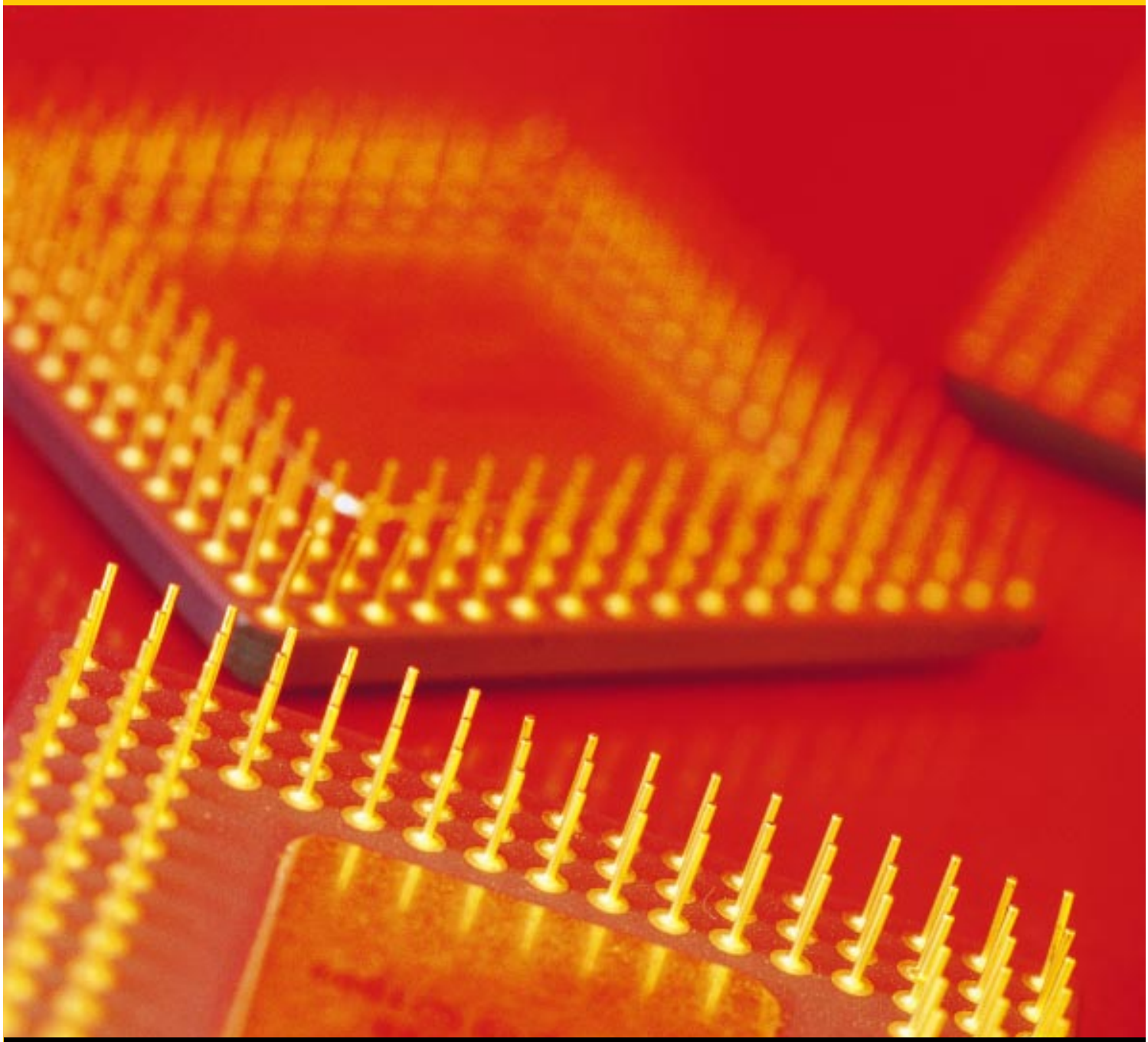
camfil FARR



microelectronics

Camfil Farr	Segment brochure
Microelectronics	
Camfil Farr - clean air solutions	

camfil farr's corporate philosophy

Our global resources help our customers locally.
Camfil Farr truly practices the "think globally – act locally" concept.
For further information concerning clean room technology and the latest news please visit our web site: www.camfilfarr.com.

Camfil Farr is a world leader in clean air technology and air filter production.

The Group is represented through subsidiaries and distributors throughout Europe, the United States and Asia.

We are the first choice for companies who have critical requirements for the quality of air within their processes.

During this decade, we have supplied over 500,000 m^2 of clean room area with a performance exceeding ISO Class 5. (ISO Class 5 corresponds to M 3.5 according to US Fed. 209E, see also page 4).

Strength factors

As an international air filtration leader, Camfil Farr offers our customers a security of long-term partnership that is backed by a documented capability to analyse needs and supply total air filtration solutions.

Our product range can meet your every need – from standard ventilation filters to highly specialised filters for applications that are extremely sensitive to air pollution. We provide the best possible clean air solutions, customised and optimised for price/performance.

We are a driver and standard setter in the filter industry's major trade groups and organisations.

We are active members and participants in the following:

Eurovent 4b Air Filters: CEN/TC 195

ISO/TC 209 working group 8 (A.M.C. airborne molecular contamination)
Note: ISO 14644 will replace individual country standards in a couple of years.

I.E.S.T. working group for recommended practices related to clean room and clean room filtration.

JACA clean room out gassing materials and leak testing substitutes for DOP.

J.I.S. Procedures for testing clean room filters & measurement of cleanliness classifications.

Research & Development

At Camfil Farr, we are deeply committed to R&D and quality control, performing rigorous laboratory testing and field trials under controlled conditions.

We design, develop and build our own production equipment to maximise our control over the quality and performance of the filtration products that we manufacture.

We also design software packages that make it easier for our customers to calculate their needs and then select the Camfil Farr products that provide the optimal clean air solutions.

New materials and equipment

We are always on the forefront of and continuously developing new materials in order to optimise our clean air solutions.

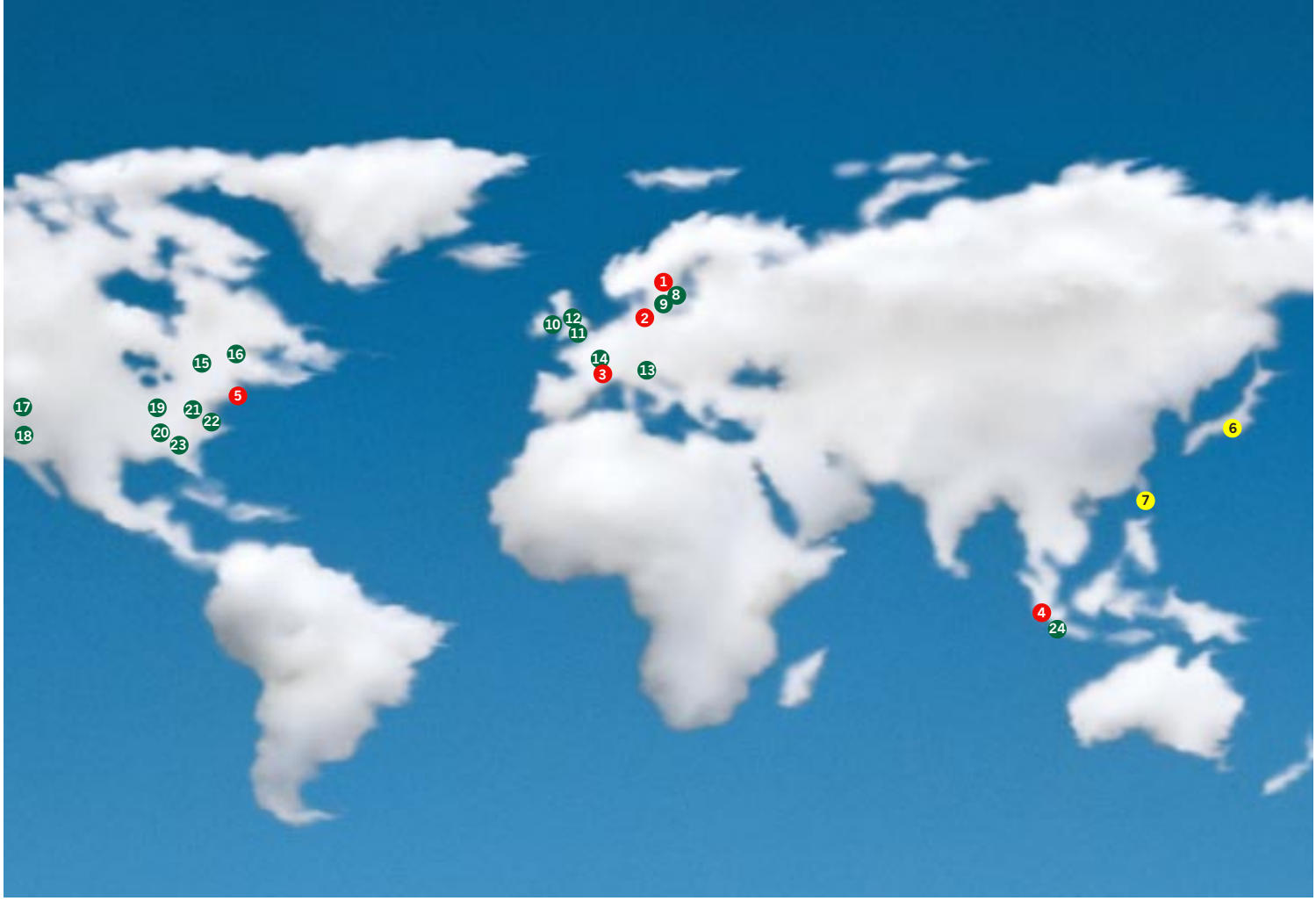
We have developed our own unique production and testing equipment for our standard glass fibre Megalam filters.

We also have our own proprietary production equipment which was specially developed for our new

e-PTFE, low boron and chemical filter range.

Our main R&D centre is located at our corporate headquarters in Trosa, Sweden and is well equipped with, amongst others, a SEM (Scanning Electron Microscope) and test rigs for both particle and gas measurement analysis.

Additionally, our production plants typically have their own R&D programs and staff in order to satisfy the local needs of their customers.



Camfil Farr plants with HEPA/ULPA filter production
1. *Camfil Svenska AB, Sweden*
2. *Camfil KG, Germany*
3. *Camfil SA, France*
4. *Camfil Air Filter SDN BHD, Malaysia*
5. *Camfil USA Inc., USA*

Camfil Farr licenses with HEPA/ULPA filter production
6. *Nitta Corp., Japan*
7. *Nitta Corp., Taiwan*

Camfil Farr plants
8. *Camfil Component AB, Sweden*
9. *Camfil Industrifilter AB, Sweden*
10. *Camfil Ireland LTD, Ireland*
11. *Camfil Farr, England*
12. *Camfil LTD, England*
13. *Camfil AG, Switzerland*
14. *SADI SA, France*
15. *Camfil Inc., Canada*
16. *Camfil Farr, Laval, Canada*
17. *Camfil Farr, Corcoran, USA*
18. *Camfil Farr, Delano, USA*
19. *Camfil Farr, Crystal Lake, USA*
20. *Camfil Farr, Jonesboro, USA*
21. *Camfil Farr, Conover, USA*
22. *Camfil Farr, Washington, USA*
23. *Camfil Farr, Holly Springs, USA*
24. *Camfil Farr, Malaysia*

In our major plants, filters are produced in controlled environments. As added security for our key customers, we can produce the same type of filters at multiple manufacturing sites.

Our large production capacity ensures the availability of our products at all times - throughout the world.

Camfil Farr is recognised as the number one supplier of high efficiency filtration products for the microelectronic industry.

All our plants are of course ISO 9000 certified and some are 14001 certified.

Final inspection and packing area in one of our plants. This area is classified in accordance with ISO 5, (M 3.5 Fed. 209E) to meet the requirements of our most demanding customers.

clean room standards: microelectronic industry

Year	Memory (bits/chip)	Line width (nm)	Critical size µm	Critical concentration* Particles/m
1997	256 M	250	0.125	27
1999	1 G	180	0.090	12
2001	1G	150	0.075	8
2003	4 G	130	0.065	5
2006	16 G	100	0.050	2
2009	64 G	70	0.035	1
2012	256 G	50	0.025	1

Table 1. Development of memory capacity and line width in integrated circuits. /1997 Semiconductor Roadmap/
*** Number of particles larger than critical size.**

Particles per m ≥0.5 µm	ISO class 14644-1 1999	US 209E 1992	US 209D 1988	EEC GGMP 1989	France AFNOR 1991	Germany VDI 2083 1990	Britain BS 5295 1989	Japan JACA 1989
1	-	-	-	-	-	-	-	-
3.5	2	-	-	-	-	0	-	2
10.0	-	M 1	-	-	-	-	-	-
35.3	3	M 1.5	1	-	-	1	-	3
100	-	M 2	-	-	-	-	-	-
353	4	M 2.5	10	-	-	2	-	4
1,000	-	M 3	-	-	-	-	-	-
3,530	5	M 3.5	100	A + B	4,000	3	E or F	5
10,000	-	M 4	-	-	-	-	-	-
35,3000	6	M 4.5	1,000	1,000	-	4	G or J	6
100,000	-	M 5	-	-	-	-	-	-
353,000	7	M 5.5	10,000	C	400,000	5	J	7
1,000,000	-	M 6	-	-	-	-	-	-
3,530,000	8	M 6.5	100,000	D	4,000,000	6	K	8
10,000,000	-	M 7	-	-	-	-	-	-
	-	-	-	-	-	-	(L) (M)	-
	-	-	-	-	-	-	-	-

Table 2. Clean room class comparison at 0.5 µm particle size.
***Note: different classifications use different concentrations, particle sizes and different slopes of the curve as the base for respective classification.**

Step	Max. Sit time (h)	AMC limits in pptM			
		MA	MB	MC	MD
Pre-Gate oxidation	4	13,000	13,000	1,000	0.1
Salicidation	1	180	13,000	35,000	1,000
Contact formation	24	5	13,000	2,000	100,000
Photolithography	12	10,000	1,000	100,000	10,000

Table 3. Sematech forecast for 0.25 µm logic process.

Contamination category	Cassification				
	1 pptM	10 pptM	100 pptM	1,000 pptM	10,000 pptM
Acids	MA-1	MA-10	MA-100	MA-1,000	MA-10,000
Bases	MB-1	MB-10	MB-100	MB-1,000	MB-10,000
Condensables	MC-1	MC-10	MC-100	MC-1,000	MC-10,000
Dopants	MD-1	MD-10	MD-100	MD-1,000	MD-10,000

Table 4. SEMI Standard F21-95 classification.

Integrated circuits (IC)

The critical "killer defect" particle size is one-half of the process line width and the particle concentration decreases down to class 1 for the critical particle sizes.

Currently, IC's are manufactured with line width geometry as low as 0.25 µm size or 250 nm technology. There are existing filtration products to meet the needs of 180 nm technology, but at 150-130 nm, new solutions will have to be found. At 130 nm and smaller, there are no known solutions and, in some cases, there are also physical limits.

ISO 14644

Camfil Farr is deeply involved in cleanroom standards for the microelectronic industry.

ISO 14644 is being finalised as an international standard to replace the various national standards that currently exist.

An approximate comparison of major clean room classes, based on 0.5 µm particle size, is given in table 2.

SEMATECH

Sematech has made a forecast for permissible AMC concentrations in the 0.25 µm logic process. The most sensitive steps are "Pre-Gate oxidation", "Salicidation", "Contact Formation" and "Photolithography".

Acids and bases are corrosive gaseous whose chemical reaction characteristics are those of an electron acceptor and electron donator, respectively. Contact Formation and Salicidation are most sensitive to acids while Photolithography is most sensitive to bases.

Chemical classification

Control of gaseous impurities is a requirement for the manufacture of integrated circuits. Table 4 is a classification, per SEMI Standard F21-95, which allows specification of an acceptable limit for molecular contamination in conjunction with particulate contamination control.

Camfil Farr laser Scanner test for production control and classification of Absolute filters.

EN 1822:1999 HEPA/ ULPA filters. CEN

The European standardisation body, has launched EN 1822 for classification and testing of HEPA and ULPA filters based on filter efficiency at the most penetrating particle size (MPPS).

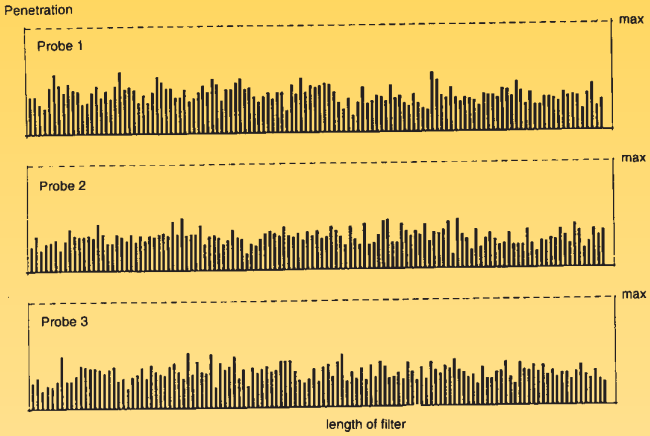
Camfil Farr manufactures Megalam (HEPA/-ULPA) filters to the most stringent industry and/or customer standards. We also test raw material components for "outgassing" e.g. organophosphates from PU sealants. Solid latex spheres or silica are normally chosen as test aerosols for the microelectronic industry due to their low "outgassing" properties.

Camfil Farr has a policy of continuous improvement as a means of insuring our leadership position in the high efficiency filtration market-place. We maintain extensive joint R&D programs with our key suppliers to develop and test next generation filtration media. Such efforts allow us to provide the highest performing filtration products to meet the demands of emerging technologies.

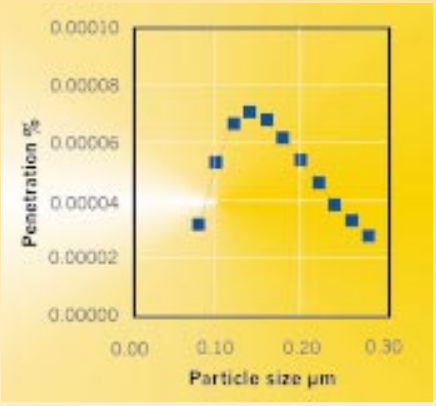
Camfil Farr was the first to provide U17 grade ULPA filters utilising "low boron" media.

We also manufacture e-PTFE filters in grades U15 and higher.

For further detailed information on above classifications and world wide standards currently in use please request Camfil Farr's brochures "Clean room filters a guide – 99" and "Absolute Filters – test methods and classifications" from your nearest Camfil Farr Sales Office.



Result from laser scanner test. The bar diagrams represent the parallel probes when moving over (scanning) the filter. Each bar indicates the local penetration at different points. The dotted lines indicate the maximum penetration to meet the classification limits of the local penetration. The average of all the points gives the total integrated value of the penetration for the tested filter.

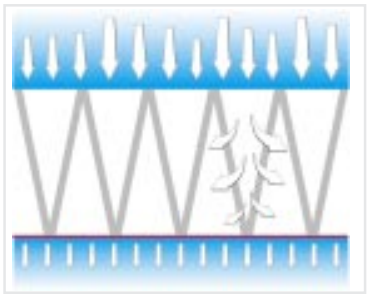


Penetration vs. particle size for an ULPA filter.

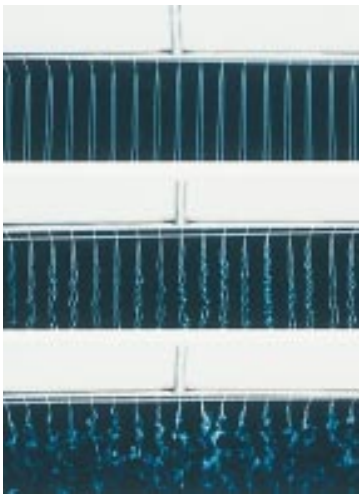
EN 1822 Class	Efficiency MPPS %	Leak test local %	Leak test method
H10	85	-	-
H11	95	-	-
H12	99.5	-	-
H13	99.95	99.75	visible/scanning MPPS
H14	99.995	99.975	scanning MPPS
U15	99.9995	99.9975	scanning MPPS
U16	99.99995	99.99975	scanning MPPS
U17	99.999995	99.9999	scanning MPPS

Table 5. EN 1822 Classification of HEPA and ULPA filters

HEPA/ULPA filter technologies



The unique Camfil Farr V-shape pleats produce extremely low pressure drop and efficient utilisation of the media surface area, which keeps the energy costs low and results in long service life.



Smoke trace demonstration of unidirectional flow from different filters.

V-shape

Camfil Farr's patented filter construction ensures perfectly shaped conical pleats that keep the pressure drop loss caused by dynamic filter design to a minimum.

Unidirectional flow

Unidirectional/laminar flow, the parallel streaming of air, is an important factor for the effective removal of contaminants inside a clean room. When airflow patterns are non-unidirectional, there is an increased risk that contaminated air will be inducted into the flow and that the movement of conta-minants across the flow of air will increase.

Most standards for unidirectional/laminar flow systems take this into account and impose definitive requirements on velocity distribution. Uneven distribution can be caused by a poorly designed ventilation system and/or by the uneven flow of air exiting from the filter.

The demands of air flow uniformity are magnified with the increased requirements of lower room cleanliness classifications and more end users are specifying reduced variation of velocity profiles. Camfil Farr's patented "laminator" technology guarantees the necessary air velocity uniformity to provide the tightest unidirectional/laminar flow.

e-PTFE

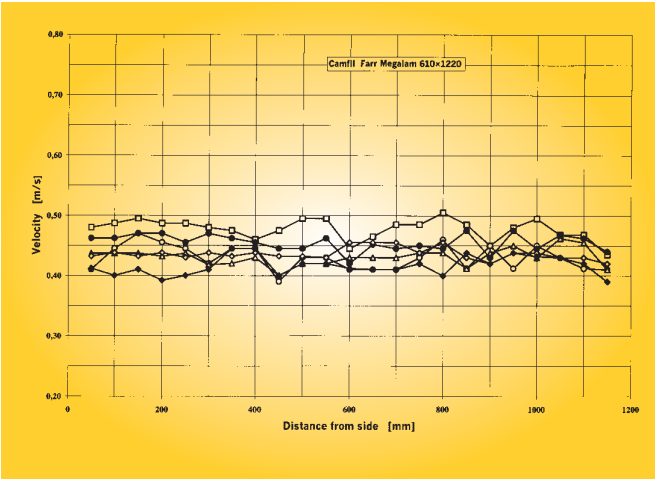
Camfil Farr, together with our partners, has succeeded in developing advanced membrane filtration products. It is now possible to manufacture ULPA filters from e-PTFE material that does not contain substances that may out-gas or evaporate. It is rugged, durable and emits very few particles during manufacture or use.

In addition, the pressure drop can be up to one-half the pressure drop of a conventional glass fibre filter of the same efficiency.

e-PTFE filters are also compatible with future Fab needs.

Sealing

Camfil Farr integrates the finest sealing and gasketing methods in their filters. The latest and most modern dispensing technology is used to ensure highest gasket quality.



This graph shows the air flow velocity 100 mm downstream of an Absolute filters at different points. The air distribution will be within the specified norms, which is a neccessity to reach laminarity at the production level.

energy impact

The semiconductor industry is becoming increasingly competitive. More and more manufacturers are now turning to Camfil Farr to make their plants as energy efficient as possible.

Recently published figures in the U.S.A., from the Environmental Protection Agency (EPA), highlight some quite startling figures concerning average energy consumption and potential savings which could be made by the selection of the correct filters in the HVAC system.

The average plant can use a minimum of a 100 million kWh per year. EPA research shows that the energy to run the HVAC systems that supply the clean room accounted for an average of 46% of the plant's overall energy use.

Graph and energy formula

At the present time the reduction of filter face velocity from the traditional 0.5m/s to as low as 0.3m/s is common practice and represents significant energy savings.

Lower velocity also increases the efficiency and extends the filter's service life. Camfil Farr estimates as much as 30% can be saved on annual operating costs by optimising the design airflow and selecting the lowest pressure drop filter for the HEPA/ULPA, make-up, recirculating and exhaust air systems.

Camfil Farr is an environmentally friendly company. We firmly believe it is our responsibility to inform and update our customers of the available savings which can/will make them more competitive and which will also deliver real environmental benefits to the global community.

Figure 1.

Filter economy

Figure 1 shows the benefit of using Camfil Farr ULPA filters with the optimised surface area of a 100 mm media package depth.

For the makeup air an energy optimisation can be made with Camfil Farr's LCC (Life Cycle Costs) computer program.

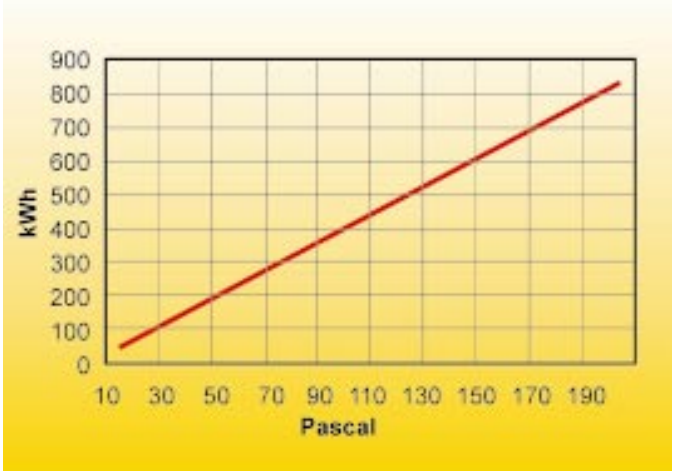
Camfil Farr's filter has proven to be the top filter in several independent tests and competitions about the lowest Life Cycle Cost.

The energy consumption is easily calculated with the formula stated below:

$$E = \frac{q \times p \times h}{\eta \times 1000}$$

Where:

E = energy output/year
q = airflow m^3/s
p = pressure drop
h = operating time hours/year (year round operation 8760 h)
η = fan efficiency



energy consumption vs. pressure drop

The diagram shows a typical energy saving per filter at various pressure drops differences.

software programs for clean rooms

Camfil Farr software development is to serve you.

Camfil Farr has developed a computer program for estimating the cleanliness level and influence of different ventilating systems, room configurations and airflows. It is also easy to estimate the effect of different particle sizes, outdoor air concentrations and the number of people in the room.

The heart of the clean room consists of the filters, which can be selected in different performance/efficiency/configurations and used in different places in the process or ventilating system. The program uses the above theory for calculating the class of the room.

Some basic parameters used in the program are described in the figure 1 sample print out.

Ventilating system

Different airflow systems, from "unidirectional (laminar)" to non-unidirectional flow systems can be selected.

The airflow and the recirculating percentage, as well as the effectiveness of the ventilation to exhaust the contaminants, can also be varied in the program.

Particles

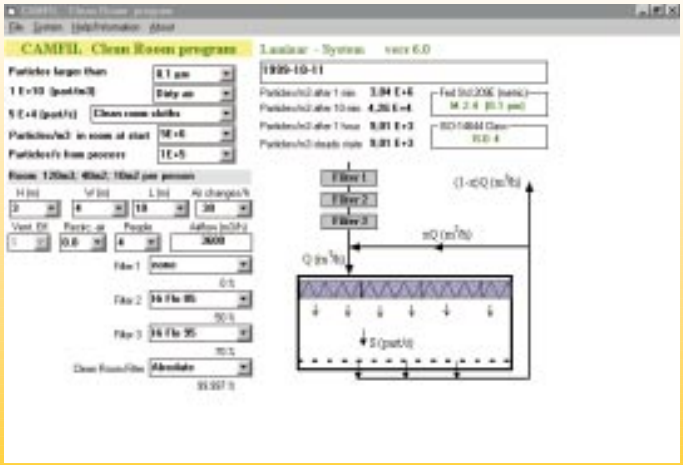
The calculation of the cleanliness or the room class can be based on three particle sizes: 0.1, 0.3 or 0.5 µm.

Outdoor air particle concentration:

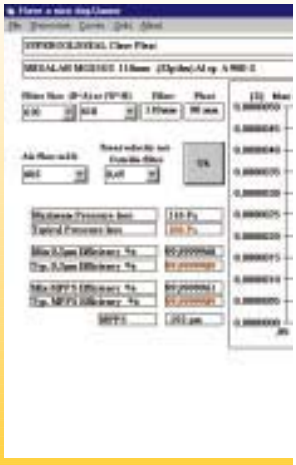
Some air conditioning systems are based on outdoor air and its contamination level has to be known. Of course, this varies considerably with place and time. Table 1 is an estimation of particle concentrations for clean and dirty outdoor conditions which are used in the Camfil Farr computer program.

Size µm	Particles/m	
	Dirty air	Clean air
0.1	1×10	5×10
0.3	3×10	2×10
0.5	3×10	1×10

Table 1. Particles in outdoor air. (Number of particles larger than size). It can be seen in the table that clean air can have 5x108 particles per m^3 of air which are larger than 0.1 µm. In dirty outdoor air, the number of particles can be as high as 1010 particles per m^3.



Example of printout from the Clean Room computer programme.



Protocol from PQ software programme tion of a Megalar Super Goldseal filter.

LCC software program

Camfil Farr has developed a new LCC, *Life Cycle Cost*, program.

This software takes into account all important factors such as installation issues, condition of ducts, change of filters, energy consumption, purchase, maintenance, and disposal issues. With well defined calculation steps, we can help to optimise the choice offilters for your specific needs.

PQ software program

The Camfil Farr PQ program allows engineers/endusers the opportunity to "maximise" HEPA/ULPA selection.

By simply inputting the actual filter dimension, desired efficiency and airflow/face velocity, the program automatically shows you the actual efficiency at 0.3 µm and MPPS (**M**ost **P**enetrating **P**article **S**ize), the typical and maximum air resistance across the selected media pleat depth and the MPPS particle size.

Chemical/carbon filter software program

The Camfil Farr chemical/carbon selection program is designed to help users and design engineers to estimate lifetime and efficiency of chemical/carbon filters against specific target gases at given concentrations.

The software programs clearly demonstrate Camfil Farr's continuing commitment to serve our customers and optimise filter selection for the microelectronics industry.

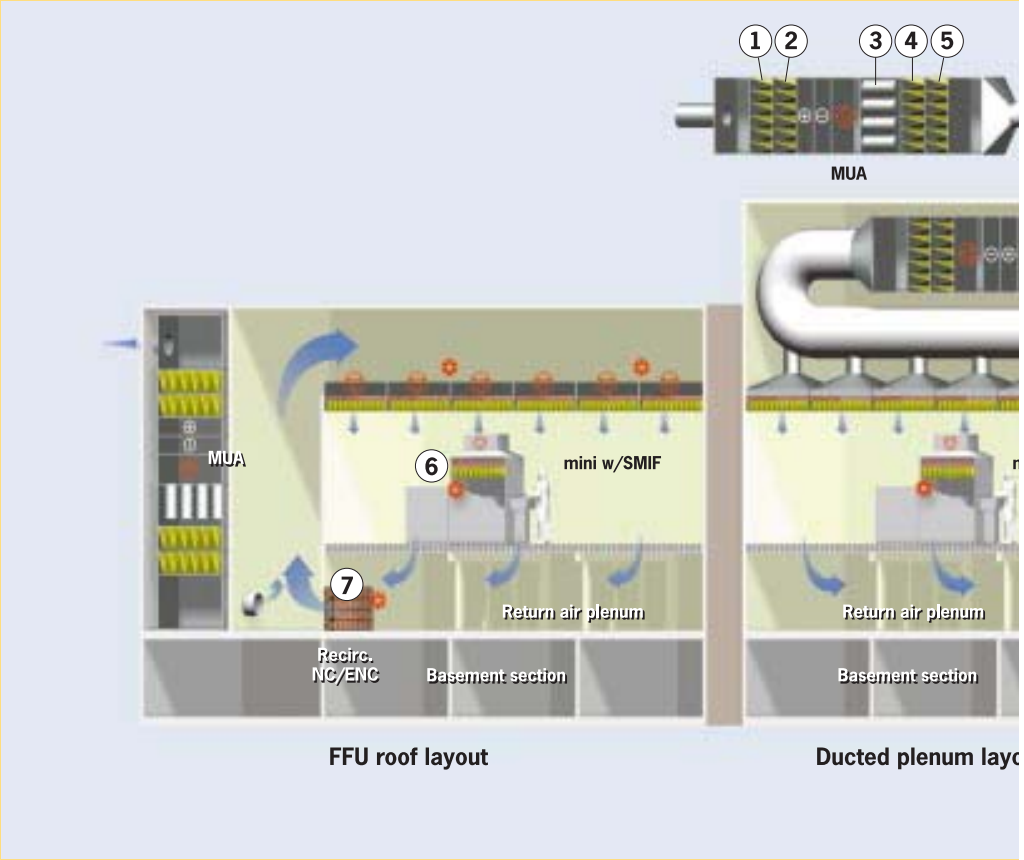
showing maximum and typical penetra-

Interface from the Camfil Farr chemical/carbon selection program.

camfil farr clean air soluti

1 Prefilter. Camfil Farr recommends a high quality bagfilter with a large surface area to keep the total system energy cost and pressure drop as low as possible.
Filter class F6-F7.
Filter type: Hi-Flo 3M-85.

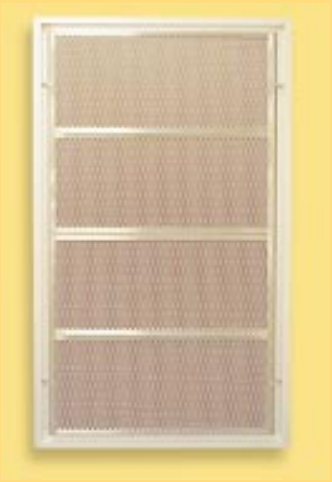
2 Use a high performance fine fibre filter with a large media surface area. A bagfilter with a large area (Hi-Flo M-type) or a pleated Opakfil type filter is recommended.
Filter class F8-F9.
Filter type: Hi-Flo 3M-95.



FFU roof layout

Ducted plenum layo

6 Gigalam is a ULPA filter in combination with Gigasorb chemical filter for control of both particulate and airborn molecular contamination (AMC), normally used for Mini Environment Applications.



7 Camfil Farr's Gigasorb ENC type can be mounted with two layers of acid, base and/or organic impregnated carbon.
Filter type: Gigasorb ENC-22-A.

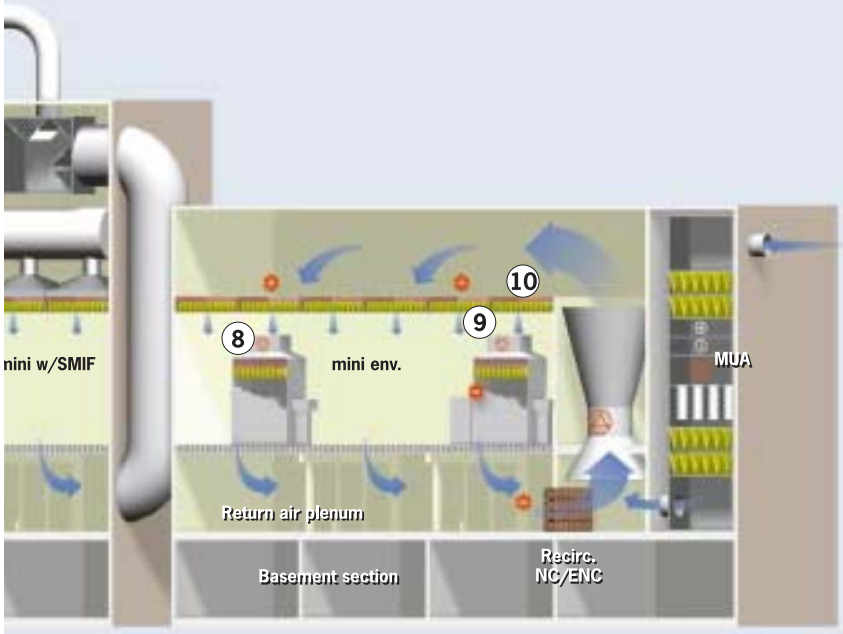
8 The result of high-tech requirements for clean rooms, Silent Hood has been designed to meet the requirements of installers and users in the micro-electronics sectors.
Filter type:
Megalam MGLSGSSH-1219x610-01.

ons for clean rooms

3 In carbon filtration, Camfil Farr has a number of different solutions. Camcarb activated carbon filters consist of a galvanised/stainless steel base plate and cartridges containing activated carbon.
Filter type: Camcarb 2600-16/CM07 for SO_2 gas.

4 If space is limited, Camfil Farr compact filters like Opakfil are the perfect choice when longer running times and low pressure drop are needed.
Filter class F7-F9
Filter type: Opakfil 3OPGHF 242412-95.

5 Camfil Farr has a wide range of micro glass fibre filter cells in V-bank figuration. Sofilair is a perfect choice for low pressure drop and extended service life.
Filter type: Sofilair Absolute 1560.02.



ut

Fan tower layout

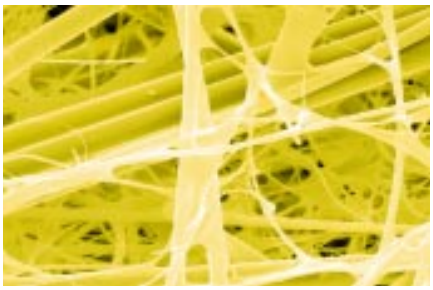
11 The Camfil Farr Gigacheck™ selectively measures gaseous airborne molecular contamination (AMC) in clean rooms and accompanying air handling systems.

10 Gigasorb ENP type can be mounted with up to three layers of carbon or more depending on target gas.
Filter type: Gigasorb ENP-24-ALC.

9 The selection of Camfil Farr Megalam, 90 mm media package, optimises pressure drop.
The laminator can achieve ± 10% unidirectional flow at 0.45 m/s.
Filter type:
Megalam MGLSGS-1219x610-01.

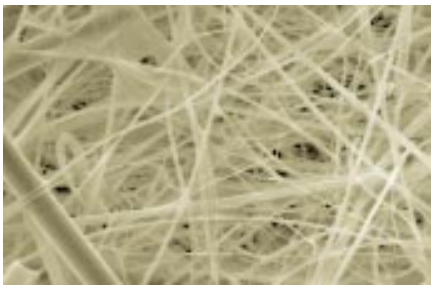
megalam filters; construction, types and protocols

Our standard range of Megalam filters are manufactured in three basic types:
MD - 66 mm filter depth
MX - 90 mm filter depth
MG - 110 mm filter depth
Our raw materials used in the manufacture of our Megalam filters are rigorously controlled from receipt into our factory right through to delivery to customers.

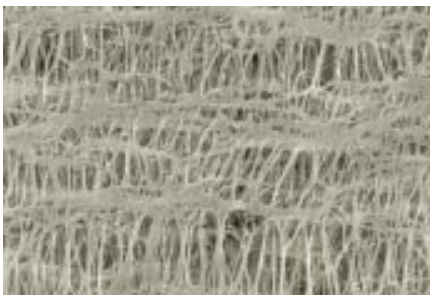


Media Types

Borosilicate glass fibre
Contains approximately 11% B_2O_3 (by weight)
Applications: Clean Rooms



Low Boron glass fibre
Contains approximately <0.5% B_2O_3 (by content)
Applications: Clean Rooms, where AMC is a growing concern



e-PTFE (polytetraflouroethylene)
Contains no B_2O_3
Applications: Clean Room and mini-environments where AMC is a growing concern.

All of the above medias to be used in conjunction with Camfil Farr Gigasorb filters.

Frames

Extruded anodized aluminium
1. Standard (gasket)
2. Liquid Seal, for installation in clean room liquid seal frame system
3. Knife, for installation in clean room liquid seal frame system
4. Hood, for ductwork connection

Separator types

1. Hotmelt
2. Glass fibre threads

Test aerosols

1. DEHS, DOS
2. PSL (latex)
3. Silica
4. Athmospheric air

Efficiencies*

H10	≥85
H11	≥95
H12	≥99.5
H13	≥99.95
H14	≥99.995
U15	≥99.9995
U16	≥99.99995
U17	≥99.999995

* efficiency (%) at MPPS according to EN 1822

Gaskets

1. PU - Polyurethane, endless
2. Neoprene
3. Gel

Operating temperature

Max 70 °C

Humidity

Max 100%

Manufacturing Cleanliness

All dry manufacturing testing procedures and repairing shall be performed inside a minimum Class M 6.5 cleanroom in accordance with Fed.std 209E.

Compliance with test and Testing protocol

Camfil Farr can provide a testing protocol either on CD ROM, floppy disk or a written copy.

Filter and carton labeling

Each filter is labeled with a three part labeling system.
The first label shows:

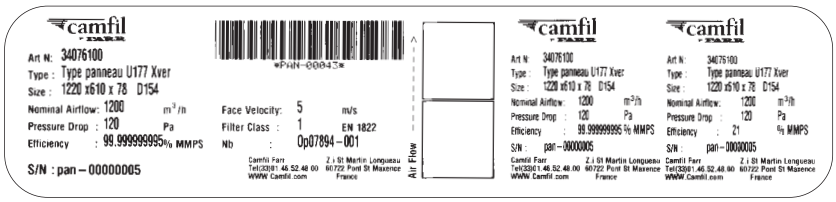
- filter type
- pressure drop
- air flow
- efficiency
- serial number

A second two part label is affixed on the manufactured filter until installation, when the installer shall remove one part for identification/location purposes for the end user's "quality" records.

Third part of the label system shall be mounted on the outside of the "packed" filters for easy identification purposes.

Packing

All filters are wrapped in a polybag, sealed and packed in cardboard carton with cardboard spacers between the filters.



camfil farr technical specification data

Specifications – Megalam

A Megalam filter consists of pleated glass fibre/e-PTFE media with an efficiency of up to 99.999995% at MPPS (Most Penetrating Particle Size).

The frame is made of anodized aluminium and the filter media's separators are composed of glue strings which are arranged so that the media takes on a V-shape ensuring maximum utilisation of the filter surface.

A laminar sheet could be fitted on the air outlet side of the filter to produce a laminar flow of air from the filter.

Normal working temperature is maximum 70 °C although a peak of 90 °C can be withstood.

Technical data

Efficiency	.....% at MPPS
Media surface	..... m^2
Air flow	..... m^3/h (m^3/s)
Initial pressure drop	..... Pa

Type of filter	MD=66 mm
	MX=90 mm
	MG=110 mm
Filter quality	According to EN 1322
Filter construction	H=Hood
	K=Knife
	LS=Liquid Seal
Size	1219x610 mm

For standard size the following is added:

-01 gasket on air outlet side
-10 gasket on air inlet side
-11 gasket on air both sides
-00 without gasket

Example 1:

MXLA-305x305-10

Megalam, filter class H14, 90 mm filter depth and standard frame with gasket on air inlet side.

Example 2:

MDLGSLS-610x610

Megalam, filter class U15, 66 mm filter depth, with Liquid Seal frame and grill on the air outlet side, without gaskets.

make-up, recirculation and exhaust air

Make-up air

Ventilation filters stop airborne particles from diminishing airflow volumes in make up air system systems and protect the clean room from contamination from the outside air.

Particulate, therefore, must be captured as early as possible to the highest efficiency possible. In addition, capturing gas phase contamination in outside air is increasingly becoming an issue for make up air handling systems.

Low pressure drop decreases energy consumption.

By choosing more efficient filters you will be sure to keep the Life Cycle Cost (LCC) of your installations at the lowest possible level.

Our filters maintain their efficiency during their entire lifetime which operating at low pressure drop thereby requiring less energy for the filter to fullfill its function.

When selecting filters for a system, the LCC should always be taken into account. All our filter media is produced according to Camfil Farr's rigorous specifications to meet the performance and uniformity requested of our customers.

Camfil Farr filters have the markets largest filter surface area in proportion to the face area Thereby ensuring the best price/performance ratio.

Our filters are tested by independent laboratories according to world-wide industry standards. The results are then used in our computer programmes and displayed in our data sheets

Step 1: Prefilter. Preferably, use a high quality bagfilter with a large surface area to keep the total system energy cost and pressure drop on as low as possible. Filter class F6-F7.

Step 2: Use a high performance fine fibre filter with a large media surface area. A bagfilter with a large area (Hi-Flo GM-type) or a pleated Opakfil type filter is recommended. Filter class F8-F9.

Step 3: Gas filtration. An effective filter is Camfil Farr's Camcarb Cylinder.

Step 4: Use a high performance fine fibre filter with a large media surface area. A bagfilter with a large area (Hi-Flo M-type) or a pleated Opakfil type filter is recommended. Filter class F7-F9.

Step 5: Camfil Farr recommends an extended surface HEPA filter with low pressure drop and long service life, such as the Sofilair, filter class H13-H14.

Recirculation air

Step 1: Use a high performance fine fibre filter with a large media surface area. A pleated Opakfil type filter is recommended. Filter class F7-F9.

Step 2: A chemical filter such as Gigasorb ENC, to control AMC.

Exhaust air

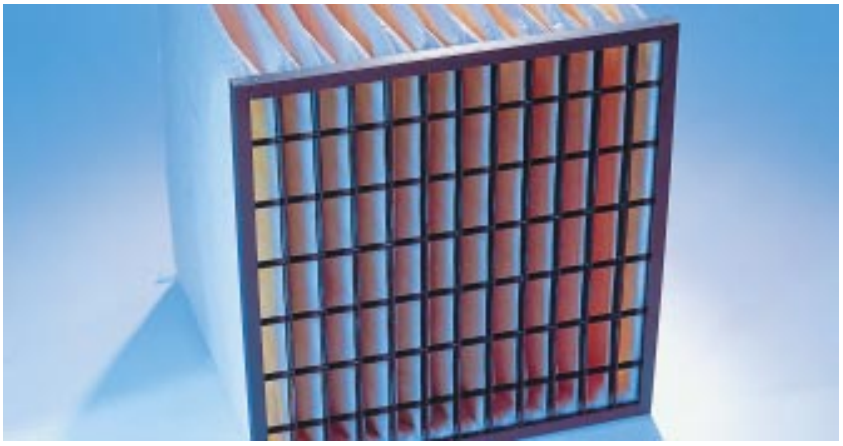
Camfil Farr has collaborated with a biotech and specialty control company to develop Biovox®. This new technology has proven to effectively treat volatile organic compounds (VOCs) and odours, at low cost, in applications where carbon and incinerators can not be economically operated.

Applications – VOC extraction from process manufacture of

- Data storage disks
- Optical fibres
- Printed circuit boards
- Plastic components
- Laminated products
- Printers
- Magnetic data strips
- Capacitors

Features & Benefits

- Low operational cost
- Very low maintenance required
- Treats VOCs in the 0.1 – 3 g/m^3 range
- Long service life
- No safety issues
- No exhaust issues (no NOx, Sox, dioxins, or CO)
- Operates at ambient temperature
- Durable materials of construction
- No media change
- The "system" can be moved and/or expanded.



A bagfilter with a large area (Hi-Flo GM-type).

airborne molecular contamination (AMC)

For more detailed info please contact your nearest Camfil Farr sales office.

SEMI and SEMATECH

Since 1995, SEMI and SEMATECH have been investigating the effects of AMC on microelectronic production yields. Per the SEMI F21-95 standard, AMC are classified into Acids (A), Bases (B), Condensables (C) and Dopants (D). This standard establishe a basis for assessing AMC problems using the four "chemical" classes MA, MB, MC and MD. Additionally, maximum permissible levels are defined by a numerical system of 1, 10, 100 etc., pptM (**p**arts **p**er **t**rillion **M**olar).

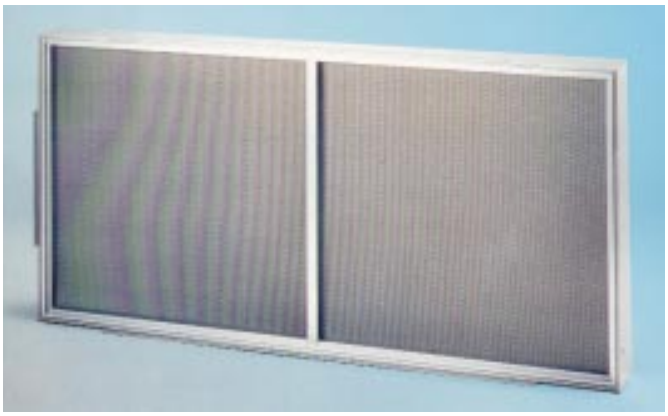
SEMATECH has identified the process steps that are the most sensitive to AMC related yield loss (SEMATECH Technology Transfer 95052812A-TR): pre-gate oxidation, salicidation, contact formation and DUV photolithography.

Pre-gate oxidation is extremely sensitive to dopants, salicidation and contact formation are most sensitive to acids and the DUV photolithography process to bases.

AMC sources need to be identified, actual concentrations measured and distribution patterns evaluated.

With this information in hand, acceptable concentration levels can be determined thereby allowing filtration products and systems to be selected that will meet critical perfomance parameters.

Gigasorb ENP series, panel type



Camfil Farr is collecting and analysing data and industry experiences for identification of sensitive process steps and possible problem areas.

Camfil Farr provides methods for measuring the chemical content of clean rooms and make up air, e.g. GIGACHECK. Camfil Farr has also developed a chemical filter, GIGASORB, that effectively controls AMC.

Sources of AMC

In order to prevent yield losses, AMC sources must first be identified.
Known sources are for example:

- Aggressive chemicals used in microelectronics manufacture.
- Out-gassing from construction materials used in cleanrooms and production tools.
- Make up air (MUA) contaminated by urban pollutants.

Counter measures

Due to the various effects from a wide range of chemicals, AMC is more difficult to control than partic-les. However, solutions are currently available and/or are under development.

Issues to address:

- Minimise contamination from chemicals used in production
- Construct cleanrooms and tools from low out-gassing materials
- Develop reliable methodology to assess problems and verify solutions

AMC can be:

- Eliminated at its source (Suitable for point sources and isolated leaks.)
- Minimised by reducing the sit/exposure time
- Removed by chemical filtration. (Suitable for diffusive leaks, out-gassing, operator related leaks/spills or MUA pollution.)

After assessing these three issues, the most cost effective solution or combination of solutions can be selected and implemented!

mini environment

Mini environment

In applications where a very high cleanliness class is not needed in the complete production area, a “mini environment” is often the best solution.

A mini environment is defined as a unified combination of physical conditions that is distinct from the surrounding conditions.

The microelectronics industry is clearly moving towards the 300 mm wafer size. This increases the demands on environment control with special emphasis on:

- AMC and airborne particulate control
- Control of turbulent airflow
- Reduced pressure drops
- Temperature & humidity control
- Low outgassing materials

Camfil Farr offers diversified solutions for such applications with a wide range of “value engineered” and/or specialised products:

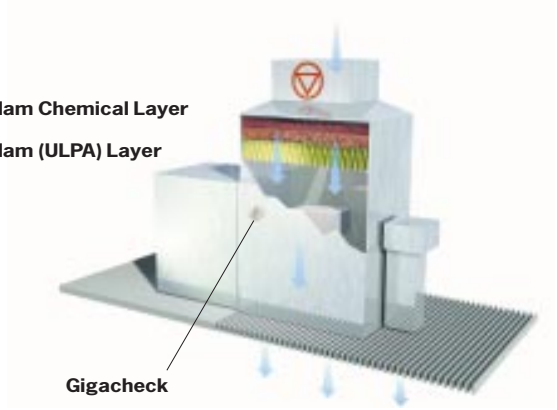
- Megalam filters with e-PTFE or ”low” boron glass fibre media to significantly reduce the risk of AMC.
- Filtertesting with PSL spheres or silica to avoid problems with DOP and other oil based challenge aerosols.
- Filters with optimised media packs without aluminium separators eliminating the risk of shedding while providing the highest performance with highest quality.
- Filters with anodised aluminium frames to maximise strength and rigidity while eliminating particle shedding and leakage from the frames.

Tailoring need based solutions while meeting and/or exceeding industry and customer standards for perfor-mance and quality, has led to Camfil Farr becoming a world wide preferred supplier for high efficiency filtration products.

Gigalam

SEMATECH recently recommanded the use of e-PTFE or, at a minimum, low boron ULPA filters in mini-environment equipment.

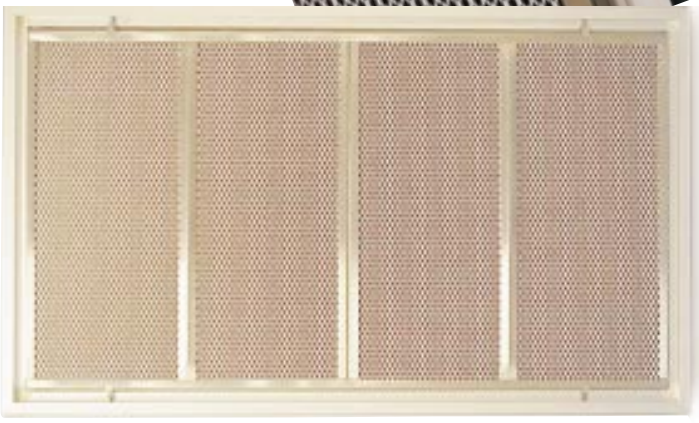
Camfil Farr has developed an ULPA filter (normally e-PTFE) and a chemical filter, GIGASORB, in combination. Due to Gigasorb’s extremely low pressure drop we are able to combine up to 4 layers of chemical filtration mounted into the ULPA filter frame.



Camfil Farr’s GIGALAM can be manufactured of less than 100 mm (one layer type) in overall height with a resistance of as low as 130 Pa. Customised solutions are of course available.

Camfil Farr’s GIGALAM is the ”filter of choice” for mini-environment manufacturers.

Details of Gigalam



services and accessories

GIGACHECK

The Camfil Farr GIGACHECK™ selectively measures gaseous airborne molecular contamination (AMC) in clean rooms and accompanying air handling systems.

The device measures, by passive diffusion, several different gaseous components over a time period of one day, one week or one month and will, upon analysis, give the average concentration with detection limits in the ppb or sub ppb range.

GIGACHECK™ uses a proven technique, is cost effective, user friendly, noiseless and ideally suited for screening and average level monitoring.

The only requirements are ambient temperature and normal air flow. Application areas are detection of “acid gases” and acidic contamination in contact formation processes and detection of ammonia in DUV photolithography.

CAMGEL

Camgel is a fluid in for example Camfil Farr's Snap Seal frame system for use in “small” applications in the microelectronic industry.

SM10/SM20

SM10/SM20 is a mechanical (“dry”) grid system.

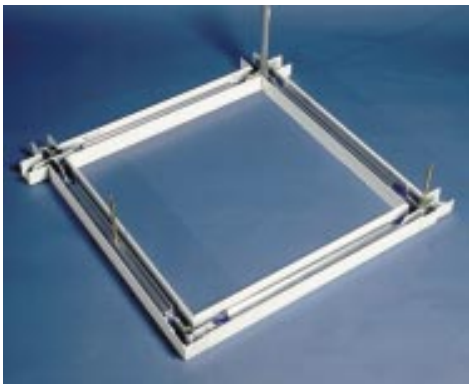
TFM (Total Filter Management)

Camfil Farr is more and more being asked to lend our expertise to manage the total filter installation, including monitoring and reporting.

Gigamonitor

This unique service allows you to constantly monitor the useful life of your chemical filter installation.

SM10/SM20 grid system.



Camgel is a fluid for use in for example Camfil Farr's Snap Seal frame system.

plants with HEPA/ULPA filter production

Camfil AB

Camfil AB is the parent company for the Camfil Group of companies. The company has central functions such as marketing, finance logistics, IT and product & production development. Camfil AB is located in Trosa, Sweden.


Camfil AB, Sweden

Camfil SA

has been the leading French air filter manufacturer for over 30 years.
Our quality insurance system has been certificated ISO 9001 since 1995.
"A unique know-how to serve your air quality"


Camfil SA, France

Camfil KG

Camfil KG with head office in Reinfeld/Holstein is more than 30 years supplier of airfilters for the German market. Qualified according to DIN EN ISO 9001 and KTA 1401.

Camfil USA Inc.

Located in Riverdale, New Jersey (25 miles west of New York City), Camfil USA Inc. is ISO 9001 certified. All of its high-efficiency air filtration products are manufactured in a Class 10,000 (M5.5) cleanroom, utilizing the most advanced production and testing equip-ment available in the world today.

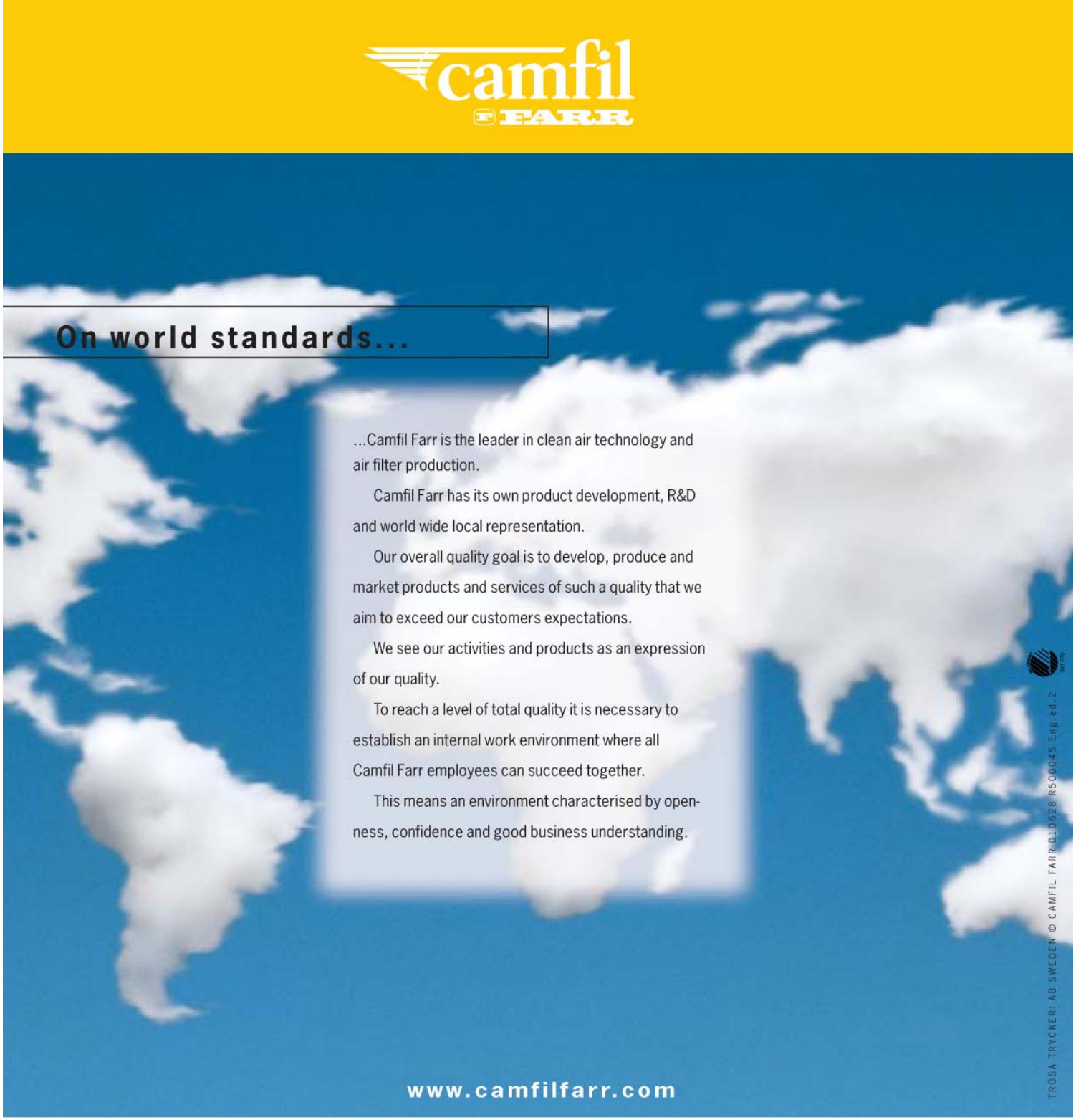

Camfil KG, Germany

Camfil Air Filter Sdn Bhd

We use modern production equipment and all production takes place under clean room conditions. We are committed to supplying filters with the correct quality and are certified according to ISO 9002.


Camfil Air Filter Sdn Bhd, Malaysia


Camfil USA Inc., USA



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