

A perspective view of a long, curved aisle in a data center. The aisle is lined with rows of server racks on both sides. The racks are filled with server units, some with glowing green lights. The ceiling is dark with a series of recessed, rectangular light fixtures that create a rhythmic pattern of light and shadow. The floor is dark and reflective, mirroring the lights and the racks. The overall atmosphere is clean, modern, and high-tech.

Protect
Your Best in
Class Technology
With Ours

Clean air solutions

Costly Fan Energy Reduced by Camfil

Power Usage Effectiveness

Power Usage Effectiveness (PUE) is an important metric tool that measures and tracks where and how improvements can be made in efficiency performance of the electrical and mechanical infrastructure—the lower the ratio, the better the efficiency. A PUE ratio can be dramatically lowered by the reduction of electrical energy draw, or fan energy in the data centre's cooling system.

The efficiency and energy curves of fans used in the cooling systems is far from constant. There can be a difference of 30% or more between peak and low efficiency in fan working range. Filter pressure drop is the driving force behind fan energy expenditures. If low cost filters are installed, pressure drop will cause the system to lose efficiency, sending fan energy costs soaring, which in turn will show a rise in the PUE ratio.

Filter efficiency and TCO

Regardless of the type of cooling or AHU system installed in a facility, to manage pressure drop and maintain as close to peak fan efficiency as possible, it's imperative to evaluate the choice of filters used. When you consider the number of filters needed annually in a system, the guaranteed efficiency and Total Cost of Ownership (TCO) should be the key drivers for

*“ It's a fact—
Data Centres consume an
exorbitant amount of energy.
With Camfil, data centres have
documented six figure savings
in Total Cost of Ownership. ”*

determining which filter selection is the best solution.

No electrostatic charges

Camfil Hi-Flo and Opakfil filters have all been certified by Eurovent to ensure highest energy efficiency and guaranteed performance. Camfil uses a proprietary blend of fine fibers that uses a mechanical particle capture principle which does not require an electric charge. This offers the longest life and lowest average pressure drop while in service over the life of the filter...Guaranteed!

Low cost, coarse fiber filters, which incorporate an electric charge to operate, can drop in efficiency and increase in pressure drop in a short period of time resulting in increased fan energy consumption

The majority of the energy consumption in your facility is the data centre. This chart represents the energy survey of a 21-story office building.

	Data Centre	Total Office Building	Data Centre as % of Building Total
Area	300 sqm	35,000 sqm	0,8%
Average Monthly Real Demand	189 kW	1,889 kW	10%
Average Monthly Consumption	140,000 kWh	701,300 kWh	20%

and shorter filter life. Although the upfront cost for these filters may be lower, the Total Cost of Ownership (TCO) is higher because they are on the negative side of Life Cycle Cost (LCC) values when compared to the fine fiber media used in Camfil products.

Camfil's low average pressure drop filters allow AHUs and fans to be downsized, saving operating costs and capital costs on initial installation. Conversely, if a system isn't optimized at design, Camfil filters can replace standard filters for short term payback.

LCC software

These are just some of the factors that are considered in Camfil's LCC Software (see page 3).

Camfil's longer lasting, fine fiber filters extend equipment life and reduce maintenance. Camfil has documented significant energy savings for our data centre customers, in some cases, by as much as six figures annually.

Learn more on www.camfil.com:



[“Data centre air filtration”](#)

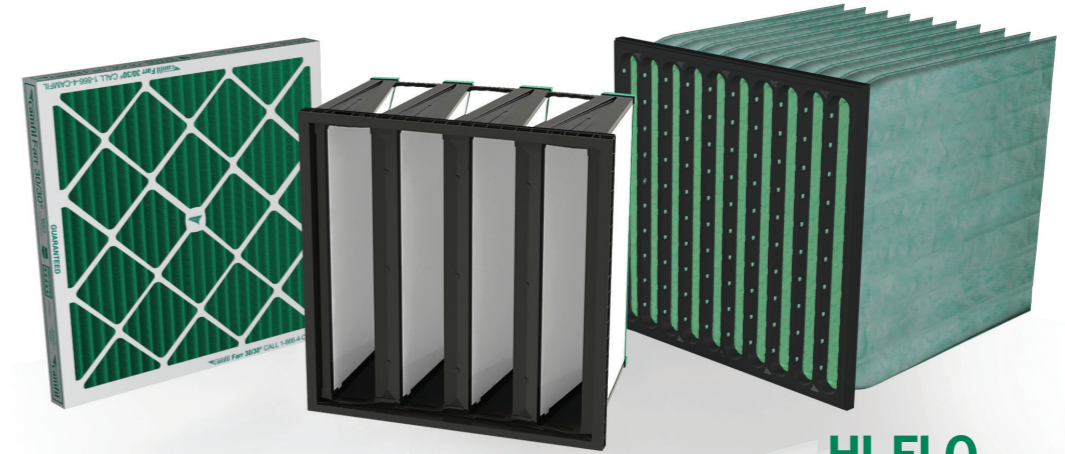
[“Keeping the information superhighway clear”](#)



According to US DOE statistics, the data centre electricity usage of 30 billion kilowatt hours, in 2001, soared to 100 billion kilowatt hours by 2013.

Business enablement platforms bear increasing demands for cloud access — this drive pushed mega data centre production to jump eight times by the year 2018.

Premium Products = Cost Savings



30/30®

With its industry leading energy rating, the Camfil 30/30® sets the standard for medium efficiency air filtration. When used as a prefilter, a stand-alone HVAC filter, or as the main filter in custom data room air conditioning units, the 30/30 will remove nuisance dusts and staining particles, and increase the life of downstream final filters by removing contaminants that shorten the life of final filters. Using a mechanical efficiency to provide ISO ePM10 50% (MERV 8 & 8A) performance levels, the 30/30 will maintain its efficiency throughout the life of the filter.

OPAKFIL

The Opakfil offers high efficiency particle removal down into the sub-micron particle range to protect the most sensitive semiconductor and electromechanical equipment from contamination. Its glass mat media maintains efficiency throughout the life of the filter and its increased media area ensures maintained low pressure drop and longer filter life. The Opakfil can save 40% or more in energy expenditures when compared to competitive products.

HI-FLO

The Hi-Flo uses a Camfil-exclusive high loft micro fine glass media to capture particles down into the sub-micron particle range to protect data centre equipment from contamination. The Hi-Flo may be used as the only filter in a single-stage system eliminating pressure drop and service requirements associated with two-stage filtration systems that require a prefilter. Hi-Flo are available in ISO ePM10 60% to ISO ePM1 85% filter classes (MERV 9 to MERV 15). Its MERV and relative MERV-A testing values are equivalent ensuring that performance is maintained throughout filter life.



LCC SOFTWARE

The selection of air filters for data processing facilities is a critical decision when considering filter effectiveness in providing a clean environment. An almost equally critical factor is what a filter will cost over its lifetime in the system, or its Total Cost of Ownership (TCO). There are hidden costs to air filters, with energy usage at the top of the scale. This is followed by associated labor to service the filters, disposal costs and carbon footprint.

Camfil can predict your TCO using our proprietary Life Cycle Costing (LCC) software. It can also predict the optimum filter change-out point to optimize energy usage and filter life based upon the actual operating parameters of your facility.

Life Cycle Costing software is a proprietary modeling tool developed by Camfil that allows users to evaluate and optimize air filter selection and change out points to reduce total cost of ownership

COST SAVINGS EXAMPLE	1 AHU	45 AHU
Energy saving	€48,408	€2,178,360
CO ₂ Emissions saving (1)	217 TONS	9,765 TONS
Total cost of filter change (2)	€11,616	€522,720
Labour & waste savings (3)	€14,520	€653,400

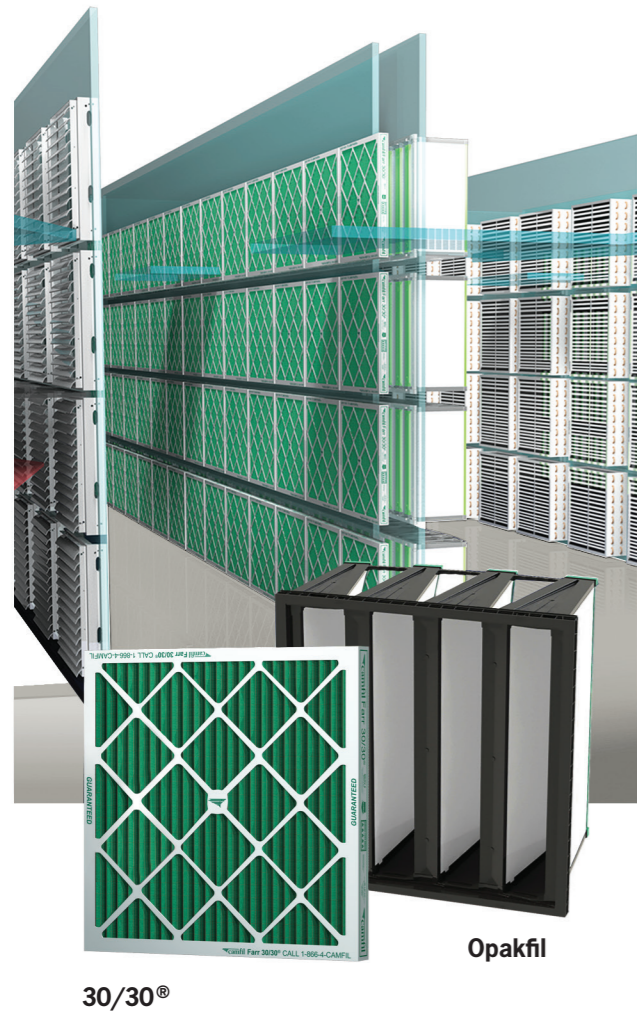
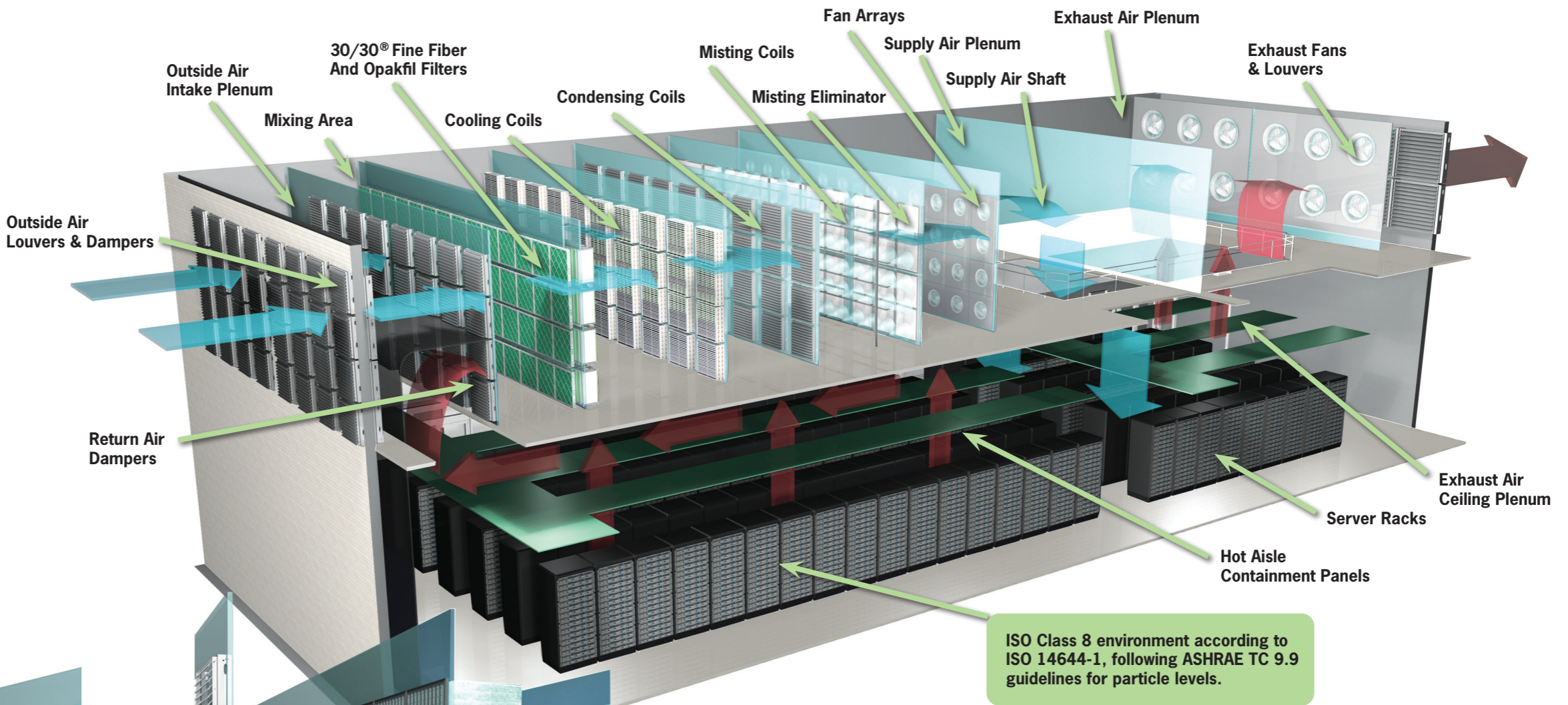
(Over 10 years) (1) This is based on 600g/kwh, (2) See average cost over 10 years, (3) See average costs over 10 years per change

Air Filtration Optimization

ASHRAE TC 9.9 conformity

In order to comply with ASHRAE TC 9.9 (gaseous and particulate contamination guidelines for data centres), Camfil recommends ISO ePM1 60% (MERV 13) filters for the best balance of particle removal efficiency, low energy expenditures and a long filter life. Depending upon individual facility considerations, common configurations may include the Hi-Flo as the only filter stage or a Camfil 30/30® with a Opakfil for two-stage designs.

Data centres have critical cleanliness requirements, which is why Camfil recommends filters to follow ISO 16890 requirements or have a MERV-A equivalent to their published MERV rating according to ASHRAE 52.2-2017. This ensures sustained filter performance over the entire life of the filters. Coarse fiber, or synthetic media products, lose efficiency over time often sacrificing filter efficiency resulting in a dirtier environment.



EUROVENT CERTIFICATION

Using the right air filter will not only help you to maintain ISO Class 8 indoor air quality. It will also help you to save energy and money. Eurovent combines a stringent efficiency standard with energy consumption for optimal solutions and transparency for the user.

With Eurovent's new and objective system for classifying energy efficiency, it will now be easier for you to find the right air filter for the lowest energy usage and highest indoor air quality.

Today, all air filters can be graded from A+ to E. Grade A+ stands for the lowest energy consumption and E for the highest. The classification, based on ISO 16890, will give you a better understanding of a filter's annual energy consumption, initial efficiency and minimum efficiency.



CAMFIL
 Hi-Flo XLT7/670
 HFGX-F7-0592/0592/0670-10-25
www.eurovent-certification.com

ISO ePM₁ 60%
 EN-ISO16890-1:2016

Nominal airflow:	0.944 m ³ /s
Efficiency:	ePM ₁ 62 %
Minimum efficiency:	ePM _{1min} 62 %
Annual Energy Consumption:	838 kWh/annum

A+
2019

Corrosion Control Sensitive Electronics

The degradation of electrical control equipment by corrosive gases is a well-known effect. In fact, virtually all manufacturers of sensitive electronic/electrical equipment specify the required environmental conditions for their equipment as part of the warranty conditions. These specifications set limits for temperature, relative humidity and chemical contaminants as they all influence the rate of corrosion.

Many individual electronic components are afforded some protection from corrosive agents due to the fact they

are encapsulated inside an airtight plastic or resin body. The components that are most susceptible to damage are printed circuit boards (PCBs), exposed contacts and conductors.

There are several established techniques for PCB production. They differ in terms of cost, surface flatness, shelf life and corrosion resistance.

The method that is gaining most popularity following the introduction of RoHS legislation (restriction of hazardous substances) which required

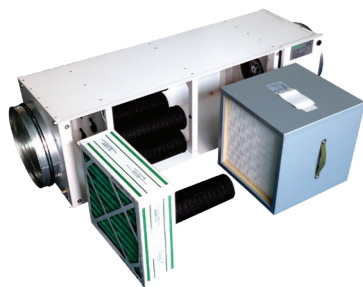
the elimination of lead from solder is "Immersion Silver" (iAg or IM Ag). In this method, the copper tracks on the PCB are coated with a thin layer of silver (< 0.25 microns) prior to adding the on-board components. However, the exposed edges of the copper sub-track and the silver coating are susceptible to corrosion.

Molecular filtration using adsorption techniques is the industry accepted method to remove the corrosive agents from the air.

AIR CLEANERS

The Camfil Air Cleaners series provides clean air to data centre areas that may require a higher level of cleanliness than the rest of the facility. It is used to supplement HVAC systems that lack clean air performance required to maintain the data centre's integrity. The units are available as free-standing portable, or in a horizontal configuration that suspends within a room or connects to a ducted air distribution system above a ceiling.

Available in 300 cmh to 6000 cmh airflow capacities, the Air Cleaner accepts a variety of particle air filter efficiencies from ISO ePM10 (MERV 8) pre-filtration, various configurations and high efficiency final filtration, to HEPA H13 level filtration for removing ISO cleanroom level contaminants. All units may include CamCarb or GigaPleat molecular filtration capabilities for facilities with corrosive gas concerns.



CC Concealed



CC1700



CC6000

MOLECULAR FILTERS

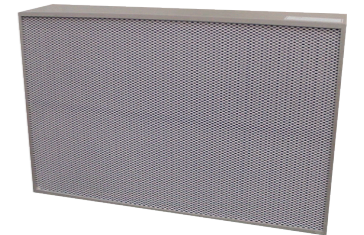
GIGAPLEAT – HIGH CLEANLINESS SOLUTIONS

GigaPleat is Camfil low energy usage molecular filter product line specifically dedicated to microelectronic cleanroom environments having high particle cleanliness requirements. Adsorbents are trapped within 2 non-wovens to ensure ISO Class 6 (acc. ISO 14644-1) throughout the filter life, well below the ISO Class 8 level recommended by ASHRAE TC 9.9 for data centres.

GigaPleat NXPH is also available with combined performance for particle and corrosive gases making it an ideal solution for upgrade of existing systems with limited space.



Gigapleat NXPH for AHU



Gigapleat NXPP for Air Cleaners

CAMCARB – HIGH CAPACITY SOLUTIONS

The CamCarb filters are Camfil's flagship molecular products for moderate duty applications in corrosive environments. When mounted on their dedicated holding frames or housings, all internal leaks are eliminated and very high efficiency values are achieved. CamCarb are ideally suited to use in makeup air units or in Camfil Air Cleaners, in applications where moderate gas concentrations are expected.



CamCarb and CamPure adsorbents for corrosion control



Camfil leak-free PSSA housing with CamCarb VG modules



CamCarb CG filters

On-Site Testing

CORROSION CONTROL REQUIREMENTS

The use of molecular filtration for the prevention of corrosion in electrical or electronic equipment is a critical application. The safe and reliable operation of end-user assets and processes are dependent on the performance of the molecular filters.

Camfil provide customers with support services to monitor the on-going effectiveness of their filters. The impact of the air quality is assessed by reactivity monitoring or measuring the rate of corrosion of copper and silver sensors.

This can be done by either a passive (coupons) or a continuous real-time technique (ISA Check II unit), to determine the corrosion levels according to ISA 71.04-2013.

ISA CLASSIFICATION OF REACTIVE ENVIRONMENTS (ANSI/ISA 71.04-2013)

	Environment sufficiently well controlled such that corrosion is not a factor in determining equipment reliability.	Environment in which the effects of corrosion are measurable and may be a factor in determining equipment reliability.	Environment in which there is a high possibility that corrosive attack will occur. These harsh levels should prompt further evaluation resulting in environmental controls.	Environment in which only specially designed and packaged equipment would be expected to survive.
Security level	G1 (MILD)	G2 (MODERATE)	G3 (HARSH)	GX (SEVERE)
Copper reactivity level*	<300	<1000	<2000	≥2000
Silver reactivity level*	<200	<1000	<2000	≥2000

*In angstroms, normalized to a 30-day exposure.

Required level according to ASHRAE TC 9.9, gaseous and particulate contamination guidelines for data centres.

COPPER REACTIVITY LEVELS (A/month)		G1 (MILD)	G2 (MODERATE)	G3 (HARSH)	G4 (SEVERE)
		<300	<1,000	<2,000	>2,000
GROUP	GAS	GAS CONCENTRATION (parts per billion)			
A	Hydrogen sulfide (H ₂ S)	<3	<10	<50	>50
	Sulfur dioxide (SO ₂)	<10	<100	<300	>300
	Sulfur trioxide (SO ₃)	<1	<2	<10	>10
	Chlorine (Cl ₂)	<50	<125	<1,250	>1,250
	Nitrogen oxides (NO _x)	<1	<2	<10	>10
B	Hydrogen fluoride (HF)	<500	<10,000	<25,000	>25,000
	Ammonia (NH ₃)	<2	<25	<100	>100
	Ozone (O ₃)				

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ISA-Check II unit with copper and silver sensors.



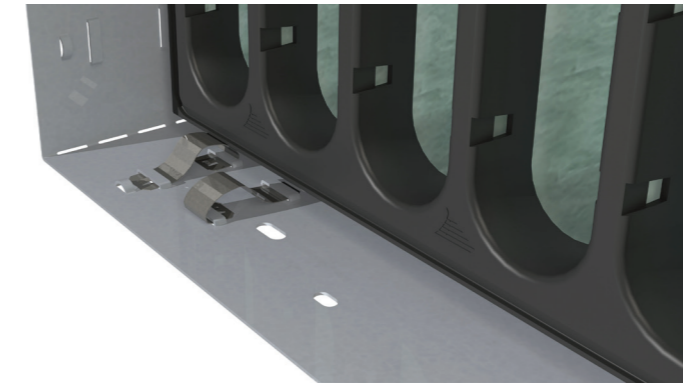
CamPure coupon

Other Data centre products

FASTFRAME

In Data centres filter changeouts and filter installations often result in server operational downtime. During filter changeouts no cool air is entering the server room, servers need to be switched off to stop from overheating.

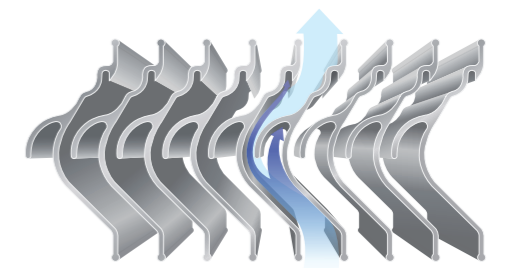
Using Camfil FastFrame technology, your filter changeout times can be dramatically reduced. Datacentres can experience a 30-50% reduction in server downtime from the use of the FastFrame in their HVAC systems. Each FastFrame can hold single and dual stage filtration levels to allow for filtration upgrades when required



CAMVANE

Data centres are often built in areas of low temperature to encourage free air cooling. Although these centres can benefit from less cooling costs, low temperature environments can often have their own problems. Increase rain fall, snow and ice can affect the performance of your back up generators and HVAC systems.

The CamVane has been designed to protect your equipment from the effects of water. With near 100% removal of water droplets from the air, the CamVane can give your datacentre the extra protection needed.



Leading the Way in Clean Air Technology

THE SOLUTION IS CLEAR— PROTECT YOUR BEST IN CLASS TECHNOLOGY WITH OURS.

Camfil is a family company with an unusually strong interest in technology. Since the earliest days we have invested large amounts of money in research and development.

We believe that R&D is one of the most important factors behind our success. By constantly investing in our business,

we have become the world's leading filter manufacturer. And by collaborating with universities, colleges and organisations such as the Karolinska Institute, the Wallenberg Laboratory and the IVL Swedish Environmental Research Institute, we keep ourselves permanently up-to-date.

We also have representatives within a number of international organisations, including Eurovent, CEN, ISO and ASHRAE. We are continuously working to ensure that our end-products are the best on the market. And by staying at the leading edge, we can meet the requirements of the future.

EXPERTISE AND SERVICE

Camfil can assist customers in determining air quality in their facilities by analyzing samples taken on-site and submitted to one of our international laboratories.

We can test these samples against existing regulations or we can follow internal guidelines established by our customers and based upon their unique circumstances.

We send our own teams on-site for delivery and installation. We take this step to ensure our filters are installed correctly and performing as expected. The challenge we are committed to is delivering the highest indoor air quality at the lowest total cost of ownership.

SERVICES OFFERED

Camfil Filter Management (CFM)

- Guarantees the correct implementation and standardization of the filters
- Optimizes the overall operational cost of filtration in all customers facilities
- Assists in all activities related to filtration

SERVICES INCLUDES

- Optimizing filter service life
- Scheduling filter changes
- Inventory management
- On-time delivery options
- Installation
- Disposal of used filters
- Energy cost analysis using Life Cycle Cost modeling software

WORK - INSTALLATION

- A single contact from design to installation of the equipment.
- Guaranteed results on installation commissioning.
 - Filter wall modifications
 - Filter change operations
 - Repairing, cleaning and disinfecting your textile ducts

MANAGING FILTER WASTE

We can assist you for the management of your used filters.

CHECKING YOUR EPA , HEPA AND ULPA FILTRATION SYSTEMS

Checking your EPA, HEPA and ULPA filtration systems. This is the guarantee that they will protect products, operators and the environment.

- Laminar flow hoods
- Microbiological Safety Stations
- Closed hoods
- Blowing ceilings
- Filter checking in Air Handling Units

CAMFIL ACADEMY

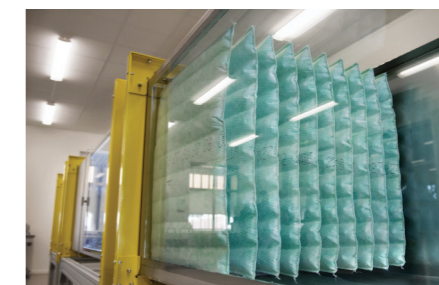
Camfil offers training courses: "Practice of air filtration" at Camfil Academy.

- For a pragmatic approach of air filtration



1. MOLECULAR LAB

- Development of molecular filters
- Climate controlled test rigs for activated carbon media and full-size molecular filters
- Adsorbent porosimetry (surface characterization)



2. GT/APC LAB

- Development of filter solutions for dust collection and gas turbines
- High-Speed filter rig for gas turbines
- Climate simulation



3. PROCESS DEVELOPMENT WORKSHOP

- Development of process equipment for manufacturing filters
- Fully equipped machine shop
- 3D printer for prototyping



4. PARTICLE LAB 1

- Development of comfort and HEPA filters
- Aerosol research
- Test rig for full-scale filters and smaller filters
- Nano particle measurements using an electrostatic classifier with CPC
- Filter media testing and development



5. PARTICLE LAB 2

- Classification of filters according to ISO 16890 and ASHRAE 52.2
- Energy classification of filters
- Classification rig and IPA discharge rig
- Remote-controlled mobile laboratories for testing air filters in the field



6. IAQ LAB

- Quantitative and qualitative air quality analysis
- Media and fibre development
- Air quality research
- Scanning Electron Microscope, SEM

Camfil – a global leader in air filters and clean air solutions

For more than half a century, Camfil has been helping people breathe cleaner air. As a leading manufacturer of premium clean air solutions, we provide commercial and industrial systems for air filtration and air pollution control that improve worker and equipment productivity, minimize energy use, and benefit human health and the environment.

We firmly believe that the best solutions for our customers are the best solutions for our planet, too. That's why every step of the way – from design to delivery and across the product life cycle – we consider the impact of what we do on people and on the world around us. Through a fresh approach to problem-solving, innovative design, precise process control and a strong customer focus we aim to conserve more, use less and find better ways – so we can all breathe easier.

The Camfil Group is headquartered in Stockholm, Sweden, and has 33 manufacturing sites, six R&D centres, local sales offices in 30 countries, and 4,800 employees and growing. We proudly serve and support customers in a wide variety of industries and in communities across the world. To discover how Camfil can help you to protect people, processes and the environment.

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