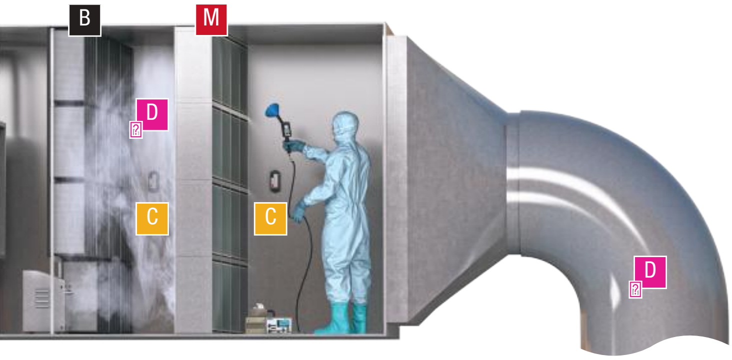
**AstroHood® S-I**
Aerosol dispersion ring with integrated ESD damper

**AstroHood® S-II**
Guillotine damper and aerosol injection

**AstroHood® S-III**
Integrated centerboard test port and diffusion disc



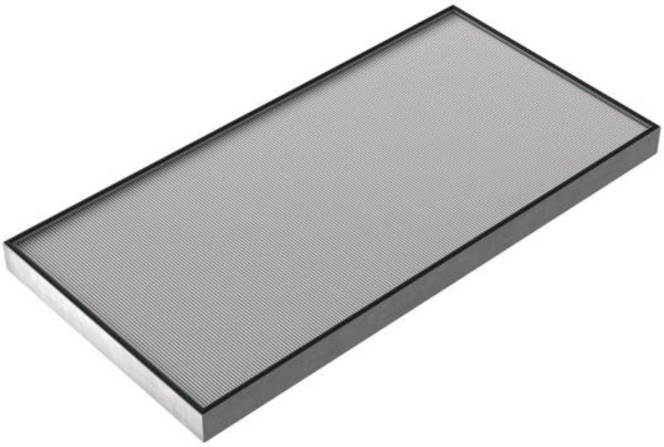

**AstroSafe® V-BIBO**
A ‘safe change’ or BIBO (Bag-In-Bag-Out) housing with an integrated manual scan section normally utilized when potent or hazardous compounds are in use.




## MEGAcel® eFRM M

eFRM media exceeds industry requirements from an efficiency and aerosol challenge compatibility standpoint.

E F G H K N P

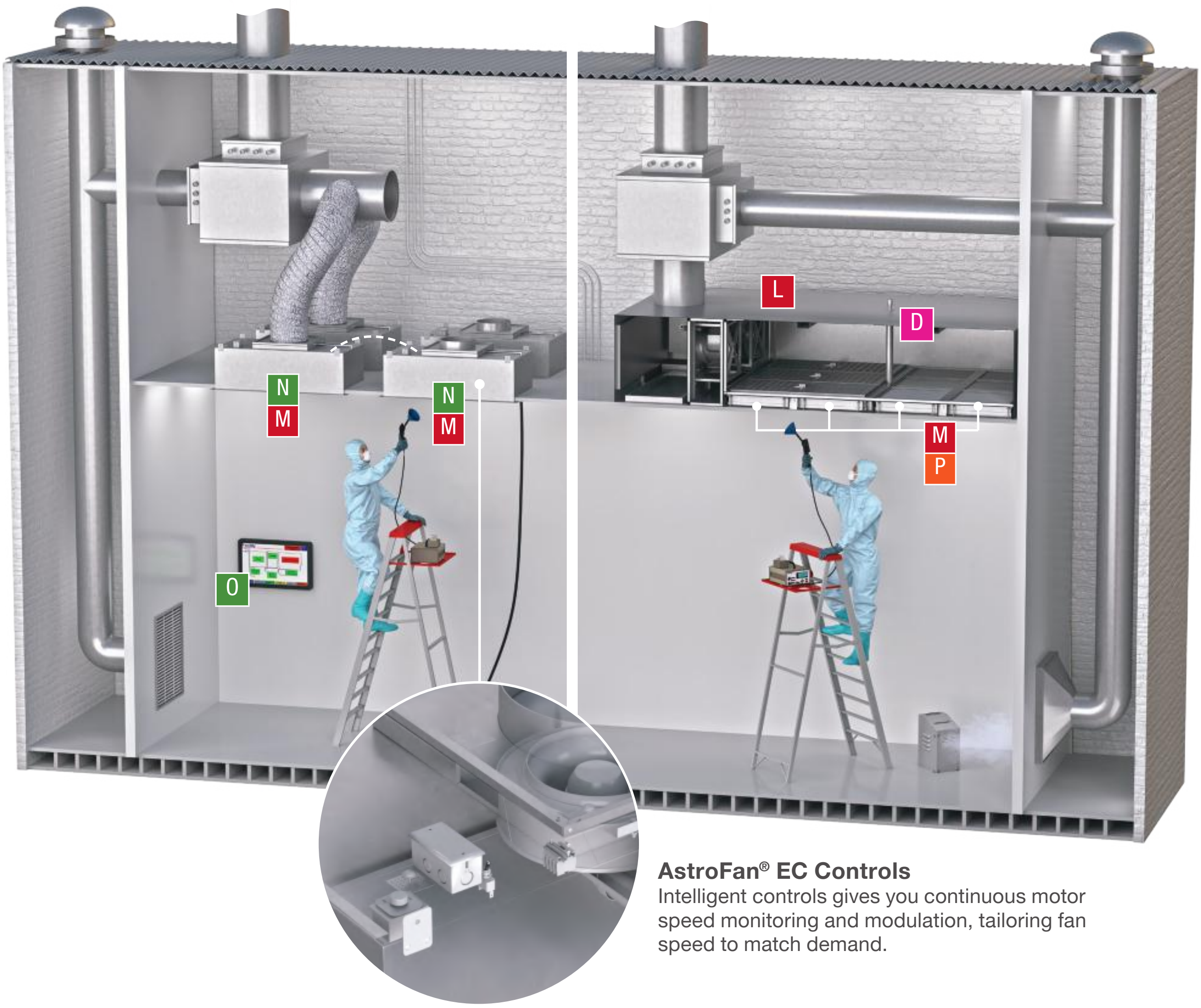


## AHU Filter Testing

In situ integrity testing of HEPA filter banks is accomplished by injecting an aerosol (PSL) upstream of the filters and manually scanning the downstream side of the filters.

**Alternate Overall Efficiency Test** This can be performed by measuring a single point *upstream* and *downstream* of the filter.

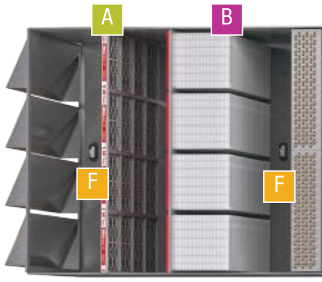
| | |
|---|---|
| A | DriPak® |
| B | VariCel® VXL/DriPak® NX |
| C | Sensor360® |
| D | Test Port |
| E | AstroSafe® V-BIBO |
| F | AstroHood® S-I |
| G | AstroHood® S-II |
| H | AstroHood® S-III |
| I | Injection Port |
| J | Central Test Port |
| K | AstroHood® E-I |
| L | AstroHood® Plenum |
| M | MEGAcel® eFRM |
| N | AstroFan® |
| O | AstroDrive™ |
| P | ESD Damper |




## AstroFan® EC Controls

Intelligent controls gives you continuous motor speed monitoring and modulation, tailoring fan speed to match demand.

# Microelectronic Cleanrooms

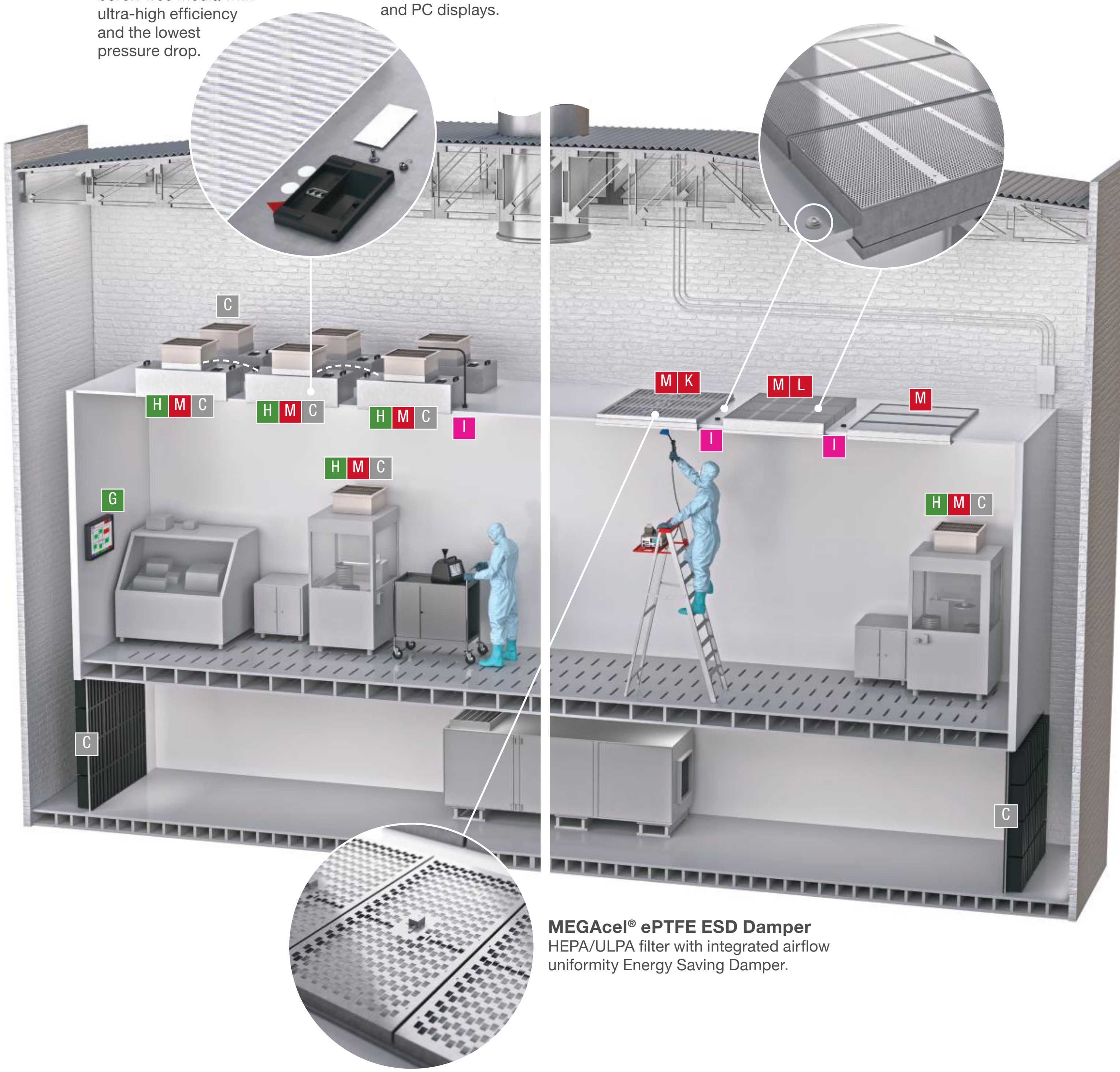



**Historically the need to control particulate in semiconductor applications has been addressed with conventional HEPA/ULPA filtration. In the last decades the need to control AMC (Airborne Molecular Contamination) has increased where specific grades of chemical filters and membrane ULPA filters have been deployed. Reduction of energy consumption by optimizing construction and media types has become 'the norm' as the industries thirst for lower operating costs and increased yields continues to drive our product development and technical leadership in this segment.**

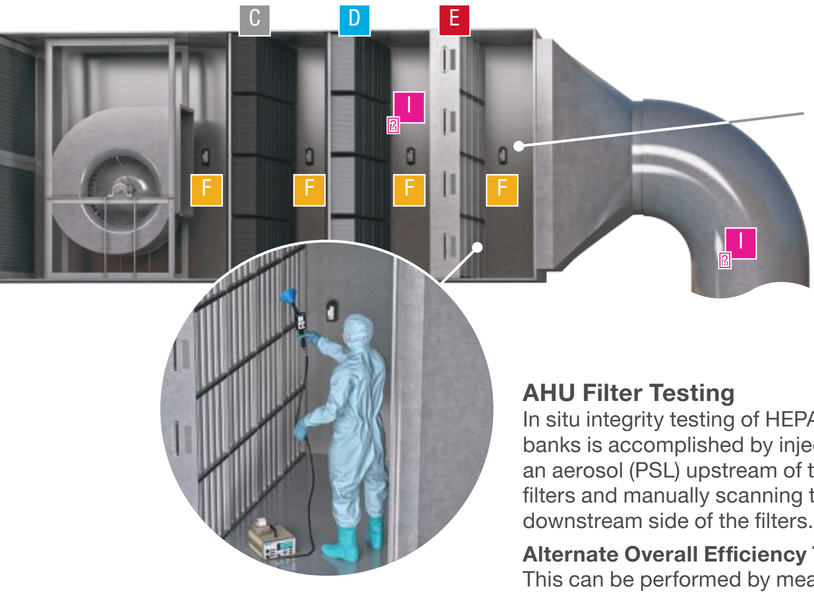
**MEGAcel® ePTFE HEPA/ULPA Filter**
High tensile strength, boron-free media with ultra-high efficiency and the lowest pressure drop.

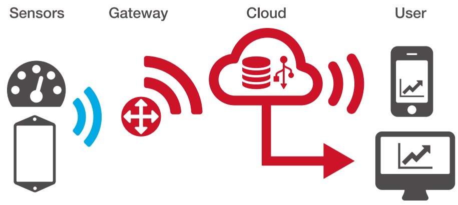
**AstroFan™-SCS**
Control options range from 0-10 V potentiometers to fully customizable PLCs and PC displays.

**MEGAcel® ePTFE Walk-on Back Plate**
For open plenum applications, HEPA/ULPA filters can be supplied with walk-on back plates to facilitate ease of maintenance.




**MEGAcel® ePTFE ESD Damper**
HEPA/ULPA filter with integrated airflow uniformity Energy Saving Damper.




**Sensor³60®**
Cloud-based air quality and pressure drop measurement technology.

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This can be performed by measuring a single point *upstream* ⍰ and *downstream* ⍰ of the filter.

**MEGAcel® ePTFE** M
The industry standard with the lowest TCO and durability. The cleanest product for the most sensitive processes.

H J K L N


| | |
|---|---|
| A | DriPak® |
| B | DriPak® NX |
| C | VariSorb® |
| D | VariCel® VXL |
| E | MEGAcel® III |
| F | Sensor360® |
| G | AstroDrive™ |
| H | AstroFan® FFU |
| I | Test Port |
| J | AstroHood® S-III |
| K | ESD Damper |
| L | Walk-on Back Plate |
| M | MEGAcel® ePTFE |
| N | In-room HEPA Test Bench |

**AstroHood® S-III**
Disposable ducted HEPA with integrated centerboard test port and diffusion disc.

# Testing and Certification

**Ensuring system integrity does not end with product selection, configuration, and installation.**
Monitoring and maintaining system integrity in the field is another 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 below 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.*

*In situ integrity testing of HEPA filter banks is accomplished by injecting an aerosol upstream of the filters and manually scanning the downstream side of the filters. Photometer scan test downstream.*

*Removal of prefilter to inject smoke*

## 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*

## 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*

## Equipment Tested in Room

*Bench testing of a HEPA/ULPA filter*

*Aerosol Injection Dispersion Ring upstream of the filter*

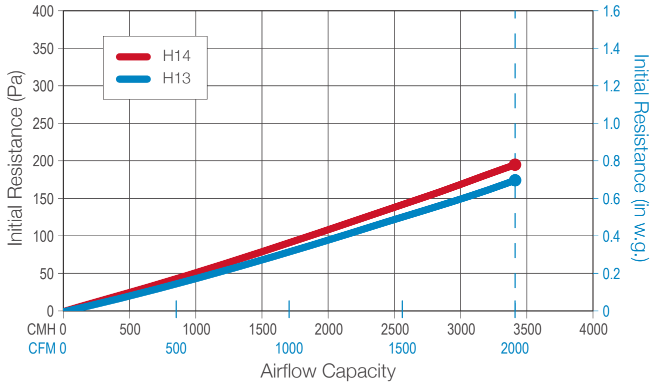
*Aerosol Injection for a FFU*

Below you will find the most significant features of each HEPA/ULPA filter highlighted. This information is presented in order for you to make the best filter choices for your particular needs.

## MEGAcel® I ePTFE

- ePTFE media combines ultra-high efficiency with the lowest possible pressure drop
- High tensile strength and chemically inert ePTFE reduces risk of media damage and degradation
- No boron outgassing
- Compatible with Discrete Particle Counter (DPC) test methods

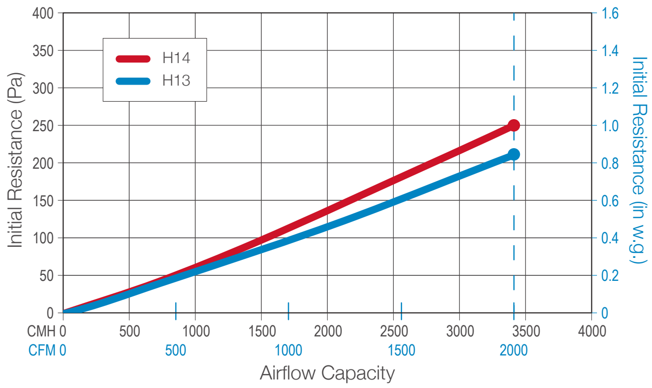
### Initial Resistance vs. Airflow Capacity




## MEGAcel® I eFRM

- Dual-layer eFRM media combines ultra-high efficiency and particulate loading with low pressure drop
- High tensile strength and chemically inert eFRM reduces risk of media damage and degradation
- No boron outgassing
- Compatible with Discrete Particle Counter (DPC) and photometric test methods, including high concentration oil-based aerosol testing

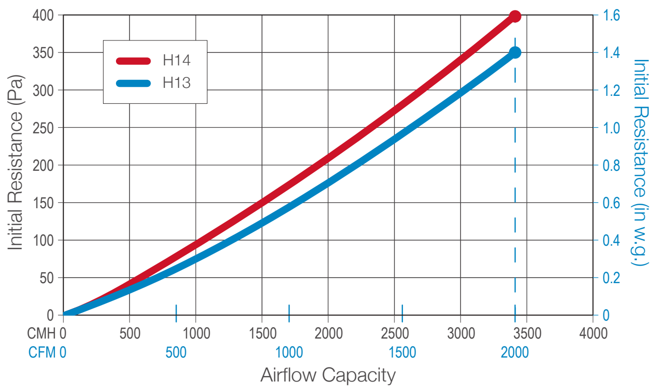
### Initial Resistance vs. Airflow Capacity




## AstroCel® I

- Utilizes high performance microglass media to provide high efficiency particulate removal
- Available as standard or high capacity (HC) with a variety of construction materials and cell side configurations
- HC configuration offers twice the airflow with a limited increase in initial resistance
- Compatible with Discrete Particle Counter (DPC) and photometric test methods

### Initial Resistance vs. Airflow Capacity




*UL classified according to UL Standard 900, ULC S111, and UL586.*

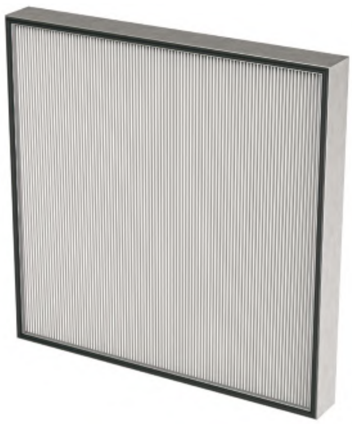
# HEPA/ULPA Filters – Series II

## MEGAcel® II ePTFE

- ePTFE media combines ultra-high efficiency with the lowest possible pressure drop
- High tensile strength and chemically inert ePTFE reduces risk of media damage and degradation
- No boron outgassing
- Compatible with Discrete Particle Counter (DPC) test methods

## MEGAcel® II eFRM

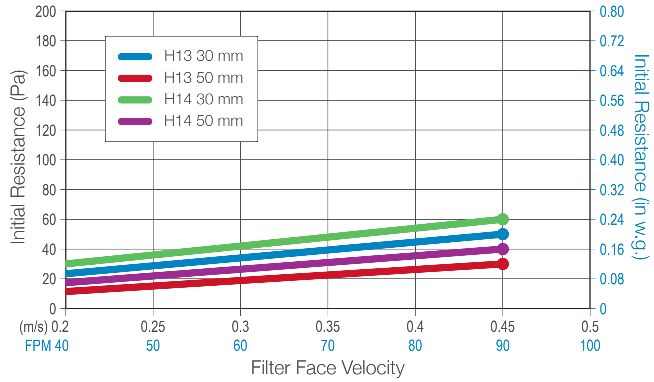
- Dual-layer eFRM media combines ultra-high efficiency and particulate loading with low pressure drop
- High tensile strength and chemically inert eFRM reduces risk of media damage and degradation
- No boron outgassing
- Compatible with Discrete Particle Counter (DPC) and photometric test methods, including high concentration oil-based aerosol testing



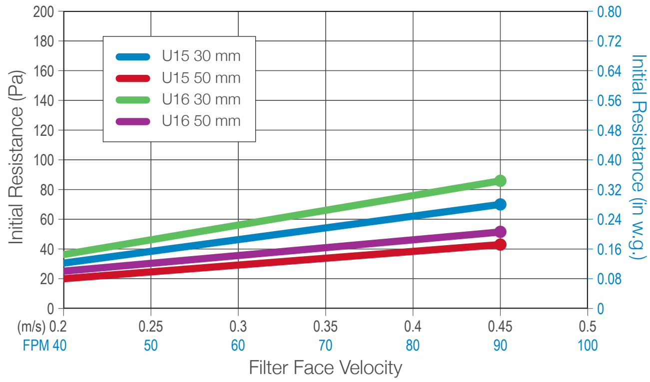
## AstroCel® II

- Utilizes high performance microglass media to provide high efficiency particulate removal
- Optimally spaced mini-pleat media pack further minimizes pressure drop in this cleanroom panel configuration
- Wide range of efficiencies and pack depth options available
- Compatible with Discrete Particle Counter (DPC) and photometric test methods

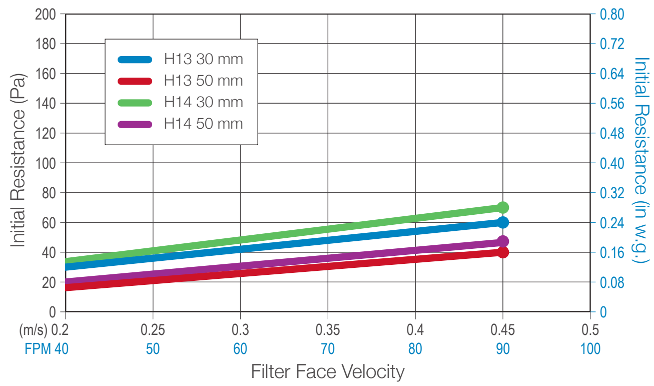
### MEGAcel II ePTFE H13/H14
### Initial Resistance vs. Filter Face Velocity




### MEGAcel II ePTFE U15/U16
### Initial Resistance vs. Filter Face Velocity




### MEGAcel® II eFRM H13/H14
### Initial Resistance vs. Filter Face Velocity

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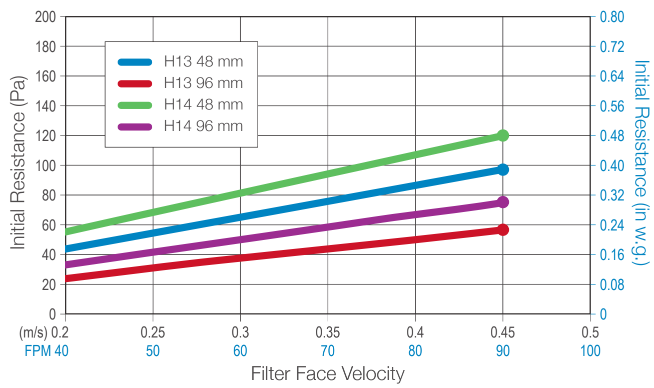
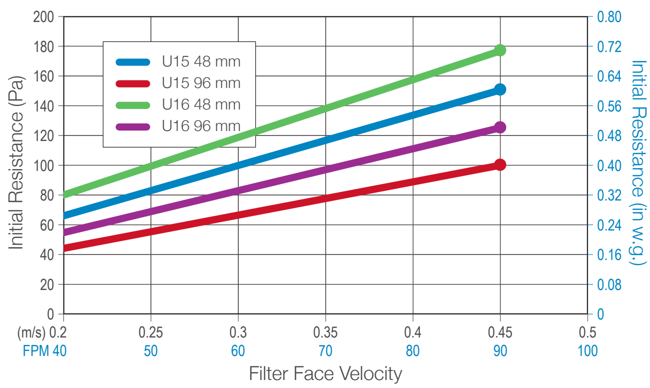
### AstroCel® II H13/H14
### Initial Resistance vs. Filter Face Velocity




### AstroCel® II U15/U16
### Initial Resistance vs. Filter Face Velocity

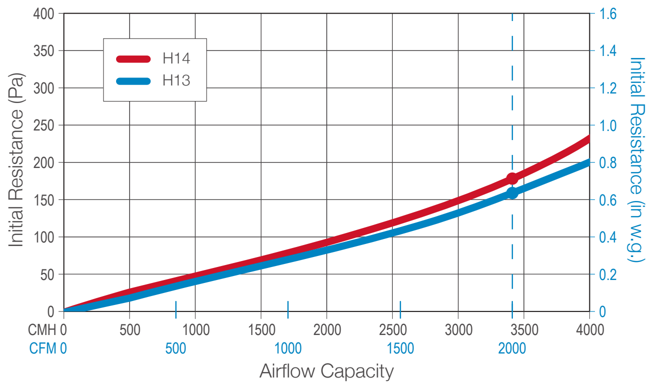


# HEPA/ULPA Filters – Series III

## MEGAcel® III ePTFE

- V-shaped filter configuration, combined with ePTFE media, delivers higher flow at the lowest possible pressure drop vs traditional box style HEPA filters
- High tensile strength and chemically inert ePTFE reduces risk of media damage and degradation
- No boron outgassing
- Compatible with Discrete Particle Counter (DPC) test methods as access and instrumentation allow

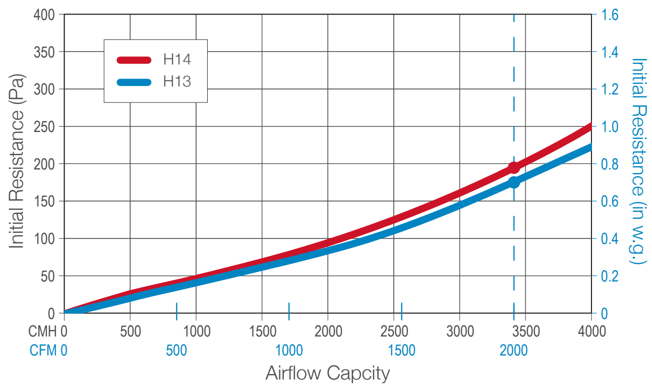
### Initial Resistance vs. Airflow Capacity




## MEGAcel® III eFRM

- V-shaped filter configuration, combined with dual-layer eFRM media, delivers higher flow and high capacity particulate loading with low pressure drop
- High tensile strength and chemically inert eFRM reduces risk of media damage and degradation
- No boron outgassing
- Compatible with Discrete Particle Counter (DPC) and photometric test methods, including high concentration oil-based aerosol testing as access and instrumentation allow

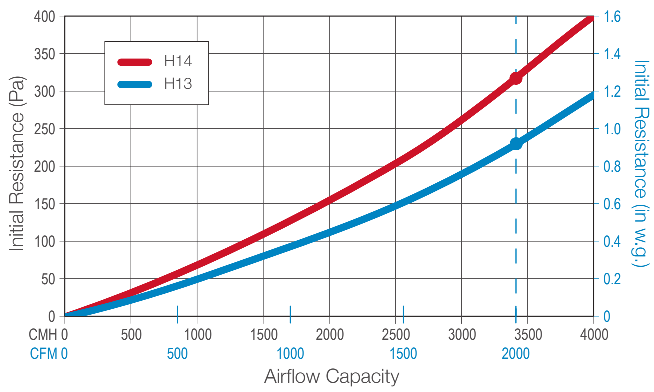
### Initial Resistance vs. Airflow Capacity




## AstroCel® III

- V-shaped filter configuration, combined with high performance microglass media, delivers higher flow and a lower pressure drop vs traditional box style microglass HEPA filters
- Utilizes high performance microglass media to provide high efficiency particulate removal
- Compatible with Discrete Particle Counter (DPC) and photometric test methods as access and instrumentation allow

### Initial Resistance vs. Airflow Capacity



# 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 ( ).**

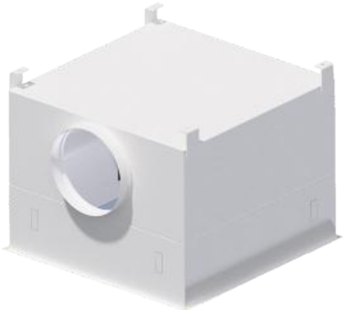
| | MEGAcel® I ePTFE* | MEGAcel® II ePTFE* | MEGAcel® III ePTFE* | MEGAcel® I eFRM | MEGAcel® II eFRM | MEGAcel® III eFRM | AstroCel® I | AstroCel® II | AstroCel® III |
|---|---|---|---|---|---|---|---|---|---|
| Expanded PTFE Membrane (ePTFE) | • | • | • | | | | | | |
| Expanded Fluororesin Membrane (eFRM) | | | | • | • | • | | | |
| Glass Fiber Media | | | | | | | • | • | • |
| Hot Melt Separators | | • | • | | • | • | | • | • |
| Ribbon Pleat | | | | | | | | Option | |
| Aluminum Separator | • | | | • | | | • | | |
| Vinyl Coated Aluminum Separator | Option | | | Option | | | Option | | |
| Stainless Steel Separator | 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 | | | | | |
| 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) | • | • | • | • | • | • | • | • | • |
| Centerboard for PD or Upstream Concentration Measurement | | Option | | | Option | | | Option | |

# AstroHood® Series

**The AstroHood® Series of supply and exhaust housings allows the user to optimize the design selection to suit specific room requirements.**

## AstroHood® S-I

- Fully welded hood body, pressure tested delivering a guaranteed leak free housing for life
- Gel or gasket seal bottom load design ensures a positive seal between the knife-edge or housing plenum
- All test ports and damper controls are accessible from the room side, fully sealed and pressure tested to ensure no bypass of contaminant
- ESD (Energy Saving Damper) is standard in the S-1 series, ensuring lowest operating costs when combined with the MEGAcel eFRM HEPA filter
- Fixed or removable trim with 1/4 turn fasteners or acorn nuts and integrated diffuser ensures a flush, easily accessible, low-maintenance solution



## AstroHood® S-II

- Spot welded leakfree housing
- Gel or gasket seal bottom top load design
- All test ports and damper controls (optional) are accessible from the room side
- Different inlet design: top circular, side circular, side rectangular
- Different diffusers: Perforted, 4-Ways, Swril

## AstroHood® S-III RSR

- The S-III RSR module has a roomside replaceable filter capability, combined with an extruded aluminum lightweight slim design housing
- AstroCel® II HEPA filter is standard, MEGAcel® eFRM filter is optional for lower operating costs
- Perforated diffuser with acorn nuts as standard
- Butterfly damper as standard accessible from the room side

## AstroHood® S-III

- Lightweight disposable HEPA ceiling module
- Extruded aluminum housing and HEPA filter are factory sealed as one unit, eliminating potential leak paths through the housing
- Optional: Adjustable air diffusion disc and roomside accessible test port are available options
- Optional: Upstream pressure drop and aerosol measurements are available from the room side

# AstroHood® Construction and Testing Options

**This table provides a thorough overview of the options available for our ducted modules, allowing you to make informed decisions for a given application and configuration. Each feature is denoted as standard (•), optional (Option), or not available ( ).**

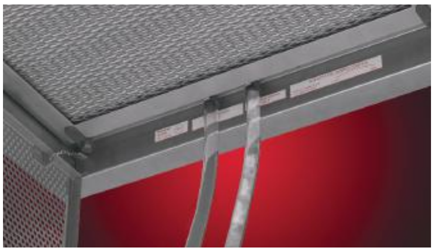
| | AstroHood® I | AstroHood® II | AstroHood® II RSR | AstroHood® III |
|---|---|---|---|---|
| Stainless Steel (304L) | • | Option | | |
| Stainless Steel (316L) | Option | Option | | |
| Painted mild steel (RAL 9010) | | • | | |
| Anodised Aluminium | | | • | • |
| Fully welded | • | Option | | |
| Spot welded and caulked | | • | | |
| Pressure Test Certificate (750 Pa) | • | Option | | |
| Manual scan section | | | | |
| Roomside Change | • | • | • | |
| ePTFE Filter | • | • | Option | Option |
| Filter Depths | 2” / 50 mm ePTFE Standard | 2” / 50 mm ePTFE Standard | 2” / 48 mm AstroCel II | 2” / 48 mm AstroCel II |
| Gel seal filters | • | • | | |
| PU dry seal filters | | Option | | |
| Validated Aerosol Injection | • | Option (Tygon tubing) | | |
| Upstream 100% PAO concentration port | • | • | | |
| Filter Pressure monitoring | • | • | | |
| Bubble-tight Damper (upstream) | Option | Option | | |
| Guillotine (Flanders) Damper | • | | | |
| Butterfly Damper | Option | Option | Option | Option |
| Insulation | • | | | |
| Filter Guides | • | • | | |
| Hinged Stainless Steel | • | | | |
| Mild Steel Painted Perforated Plate Diff | | Option | | |
| Four-way throw diffuser | | Option | | |
| Swirl diffuser | | Option | | |
| Perimeter Ceiling Trim | • | Option | | |
| Circular top inlet | • | • | • | • |
| Circular side inlet | Option | Option | | |
| Rectangular side inlet | | Option | | |

# AstroHood® HEPA Ducted Ceiling Module

**Basic Housing**
All AstroHood housings are 100% welded.

**Materials of Construction**
AstroHood units are available in extruded anodized aluminum, 1,6 mm fabricated aluminum, 1,3 mm 304 S/S, and 1,3 mm 316L S/S as required.

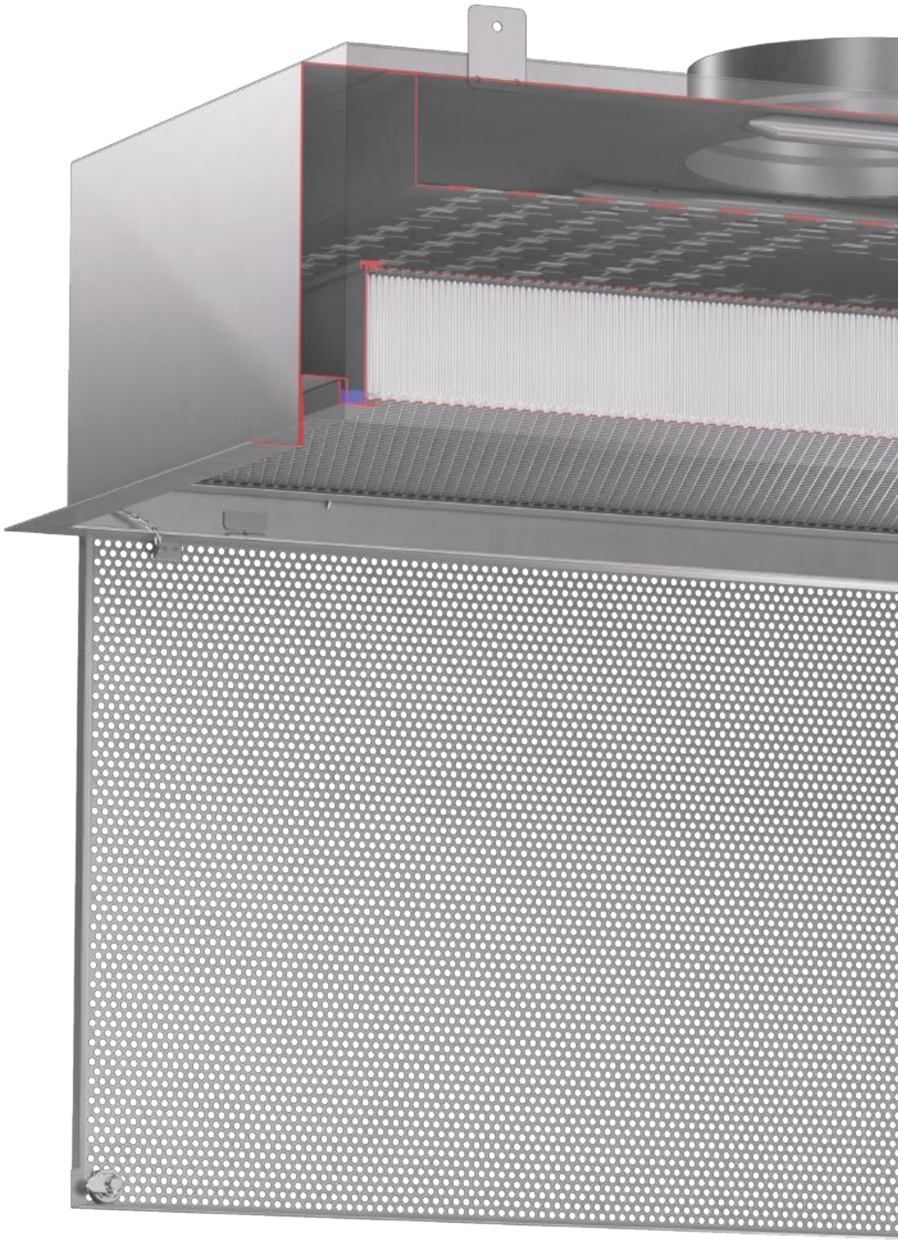
**Pressure Testing**
All AstroHood housings are tested and certified to 750 Pa. Units are serialized and labeled with test criteria.

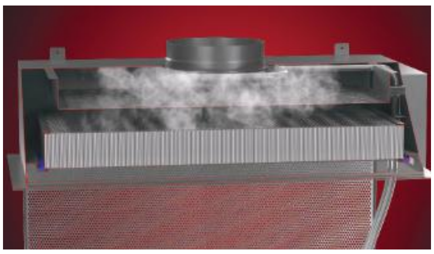


**Injection and Sample Ports**
Quick disconnects are standard. Chrome plated brass construction with penetrations through the pressure boundary seal welded.

**Hinged Grill Option**
Unit comes standard with S/S hinged grill with safety latches and slide off hinges. Unit can come with flush S/S, CRS painted white, or anodized aluminum if desired.

**Filter Guides**
Supplied as standard and constructed of same material as the hood.





**Aerosol Dispersion System**
Assembly is the same material as the hood and has been validated to deliver guaranteed aerosol uniformity.

| Hood Sizing | | | | |
|---|---|---|---|---|
| W x L | Body Actual Size (Add 1˝ of 3˝ depending on trim option) | Rated Airflow | Alum Weight | S/S Weight |
| 2x2 | 576,26 x 576,26 mm | 680 m³/h | 11,3 kg | 13,6 kg |
| 2x3 | 576,26 x 881,06 mm | 1020 m³/h | 15,9 kg | 18,1 kg |
| 2x4 | 576,26 x 1185,86 mm | 1360 m³/h | 18,1 kg | 20,4 kg |

*Proposal drawings and detailed specifications for all housing and filter options are available upon request from your local AAF office.*

**Hanging Tabs**
Welded to the housing as standard.

**Insulation Options**
Standard unit has 50 mm +foil backed insulation, optional Armaflex and knauf duct as required.

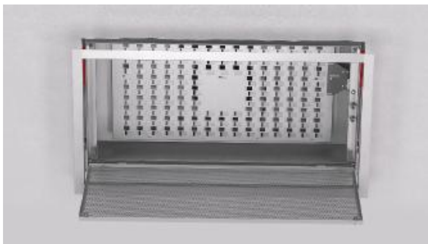
**eFRM HEPA Filters**
H14 (99,995% at MPPS) provided as standard - PAO compatible membrane technology.

**Various Height Options**
The innovative ESD damper allows the hood to be produced in 203 mm body heights.

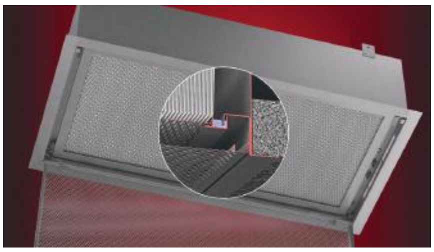
**Inlet Collar**
100% welded as standard.

**Inlet Collar Location**
Unit can have its air inlet mounted on top, long side, or short side.

**Sliding ESD Damper**
Innovative sliding damper results in lowest initial static pressure across the assembly. (25 Pa). Damper yields velocity STD deviation within 5%.



**Removable Sealed Swirl Perimeter Trim**
All trim is 1 mm SS with rounded edges. Holes for attachment of removable options are predrilled and sealed. Available in 12,7 mm and 38,1 mm options for finishing of hard ceiling.



**Seal Welded Knife and Roomside Flange**
Knife-edge and trim is of the same material as the hood body with rounded edges. 100% seal welded and machine polished to a #3 finish (SS) on the roomside.

# AstroFan® FFU EC

In addition to air filters and non-powered supply housings, certain applications also require unit specific control of the speed and consistency of airflow into large-scale production spaces. Fan Filter Units (FFUs), especially when paired with robust electronic control systems, help to ensure the integrity of production processes within these applications and serve to maximize overall system economy.

Selecting the right FFU depends upon a number of factors, including the degree of airflow control required, the desired level of energy efficiency, filter testing requirements for the space, and accessibility to the filter itself for testing and replacement. The information provided below and in the table to the right provide introductory guidance on selecting the ideal FFU for a given application.

## EC FFU

- Energy efficient motor minimizes operating costs
- Intelligent control system for large-scale networks of integrated FFUs
- Continuous motor speed monitoring and self-compensating fan speed
- Operates at near silent noise levels

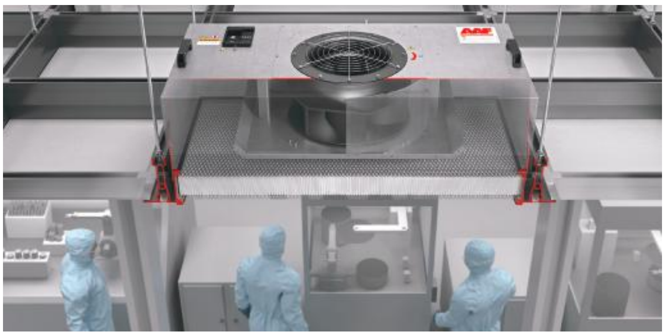
## Installation Method

*Top Side*

*Roomside Change Frame*

*Roomside Change Grid*

## Installed Filters

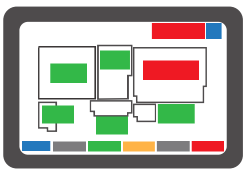


*ePTFE Membrane Media for Microelectronics*
**Also available with microglass HEPA & ULPA filter*

*eFRM Membrane Media for Life Sciences*

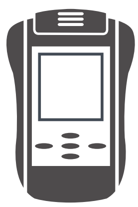
## Control System Platform– AstroDrive™

*PC Smart Control System*



*PLC Program Logical Control*

*IoT (Internet of Things)*



*MC Manual Control*

## Specification

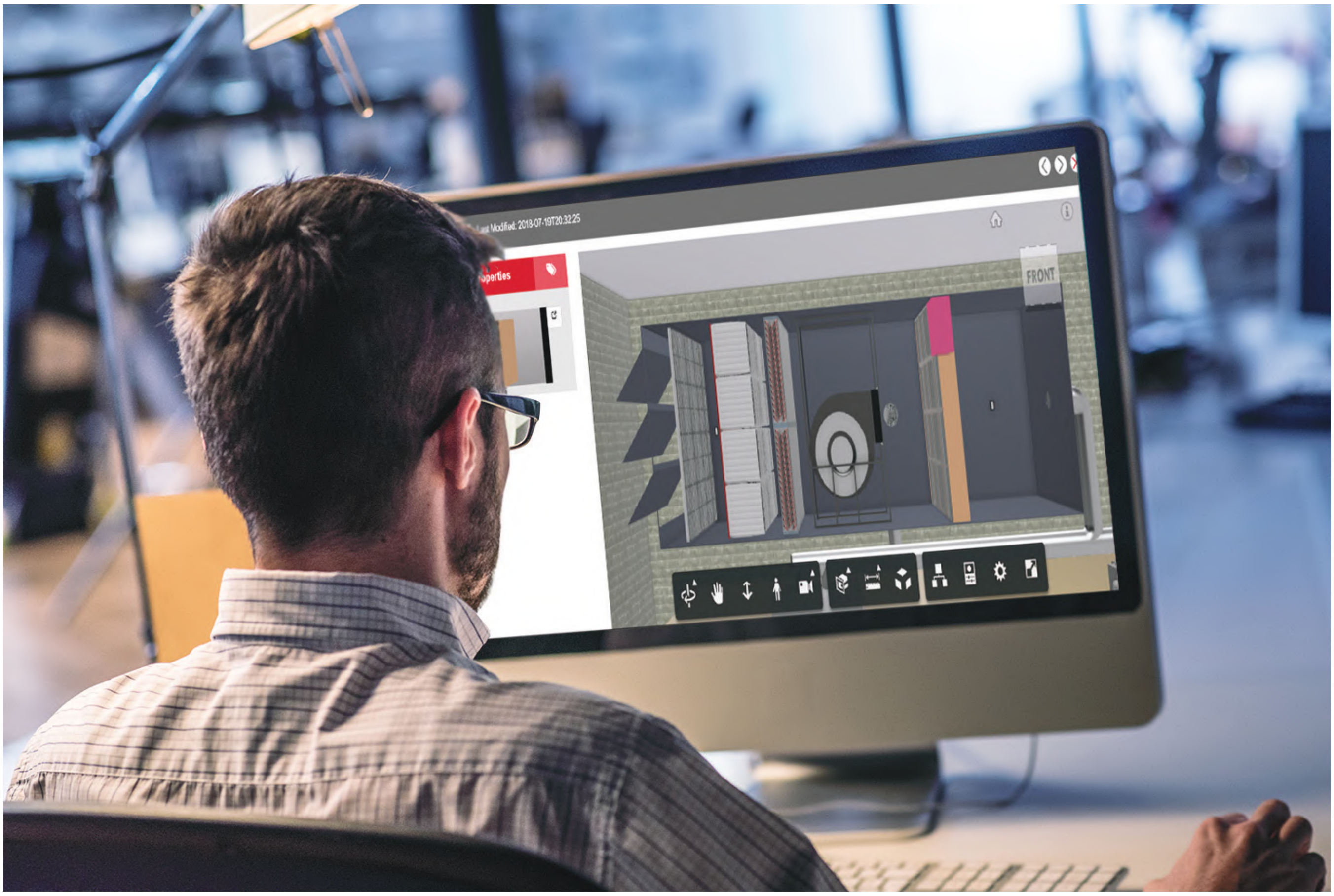
| AstroFan® EC FFU – Metric (Imperial) | | | | |
|---|---|---|---|---|
| Dimension | 6 x 6 (2 x 2) | 6 x 9 (2 x 3) | 6 x 12 (2 x 4) | 12 x 12 (4 x 4) |
| Housing | | | | |
| Actual Dimension | Refer to drawing | | | |
| Unit Height | 355 mm (14 in.) | | | |
| * Weight | 13 - 17 Kg (29 - 38 lbs.) | 15 - 20 Kg (33 - 44 lbs.) | 17 - 26 Kg (38 - 57 lbs.) | 32 - 35 Kg (71 - 77 lbs.) |
| * Material | Aluminum | | | |
| Motor information | | | | |
| Power supply | Single-phase - 208-277 VAC - 50/60Hz | | | |
| Rated current | 1,8 A | 1,8 A | 1,5 A | 1,5 A |
| Performance Data | | | | |
| * Noise Level | < 50dB(A) | | | < 55 dB(A) |
| Air flow | 520 $m^3/h$ (306 CFM) | 800 $m^3/h$ (471 CFM) | 1080 $m^3/h$ (636 CFM) | 2220 $m^3/h$ (1307 CFM) |
| Total fan static pressure | 350 Pa (1.4 in. w.g.) | 350 Pa (1.4 in. w.g.) | 350 Pa (1.4 in. w.g.) | 320 Pa (1.3 in. w.g.) |
| Filter | | | | |
| Filter Type | Glassfiber / Membrane | | | |
| Height | 50 - 134mm (2 -5.3 in.) | | | |
| Gasket type | gel / gasket | | | |
| Efficiency | E 10 to U 17 | | | |
| Installation Options | Top side / Roomside change frame / Roomside change grid | | | |
| Accessories | Cooling coils / Prefilter / AMC filter / Diffuser / Sensor / Test port | | | |
| Controls Platform | PC / PLC / IoT / Manual | | | |

# VisionAir™ Clean with TCO Diagnostics®

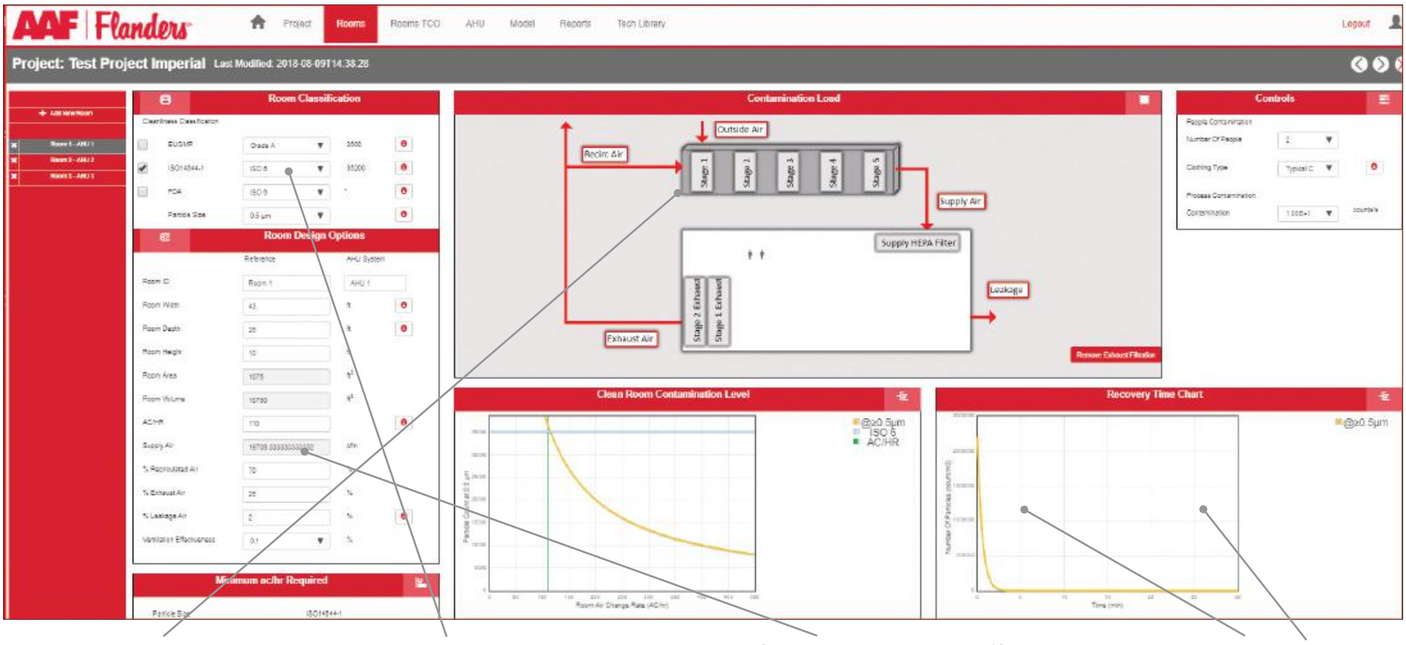
This revolutionary high purity software simplifies the complexities involved in cleanroom design by guiding you through the entire filtration configuration process. This dynamic program can then be used to model interactive, 3D visualizations of potential configuration solutions, calculating annual costs for filters, energy, and labor. You can then gain a better understanding of cleanroom design requirements and potential filtration solutions. Identify opportunities to save time and money, improve air quality, minimize total cost of ownership, and optimize solution design.

**A revolutionary new cleanroom design and air filter selection program with energy optimization:**

- High Purity Filtration Selection and Design Software for multiple market segment applications
- Air Change Rate Selection– make science based decisions to deliver optimum cleanroom efficiency
- Calculate multiple rooms for a cross functional facility.
  Greenfield and existing facility design considerations built into the software
- TCO Calculations for ALL stages of filtration and housing selection reports
- Generate detailed recovery time and air change rate optimization reports
- Generate latest industry specifications with Revit drawings for BIM Models
- Technical library– access latest industry standards and International guidelines




*3D Dynamic Animation*

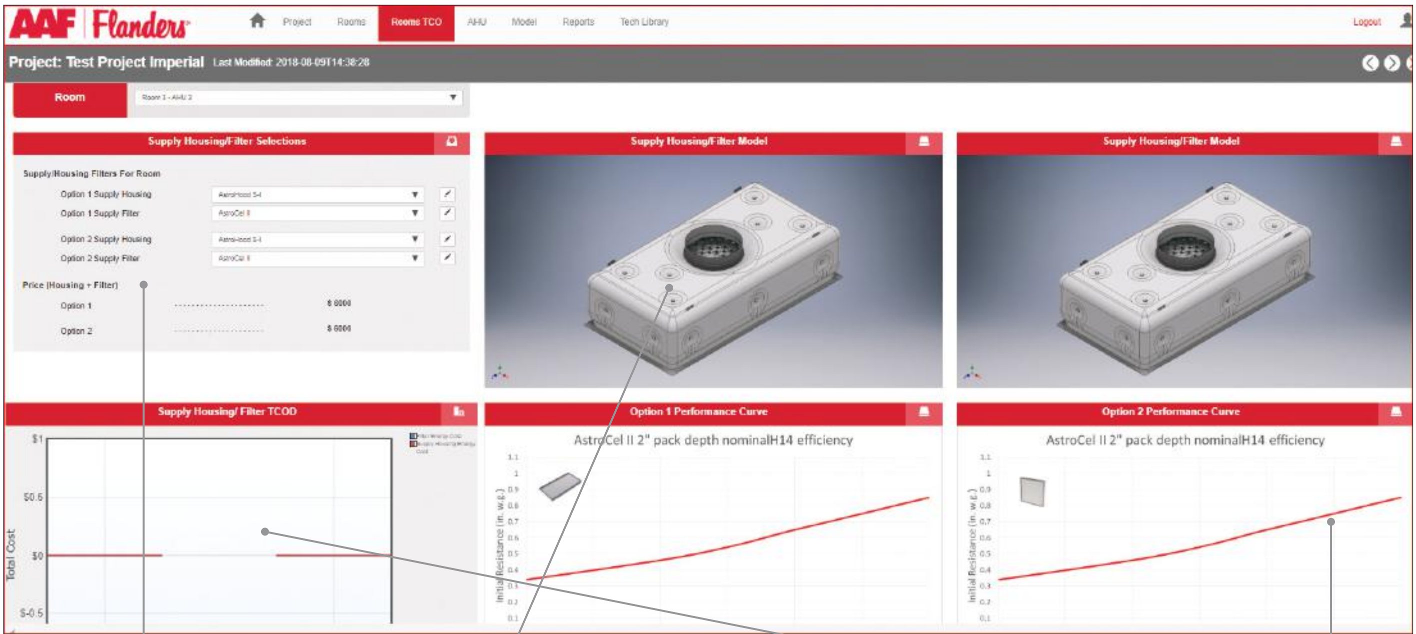



Filter class selection to see impact on downstream cleanliness levels/recovery time

Cleanroom classification options, EU GMP, ISO, FDA

Contamination levels and A/C rate minimum calculations to meet target
room classification and optimized design comparison

Room recovery calculation-contamination
level vs. time




Housing (AstroHood® I-III) and Filter (Membrane vs. Glass)
comparison selection options

3D dynamic image of product selection

TCO calculation on Housing and Filter (damper/'system' resistance)

HEPA performance curve comparisons

# AAF International Plant Locations

AAF, the world's largest manufacturer of air filtration solutions, operates production, warehousing and distribution facilities in 22 countries across four continents. With its global headquarters in Louisville, Kentucky, AAF is committed to protecting people, processes and systems through the development and manufacturing of the highest quality air filters, filtration equipment, and associated housing and hardware available today.

Contact your local AAF representative for a complete list of AAF Air Filtration Product Solutions.

**Americas**

Louisville, KY
Atlanta, GA
Ardmore, OK
Bartow, FL
Columbia, MO
Fayetteville, AR
Hudson, NY
Momence, IL
Ontario, CA
Smithfield, NC
Tijuana, Mexico
Votorantim, Brazil
Washington, NC

**Europe**

Cramlington, UK
Gasny, France
Vitoria, Spain
Ecoparc, France
Trencin, Slovakia
Olaine, Latvia
Horndal, Sweden
Vantas, Finland

**Asia & Middle East**

Riyadh, Saudi Arabia
Shah Alam, Malaysia
Suzhou, China
Shenzhen, China
Miaoli, Taiwan
Bangalore, India
Noida, India
Yuki, Japan (Nippon Muki)

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AAF has a policy of continuous product research and improvement and reserves the right to change design and specifications without notice.



ISO Certified Firm