dado lab

Consumables Guide 2018

A guide to sampling media selection

Introduction

Dado lab designs and realizes sampling lines dedicated to particulate matter and gasesous micropollutants determination in stack emission, ambient and occupational hygiene.

The continuous instrument innovation and official methods as well, require new and advanced samplingmedia able to grant higher performances, determination accuracy and also easier the sampling operation.

Following the market requests, we realized this guide to supply to our customers an useful tool for the best sampling support identification in combination with our sampling solutions.

To supply best solutions, we have included in this guide only the high quality and tested products coming by reliable manufacturers.

The feedbacks coming from our customers was also kept in consideration during the evaluation process.

Sampling media application will be identified also by the following icons:

- Stack Emission
- Environment
- Occupational Hygiene

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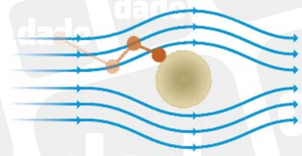
How filters work

Operation principles

Flat filters, membranes and thimbles are capturing elements used to separate solid particles or aerosol fractions from the gas stream.
The capability of a filter or membrane to block and retain the particles is not only related to the mesh "sieve" effect but also to the combination of various physical principle effects contributing to obtain the maximum separation efficiency.
Filtration is achieved thanks to the combined result of those principles, which are mostly related to the filter or membrane type:

Brownian motion (Diffusion)

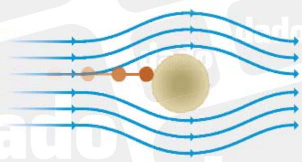
The brownian motion (diffusion) refers to the random movement of a particle caused by the collision with gas molecules/atoms at molecur scale.
During the free movement in the gas stream, the particle will hit the filter fiber.



Smaller is the particle (< 0,1 µm) and greater is its probability to hit a fiber of the filter element, and then get separated from the gas stream. The filters using the brownian movement give better separation efficiencies with particles having smaller diameters.

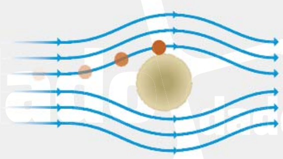
Inertia (Impact)

Particles with diameters greater than 0,3 µm do not follow the gas streams through the filters fibers because of their higher inertia, but inertia is also the reason of their impact on the filter fibers.
When getting close to the fiber, the flow direction change and is deviated but the inertia of the particle, will prevent it from following the flow and will proceed on straight line impacting on the fiber.



Direct interption

Particles following the gas flow may still be collected on the fiber even without inertia effect. For instance, if a particle with 1 µm diameter follows the gas direction but gets close to the fiber at <0,5 µm, this particle will touch the fiber and be removed from the flow.

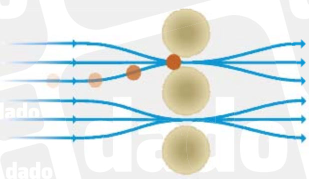


Electrostatic affinity

Particles may be attracted from electrostatically charged fibers .
This capture mechanism is independent from the size of the particle matter.

Sieve

Particles with dimensions bigger than the interspaces between fibers are trapped within the mesh.



The elusive particle

When a particle enters in contact with a fiber of the filter, it is captured and removed from the air flow.

Filters are designed to have very short distances between the fibers of the mesh in order to have also Van der Waals forces attracting the particles.

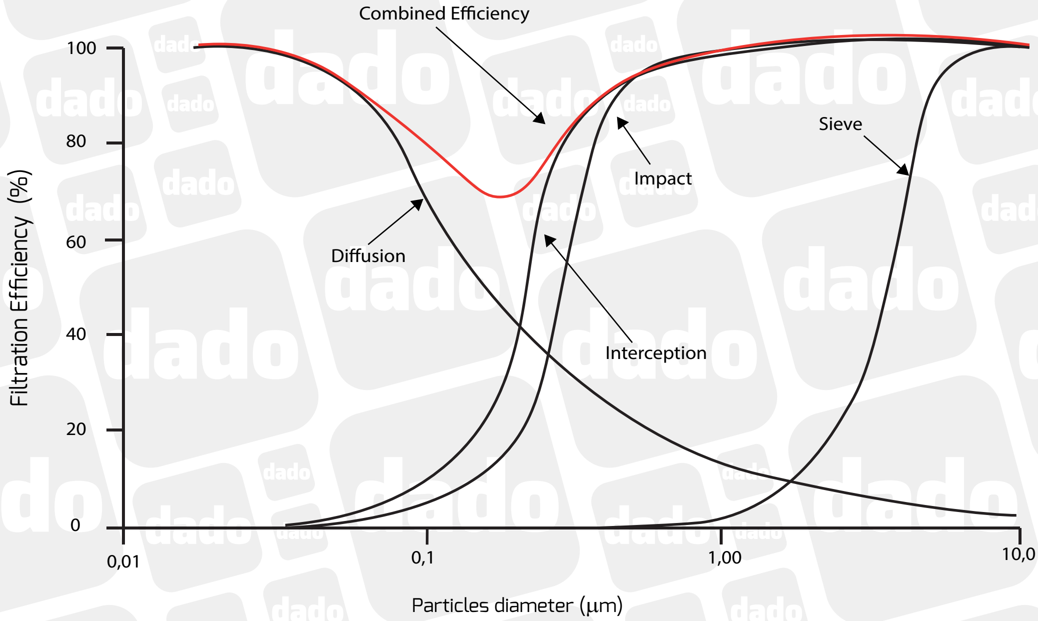
Once they are collected, it is very difficult to remove them efficiently.

In the picture here below, it is possible to notice that exists a particular size to which no one of the previously decribed collection mechanisms (diffusion, impact etc) work well.

This is defined as the most penetrating particle size (MPPS) and represents the best indicator for the filter performances.

If the filter has a high MPPS performance value, then both smaller and bigger particles will be collected with even higher efficiency.

This is reason why 0,3 μm is considered the reference size to test a filter.



Glass Fiber

Those filters are made of high purity borosilicate fibers. Glass fibers filters became, during the last 20 years, the most diffused filtering elements for stack emission and ambient sampling thanks to their low cost but also because of the quality improvement granting better resistance and easier to handle.

They are mostly adopted for particulate matter sampling in every application but can be also used for micropollutants determination such as PCDD/PCDF or PAH. Since they may contain metals, such as, lead, they are not the best solution for heavy metals determination.

Thanks to their resistance to high temperatures, up to 500°C, and to humidity, glass fiber filters partially replaced the classic cellulose filters. Weak point of the glass fiber filters is their fragility due to low mechanical resistance. To compensate this problem, organic binders were used to increase the fibers cohesion. During the last years, the mechanical resistance of those filters was improved thanks to new production technics.

Today, glass fiber filters are available with organic binders and binderless.

Binderless

The realization of binderless glass finers fibers allowed them to be used also as sampling filters for determination of the organic compounds, such as PAH, PCDD/PCDF or other semi-volatile compounds, on the particulate matter phase.
Thanks to the very low organic compounds content, they can be also used for the those sampling where the organic compounds are present in the gas phase, which will be then captured on the suitable substrate or adsorbed using an impingers train.

Because of the absence of binders, those filters are more delicate than the others and particular care is needed during handling, especially during insertion and extraction of the filter from the filterholder cartridge, and transport because of the risk to loose fibers and invalidate the sampling.

Binderless filters are preferred for stack emission sampling because the absence of binders make them more resistant when exposed to high temperature since don't loose their characteristics.

Binderless glass fibers filters are available with different grades :

Grade	Efficiency (0,3mm)	Weight (gr/m²)	Thickness(mm)	T_{max} (°C)	Application
MGA - GF 50	99,98%	52	0,23	500	PMx and total suspend particles in stack emissioni and ambient
MGB	99,98%	143	0,70	500	PMx and TSP in stack emissioni and ambient for long terms
MGC	99,98%	52	0,24	500	PMx and TSP in stack emissioni and ambient
MGD	99,9%	75	0,53	500	TSP in stack emissioni and ambient
MGF	99,9%	75	0,45	180	PMx in occupational hygiene
MGG	99,98%	65	0,70	500	PMx and TSP in ambient and occupational hygiene
MG 550 HA	99,98%	65	0,30	550	TSP in stack emissioni up to 500°C
MG 160	99,98%	75	0,40	500	HVS/LVS PM10 in ambient

With binders
Use of hydrophobic organic or inorganic binders makes those filters more resistant to mechanical stress, increasing considerably the weighting accuracies because of the greater weight stability.

This is especially true for those applications where there aren't particular temperatures, huidities or aggressive gas compositions which may weaken or destroy the binders.

Organic binders
Glass fiber filters with organic binders are the most resistant to physical and chemical stress I filtri and the cheaper as well. Are also the most suitable for high humidity concentrations since are hydrophobics.

On the other hand, in presence of high temperatures (> 180°C) or organic solvents, their strenght point becomes their weakness because, when exposed to those conditions, those filters become much more fragile than the binderless ones.

Among the glass fiber filters with organic binders, the polyester laminated ones are particularly interesting because of their chemical compatibility to a wide range of organic and inorganic compounds. Those filters are often used to sample particulate matter in presence of aggressive compounds or in case the following chemical speciation is required.

Grade	Efficiency (0,3mm)	Weight (gr/m²)	Thickness(mm)	T_{max} (°C)	Application
MG 227	99,93%	75	0,45	180	PM at low temp
GF 10	99,97%	70	0,35	180	PM at low temp
MG 1337	99,97%	104	0,45	190	PM and semi-volative at low temp

Inorganic binders
Differently from the filters with organic binder, those ones are manufactured using inorganic binders to increase the stability and resistance versus physical stress and to chemicals, having, at the same time, a low blank levels, especially for heavy metals.

The presence of inorganic binders also increase the filtering efficiency and allow the use of those filters in applications such as PM determination and following VOC determination in the gas phase.

Grade	Efficiency (0,3mm)	Weight (gr/m²)	Thickness(mm)	T_{max} (°C)	Application
GF 6	99,97%	80	0,35	500	PM at low temp
GF 9	99,97%	70	0,35	500	PM at low temp

Extraction thimbles

Compared to flat filters/membranes, thimbels are heavier and more resistant to pressure drops and are the best choice for high PM concentration, even at gr/liter or harsh conditions. Thimble are also preferred supports when oil aerosols have to be collected.
Their intrinsic resistance, make them suitable also when high water content are present, also with absolute humidity levels higher than 20%, or long term sampling are required.

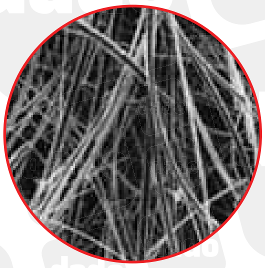
Glass Fiber

p/n	Description	Grade	Size	Q.ty
110 105 1001	Binderless glass fiber filters	MGA	25	100
110 105 1002	Binderless glass fiber filters	MGA	37	100
110 105 1003	Binderless glass fiber filters	MGA	47	100
110 105 1004	Binderless glass fiber filters	MGA	90	100
110 105 1006	Binderless glass fiber filters	MGA	110	100
110 105 1011	Binderless glass fiber filters	MGB	25	100
110 105 1013	Binderless glass fiber filters	MGB	47	50
110 105 1014	Binderless glass fiber filters	MGB	90	50
110 105 1016	Binderless glass fiber filters	MGB	110	50
110 105 1021	Binderless glass fiber filters	MGC	25	100
110 105 1023	Binderless glass fiber filters	MGC	47	100
110 105 1024	Binderless glass fiber filters	MGC	90	100
110 105 1026	Binderless glass fiber filters	MGC	110	100
110 105 1031	Binderless glass fiber filters	MGD	25	50
110 105 1033	Binderless glass fiber filters	MGD	47	50
110 105 1034	Binderless glass fiber filters	MGD	90	50
110 105 1036	Binderless glass fiber filters	MGD	110	50
110 105 1041	Binderless glass fiber filters	MGF	25	100
110 105 1043	Binderless glass fiber filters	MGF	47	100
110 105 1044	Binderless glass fiber filters	MGF	90	100
110 105 1046	Binderless glass fiber filters	MGF	110	100
110 105 1051	Binderless glass fiber filters	MGG	25	100
110 105 1052	Binderless glass fiber filters	MGG	37	100
110 105 1053	Binderless glass fiber filters	MGG	47	100
110 105 1054	Binderless glass fiber filters	MGG	90	100
110 105 1056	Binderless glass fiber filters	MGG	110	100
110 105 1073	Binderless glass fiber filters	MG 160	47	50
110 105 1074	Binderless glass fiber filters	MG 160	90	50
110 105 1076	Binderless glass fiber filters	MG 160	110	50
110 105 1101	Binderless glass fiber filters	MG 550 HA	25	100
110 105 1102	Binderless glass fiber filters	MG 550 HA	37	100
110 105 1103	Binderless glass fiber filters	MG 550 HA	47	100
110 105 1104	Binderless glass fiber filters	MG 550 HA	90	100
110 105 1106	Binderless glass fiber filters	MG 550 HA	110	100

Glass Fiber

p/n	Description	Grade	Size	Q.ty
110 105 1151	Glass fiber filters w/ organic binders	MG227	25	100
110 105 1152	Glass fiber filters w/ organic binders	MG227	37	100
110 105 1153	Glass fiber filters w/ organic binders	MG227	47	100
110 105 1203	Glass fiber filters w/ laminated polyesters	MG1337	47	100
110 107 1308	Glass fiber filters w/ organic binders	ET/MG	25x100	25
110 107 1309	Glass fiber filters w/ organic binders	ET/MG	30x100	25
110 105 2001	Glass fiber filters w/ inorganic binders	GF 6	25	100
110 105 2003	Glass fiber filters w/ inorganic binders	GF 6	47	100
110 105 2004	Glass fiber filters w/ inorganic binders	GF 6	90	100
110 105 2006	Glass fiber filters w/ inorganic binders	GF 6	110	100
110 105 2007	Glass fiber filters w/ inorganic binders	GF 6	150	100
110 105 2024	Glass fiber filters w/ inorganic binders	GF 8	90	100
110 105 2033	Glass fiber filters w/ inorganic binders	GF 9	47	100
110 105 2034	Glass fiber filters w/ inorganic binders	GF 9	90	100
110 105 2043	Glass fiber filters w/ organic binders	GF	47	100
110 105 2051	Binderless glass fiber filters	GF	25	100
110 105 2052	Binderless glass fiber filters	GF	37	100
110 105 2053	Binderless glass fiber filters	GF	47	100
110 105 2054	Binderless glass fiber filters	GF	90	100
110 105 2056	Binderless glass fiber filters	GF	110	100
110 105 2057	Binderless glass fiber filters	GF	150	100

Quartz fiber



Manufactured with high purity quartz, those filters are the best filtering media with high temperatures condition, because they can stand temperatures up to 900°C, and offer a very high chemical stability.

Quartz fiber filters also have a very low heavy metals content, their purity can be also increased whit thermal processes.tamenti termici.

Because of their high purity grade combined with thermal and chemical resistance, even in case of very aggressive acids, quartz fiber filters are the required filtering supports in different sampling methods, both EN and EPA, for stack emission and environmental determinations of particulate matter and pollutants such as heavy metals, according to EN14385, and are suitable also for other parameters such as PAH, PCDD/PCDF or fluorides determinations.

Other characteristics of those filters are :
- Superior retention capability towards wide aerodynamic diameter range.
- High air permeability
- Exellent chemical stability with solvents or acids

Quartz fiber

Grade	Efficiency (0,3mm)	Weight (gr/m²)	Elements (icp)	T_{max} (°C)	Application
MK5	99,998%	85	basso	900	PMx and TSP in stack emission at high temperatures
MK360	99,998%	85	tracce	900	PM and heavy metals determinations at high temp.
T293	99,999%	85	basso	900	PMx and TSP stack emission/environment
QFH	99,999%	85	basso	1000	PMx and TSP in stack emission at high temperatures

Heavy Metals content

	Al	Cd	Co	Cr	Cu	Fe	Hg	Mg	Mn	Ni	Pb	Sn	Ti	V
MK5	50	1,5	1	5	1,25	30	<0,05	25	1,25	2	0,75	0,5	2,5	0,5
MK360	25	<0,02	1	3,5	< 1	20	<0,025	15	1	0,5	0,3	<0,5	1,5	<0,5

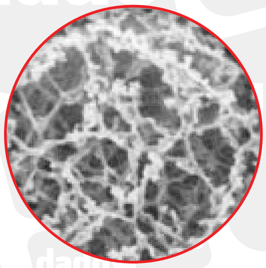
Thimbles

For micropollutants long term samplings (LTS), or in case of high dust and/or humidity concentration, the MK360 thimbles represents the best and reliable solution.

Quartz fiber filters

p/n	Description	Grade	Size	Q.ty
110 106 1003	Quartz fiber filters binderless	MK 5	47	50
110 106 1004	Quartz fiber filters binderless	MK 5	90	50
110 106 1007	Quartz fiber filters binderless	MK 5	150	50
110 106 1011	Quartz fiber filters binderless high purity	MK 360	25	25
110 106 1012	Quartz fiber filters binderless high purity	MK 360	37	25
110 106 1013	Quartz fiber filters binderless high purity	MK 360	47	25
110 106 1015	Quartz fiber filters binderless high purity	MK 360	103	25
110 106 1017	Quartz fiber filters binderless high purity	MK 360	150	25
110 106 1031	Quartz fiber filters binderless low heated	T293	25	50
110 106 1032	Quartz fiber filters binderless low heated	T293	37	50
110 106 1033	Quartz fiber filters binderless low heated	T293	47	50
110 106 1034	Quartz fiber filters binderless low heated	T293	90	50
110 106 1035	Quartz fiber filters binderless low heated	T293	100	50
110 106 1036	Quartz fiber filters binderless low heated	T293	110	50
110 106 1037	Quartz fiber filters binderless low heated	T293	150	50
110 106 1108	Quartz fiber thimbles binderless high purity	ET/MK 360	25x100	25
110 106 1109	Quartz fiber thimbles binderless high purity	ET/MK 360	30x100	25
110 106 2001	Quartz fiber filters binderless	QFH	37	50
110 106 2003	Quartz fiber filters binderless	QFH	47	50
110 106 2007	Quartz fiber filters binderless	QFH	150	50

Cellulose



After the introduction on the market of more reliable, pure and cheaper glass/quartz fibers filters, the cellulose filters use started to decrease, especially for those application where their weak points, such as the limitations for high temperature and humidity in stack emission, may have risked to compromise the whole sampling operation.

Their are still occasionally used in stack emission for the heavy metals determination because of the relative low price heavy metals determination with atomic absorption analysis. However, this analysis method hasn't the required sensibility for the low concentrations compared to other technics, such as ICP-MS spectroscopy.

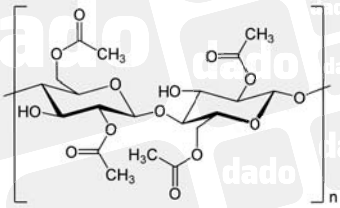
Round filters

Since cellulose is relatively easy anch cheap material to process, on the market are available different types of cellulose membranes.

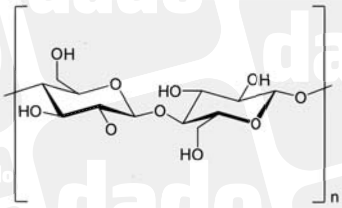
Cellulose is used as filtration material from centuries and recently was also used as first filter supports when environmental and occupational hygiene started to collect samples. Easy to manufacture and also cheap, cellulose material was used for all kind of sampling determination, from stack emission isokinetic sampling , environmental control or work safety evaluations.

Thanks to its versatility, it's possible to manufacture supports with different characteristics and sizes from the standard 47mm diameter or 25x100mm thimbles.

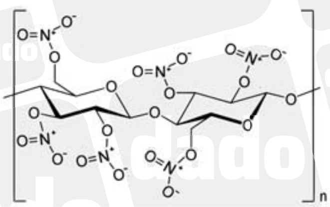
Most diffused cellulose filters available on the market are :



Celllulose Acetate (CA)
Among all cellulose filters, the Acetate ones are the most resistant to aggressive chemicals.
Those filters also offers a low resistance to air passage and a thermal resistance up to 180°C.



Cellulose Nitrate (CN)
The very classic membranes for particulate matter sampling, or other parameters, such asbestos fibers, available also with printed grid for microscopy fibers count.



Mixed Cellulose Esters (MCE)
Those membranes are composed by a mix of nitrate and acetate cellulose fibers. The constant pore size and resistance to high working flowrates, compared to other cellulose filters, make them particularly suitable for particulate matter sampling at higher flowrates and microbiological determinations.

Mixed Cellulose Esters (MCE)

p/n	Description	Pore size	Ø mm	Q.ty
110 110 2021	MCE membranes	0.45 µm	25	100
110 110 2023	MCE membranes	0.45 µm	47	100
110 110 2073	MCE membranes	3 µm	47	100
110 110 2083	MCE membranes	5 µm	47	100
110 110 2093	MCE membranes	8 µm	47	100
110 110 2123	MCE membranes w/ grid	0.45 µm	47	100
110 110 4021	MCE membranes	0.45 µm	25	100
110 110 4022	MCE membranes	0.45 µm	37	100
110 110 4023	MCE membranes	0.45 µm	47	100
110 110 4031	MCE membranes	0.65 µm	25	100
110 110 4033	MCE membranes	0.65 µm	47	100
110 110 4041	MCE membranes	0.8 µm	25	100
110 110 4042	MCE membranes	0.8 µm	37	100
110 110 4043	MCE membranes	0.8 µm	47	100
110 110 4051	MCE membranes	1.0 µm	25	100
110 110 4053	MCE membranes	1.0 µm	47	100
110 110 4071	MCE membranes	3.0 µm	25	100
110 110 4072	MCE membranes	3.0 µm	37	100
110 110 4073	Membrane in MCE	3.0 µm	47	100
110 110 4081	Membrane in MCE	5.0 µm	25	100
110 110 4082	Membrane in MCE	5.0 µm	37	100
110 110 4083	Membrane in MCE	5.0 µm	47	100
110 110 4091	Membrane in MCE	8.0 µm	25	100
110 110 4093	Membrane in MCE	8.0 µm	47	100
110 110 4123	Membrane in MCE c/ griglia	0.45 µm	47	100
110 110 4141	Membrane in MCE c/ griglia	0.8 µm	25	100
110 110 4143	Membrane in MCE c/ griglia	0.8 µm	47	100

Cellulose Acetate (CA)

p/n	Description	Pore size	Ø mm	Q.ty
110 108 1003	Acetate Cellulose Membranes	0.2 µm	47	100
110 108 1011	Acetate Cellulose Membranes	0.45 µm	25	100
110 108 1013	Acetate Cellulose Membranes	0.45 µm	47	100
110 108 1014	Acetate Cellulose Membranes	0.45 µm	90	25
110 108 1023	Acetate Cellulose Pads	5.0 µm	47	100

Cellulose Nitrate (CN)

p/n	Description	Pore size	Ø mm	Q.ty
110 109 1011	Nitrate Cellulose Membranes	0.45 µm	25	100
110 109 1013	Nitrate Cellulose Membranes	0.45 µm	47	100
110 109 1023	Nitrate Cellulose Membranes	0.65 µm	47	100
110 109 1033	Nitrate Cellulose Membranes	0.8 µm	47	100
110 109 1043	Nitrate Cellulose Membranes	1.2 µm	47	100
110 109 1064	Nitrate Cellulose Membranes	3 µm	90	25
110 109 1073	Nitrate Cellulose Membranes	5 µm	47	100
110 109 1083	Nitrate Cellulose Membranes	8 µm	47	100
110 109 1103	Nitrate Cellulose Membranes w/ grid	0,2 um	47	100
110 109 1113	Nitrate Cellulose Membranes w/ grid	0.45 µm	47	100

Regenerated Cellulose (RC)

p/n	Description	Pore size	Ø mm	Q.ty
110 111 1011	Regenerated Cellulose Membranes	0.2 µm	25	50
110 111 1023	Regenerated Cellulose Membranes	0.45 µm	47	100

Extraction Thimbles

p/n	Description	Grade	Size	Q.ty
110 107 1008	Cellulose extraction thimbles	ET/C	25x100	25
110 107 1009	Cellulose extraction thimbles	ET/C	30x100	25
110 107 1073	Cellulose extraction thimbles	ET/C	48x145	25
110 107 1074	Cellulose extraction thimbles	ET/C	48x200	25

Phase separation paper

p/n	Descrizione	Grade	Diam.	Q.tà
110 180 1011	Phase Separation paper	480	70	100
110 180 1021	Phase Separation paper	480	90	100
110 180 1031	Phase Separation paper	480	110	100
110 180 1041	Phase Separation paper	480	125	100
110 180 1051	Phase Separation paper	480	150	100
110 180 1061	Phase Separation paper	480	185	100
110 180 1071	Phase Separation paper	480	240	100

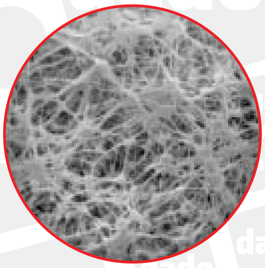
Polymeric Membranes

To the glass/quartz fiber filters and cellulose membranes, a whole new pletora of supports realized with high tech polymeric materials are now available.

Materials such as PTFE or Policarbonate allowed to manufacture high quality supports with a high constant pore size distribution and chemical characteristics making them suitable for a large variety of parameter collections.

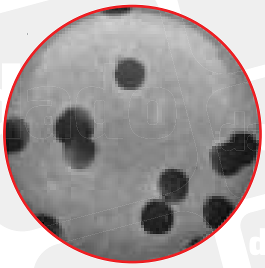
Other characteristics of those membranes are:
- Superior particles retention capability
- High air permeability
- Excellent chemical stability and resistance to aggressive compounds
- Very low unladen weight variation

Most diffused polymeric materials used for sampling membranes production :



Polytetrafluoroethylene (PTFE)
thanks to its low resistance to air passage and minimal reactivity to chemical compounds, the PTFE is used for the realization of membranes mainly dedicated to PM fraction sampling, in particular PM2.5, in environmental applications where the sample chemical integrity is a must.
On the other hand, this material tends to be easily electostatically charged and has a low resistance to mechanical stress, it must be handled with care.

PTFE membranes may also be used in stack emission sampling but their low resistance to temperatures (max 230°C) must be kept in consideration. For PMx sampling, PTFE membranes are available also with PP or PMP support ring, which increases their resistance.



Policarbonate Track Etch (PCTE)
Polycarbonate membranes are characterized by their omogeneous pore size distribution, obtained through the “track-etching” process, where the thin membrane is crossed by particles with constant diameter and charged with high energy, which perforate it with high precision.

Thanks to their thickness and glass-like translucency, polycarbonate offers an exceptional particles or fibers visibility when analized at microscopy. They are the optimal choice for asbestos fiber determination.

Polycarbonate track etch membranes are also available with gold coating of 40 nm on both sides. The high electric conductivity of the PCGC membranes avoid electrostatical charges formation on the sample and enhance the scanning electron microscopy (SEM) quality.

Other availale materials	
Nylon	polyamide
PES	polyethersulfone
PP	polipropilene
PAN	polyacrylonitrile
PEEK	Polyether ether ketone
PETE	Polyester
PVDF	polyvinylidene fluoride

Polyamide (Nylon)

p/n	Description	Pore size	Ø mm	Q.ty
110 112 1011	Nylon Membranes	0.2 µm	25	50
110 112 1021	Nylon Membranes	0.45 µm	25	50
110 112 1023	Nylon Membranes	0.45 µm	47	100
110 112 4021	Nylon Membranes	0.45 µm	25	100
110 112 4023	Nylon Membranes	0.45 µm	47	100
110 112 4031	Nylon Membranes	0.65 µm	25	100
110 112 4033	Nylon Membranes	0.65 µm	47	100
110 112 4041	Nylon Membranes	0.8 µm	25	100
110 112 4043	Nylon Membranes	0.8 µm	47	100
110 112 4051	Nylon Membranes	1.2 µm	25	100
110 112 4053	Nylon Membranes	1.2 µm	47	100
110 112 4081	Nylon Membranes	5 µm	25	100
110 112 4083	Nylon Membranes	5 µm	47	100
110 112 4123	Nylon Membranes w/ grid	0.45 µm	47	100
110 112 4153	Nylon Membranes w/ grid	1.2 µm	47	100

Polyethersulfone (PES)

p/n	Description	Pore size	Ø mm	Q.ty
110 113 4021	PES Membranes	0.45 µm	25	100
110 113 4022	PES Membranes	0.45 µm	37	100
110 113 4023	PES Membranes	0.45 µm	47	100
110 113 4031	PES Membranes	0.65 µm	25	100
110 113 4033	PES Membranes	0.65 µm	47	100
110 113 4041	PES Membranes	0.8 µm	25	100
110 113 4042	PES Membranes	0.8 µm	37	100
110 113 4043	PES Membranes	0.8 µm	47	100
110 113 4051	PES Membranes	1.2 µm	25	100
110 113 4052	PES Membranes	1.2 µm	37	100
110 113 4053	PES Membranes	1.2 µm	47	100
110 113 4081	PES Membranes	5 µm	25	100
110 113 4082	PES Membranes	5 µm	37	100
110 113 4083	PES Membranes	5 µm	47	100
110 113 4091	PES Membranes	8 µm	25	100

Polytetrafluoroethylene (PTFE)

p/n	Description	Pore size	ø mm	Q.ty
110 115 1011	PTFE Membranes	0.2 µm	25	50
110 115 1013	PTFE Membranes	0.2 µm	47	100
110 115 1021	PTFE Membranes	0.45 µm	25	100
110 115 1023	PTFE Membranes	0.45 µm	47	100
110 115 1053	PTFE Membranes	1.2 µm	47	100
110 115 3063	PTFE Membranes w/ PP support	2 µm	47	100
110 115 5063	PTFE Membranes w/ PMP support	2 µm	47	50

Polycarbonate (PC TE/GC)

p/n	Description	Pore size	ø mm	Q.ty
110 116 4021	PCTE Membranes	0.4 µm	25	100
110 116 4022	PCTE Membranes	0.4 µm	37	100
110 116 4023	PCTE Membranes	0.4 µm	47	100
110 116 4031	PCTE Membranes	0.6 µm	25	100
110 116 4033	PCTE Membranes	0.6 µm	47	100
110 116 4041	PCTE Membranes	0.8 µm	25	100
110 116 4042	PCTE Membranes	0.8 µm	37	100
110 116 4043	PCTE Membranes	0.8 µm	47	100
110 116 4051	PCTE Membranes	1.0 µm	25	100
110 116 4052	PCTE Membranes	1.0 µm	37	100
110 116 4053	PCTE Membranes	1.0 µm	47	100
110 116 4061	PCTE Membranes	2.0 µm	25	100
110 116 4062	PCTE Membranes	2.0 µm	37	100
110 116 4063	PCTE Membranes	2.0 µm	47	100
110 116 4071	PCTE Membranes	3.0 µm	25	100
110 116 4073	PCTE Membranes	3.0 µm	47	100
110 116 4081	PCTE Membranes	5.0 µm	25	100
110 116 4083	PCTE Membranes	5.0 µm	47	100
110 116 4091	PCTE Membranes	8.0 µm	25	100
110 116 4093	PCTE Membranes	8.0 µm	47	100
110 116 4121	PC Gold-Coated 40/20nm membranes	0.4 µm	25	10
110 116 4123	PC Gold-Coated 40/20nm membranes	0.4 µm	47	10
110 116 4141	PC Gold-Coated 40/20nm membranes	0.8 µm	25	10
110 116 4143	PC Gold-Coated 40/20nm membranes	0.8 µm	47	10

p/n	Descrizione	Grado	Diam.	Q.tà

Polyacrylonitrile (PAN)

p/n	Description	Pore size	ø mm	Q.ty
110 117 4001	PAN Laminated membranes	0.2 µm	25	100
110 117 4002	PAN Laminated membranes	0.2 µm	37	100
110 117 4003	PAN Laminated membranes	0.2 µm	47	100

Polyether ether ketone (PEEK)

p/n	Description	Pore size	ø mm	Q.ty
110 118 4201	PEEK Membranes	0.02 µm	25	50
110 118 4203	PEEK Membranes	0.02 µm	47	25
110 118 4301	PEEK Membranes	0.1 µm	25	50
110 118 4303	PEEK Membranes	0.1 µm	47	25

Polyester (PETE)

p/n	Description	Pore size	ø mm	Q.ty
110 119 4041	PETE Membranes	0.8 µm	25	100
110 119 4043	PETE Membranes	0.8 µm	47	100
110 119 4051	PETE Membranes	1.0 µm	25	100
110 119 4053	PETE Membranes	1.0 µm	47	100
110 119 4061	PETE Membranes	2.0 µm	25	100
110 119 4063	PETE Membranes	2.0 µm	47	100
110 119 4071	PETE Membranes	3.0 µm	25	100
110 119 4073	PETE Membranes	3.0 µm	47	100
110 119 4081	PETE Membranes	5.0 µm	25	100
110 119 4083	PETE Membranes	5.0 µm	47	100

Polyvinylidene Fluoride (PVDF)

p/n	Description	Pore size	ø mm	Q.ty
110 120 4011	PVDF Membranes	0.2 µm	25	100
110 120 4013	PVDF Membranes	0.2 µm	47	100
110 120 4021	PVDF Membranes	0.45 µm	25	100
110 120 4023	PVDF Membranes	0.45 µm	47	100

Polypropilene (PP)

p/n	Description	Pore size	ø mm	Q.ty
110 114 4021	PP Membranes	0.45 µm	25	100
110 114 4023	PP Membranes	0.45 µm	47	100

Chemical compatibility

Category	Compounds	Ag	CA	GF	MCE	NY	PCT	PES	PET	PP	PTFE*	SS
Solvents	Acetone	R	N	N	N	R	L	N	R	R	R	R
	Acetonitrile	T	N	R	N	R	L	R	R	R	R	R
	Amyl acetate	R	L	R	N	R	R	L	R	T	R	R
	Aniline	R	N	R	N	R	N	R	R	L	R	-
	Benzene	R	L	R	R	R	L	R	R	R	L	R
	Bromoform	R	N	R	R	R	N	T	R	T	R	-
	Butyl acetate	R	L	T	N	R	R	L	R	R	R	R
	Carbon Tetrachloride	R	L	R	R	R	L	R	R	L	L	L
	Cellosolve	R	R	T	N	R	R	T	R	R	R	R
	Chloroform	R	N	R	R	R	N	N	R	L	L	L
	Cicloesano	R	R	R	R	R	R	T	R	R	R	-
	Cyclohexane	R	N	R	N	R	L	N	R	T	R	R
	Diethylacetamide	R	N	R	N	R	L	T	R	R	N	-
	Dimethylformamide	R	N	R	N	R	N	N	R	R	R	R
	Dimethyl sulfoxide (DMSO)	T	N	R	N	R	N	N	R	R	R	R
	Dioxane	R	N	R	N	R	N	L	R	R	R	-
	Ethyl ether	R	L	T	L	R	R	R	R	R	R	R
	Ethyl dichloride	R	L	T	L	R	N	T	R	N	R	L
	Formaldehyde	R	L	R	N	R	R	R	R	R	R	R
	Freon TF	R	R	R	R	R	R	R	R	R	R	-
	Gasoline	R	R	R	R	R	R	T	R	R	R	-
	Exane	R	R	R	R	R	R	T	R	L	R	R
	Isopropyl acetate	R	N	T	N	R	R	T	R	R	R	R
	Kerosene	R	R	R	R	R	R	T	R	R	R	R
	Methyl acetate	R	N	T	N	R	N	T	R	R	R	R
	Methyl Ethyl Ketone (MEK)	R	N	R	N	R	L	N	R	R	R	R
	Metil Isobutil Ketone	R	N	T	N	R	L	T	T	R	R	R
	Methyl chloride	R	N	R	N	L	N	N	R	L	R	R
	Nitrobenzene	T	N	R	N	R	N	N	R	R	R	-
	Pentane	R	R	R	R	R	R	R	R	R	L	-
	Perchlorethylene	R	R	R	R	R	R	N	T	R	R	-
	Piridine	R	N	R	N	R	N	N	R	R	R	R
	Tetrahydrofuran	R	N	R	N	L	N	N	R	R	L	R
	Toluene	R	L	R	R	R	L	N	R	L	L	R
	Trichloroethane	R	L	R	N	R	N	R	T	T	R	-
	Trichlorethylene	R	R	R	R	R	N	R	R	R	L	R
	Triethylamine	R	R	R	L	R	L	T	R	L	R	-
	Xylene	R	R	R	R	R	R	L	R	L	L	R

Category	Compounds	Ag	CA	GF	MCE	NY	PCT	PES	PET	PP	PTFE*	SS
Acids	Acetic Acid, 5%	R	R	R	R	R	R	R	R	R	R	-
	Acetic Acid, 10%	R	N	R	N	L	R	R	R	R	R	L
	Acetic Acid, Glacial	R	N	R	N	N	L	R	R	R	R	L
	Boric acid	R	R	R	R	L	R	T	R	R	R	-
	Hydrochloric acid, 6N	R	L	R	N	N	R	R	L	R	R	R
	Hydrochloric acid, Conc.	R	N	R	N	N	R	R	N	R	R	L
	Fluorhydric Acid, 10%	R	N	T	N	N	R	T	R	R	R	-
	Fluorhydric Acid, 35%	R	N	N	N	N	R	T	R	R	T	-
	Nitric Acid, 6N	N	L	R	R	N	R	N	R	R	L	R
	Nitric Acid, Conc	N	N	R	N	N	R	N	N	R	N	L
	Sulfuric acid, 6N	N	L	L	R	N	R	T	R	R	L	L
	Sulfuric acid, Conc.	N	N	R	N	N	N	N	N	R	N	N
Alcohols	Amyl Alcohol	R	R	R	N	R	R	N	R	R	R	R
	Benzyl alcohol	R	L	R	R	L	L	N	R	R	R	R
	Butyl alcohol	R	R	R	R	R	R	R	R	R	R	-
	Butyl cellosolve	R	L	R	N	R	L	T	R	T	R	-
	Ethyl alcohol <80%	R	R	R	R	R	R	R	R	R	R	-
	Ethyl alcohol >80%	R	R	R	L	R	R	R	R	R	R	-
	Ethylene glycol	R	R	R	L	R	R	R	R	R	R	R
	Glicerine (Glicerol)	R	R	R	R	R	R	R	R	R	R	R
	Isobutyl alcohol	R	R	R	R	R	R	T	R	R	R	-
	Isopropanol	R	R	R	L	R	R	R	R	R	R	R
	Metanol	R	R	R	N	L	R	R	R	R	R	R
	Methilcellosolve	R	L	N	L	R	N	T	R	R	R	-
	Propanol	R	R	R	R	R	R	T	R	R	R	-
Basis	Ammonium hydroxide, 6N	R	N	R	N	N	N	R	L	R	R	R
	Potassium hydroxide, 6N	R	N	N	N	R	N	T	N	R	R	-
	Sodium hydroxide, 6N	R	N	T	N	N	N	R	L	R	R	R
Others	Cotton Oil	R	R	N	R	R	R	T	T	T	R	R
	Hydrogen peroxide (30%)	R	R	R	R	R	R	T	R	R	R	-
	Kodak KMER, FTFR	R	N	T	N	R	R	T	R	R	R	-
	Peanut oil	R	R	N	R	R	R	T	R	R	R	-
	Oil	R	T	R	R	T	R	L	R	L	T	-
	Sesam Oil	R	R	R	R	R	R	T	R	R	R	-
	Shipley (AS-111, 340, 1350)	R	N	T	N	R	R	T	R	R	R	-
	Siliconic Oil	R	R	R	R	R	R	R	R	R	R	-
	Terpentine	R	R	R	R	R	R	T	R	L	R	-

Ceramic filters

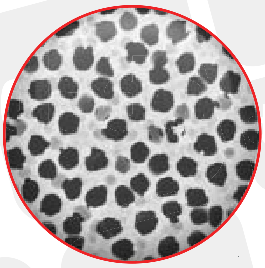
Made of Aluminum Oxides, Titanium and Zirconium, ceramic filters are used in extreme conditions or when the particulate matter must be recovered from the support with high accuracy through a washing process

In order to be used, ceramic filters need to be placed inside the filterholder with silicon or viton gaskets installed above and below the filter, those gaskets prevent the breaking of the ceramic.

Ceramic (CER)

p/n	Description	Pore size	ø mm	Q.ty
110 121 4023	Ceramic filter	0.45 µm	47	5
110 121 4033	Ceramic filter	0.8 µm	47	5
110 121 4103	Ceramic filter	1 KD	47	5
110 121 4113	Ceramic filter	3 KD	47	5
110 121 4123	Ceramic filter	5 KD	47	5
110 121 4133	Ceramic filter	8 KD	47	5
110 121 4143	Ceramic filter	15 KD	47	5
110 121 4153	Ceramic filter	50 KD	47	5
110 121 4163	Ceramic filter	150 KD	47	5

Alumina Oxide membranes (AXO)



Those membranes are made of anodized alumina and allow effcient separations with low pressure drops. Completely organic free, those membranes grant a very low adsorbing grade during the sampling operation. Max application temperature is 400°C
When humidified, alumine oxide become virtually transparent and have a low self fluorescence, which make them suitable for microscope analysis.

Alumina Oxide (AOX)

p/n	Description	Pore size	ø mm	Q.ty
110 122 4511	Alumina Oxide membranes	0.1 µm	25	10
110 122 4513	Alumina Oxide membranes	0.1 µm	47	10
110 122 4521	Alumina Oxide membranes	0.2 µm	25	10
110 122 4523	Alumina Oxide membranes	0.2 µm	47	10
110 122 4611	Alumina Oxide membranes	0.1 µm	25	50
110 122 4613	Alumina Oxide membranes	0.1 µm	47	50
110 122 4621	Alumina Oxide membranes	0.2 µm	25	50
110 122 4623	Alumina Oxide membranes	0.2 µm	47	50

Silver Membranes

Silver membranes are made by metallic silver with 99.97% purity and are used in many applications thanks to their thermal and chemical resistance.
Their main application is the crystalline silica determination with X ray diffraction in accordance to NIOSH 7500 and amorphous silica (NIOSH 7501)

Silver membranes are also used for :
- Vanadium oxide (NIOSH 7504)
- Lead sulphide (NIOSH 7505)
- Boron Carbide (NIOSH 7506
- Asbestos, Chrysotile (NIOSH 9000)
- Quartz e Crisobalite (OSHA ID-142)

Silver (Ag)

p/n	Description	Pore size	Ø mm	Q.ty
110 125 4011	Silver Membranes	0.2 µm	25	50
110 125 4012	Silver Membranes	0.2 µm	37	25
110 125 4013	Silver Membranes	0.2 µm	47	25
110 125 4021	Silver Membranes	0.45 µm	25	50
110 125 4022	Silver Membranes	0.45 µm	37	25
110 125 4023	Silver Membranes	0.45 µm	47	25
110 125 4041	Silver Membranes	0.8 µm	25	50
110 125 4042	Silver Membranes	0.8 µm	37	25
110 125 4043	Silver Membranes	0.8 µm	47	25
110 125 4051	Silver Membranes	1.2 µm	25	50
110 125 4052	Silver Membranes	1.2 µm	37	25
110 125 4053	Silver Membranes	1.2 µm	47	25
110 125 4071	Silver Membranes	3.0 µm	25	50
110 125 4072	Silver Membranes	3.0 µm	37	25
110 125 4073	Silver Membranes	3.0 µm	47	25
110 125 4081	Silver Membranes	5.0 µm	25	50
110 125 4082	Silver Membranes	5.0 µm	37	25
110 125 4083	Silver Membranes	5.0 µm	47	25

Sorbent tubes

Sorbent tubes can be used to capture many chemical compounds, especially organics, in stack emission, environment or on work places. Sorbent tubes are available as passive solutions or, more common, used in combination with active samplers .
In relation to the adsorbing material, a sorbent tube can be used to caputre a specific or groups of compound both for quantitative or quantitive determinations, also in some cases at low ppb levels thanks to the preconcentration effect.

When used in combination with active samplers, the sorbent tube is often composed by different stages, used to capture and evaluate the saturation of the tube itself. In those cases, the flow must pass through the tube with a specific direction.

The material filling the tube can be made of different materials, and it's defined as "adsorbing phase" or "adsorbent" and interacts with the chemical compound blocking it on its surface through chemical reactions, creating both ionic or covalent intramolecular bondings, or physical interactions, such as with forming van der waals bondings.

IImportant characteristics of the sorbent tubes are the affinity, capability to interact with specific or groups of compounds, and the capability to release efficiently those compounds in particular conditions.
The reverse process is called "desorption" and the procedures which allow it to take place are the chemical or the themal desorption.
With the chemical desorption, an appropriate solvent is used to efficiently extract the sample from the support. For example. volatile organic compounds (VOCs) retained on charcoal tubes, are often desorbed using carbon sulfide
The chemical desorption process require a skilled laboratory practice since the involved materials can be dangerous and expensive.
In the last years,the thermal desorption practice started to be used also for the sorbent tubes used for environmental or occupational hygiene samplings. This procedure, often automated, allow to extract the sample using high temperatures.

How are made

Tubes can be made of a single or multiple sections of the same or different materials.
Multiple sections filled with different materials has clearly the target to extend the range of compounds which can be trapped on the tube.
A tube with multiple sections filled with same material has the target to have a "backup" area needed to evaluate the breakthrough effect due to saturation of the sorbent layer or because of stripping effects due to air passage, especially at high temperatures, or water.

How to chose the tubes

There are sorbent tubes filled with adsorbent dedicated to specific chemical compounds, such as microlite for Mercury, and others which are filled with generic adsorbent material, such as charcoal.

Non specific tubes may have a certain affinity to compounds in relation to the chemical composition (chemical groups, presence of ramification or simply because of the presence of double or triple bondings), molecular weight, vapour pressure, polarity, temperature/pressure conditions and humidity.

The size of the tube and the amount of adsorbent material present in the phases can vary and the choice of a quantity or another must be made according to the concentration of the sample that is expected. Tubes are available as small, standard, large, x-large (also called jumbo) or xx-large.

The ratio between the backup phase and the main one can vary since the backup phase only serves to verify that there has been no sample passage.

For instance, charcoal tubes are available with sizes 50/100mg (6x70mm), 200/400mg (8x110mm), 200/800mg (10x110mm) and 200/1800mg (10x160mm)

Choice of which size/quantity to use is also made considering the subsequent desorption, infact, use large tubes for small concentrations then requires a greater amount of solvent for extraction, which naturally leads to a lower concentration of the sample in the resulting solution increase in the uncertainty of the analytical data.

Sorbent tubes list

Charcoal

p/n	Description	Size	Weight (mg)	Application
111 150 1001	Charcoal std - open	6x90	50/100	COV
111 150 1002	Charcoal Lrg - open	8x110	200/400	
111 150 1003	Charcoal XL - open	10x110	200/800	
111 150 1004	Charcoal std	6x70	50/100	
111 150 1005	Charcoal Lrg	8x110	200/400	
111 150 1006	Charcoal XL - Open	10x110	200/800	
111 150 1007	Charcoal - 3 sections	8x150	3 x 350	
111 150 1008	Charcoal XXL	10x160	200/1800	

Silica Gel

p/n	Description	Size	Weight (mg)	Application
111 151 1001	Silica Gel (cleaned) Std	6x70	75/150	Inorganic Acids/basis Ammines Amides
111 151 1002	Silica Gel (cleaned) XL	8x110	260/520	
111 151 1003	Silica Gel (cleaned) Lrg	7,2x110	200/400	
111 151 1004	Silica Gel (cleaned) XXL	10x110	200/800	
111 151 1005	Silica Gel + DNPH Std	6x110	150/300	Aldehydes
111 151 1006	Silica Gel + H2SO4 Std - open	6x70	100/200	Ammonia
111 151 1007	Silica Gel + H2SO4 Lrg - open	6x110	100/200	
111 151 1008	Silica Gel + H2SO4 Lrg	8x110	200/200	
111 151 1009	Silica Gel + H2SO4 Std	6x70	75/150	
111 151 1010	Silica Gel + Charcoal + NaOH (2 fiale)	2x (10x210)	250/1250/750	Hydrazoic acid

Chromosorb

p/n	Description	Size	Weight (mg)	Application
111 152 1001	Chromosorb-102 Std	6x70	33/66	PCB
111 152 1002	Chromosorb-102 XL	8x110	100/200	
111 152 1003	Chromosorb-102 Lrg	8x110	50/100	
111 152 1004	Chromosorb-104 Std	6x70	37/75	n-Butil Mercaptan
111 152 1005	Chromosorb-106 Std	6x70	37/75	COV low boiling point Benzene organic oxygenates
111 152 1006	Chromosorb-106 Lrg	7,2x70	50/100	
111 152 1007	Chromosorb-106 XL	10x150	300/600	
111 152 1008	Chromosorb-108 Std	6x70	37/75	COV
111 152 1009	Chromosorb-108 XL	10x110	200/400	

Florasil

p/n	Description	Size	Weight (mg)	Application
111 153 1001	Florisil Std	6x70	50/100	PCB
111 153 1002	Florisil XL	8x110	200/400	

Microlite

p/n	Description	Size	Weight (mg)	Application
111 154 1001	Microlite Std	6x70	200	Mercury
111 153 1002	Microlite Lrg	8x110	500	

Molecular Sieve

p/n	Description	Size	Weight (mg)	Application
111 155 1001	Molecular Sieve (TEA) Lrg	7,2x110	200/400	NO/NO_2
111 153 1002	Molecular Sieve (TEA) + Oss.	7x70 + 2x(7,2x110)	400 + 2x 800	

Poropak®

p/n	Description	Size	Weight (mg)	Application
111 156 1001	Porapak-N Standard	6x70	44/88	VOC w/ Nitrile group Dimethyl Sulfate Furfuryl alcohol
111 156 1002	Porapak-P Standard	6x110	50/100	
111 156 1003	Porapak-Q Standard	6x70	39/78	Acetone cyanohydrin methylcyclohexanone Pentachloroethane
111 156 1004	Porapak-Q Large	6x110	75/150	
111 156 1005	Porapak-R Standard	6x70	35/70	Esachloro-1,3- cyclopentadiene
111 156 1006	Porapak–T 2 fiale - Open	2x (6x40)	25 + 75	

Tenax®

p/n	Description	Size	Weight (mg)	Application
111 157 1001	Tenax® Standard	6x70	20/40	COV -Phosphorous Diphenyl Styrene Oxide α-chloroacetophenone DNT- nitroglycol Nitroglycerin - Phthalates
111 157 1002	Tenax® Small	6x70	10/20	
111 157 1003	Tenax® (2 fiale)	2x (6x130)	17 - 35	
111 157 1004	Tenax® Large	8x110	50/100	

XAD-2

p/n	Description	Size	Weight (mg)	Application
111 158 1001	XAD-2 XXL	8x110	200/400	high boiling VOC PAH - Pesticides - PCB PCDD/PCDF - EDA
111 158 1002	XAD-2 Small	7x70	40/80	
111 158 1003	XAD-2 Standard	8x110	30/100	
111 158 1004	XAD-2 Large	8x110	50/100	
111 158 1005	XAD-2 XL	8x110	75/150	
111 158 1006	XAD-2 (HMP) Large	6x110	75/150	aldehydes
111 158 1007	XAD-2 (HMP) Standard	6x110	60/120	
111 158 1008	XAD-2 (HMP) XL	8x110	225/450	
111 158 1009	XAD-2 (HMP) Small	6x70	23/45	
111 158 1010	XAD-2 (Octanoic Acid)	6x70	50/100	Diazomethane

XAD-7

p/n	Description	Size	Weight (mg)	Application
111 158 1101	XAD-7 Standard	6x70	30/60	Glicoles - Cresol Diethylamine - Phenols
111 158 1102	XAD-7 Large	6x110	50/100	

Ossidanti

p/n	Description	Size	Weight (mg)	Application
111 159 1001	Oxydizer (tube for 111 155 1002)	7,2x110	800	NO/NO_2 iin combination with molecular sieves
111 159 1002	Oxydizer (filtering tube)	7,2x110	800	

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XAD-2

p/n	Description	Size	Weight (mg)	Application
111 158 1001	XAD-2 XXL	8x110	200/400	high boiling VOC PAH - Pesticides - PCB PCDD/PCDF - EDA
111 158 1002	XAD-2 Small	7x70	40/80	
111 158 1003	XAD-2 Standard	8x110	30/100	
111 158 1004	XAD-2 Large	8x110	50/100	
111 158 1005	XAD-2 XL	8x110	75/150	
111 158 1006	XAD-2 (HMP) Large	6x110	75/150	aldehydes
111 158 1007	XAD-2 (HMP) Standard	6x110	60/120	
111 158 1008	XAD-2 (HMP) XL	8x110	225/450	
111 158 1009	XAD-2 (HMP) Small	6x70	23/45	
111 158 1010	XAD-2 (Octanoic Acid)	6x70	50/100	Diazomethane

XAD-7

p/n	Description	Size	Weight (mg)	Application
111 158 1101	XAD-7 Standard	6x70	30/60	Glicoles - Cresol Diethylamine - Phenols
111 158 1102	XAD-7 Large	6x110	50/100	

Ossidanti

p/n	Description	Size	Weight (mg)	Application
111 159 1001	Oxydizer (tube for 111 155 1002)	7,2x110	800	NO/NO_2 iin combination with molecular sieves
111 159 1002	Oxydizer (filtering tube)	7,2x110	800	