Why use an Airborne Molecular Contamination (AMC) filter?

As processes and line widths become finer the presence of even PPB level gas phase contaminates will damage processes. As processes become more demanding the use of AMC filtration will increase

How AMC filtration works

AMC filters remove gas phase contaminates by removing them as the air passes through the AMC media. Each AMC filter adsorbs the contaminates as a function of residence time, and so the manufacturer's specified flux rate (flow per unit area of media) cannot be increased or both the removal efficiency and lifetime will be substantially decreased.

AMC filtration and FFUs

Let’s take a look

An FFU is designed to delivery a typical 90 FPM air flow at the 0.48” pressure drop of the PTFE particulate filter

AmericanAirFilter

MEGAcel™ (PTFE Media)

Operating Data

High Efficiency Performance

MEGAcel provides efficiency and performance far superior to the competition. AAF is first with providing filters which meet rigorous I300I specifications for the manufacturing of 300mm wafers.

At a peak airflow of 100 fpm, Most Penetrating Particle Size (MPPS) efficiency is superior to the stringent requirements of 99.99995% efficiency.

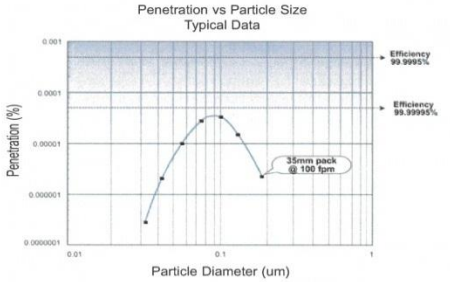
The combination of advanced levels of efficiency and the lowest possible pressure drop makes MEGAcel a simple choice for use in 300mm wafer production.

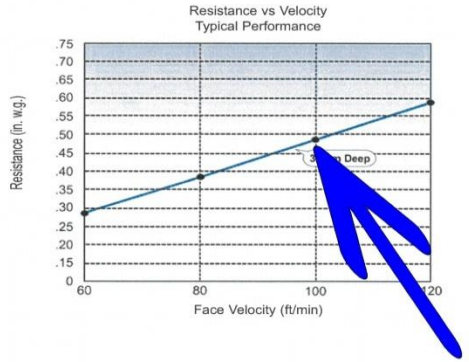
Lowest Possible Pressure Drop

Pressure drop is measured using a manometer as the test filter is subjected to a metered air volume. Testing on a volumetric basis is specified in the Institute of Environmental Sciences and Technology IEST-RP-CC007 recommended practice on ULPA filters.

AAF calculates the total square footage of usable media pack area (outside dimensions of filter minus the frame thickness and adhesive) and multiplies this number by 100 fpm to determine an accurate volumetric test flow. (This value is approximately 720 cfm for a nominal 24" X 48" filter.) This method simulates actual cleanroom airflow conditions ensuring a true measurement of pressure drop.

0.48" @ 100 FPM





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Tech note, affecting the following discussion

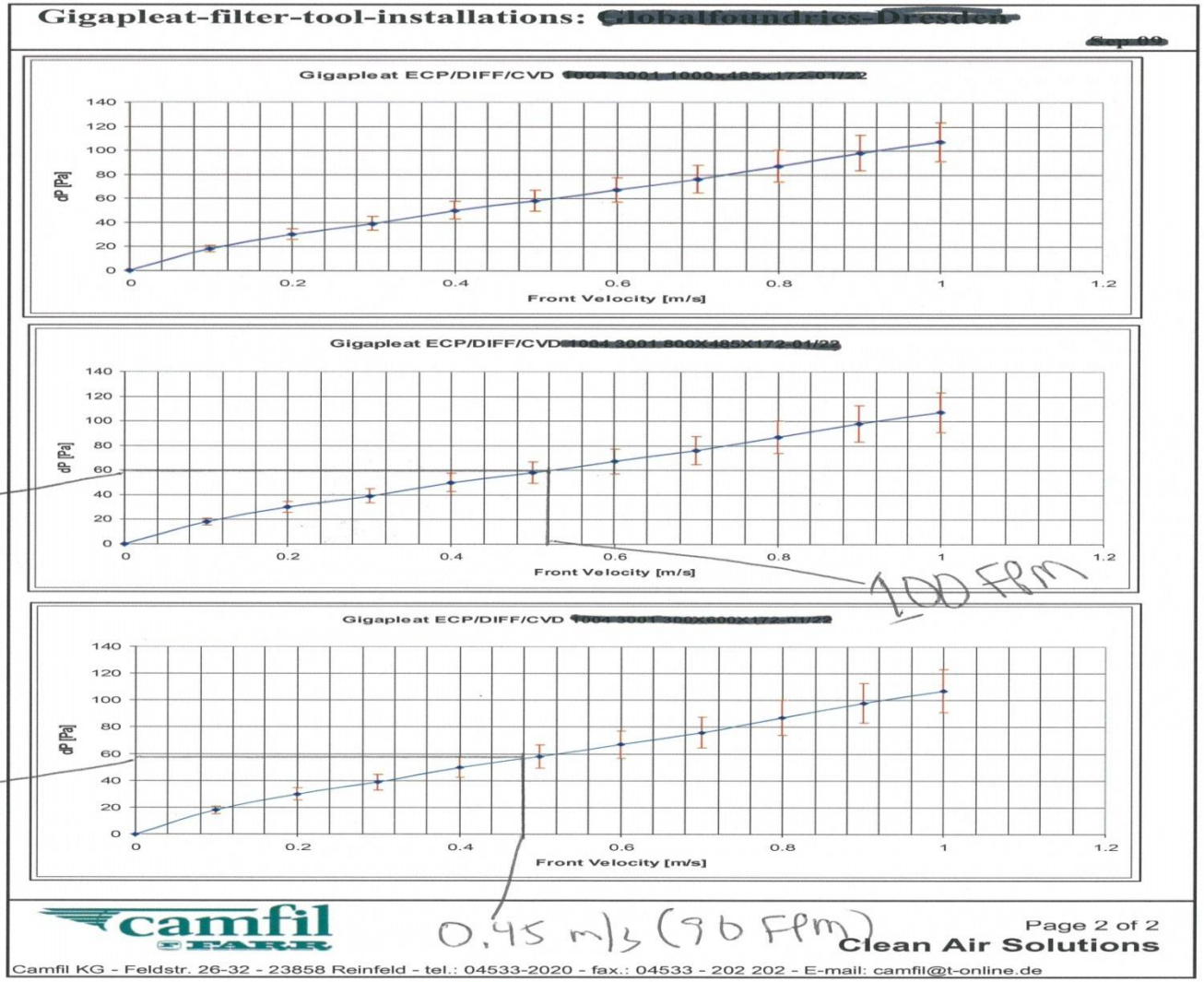
Due to the loss of effective filter area around the edges for the frame and the glue that holds the media in place, it takes roughly 100 FPM flow from the effective filter area to yield 90 FPM in the application (so the FFU is spec'd at 90 FPM which requires 100 FPM flow for both the PTFE particulate and AMC filters)

How much fan reserve is typically “built into” an FFU for filter loading and miscellaneous additional pressured drops in the system

A typical specification is for the FFU to be able to deliver 90 FPM with 20% fan reserve

When you add an AMC prefilter how much pressure drop to you add to the system?

Example 1, Camfil Gigapleat@ 0.25”

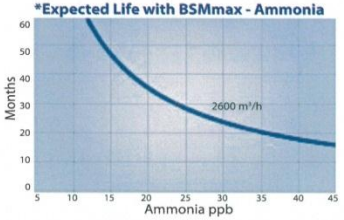


Example 2, Donaldson BSM Max @ 0.8”

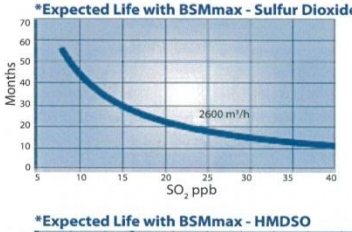
Donaldson BSMmax
Airborne Molecular Contamination Filters

*Expected life is dependent upon actual fab conditions and based on systems results using Donaldson filters in a LITHOGUARD -12 cabinet.

***Expected Life with BSMmax - Ammonia**

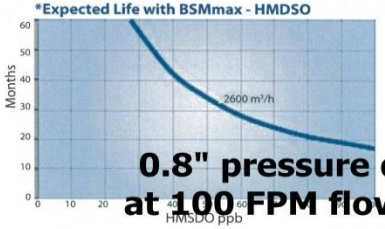


***Expected Life with BSMmax - Sulfur Dioxide**



System Results • System Results • System Results

***Expected Life with BSMmax - HMDSO**

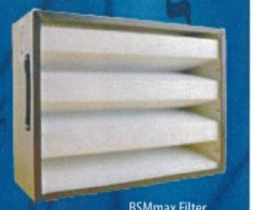


0.8" pressure drop at 100 FPM flow rate

BSMmax Filters	Part #P510805	Part #P512612
System	LITHOGUARD-12	LITHOGUARD-12
Dimensions	552mm x 185mm x 430mm 21.7” x 7.3” x 16.9”	552mm x 185mm x 430mm 21.7” x 7.3” x 16.9”
Flow	**255cfm (433 m³/h)	**255cfm (433 m³/h)
Pressure Drop	**190 Pa (0.8” water gauge)	**
Approximate Weight	**18 kg (40 lbs.)	

**Results per filter

LITHOGUARD®-12 Cabinet



BSMmax Filter

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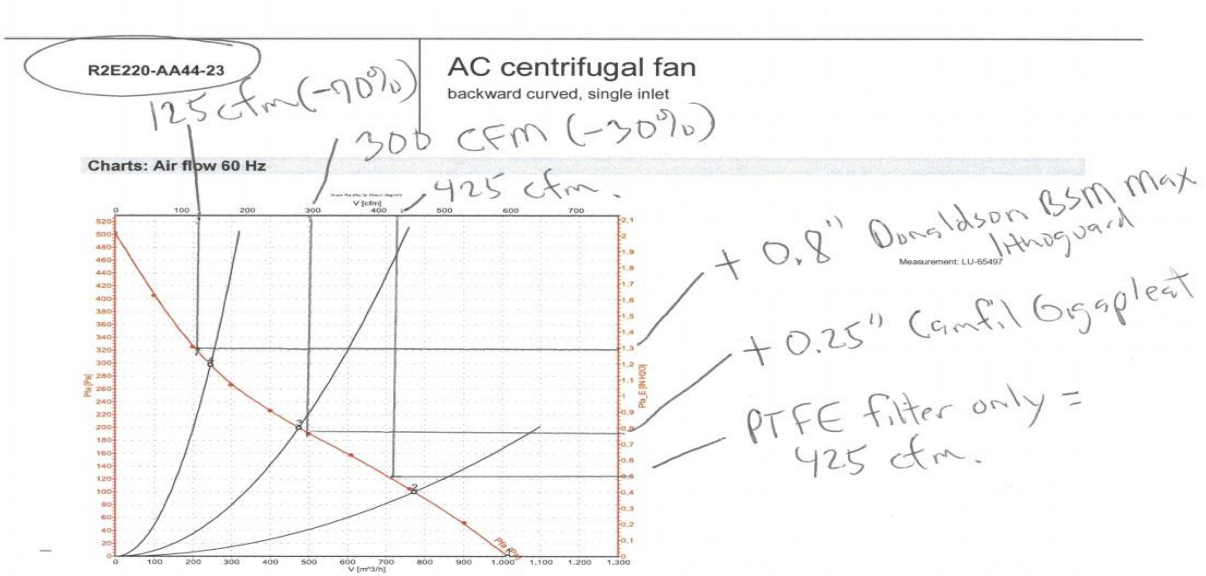
Donaldson

What will the addition of an AMC filter do to the flow of my current FFU?

See the following slide for an example. The curve you see is for our most popular fan in our FFU series, the EBM RE220, 220 mm wheel backward curved airfoil

Answer: it will knock the flow down by 30-70% from the typical 90 FPM spec, when we only have 20% reserve to work with



Measured values

	U	f	n	P_1	I	LpA_{sb}	LwA_{sb}	$\dot{V}$	p_{fs}
	[V]	[Hz]	[min⁻¹]	[W]	[A]	[dB(A)]	[dB(A)]	[m³/h]	[Pa]
1	115	60	2765	100	0.88	69	76	1015	0
2	115	60	2460	109	0.95	64	71	770	100
3	115	60	2210	114	0.99	57	65	475	200
4	115	60	2380	109	0.95	62	71	245	298

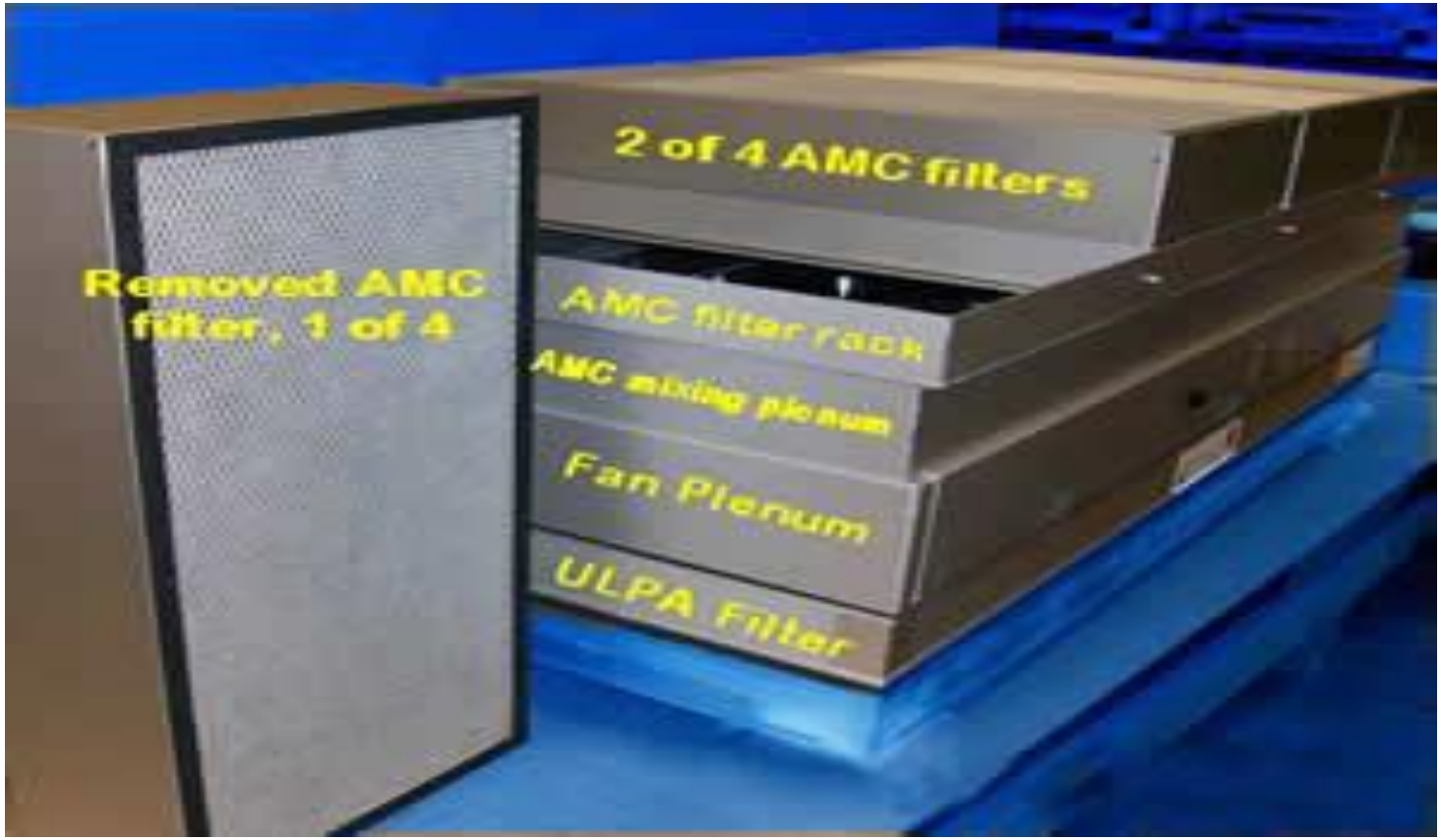
The point?

An AMC FFU will have much larger fans, capable of overcoming the substantially higher total system pressure, and retrofitting AMC filters onto an existing FFU is not typically possible if you expect to have 90 FPM flow from the FFU

An additional issue with retrofitting FFUs with an AMC filter

To stay within the typically specified 100 FPM flow rate of the AMC filter the AMC filter surface area will need to roughly equal the surface area of the FFU

Here’s an example of an AMC FFU; however the most popular market priced FFUs are designed with a single fan



And that single fan design limits the size of the AMC filter, forcing the flow rate through the AMC filter to be way to high

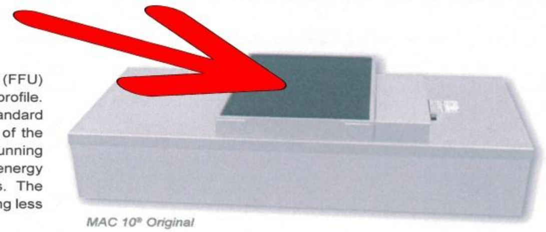
ENVIRCO
Innovators in clean air technology

MAC 10® Original

MAC 10® Introduction

Extra low watts, sound, and profile.

The Envirco® MAC 10® fan filter unit, was the first (FFU) to combine low sound, low watts and a low profile. Measuring only 51 dBA, the MAC 10® Original Standard (2 ft x 4 ft [600 mm x 1,210 mm]) provides one of the lowest sound levels of any FFU in the industry. Running at only 310 watts @ 90 fpm, the unit uses less energy than traditional FFUs, lowering operating costs. The MAC 10® Original maintains a low profile, measuring less than 13" (330 mm).



MAC 10® Original

MAC 10® Original comes standard with the filter integral with the unit housing, requiring the unit to be removed from the ceiling grid to replace the filter. The RSR unit has the filter sealed to the unit using the knife edge/gel seal construction, allowing the filter to be replaced from the roomside. The RSRE unit has the added feature of allowing the motor and filter to be replaced from the roomside.

Features

» Low sound, low watts, low profile, and low operating costs.
» Three speed switch features low, medium, and [illegible] ard [illegible] ft x 4 [illegible] mm) [illegible] nits.
» [illegible] ntrol standard on 2 ft x 2 ft [illegible] 0 mm) and 2 ft x 3 ft [illegible] mm) units.
» Forward-inclined centrifugal-type fan.
» High Efficiency Particulate Air (H[illegible]A) UL 900 Filt[illegible] 99.99[illegible] ron.
» Snap-in pr[illegible] lacem[illegible] aintenance.
» Walkable plenum (excluding prefilter), rated to 250 lbs.
» Mill finished aluminum exterior.
» [illegible]
» U[illegible] isted [illegible] V, 27[illegible] V) wi[illegible] standa[illegible] 0 filte[illegible]

approx 12" X 24" fan inlet at 700 CFM= 350 FPM inlet velocity

Options

» Solid-State Speed Control: Available on 2 ft x 4 ft (600 mm x 1,210 mm) and 2 ft x 3.5 ft (600 mm x 1, 057 mm) units; allows for a full range of settings.
» Room-Side Replacement (RSR) available with gel seal filter element; filter is replacement from the roomside.
» RSRE provides filter and motor/blower assembly replacement from the roomside.
» Ultra-low Penetration Air (ULPA) Filter: 99.9995% efficient @ 0.12 micron (U15).
» PTFE boron-free ULPA filter.
» Airflow Indicator Light: Allows external monitoring of motor operation. Red indicator is on during normal operation.
» Monitoring and Control System: On-site or remote monitoring and adjustment.
» CE Marked: 230V units available.
» Duct Collar 10" (254 mm) and 12" (305 mm): Allows direct connection to the air conditioning supply.

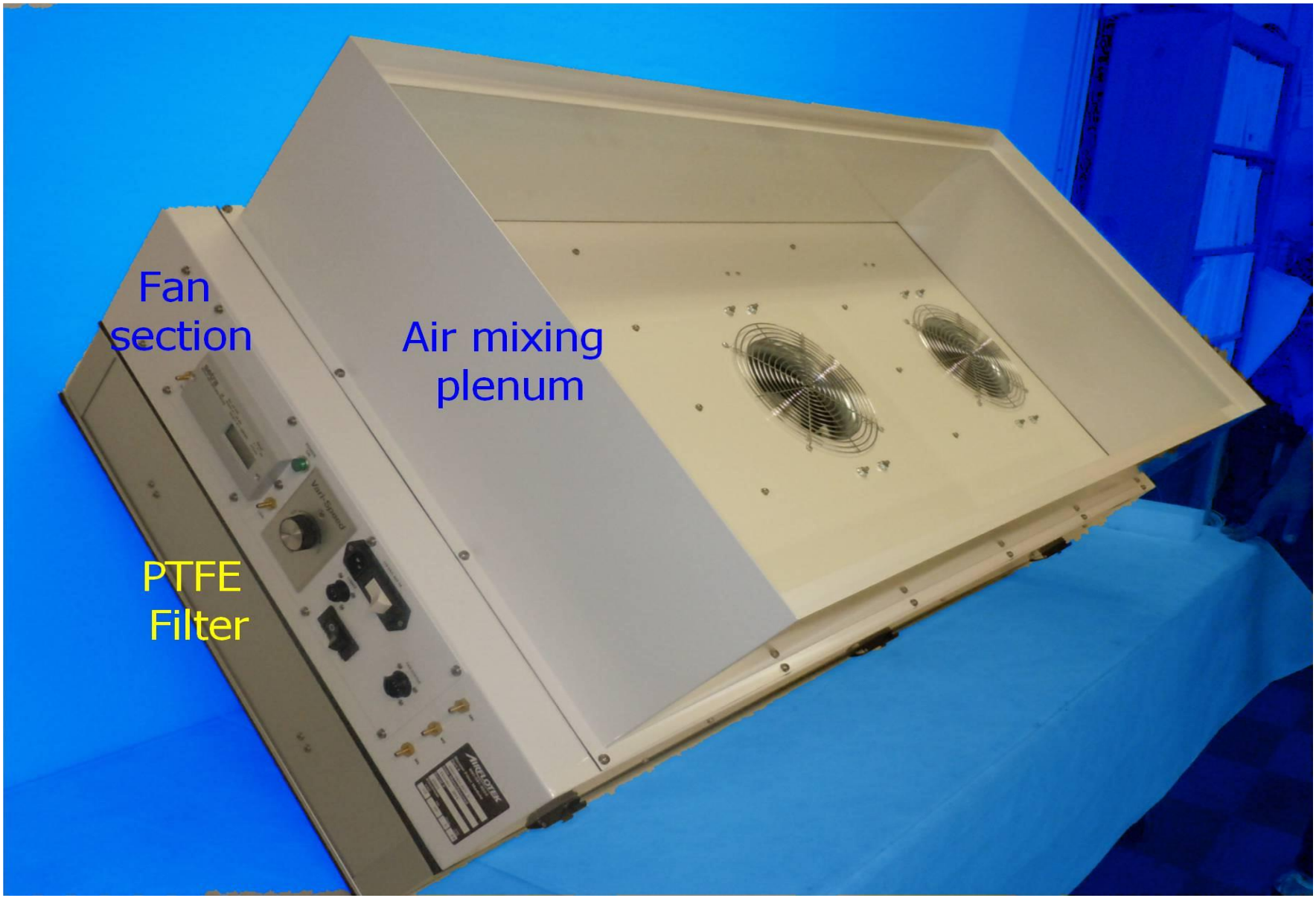
Well designed AMC FFUs

Good practices and rules of thumb

The air mixing plenum

If the AMC filter sits too close to the fan inlet, air will be selectively pulled from the area directly above the fans, resulting in a shortened life of the AMC filter(s). AMC filter manufacturers typically recommend a 8” mixing plenum, but available area often dictates a much shorter plenum. We have built well performing FFUs with plenums as short as 3”

A full height air mixing plenum



Servicing the AMC filters

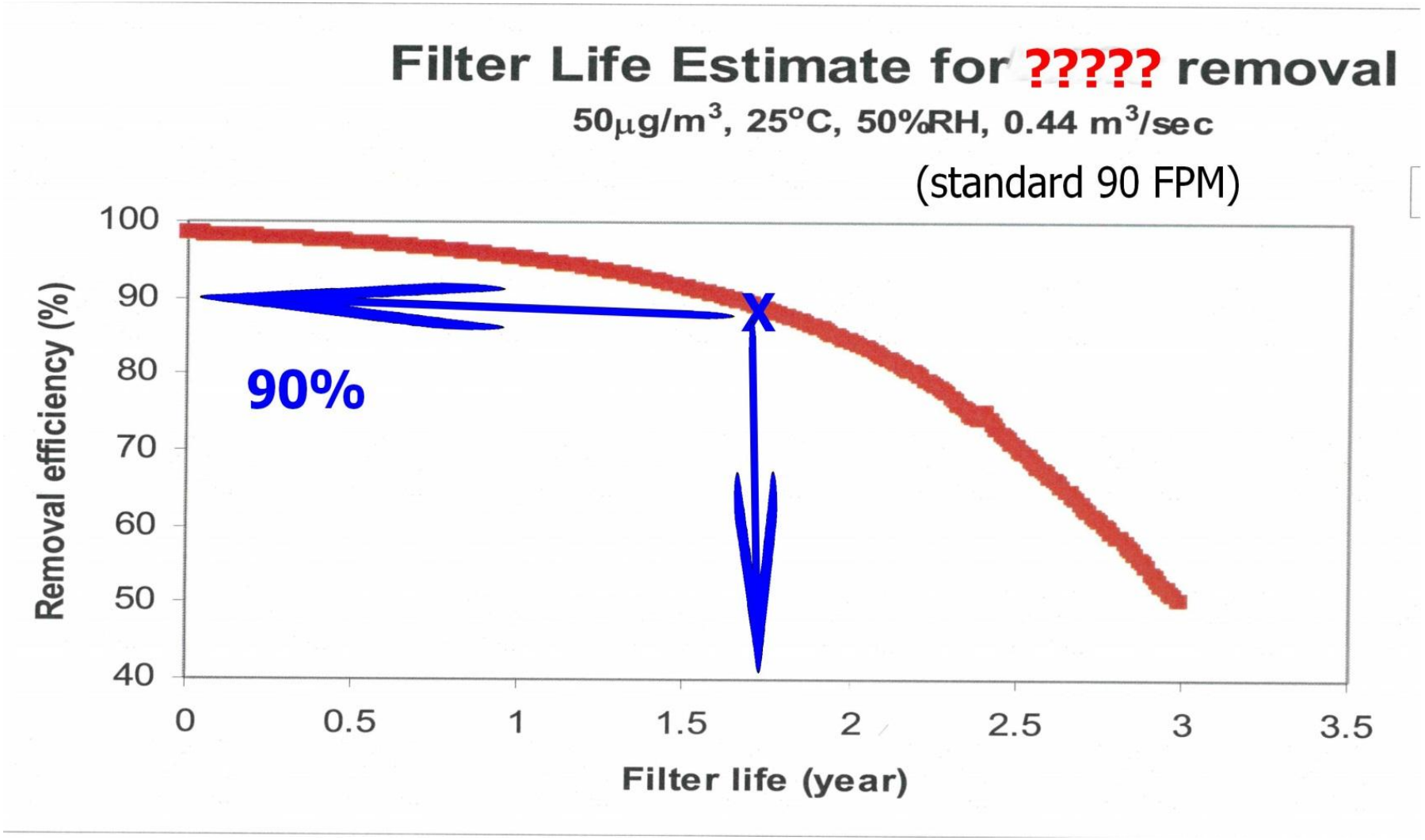
The following picture shows a FFU with handles on the AMC filters for easy removal. The AMC filter is basically a specialty prefilter, removed from the top, and so enough space must be available above the AMC filter to allow for it to be lifted up over the lips that it sits down in before being slid to the side and out of the way (this FFU also features integral ionization and the Simco-Ion Interface module is visible)

Note that the AMC filter's surface area is equivalent to the PTFE filter to hold the 100 FPM AMC filter spec.

Have an application where you need an AMC FFU?

Let us know the current concentration of the species you wish to eliminate, and we will design an AMC filter/FFU combination, providing you with an FFU that can deliver your CFM specification, plus an expected lifetime/efficiency table, as shown on the next slide.

AMC filter efficiency/lifetime curve



We have the expertise and experience. Need a quote, or just have a question? Call us at (510) 656-5333 or e-mail to Jim@tesinc.com