AAF INTERNATIONAL

bringing clean air to life:

MEGAcel® ME Membrane Filtration

Peace of Mind at Lowest Total Cost of Operation

Highest Performing Ulpa Filter Techology for Microelectronics

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.

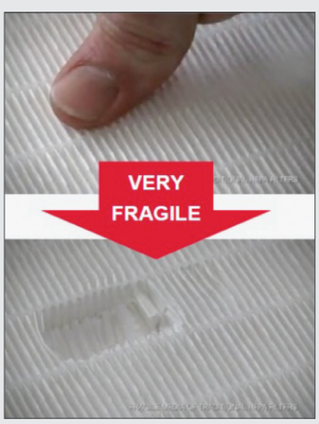
Expanded Portfolio of Membrane Technologies

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, ultra-low emissions, and superior durability when compared to glass fiber media. However, the portfolio of available media types for specific applications has expanded.

Media Resilience Comparison

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

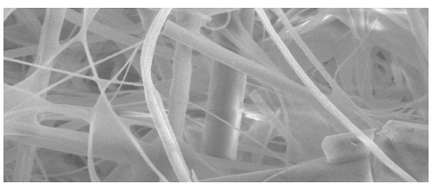
Wet laid glass fiber media is delicate and vulnerable to varying degrees of breakage, ranging from pinhole leaks to irreparable damage.



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



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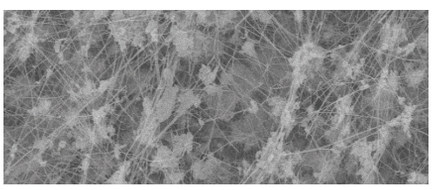
ePTFE Membrane Media:

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

- Applications: Microelectronics
- Available in U15 –U17
- Compatible with Discrete Particle Counters (DPC) testing



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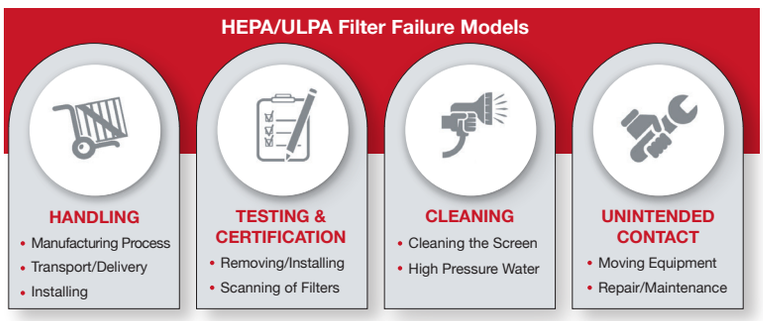
Selecting the Right High Purity Filter

Key Risk Based Considerations: Modes of High Purity Filter Failure

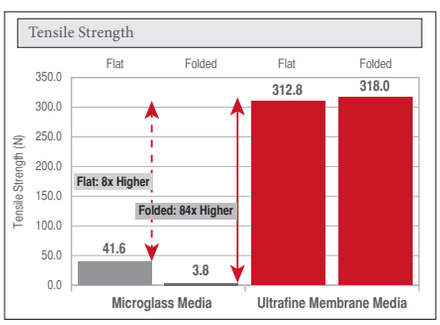
Now that we understand the critical role of media selection in the choice of High Purity filters for a given application, it's important to also review some of the in-situ risk that the filter will be confronted with in the clean space.



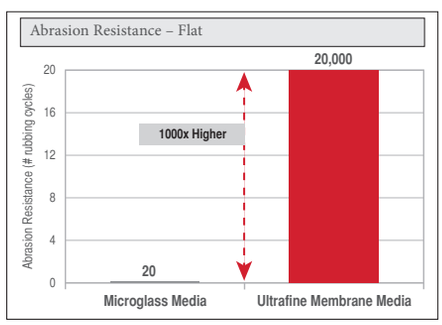
HEPA Filters typically fail due to some form of contact combined with the poor mechanical strength of the media.

Comparing Glass Fiber and Membrane Media Options

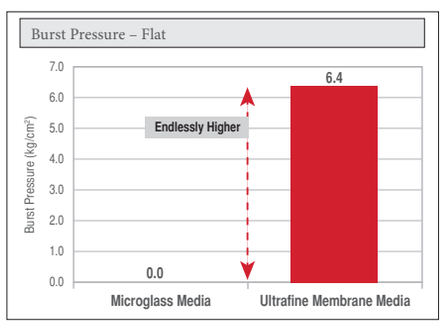
The risks listed above can be mitigated by the use of durable **PTFE** or **FRM** membrane-based HEPA/ULPA filters. The table below shows a comparison of physical properties of ePTFE, eFRM, and glass fiber HEPA filters for consideration when durability and reliability are key concerns.



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 High Purity 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

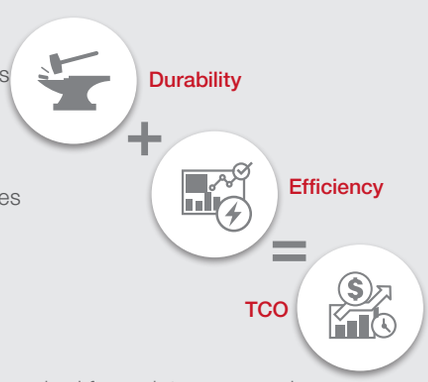


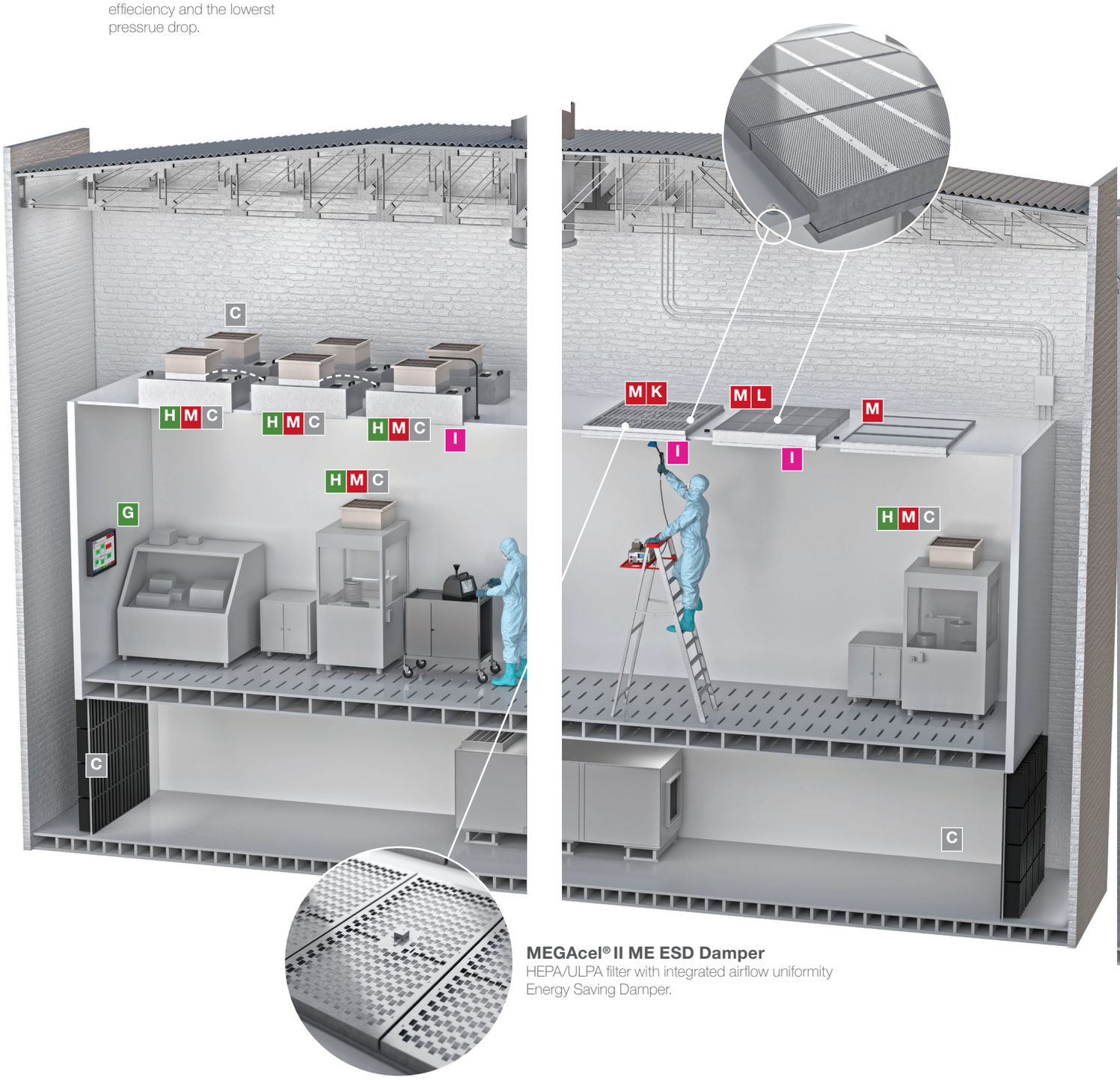
Illustration of Equipment and Test Protocol in the Microelectronics Industry

Control of viable and non-viable particles is crucial in many process applications in the Microelectronics. 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.

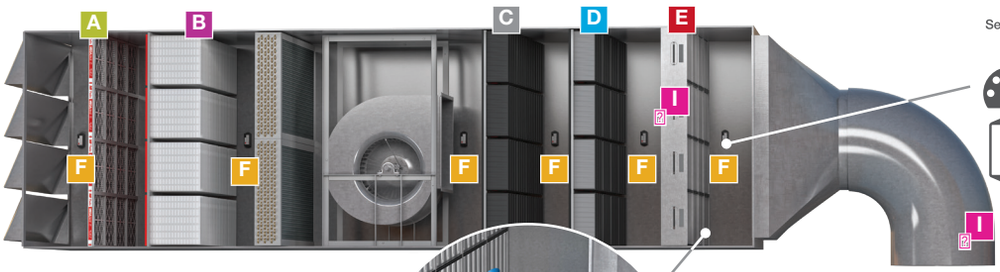
MEGAcel II ME ULPA Filter High tensile strength, boron-free media with ultra-high effieciency and the lowerst pressrue drop.

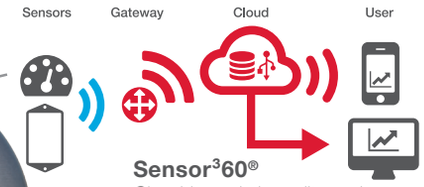
AstroDrive
Control opotions range from 0-10 V potentiometers to fully customizable PLCs and PC displays.

MEGAcel II ME 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® II ME ESD Damper
HEPA/ULPA filter with integrated airflow uniformity Energy Saving Damper.

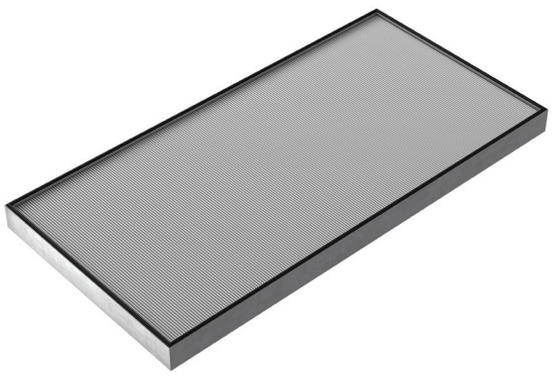


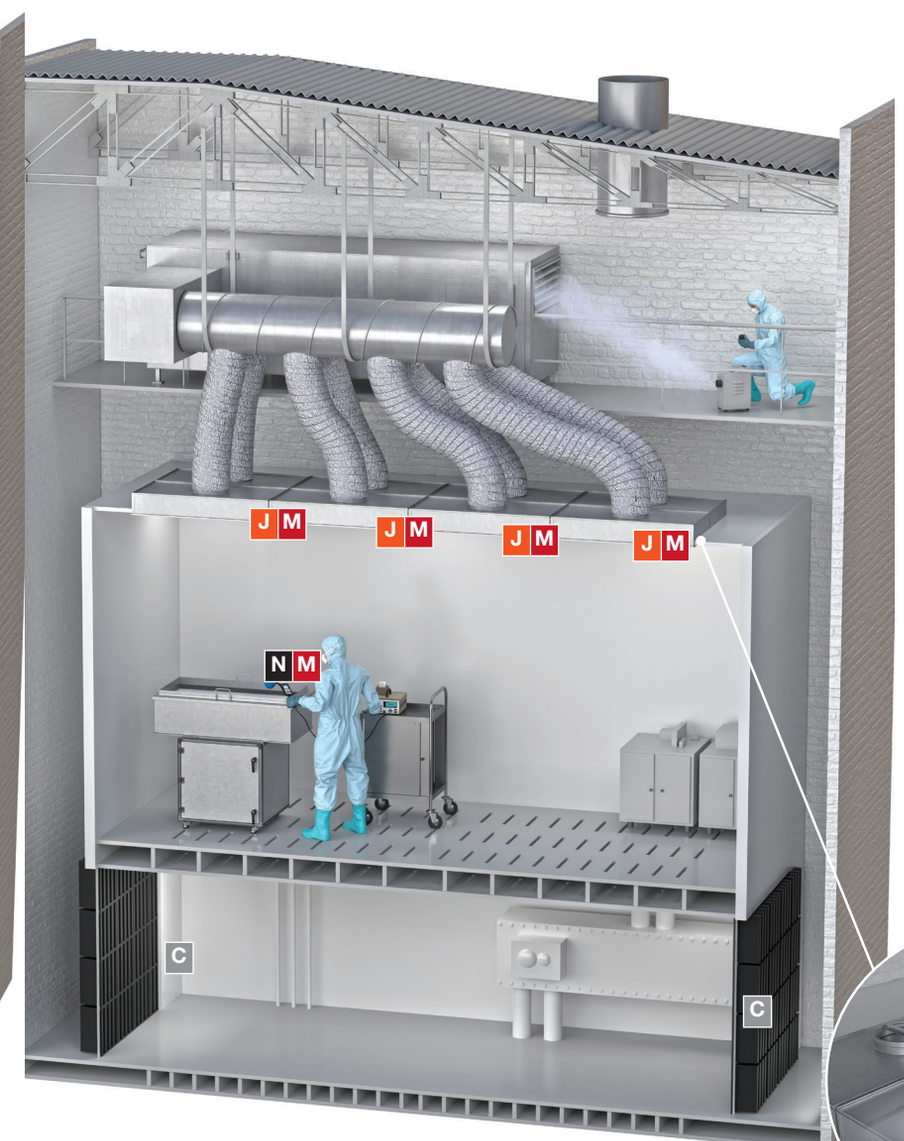


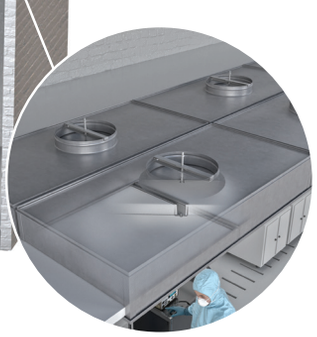
Sensor^{3}60®
Cloud-based air quality and pressure drop measurement technology.

AHU Filter Testing
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.

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







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

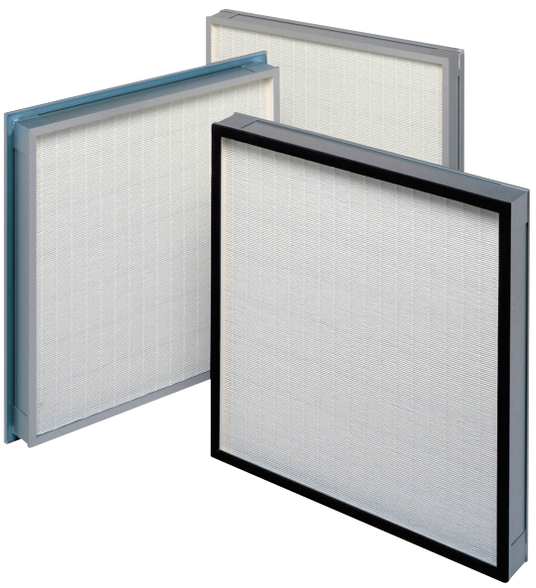
H J K L N

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

AstroHood® II
Disposable ducted HEPA with integrated centerboard test port and diffusion disc.

AAF HEPA/ULPA filters for Microelectronics

MEGAcel® II ME
Mini-pleat HEPA/ULPA Filters



Benefits

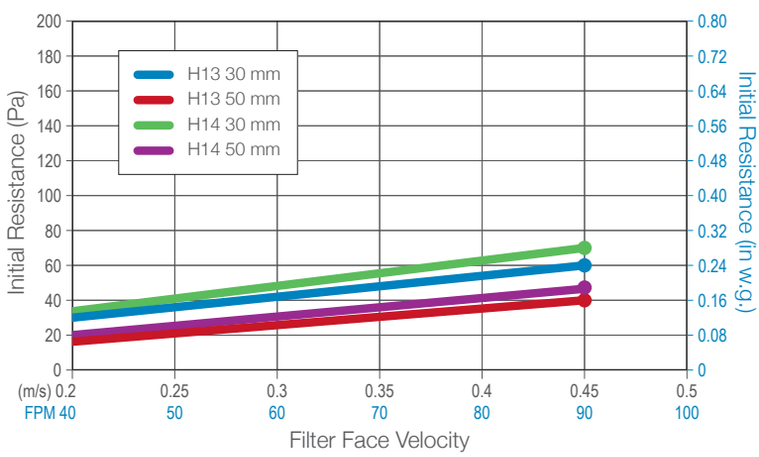
- Provides ultra-high efficiency with the lowest pressure drop
- High resistance to corrosive environments (acids, alkalis, and organic substances)
- Lowest offgassing properties available
- High tensile strength media, more resistant to rough handling in transportation and installation
- Meets I300I specifications and is UL 900 and ULC S111 classified

Highest-Performing HEPA/ULPA Filter Technology for Microelectronics

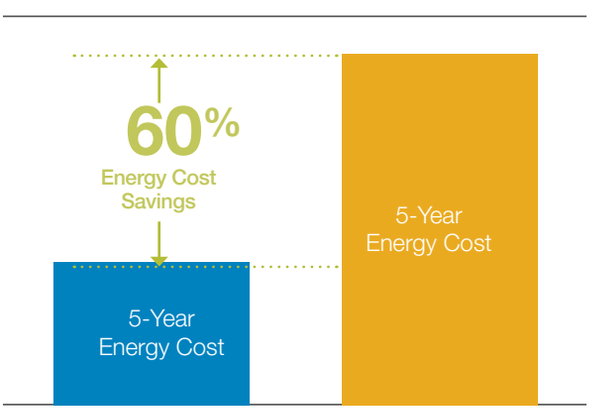
In microelectronics manufacturing, the purity of air and product is essential for proper doping of semiconductors. Like particles, certain elements can affect the electrical properties of integrated circuits negatively, effecting yield. Traditional borosilicate glass media is a potential source of boron contamination, even with “low-boron” glass media. Phosphorus can be found in flame retardants of certain polyurethane sealants used to seal the media pack to the filter frame. That is why the MEGAcel II ME is built and tested boron- and phosphorus-free.

For over 20 years, MEGAcel II ME has been the gold standard for minienvironment housings for semiconductor tool filtration systems.

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

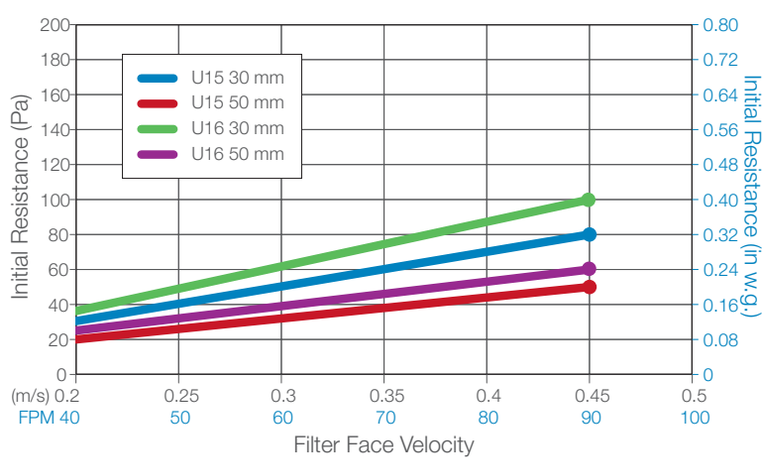


5-Year Energy Costs
MEGAcel® II ME vs. Glass ULPA Filters



Beyond the robust strength and boron-free qualities of ePTFE membrane media, it also offers significantly lower pressure drop than traditional glass media. In fact, thanks to their lower pressure drop, MEGAcel II ME HEPA/ULPA filters deliver **up to 60% energy cost savings** as compared to glass HEPA/ULPA filters.

MEGAcel® II ME U15/U16
Initial Resistance vs. Filter Face Velocity



Comparison of HEPA Media Characteristics

	ePTFE (PTFE Membrane)	Microglass (Traditional)	Polymeric (Nylon Membrane)
Applications	Microelectronics	All	Other
Longevity	Since 1994	Since 1940s	**Since 2020**
Reaction to Moisture & Vapors	Hydrophobic, repels moisture & vapors	Hydrophobic, repels moisture & vapors	**Hydrophilic**, absorbs moisture & vapors
Durability	Robust	Fragile	Robust
Chemical Compatibility[1]			
Cleaning Reagents			
Acetone	Excellent	Excellent	Excellent
Isopropyl Alcohol – IPA (70%)	Excellent	Excellent	Poor
Sodium Hypochlorite (NaOCl/NaClO)	Excellent	Excellent	Poor
Spor-Klenz® (STERIS) Peracetic Acid, H2O2, Acetic Acid	Excellent	Excellent	Poor
Vaprox® (STERIS) 35% Hydrogen Peroxide (H2O2)	Excellent	Excellent	Poor
Vesphene® IIse (STERIS) Sulfonic Acids, Phylphenol, Pentylphenol, Potassium Hydroxide, Phosphoric Acid, etc.	Excellent	Excellent	Poor
LpH® III st (STERIS) Phosphoric Acid, Phenylphenol, IPA, tert-Pentylphenol, Sulfonic Acids, etc.	Excellent	Excellent	Poor
Hypo-Chlor® (Veltek) Sodium Hypochlorite (NaOCl/NaClO)	Excellent	Excellent	Poor
Decontamination Agents			
Chlorine Dioxide (ClO2)	Excellent	Excellent	Excellent
Formaldehyde (CH2O) 100%	Excellent	Excellent	Poor
Vaporized Hydrogen Peroxide (H2O2) 30%	Excellent	Excellent	Poor
Test Aerosol Agents			
Oils/Liquid (PAO, DEHS, etc.)	Poor	Excellent	Excellent
Solids (PSLs, NaCl, Silica, etc.)	Excellent	Excellent	Excellent

1. Chemical compatibility per CP Lab Safety (www.calpaclab.com).

Comparison of HEPA Filter by Media Type

	Microglass Filters	PTFE Filters	Polymeric Filters
Solid Particle Loading	•	•	•
Liquid Particle Loading	•	Poor	•
Chemical Compatibility	•	•	Poor
Efficiency Stability	•	•	Poor
Durability	•	•	•
Pressure Drop	Higher	Lowest	Good
Lifetime	•	•	N/A
Years in Service	70+	20+	N/A
Units Fielded	Millions	Millions	N/A
Fielded Location	Global	Global	N/A

Unsurpassed Performance

The leading ULPA filtration technology for microelectronics industries, ePTFE media offers superior durability at the lowest airflow resistance. MEGAcel ME filters virtually eliminate the risks of media damage and degradation while minimizing operational expenses and interruptions. With millions of installed units worldwide, MEGAcel ME filters have exceeded the most stringent industry performance requirements for more than 20 years. MEGAcel ME is the ideal ULPA media technology to ensure peace of mind at the lowest total cost of ownership.

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 International representative for a complete list of AAF International Air Filtration Product Solutions.

Americas

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

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

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Shenzhen, China
Miaoli, Taiwan
Bangalore, India
Noida, India
Yuki, Japan (Nippon Muki)

AAF International
European Headquarters
Odenwaldstrasse 4, 64646 Heppenheim
Tel: +49 (0)6252 69977-0
aafeurope.com

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