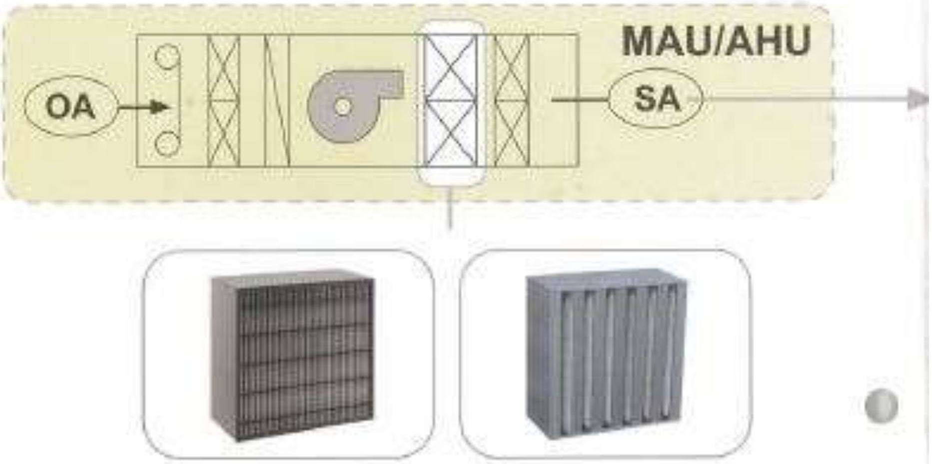
A M C Filter

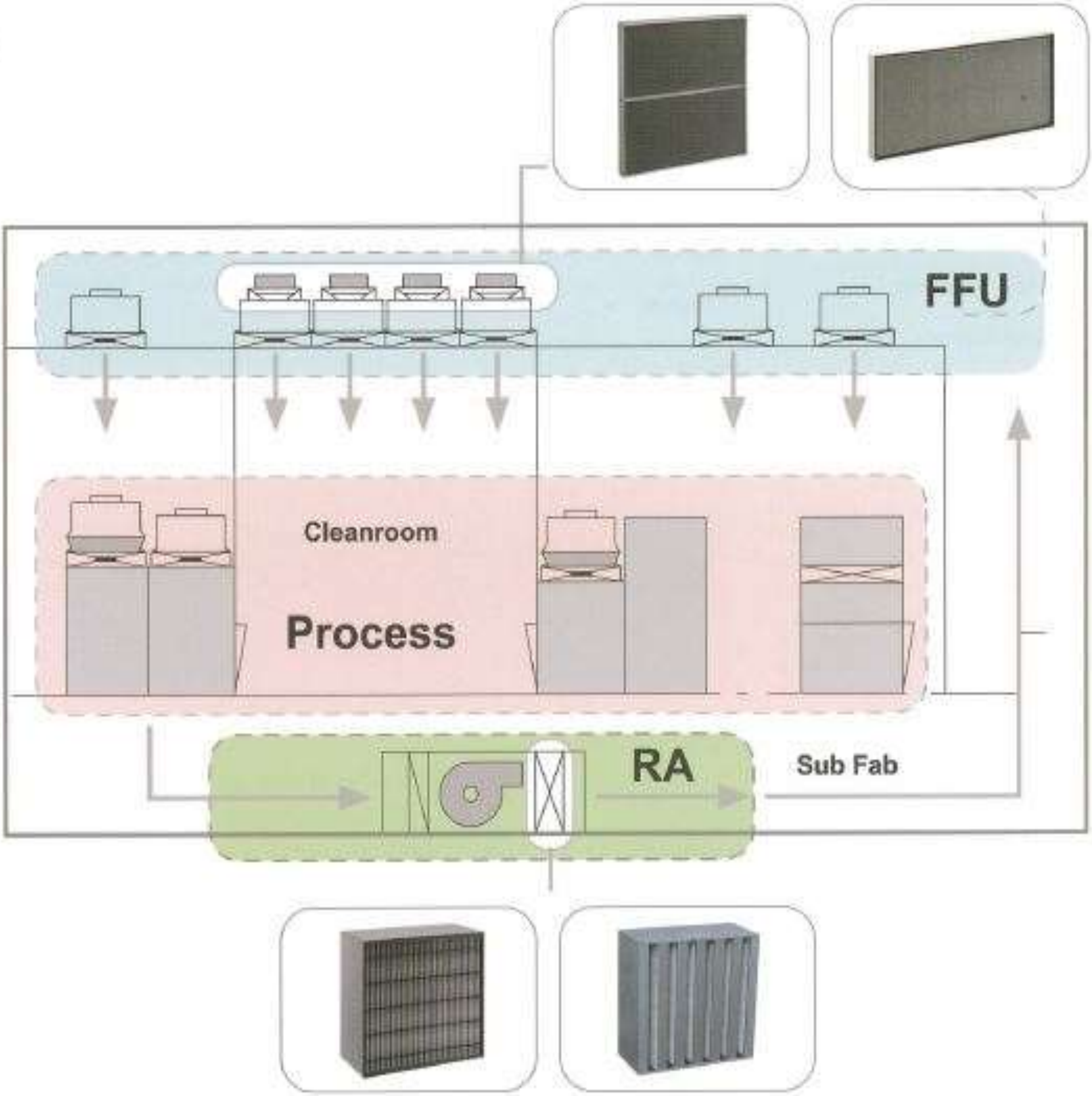
Filtration Technology Designed for you

K.J. Filtration Technologies

Airborne Molecular Contaminant (AMC)Filter Applications in a cleanroom



MAU	Designed to remove chemical contaminants in the makeup air. This can be single stage or multiple stage filtration, depending on the types of chemical contaminant in the makeup air.
RA	For removal of chemical contaminants generated in the cleanroom
FFU	Designed to protect the area under the FFU, to ensure the chemical cleanliness of the area is sound for the process undergone in that area.
Process	Installed on process equipments. These are high performance chemical filters designed to be the last line of defense against chemical contaminants.


FFU
Cleanroom
Process
RA
Sub Fab

FILTER MEDIA

Activated Carbon Basics

Activated carbon is a porous material commonly used to remove chemical pollutant in air or liquid. Its high surface area to volume ratio, and its cost effectiveness makes it an ideal solution for chemical pollutant removal.

Activated carbon can be made from raw material such as coconut shell, coal, wood, bamboo, and palm nuts, of which coconut shell and coal are the most common. Factors to consider when choosing which type of carbon to use include:

- Cost
- Activation level
- Pore size range
- Hardness / dusting
- Functional group

Performance of activated carbon is directly related to its activation level, this is also known as the amount of specific area that is activated within the carbon granule. Performance of activated carbon can be measured in several different ways:

Performance Index	Measure Unit	Standard
BET	m^2/g	BET
Iodine Value	mg/g	ASTM D 4607
CTC activity	%w/w	ASTM D 3467
n-butane activity	%w/w	ASTM D 5742

A high performance activated carbon loaded fabric.

The Aerolace® technology utilizes an aerodynamic process to simultaneously integrate bi-component fiber and granular activated carbon to form a highly homogeneous filter media.

As granule and fiber pile up to form a sheet of filter media, air passages begin to form between adjacent granules. The unique Aerolace® process ensures that the air passages developed are small and even, this causes chemical molecules to travel through filter media with longer residence time, hence maximizes it opportunity to be adsorbed.

Advantages

a. Adhesive free, leaving the external surface area of activated carbon unobstructed.

b. Reagent free, does not prematurely react with chemicals embedded within the media.

c. Adjustable micro structure. The patented manufacturing process is flexible for adjusting the structure of Aerolace® to best suit the converting and performance requirements of your filter.

d. Carbon loading from $100g/m^2$ ~ $1,500g/m^2$ in one pass with no concern of layer separation.

e. Aerolace® is edge wrapped to ensure clean converting.

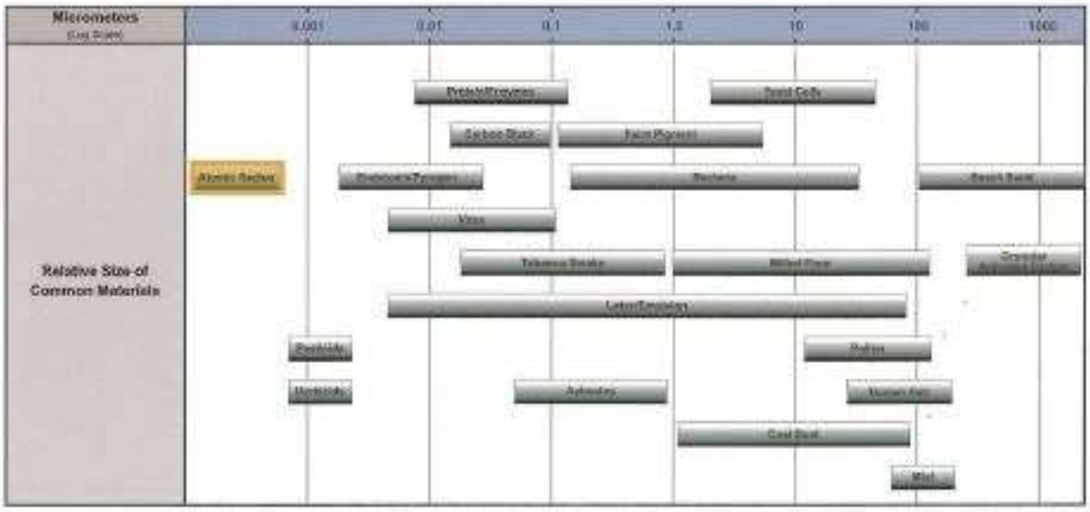
Mechanism

Most nuisance odors and chemical pollutions in the air exist in the form of molecules. The mechanism for capturing molecules in the air is by diffusion. Once diffused into the active surface of carbon granule, the molecule can be captured by either physical adsorption or chemical adsorption (chemisorption).

Physical adsorption is a reversible process. Pollutant is temporarily held within carbon's active surface by Van der Waal's force. When subjected heat, physically adsorbed pollutant will be desorbed and released back to the air. Activated carbon does not physically adsorb all gases equally well. In general, it is very effective for adsorbing organic compounds (VOC's) such as toluene, n-butane,...etc. For gases which can not be effectively adsorbed, several chemisorption solutions are available.

Chemisorption is an irreversible process, whereas activated carbon is first impregnated with a specific chemical targeting certain pollutant. When targeted pollutant is diffused into the carbon it will react with the impregnated chemical, hence turn the unstable pollutant into a stable substance. Commonly seen chemical reactions include:

1. **Acid / Base neutralization**
2. **Oxidization**
3. **Catalysis**
4. **Ion exchange**



Aerolace technology is flexible to work with a number of different materials. Common applications include activated carbon, ion exchange resin beads, activated alumina impregnated with potassium permanganate, and zeolite.

Aerolace production requires particle size range from 10 mesh to 80 mesh. Particle loading can range from 100 g/m^2 to 1500 g/m^2. The loading is adviced in an aerodynamic process in one single pass. The result is a highly homogeneous structure, which will not separate into layers. Other manufacturing features include:

- Standard with edge sealing to allow for cleaner converting process.
- Media structure may be adjusted to accommodate permeability, pleatability, and other converting requirements.
- Possible to produce with blended materials
- May be laminated with other material, such as melt blown or triboelectric particle media.

Selection of adsorbent

1 Activated carbon (generic): the most common type of adsorbent for general purpose odor adsorption. Aerolace utilizes high activity coconut carbon, which is highly effective on adsorbing organic gases such as Toluene, PGMEA, Benzene ... etc.

2 Activated carbon (impregnated): Impregnation with activated carbon causes chemical reaction between the chemical impregnant and the target gas thus neutralize the harmful target gas. This method enables activated carbon to remove gases that are otherwise not easily adsorbed by generic carbon. Commonly seen impregnated compounds are acid and alkalinity for neutralizing alkaline and acid gases respectively.

3 Ion-exchange Resin: Available with both cation and anion exchanger, which are effective for removing alkaline and acid gases respectively.

4 Potassium permanganate impregnated aluminum oxide: Potassium permanganate is a strong oxidizer that can nullify a wide range of harmful gases by oxidization. Common applications for this product including the removal of formaldehyde, and organic acides.

5 Aerolace process is flexible to impregnate any functional granule between 20 ~ 60 mesh, which can withstand curing temperature up to 150°C.

Pleating

Pleaters are available with post heating. Pleat height range from 8mm ~ 270mm.

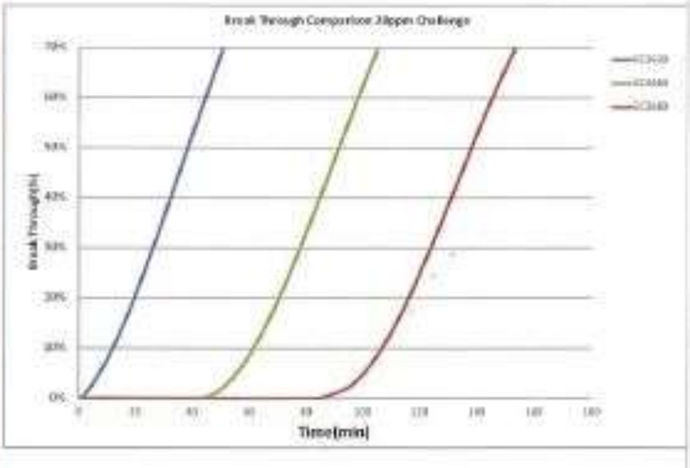
Testing

Two types of testing procedures are available in-house.

1. One pass break through test. this breakthrough testing apparatus is capable of evaluating the efficiency and service lift for flat media. Tests are conducted with 20~50 ppm of up stream concentration. The gases frequently tested in-house include :

- **Acetaldehyde**
- **Ammonia**
- **H_2S**
- **SO_2**
- **NO_2**
- **DMS**
- **Toluene**
- **N-butane**
- **CTC**

2. Closed circulation test : A one cubic meter test chamber is used to test gas removal rate for filters, or entire room air cleaner. Gases tested can be single gases as listed above, or mix gas such as cigarette smoke.



Target Gases

Different materials are utilized to remove different categories of chemical contaminants. Following tables represent some of the common applications.

Acid Gas

Classification	Example	Meida Type
Strong Acid	SO_x NO_x	PH
Weak Acid	H_2S Cl_2	PC
Organic Acid	CH_3COOH	GC PC

Base Gas

Classification	Example	Meida Type
Ammonia	NH_3	PA IXA
Organic Base	Butylamine Trimethylamine	GC GCH

Organic Gas

Classification	weight	Example	Type
C.H.O. molecule	< 80	IPA Alcohol Acetone	GCH
	80~150	Toluene Hexane Ethylbenzene	GC
	>150	Siloxane TEP DBP	GC
Organic Acid		CH_3COOH	GC PC
Organic Base		Amine	GC GCH

Media Selection

Following chart illustrates the gas removal capabilities of each type of media to be used in an AMC filter.

Gas Type \ Media Type	GC	GCH	PA	PC	PH	KM	IXA
C.H.O. molecule M<80	✦	✦	–	–	–	▲	–
C.H.O. molecule M=80~150	★	★	▲	▲	▲	–	–
C.H.O. molecule M>150	★	★	▲	▲	▲	–	–
Amine	✦	✦	★	–	–	–	–
O_3	★	★	▲	▲	▲	–	–
SO_x	▲	▲	–	✦	★	✦	–
NO_x	▲	▲	–	★	★	–	–
H_2S	▲	▲	–	★	✦	–	–
Cl_2	▲	▲	–	★	✦	–	–
NH_3	–	–	★	–	–	–	★

★ very good ▲ Removable
✦ good – N/A

FFU / Process Equipment

F ×-○-◇-□-△-▽

FAM - 6 A - 600x600x70K

- × : Frame Materia
- ○ : Pleat Spacing
- ◇ : Carbon Grade
- ▽ : Structure Type
- △ : Filter Dimension
- □ : Media Type

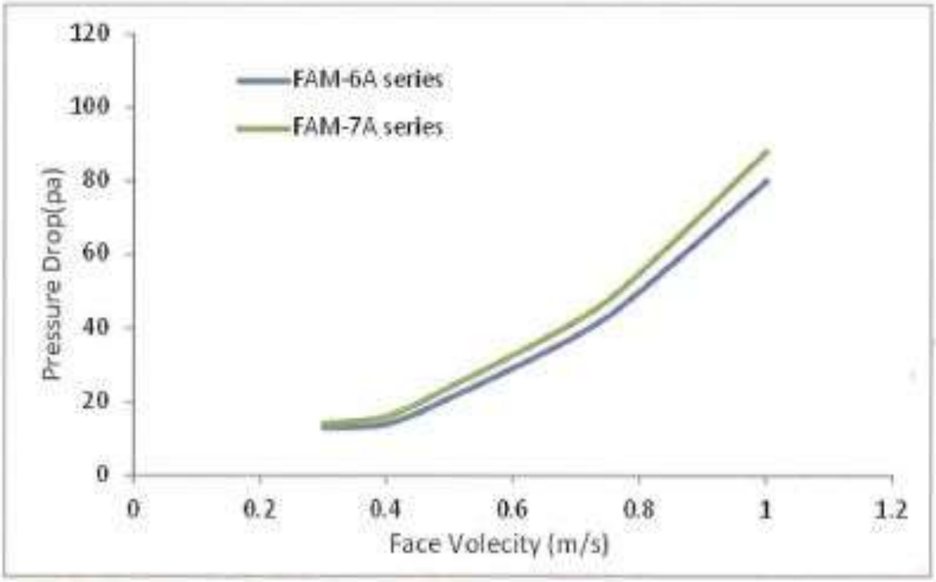
× : Frame Material	
G	Galvanized Metal
S	Stainless Steel
M	Extruted AL
A	Bended AL

○ : Pleat Spacing	
F	PE Finger
M	Mini-Pleat

□ : Media Type	
G	For VOC Gases
H	For VOC Gases
A	For Base Gases
C	For Acid Gases
IA	Ion Exchange For Base Gases

△ : Filter Dimension	W x H x D
W	Width
H	Hight
D	Depth

▽ : Structure Type	
K	Knife
D	Double Layer
T	Trinal Layer



Deep pleat Type

○ - ◇ - □ - △

RBD - 7 GAC - 593x593x290

○ : Filter Type
◇ : Carbon Grade
△ : Filter Dimension
□ : Media Type

○ : Filter Type

RBD	Box Type
RSD	Single Header Type

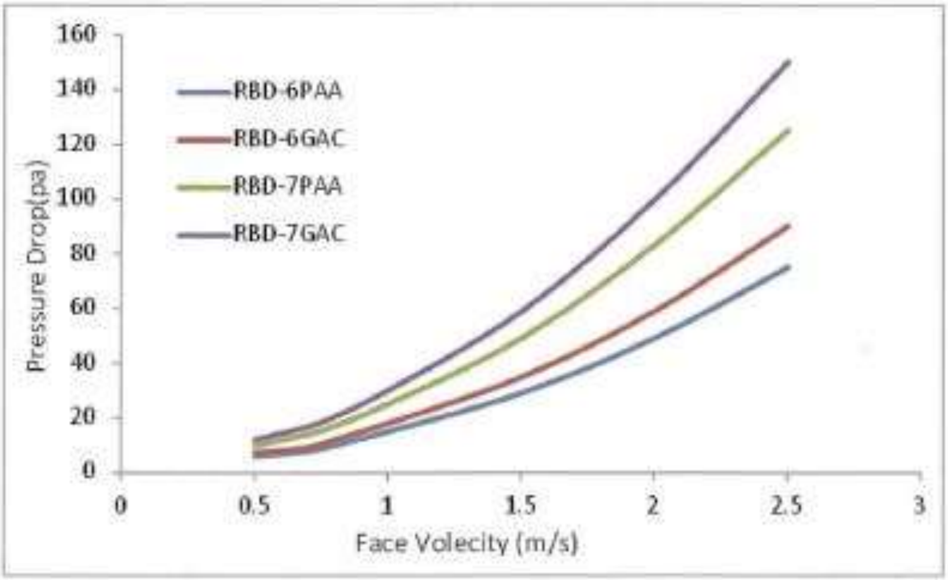
□ : Media Type

GAC	For VOC Gases
PHC	For Acid Gases
PCN	For Acid Gases
PAA	For Base Gases
IXA	Ion Exchange For Base Gases

△ : Filter Dimension

W x H x D

W	Width
H	Hight
D	Depth



V - cell Type

○ - ◇ - □ - △

PVB6V - 7 GAC - 593x593x290

○ : Filter Type
◇ : Carbon Grade
△ : Filter Dimension
□ : Media Type

○ : Filter Type

PVS4V	HIPS 4V Single Header Type
PVS6V	HIPS 6V Single Header Type
PVB6V	HIPS 6V BOX Type
RBD6V	GI Frame 6V BOX Type

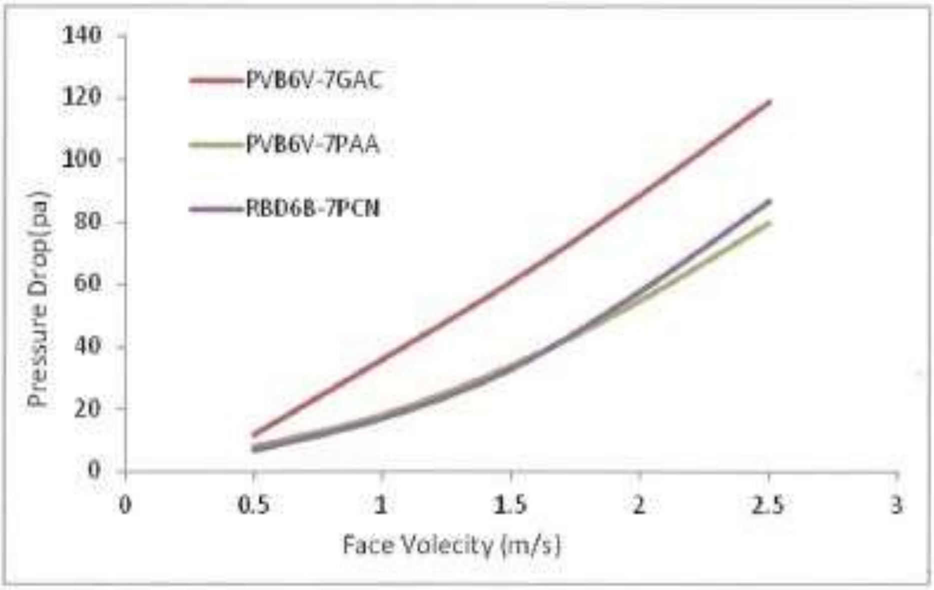
□ : Media Type

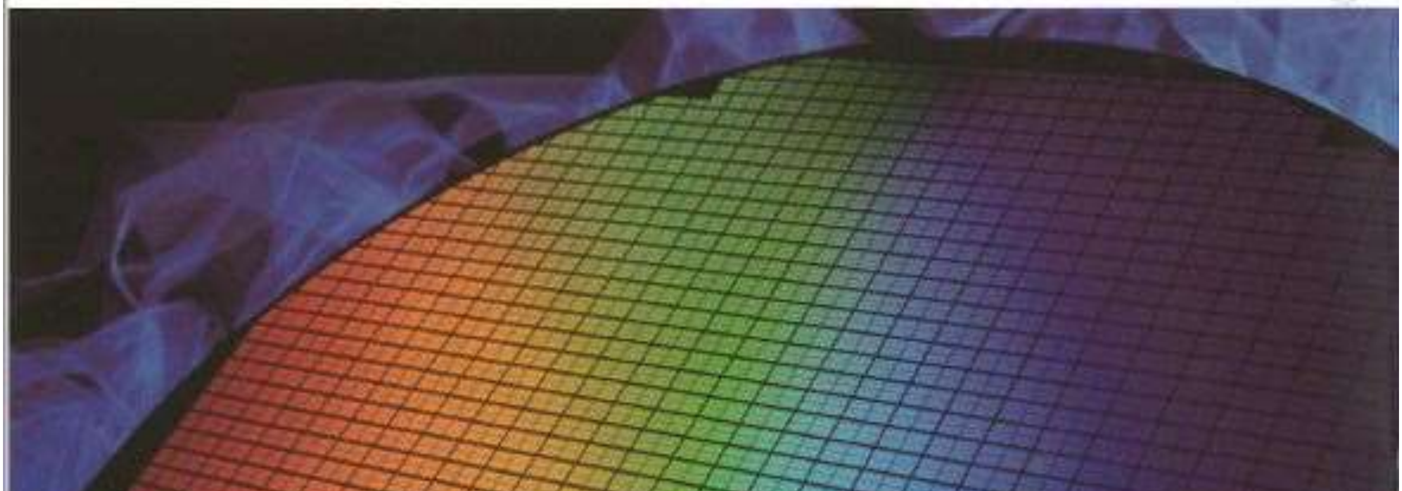
GAC	For VOC Gases
PHC	For Acid Gases
PCN	For Acid Gases
PAA	For Base Gases
IXA	Ion Exchange For Base Gases

△ : Filter Dimension

W x H x D

W	Width
H	Hight
D	Depth





K.J. Filtration Technologies Ltd.

TEL : +886-3-3547040
FAX : +886-3-3544896
e-mail : info@kjfiltration.com

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