



ANTIPOLLUTION SYSTEMS

You will find on the following pages all the necessary information for a correct use of the working unit. Therefore we suggest that the user carefully reads and follows the technical instructions. Moreover we advise to keep the user guide in a safe and handy place. The above mentioned guide can be subjected to modifications and further improvements.

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General description

The filtering units Mod. CLEAN-CARBO, consisting of modular containers made of galvanised sheet steel, are to be mounted in series: the polluted air goes in through the CLEAN side and comes out of the CARBO side. The CLEAN filter is made up of the components that can be seen in the exploded view of Fig. 1, whereas the components of the CARBO filter can be seen in the exploded view of Fig. 2.

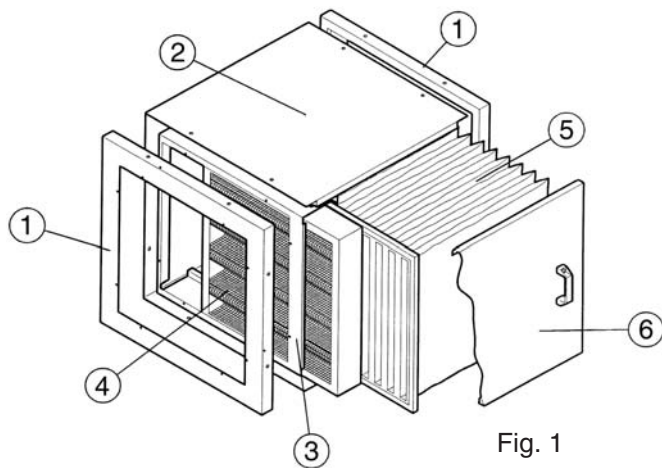


Fig. 1

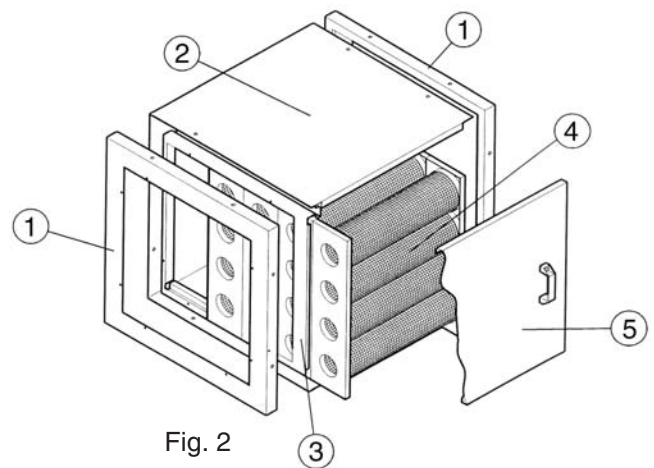


Fig. 2

- | | |
|--------------------|-----------------------|
| 1) Structure base | 4) PRECLEAN prefilter |
| 2) Outer structure | 5) SMOCLEAN filter |
| 3) Filter guide | 6) Inspection door |

- | | |
|--------------------------------|--------------------------|
| 1) Structure base | 4) Activated-carbon pack |
| 2) Outer structure | 5) Inspection door |
| 3) Activated-carbon pack guide | |

CLEAN

The first filter that has a pre-filtering action is a filter that is pleated (Item 4 of Fig. 1), which thus provides a larger filtering surface within limited dimensions.

This filter consists of a galvanised sheet steel frame and galvanised and electrically welded protection meshes. Inside this structure is housed a filtering diaphragm made of polyester fibres dressed with synthetic resins (see characteristics in Section 3).

The second filter making up CLEAN is a bag filter (Item 5 of Fig. 1) of the high efficiency type with a large filtering surface. This filter consists of a diaphragm made of glass fibres and glass microfibres.

This type of filter allows a low flow velocity of the air through the filter, thus ensuring minimal head loss, high filtering efficiency, and longer filter life.

The frame supporting the filters is built in such a way as to make it easy to handle and replace them.

The filters are tested in compliance with ASHRAE 52-76 Standards.

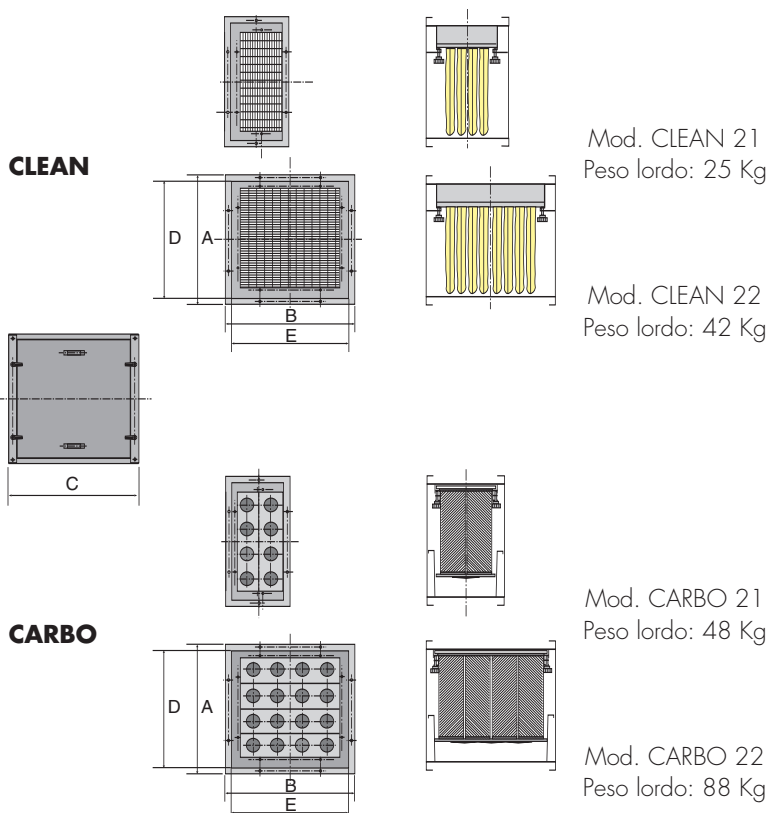
The mean efficiency and the characteristics of the filters are presented in the diagrams that follow.

CARBO

This filter consists of a modular and sectional container made of galvanised sheet steel. Inside the container there are four frames, which can be easily disassembled, where cylinders can be mounted made of plastic micromesh and containing activated carbon. Consequently, the air passes through the activated carbon inside the cylinders before being forced outside.

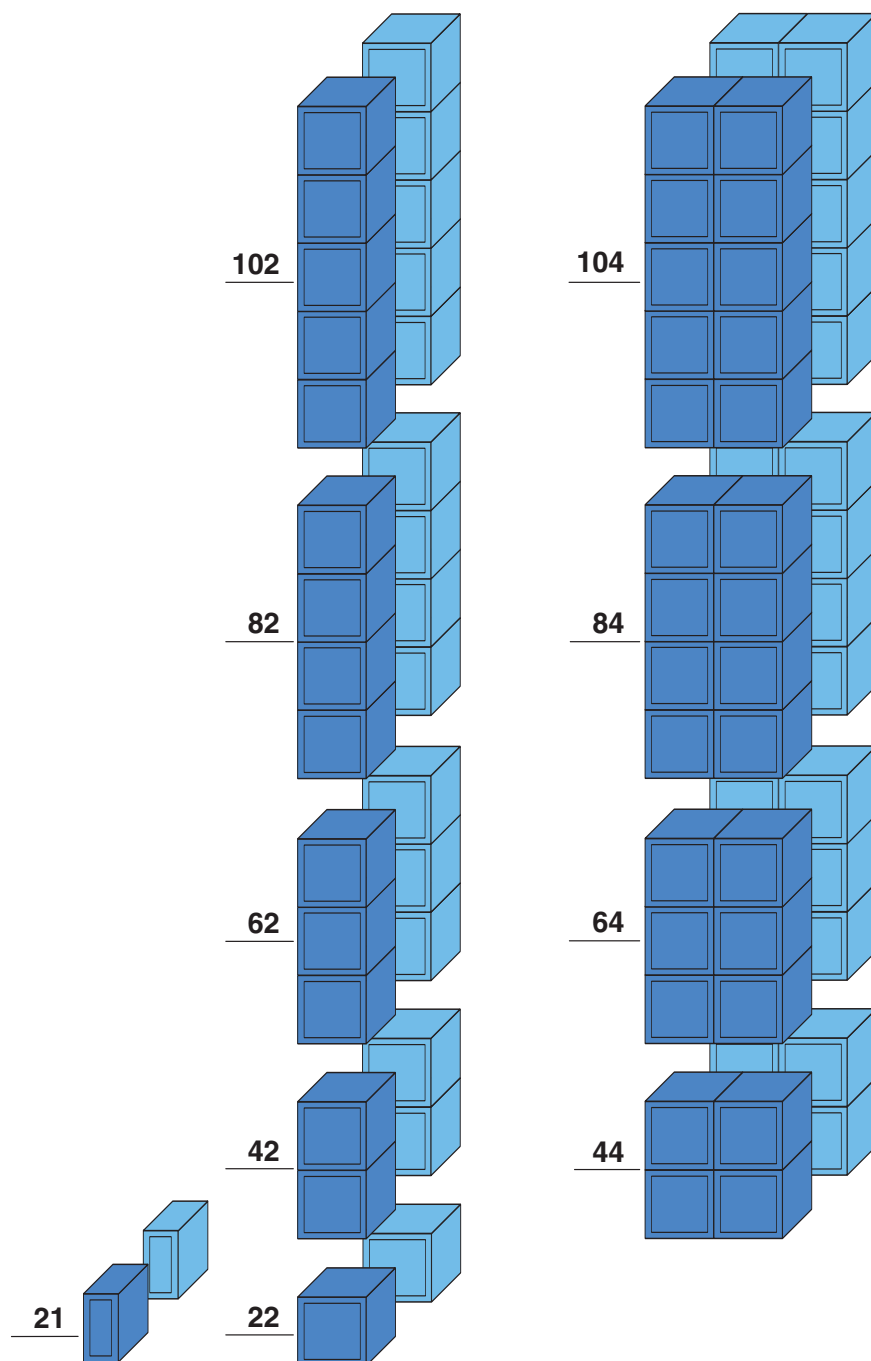
Main data

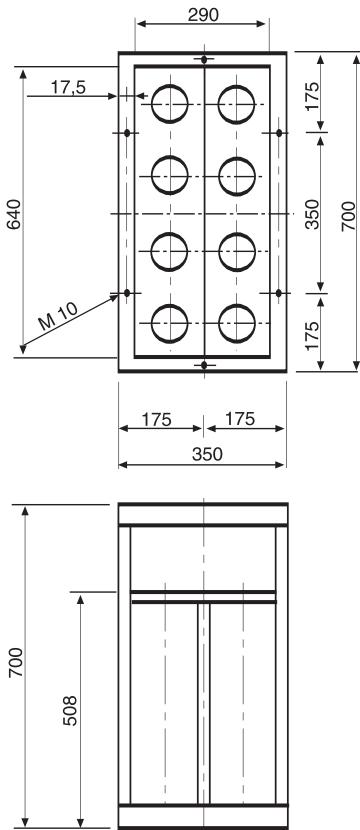
Mod.	A	B	C	D	E	Airflow (m ³ /h)	Mod.
CLEAN 21	700	350	700	640	290	1500	CARBO 21
CLEAN 22	700	700	700	640	640	3000	CARBO 22
CLEAN 42	1400	700	700	1340	640	6000	CARBO 42
CLEAN 62	2100	700	700	2040	640	9000	CARBO 62
CLEAN 82	2800	700	700	2740	640	12000	CARBO 82
CLEAN 102	3500	700	700	3440	640	15000	CARBO 102
CLEAN 44	1400	1400	700	1340	1340	12000	CARBO 44
CLEAN 64	2100	1400	700	2040	1340	18000	CARBO 64
CLEAN 84	2800	1400	700	2740	1340	24000	CARBO 84
CLEAN 104	3500	1400	700	3440	1340	30000	CARBO 104



A peculiar characteristic of the filters of the CLEAN-CARBO series is their modular structure, which makes it possible, via the combination of only two basic elements, to create a wide range of filters, so as to meet the most varied requirements as regards filtering capacity, as it is clearly illustrated in the diagram below.

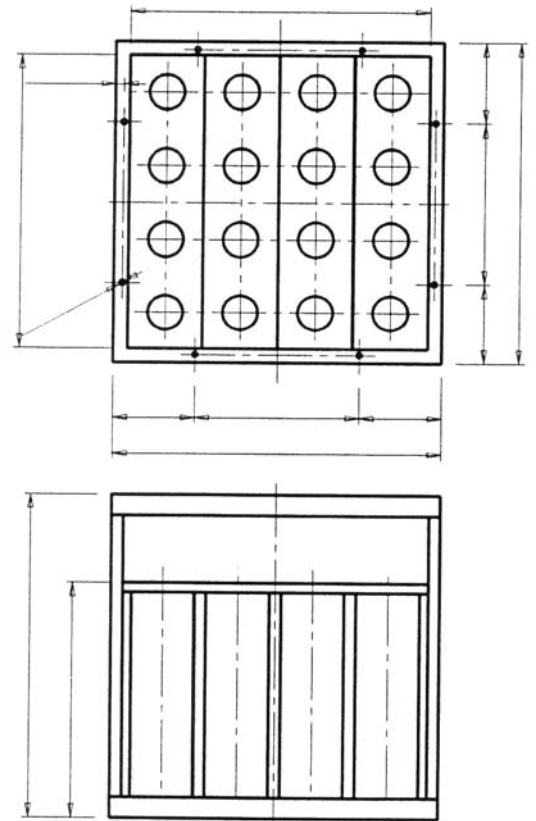
(°) Position of inspection doors in the standard configuration





Mod. CARBO 21
Gross weight: 48 Kg

Charcoal	Mod.
20 Kg	CARBO 21
40 Kg	CARBO 22
80 Kg	CARBO 42
120 Kg	CARBO 62
160 Kg	CARBO 82
200 Kg	CARBO 102
160 Kg	CARBO 44
240 Kg	CARBO 64
320 Kg	CARBO 84
400 Kg	CARBO 104



Mod. CARBO 22
Gross weight: 88 Kg

List of components Specifications of materials

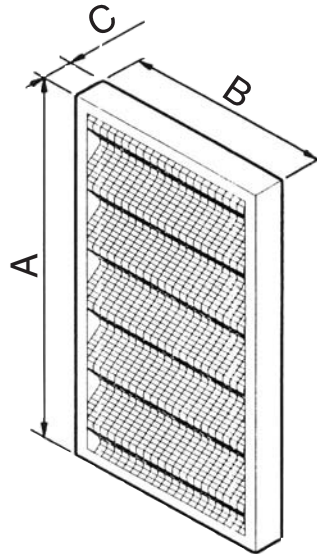
•Preclean filtering panels

Corrugated filtering panels, thickness 100 mm, consisting of a galvanised sheet steel frame and polyester filtering medium with protective mesh.

The filtering diaphragm that is generally used is the A250 type, but more efficient diaphragms or metal ones can be used.

The PRECLEAN filtering medium is made of polyester fibres dressed with synthetic resins. The main characteristic of the filtering diaphragm is the fact that it is self-extinguishing, which makes it particularly suitable for filtration in environments where there is danger of flames or sparks.

Mod.	Dimensions (mm)			Q.ty
	A	B	C	
CLEAN 21	592	287	100	1
CLEAN 22	592	592	100	1



Technical characteristics of "Preclean" filtering medium

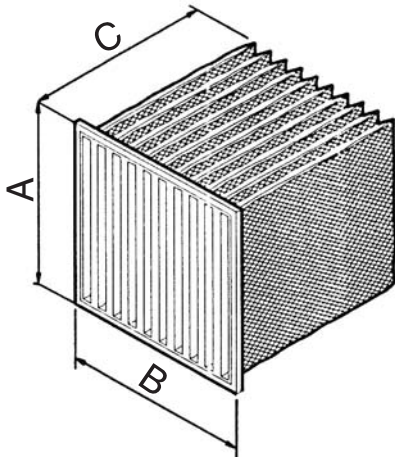
Types of fibres	Synthetic
Max. degree of separation	87.5% (ASHRAE 52-76 atm Stds)
Recommended flow rate	5400 m ³ /h/m ²
Recommended air velocity	1.5 m/s
Initial head loss	35 Pa
Final head loss	120 Pa
Regenerability	Normal
Max. operating temperature	100°C
Flame resistance	Self-extinguishing (F1 Class)
Classification	Eurovent 4/5 EU 3

Table of air flow rates (m³/s)

Air velocity	0,5	1	1,5	2	2,5	3
Mod.						
CLEAN 21	920	1840	2750	3680	4600	5500
CLEAN 22	1890	3780	5670	7560	9450	11340
Head losses [Δp Pa]	15	20	40	60	90	110

•Smoclean bag filters

These bag filters are made of filtering diaphragms made of glass fibre or glass microfibre and having different grains and lengths according to the degree of efficiency required. CLEAN mounts bags with 95% efficiency according to ASHRAE 52-76 Standards.



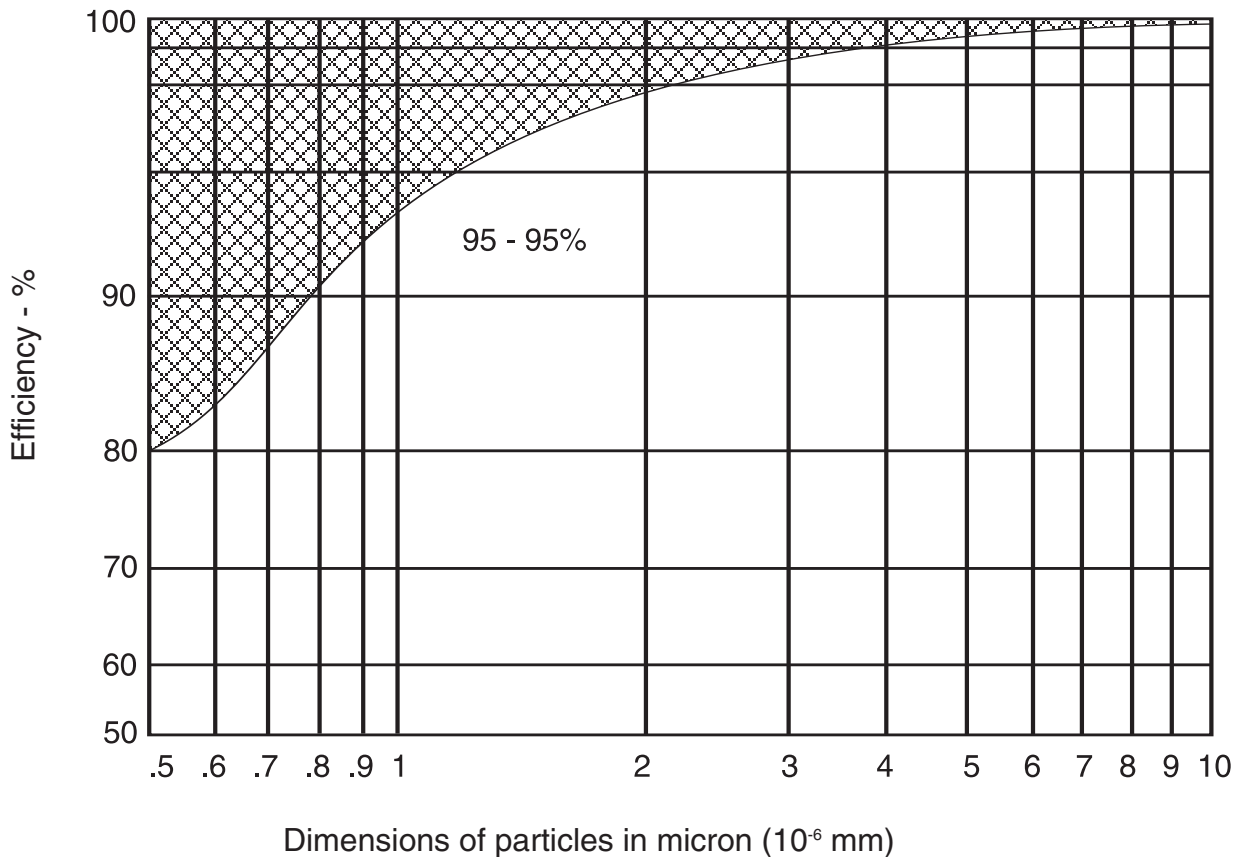
Technical characteristics of "Smoclean" bag filter

Efficiency, ASHRAE 52-76 Stds.	95%
Initial head loss	140 Pa
Final head loss	300 Pa
Regenerability	No
Max. operating temperature	90°C
Flame resistance	Non-flammable Class 2 (UL)
R.H.	90%
Class	EU 9

Mod.	Dimensions (mm)				
	A	B	C	m ²	m ³ /h
CLEAN 21	592	287	535	3.3	1500
CLEAN 22	592	592	535	6.8	3000

•Indicative diagram of Smoclean efficiency

It is not possible to give efficiency curve that is valid in absolute terms, since efficiency is influenced by too many factors, such as dust load, air velocity through the filter, etc.



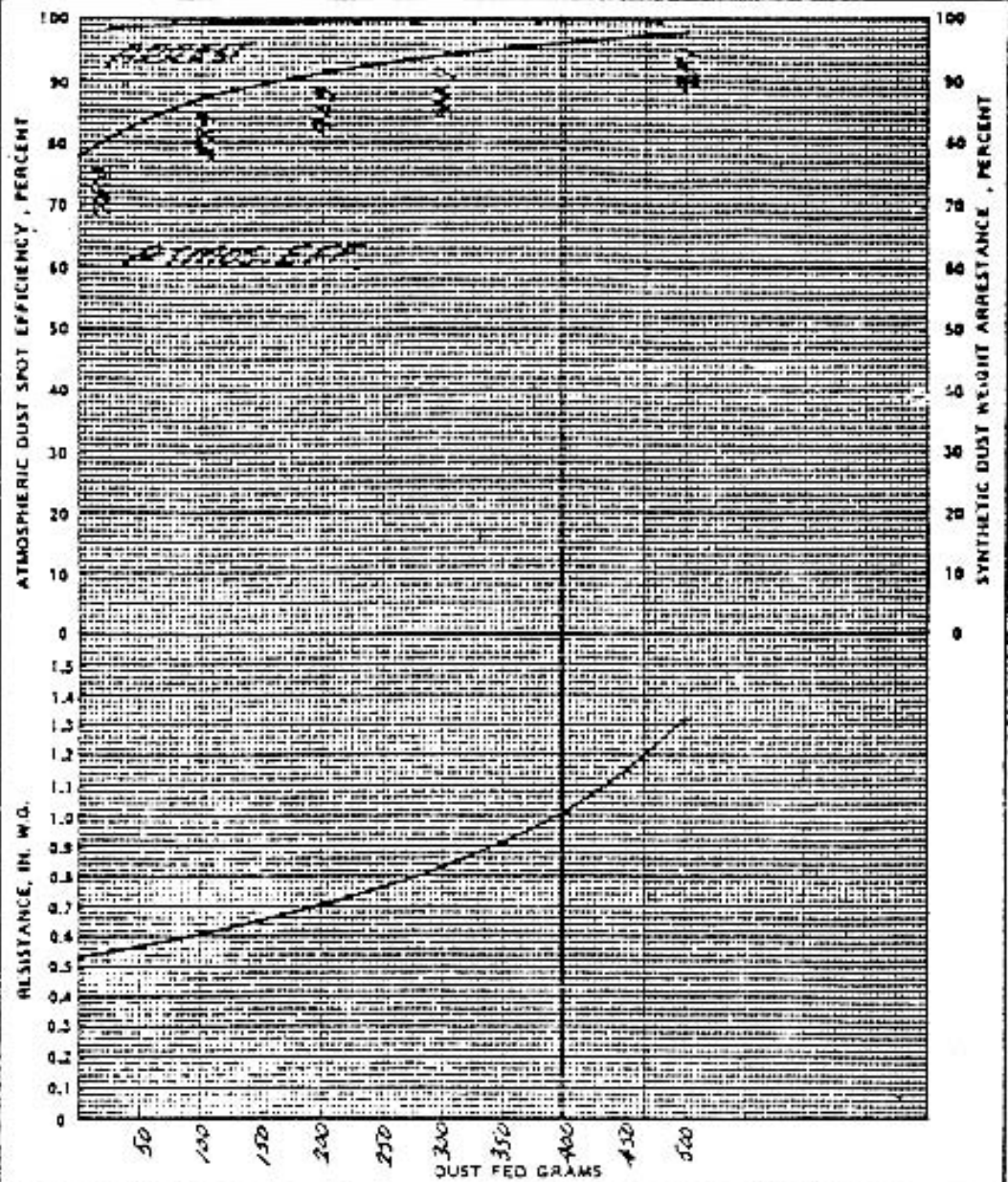


AIR FILTER TESTING LABORATORIES, INC.

ASHRAE STANDARD 52-76
AIR FILTER PERFORMANCE CURVES

NON-SUPPORTED
EXTENDED SURFACE
TYPE AIR FILTERS

REPORT NO. 3894
TEST NO. 1
SHEET NO. 1A



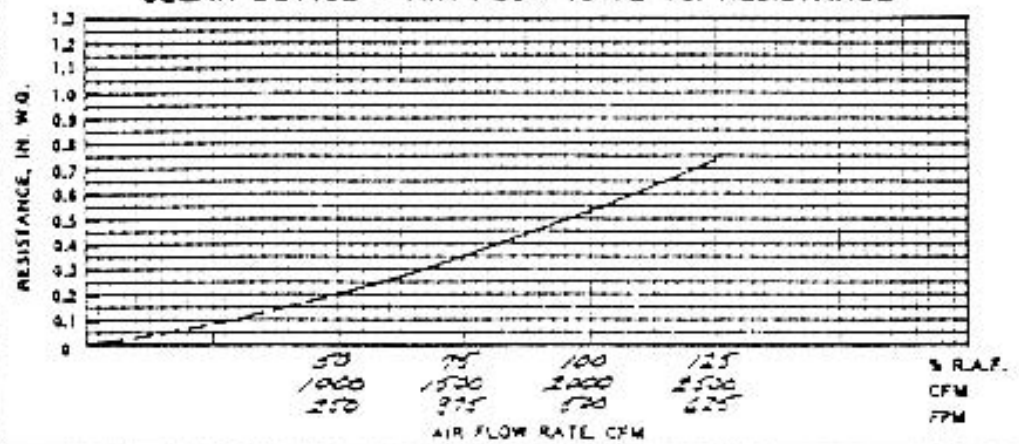
DATE
1-6-1986
TEST SUPERVISOR
J.P.S.
ENGINEERING

APPROVAL

David J. Murphy Jr.



CLEAN DEVICE - AIR FLOW RATE VS. RESISTANCE





AIR FILTER TESTING LABORATORIES, INC.

AIR FILTER PERFORMANCE REPORT ASHRAE STANDARD 52-76
NON-SUPPORTED EXTENDED SURFACE TYPE AIR FILTERS

DEVICE TESTED

TEST REQUESTED BY INDUSTRIES, INC. REPORT NO. 389-F
 MANUFACTURER INDUSTRIES, INC. TEST NO. 1A
 PRODUCT NAME VENTI-PAK SHEET NO. 1
 HOW LABORATORY PROCURED TEST SAMPLE PURCHASED FROM OPEN MARKET
 MODEL NO. 510-95-M DIMENSIONS 24IN. H " 24IN. W 25IN. D

RATED PERFORMANCE DATA FROM MANUFACTURERS CATALOG NO.	DATED
AIR FLOW CAPACITY	
INITIAL RESISTANCE	
FINAL RESISTANCE	
INITIAL ATMOSPHERIC DUST SPOT EFFICIENCY	
AVERAGE ATMOSPHERIC DUST SPOT EFFICIENCY	
AVERAGE SYNTHETIC DUST WEIGHT ARRESTANCE	
ASHRAE DUST HOLDING CAPACITY	

TEST RESULTS

TEST AIR FLOW RATE	<u>2000</u>	<u>CFM</u>
INITIAL RESISTANCE	<u>0.53</u>	<u>IN. W.G.</u>
FINAL RESISTANCE		<u>1.00</u> <u>IN. W.G.</u>
INITIAL ATMOSPHERIC DUST SPOT EFFICIENCY		<u>78.0</u> %
AVERAGE ATMOSPHERIC DUST SPOT EFFICIENCY		<u>90</u> %
AVERAGE SYNTHETIC DUST WEIGHT ARRESTANCE		<u>100</u> %
ASHRAE DUST HOLDING CAPACITY		<u>395</u> <u>GM.</u>

TEST SECTION DUCT SIZE 24.5IN. X 24.5IN. DUST FEEDING RATE 2.0GM/1000 CFM
 SEE BACK SIDE (PAGE 1A) FOR PERFORMANCE CURVES

PHYSICAL DESCRIPTION

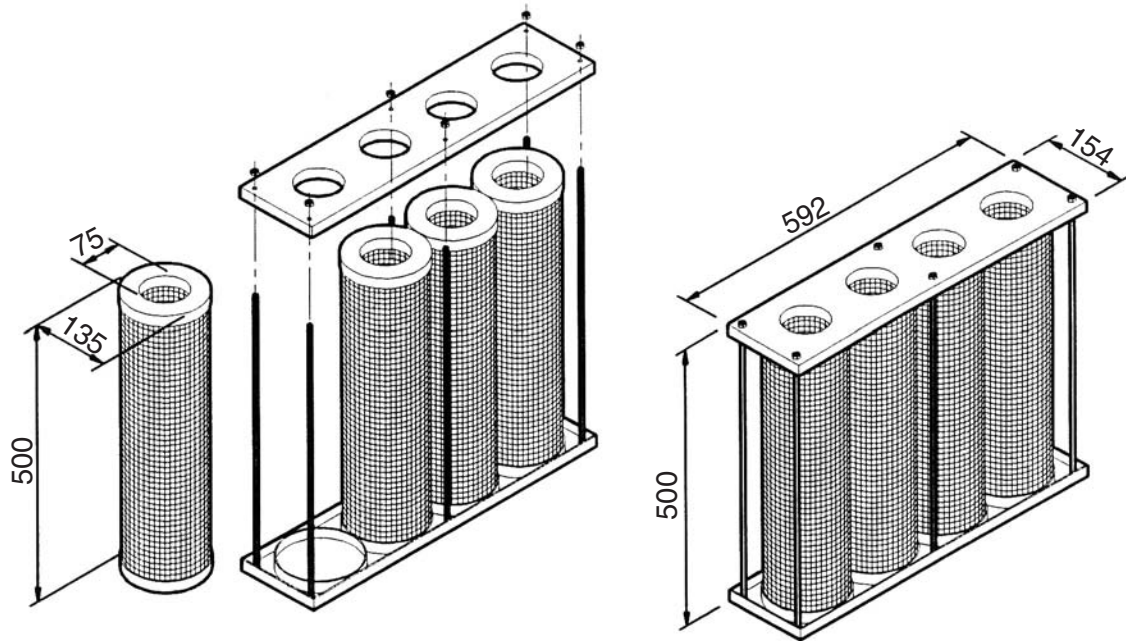
NUMBER OF PLEATS 10 PLEAT DIMENSIONS 25.0IN. L X 26.5IN. W
 MEDIA AREA - GROSS 92 FT² NET EFFECTIVE 89 FT²
 TYPE OF MEDIA GLASS FIBER THICKNESS 0.25IN. FIBER DIAMETER 0.2μ
 TYPE OF ADHESIVE ON MEDIA NONE AMOUNT NONE
 FACE PLATE CONSTRUCTION FORMED GALV. STL. CHANNEL FRAME
CONTAINS 10 HOOP PLEAT ASSEMBLIES. STIFFENERS ARE CRIMPED
 INLET OPEN AREA 2.98 FT² AS A % OF 4.0 FT² - 74% BETWEEN ADJACENT
 BACKER MATERIAL THICKNESS THIN NONWOVEN NYLON WEB POCKETS
 METHOD OF SECURING PLEATS - SIDES SEWN
 AIR ENTERING SIDE CRIMPED ASSEMBLY
 TYPE OF FASTENER USED SPAN STITCH
 NO. OF ROWS 8 NO. PER ROW 21
 SEALING METHOD USED THERMOPLASTIC



DATE 1-6-1986 TEST SUPERVISOR J.P.S. ENGINEERING APPROVAL David J. Murphy Jr.

• Activated carbon

The activated carbon is contained in micromesh plastic cylinders in packs of 4. The basic module, CARBO 22, contains 4 packs of 4 cartridges each (sixteen 2.5 kg cartridges for a total of 40 kg of activated carbon per module).



Technical characteristics of Activated carbon

Dimensions	2.4 - 4.8 mm
Apparent density	470/440 kg/m ³
Specific surface	1250 m ² /g (±50)
Humidity content	8%
Hardness index	95%
Iodine index	1150 mg/g
CCL ₄ absorption	65%
Ash content	4%

Rules for use and maintenance

• Applications

Filtration of welding fumes and of emissions containing gas that can be adsorbed by activated carbon; filtering of air for pressurised clean rooms; filtration for reintegration ducts (only CLEAN unit).

In any case, the CARBO unit must always be preceded by the CLEAN unit even if the air is not full of dust, so as to optimise the service life of the activated-carbon unit.

The filter allows recycling of the air back into the working environment when it is applied to welding fumes. It is, however, advisable to refer to local regulations set by the relevant

authorities in this regard, especially when high air flows are involved.

The CLEAN-CARBO unit can be applied as a post-filter on painting booths (solvent paints). In this case, recycling of the air back into the working environment is not allowed (universally accepted technical rule).

In the case of water booths, a regulated gate valve must be interposed between the booth fan and the filter, to prevent air loaded with drops of water drops in suspension from entering the filter. This would lead to early clogging of the bags and thus shorten the working life of the activated carbon.

•Sizing criteria

The flow rate values indicated in the table are to be considered as maximum values that cannot be exceeded. Hence, consider lower working flow rates, especially if the CARBO unit is to be used. As regards how to size CARBO, the following theoretical aspects must be borne in mind:

- Activated-carbon filters are suitable for intercepting all organic compounds and a large number of inorganic compounds.
- Activated carbon may have a vegetal origin (coconut) or a synthetic origin (petroleum)
- Activated carbon has a granular shape, with grain diameters ranging from 1 to 5 mm and grain lengths ranging from 3 to 6 mm.

•Choice of activated-carbon cell

When choosing a filter, first of all it is necessary to check whether and to what extent the activated carbon is able to adsorb the polluting substance.

If it is able, it is necessary to determine the amount of activated carbon required, according to the concentration of the pollutant, the air flow rate, and the concentration of pollutant allowed on expulsion.

Next, it is necessary to consider the number of hours of operation per day, the continuity or discontinuity of operation, and the temperature and relative humidity of the air.

The activation technique bestows a high degree of porosity on the activated carbon. This makes it possible to increase the inner surface (up to 1300 m²/g of activated carbon), and hence its retention power.

No precise rules exist on the behaviour and retention capacity of the activated carbon, but as a general rule it may be stated that:

- The greater the weight and molecular dimensions of a homogeneous lot, the higher the retention power
- Gases and vapours having high molecular weights and boiling points are generally well adsorbed.

In order to make it possible to establish the retention values, in the tables annexed a list is given of some of the more well-known substances along with the corresponding degrees

of adsorption.

As may be noted, for most solvents commonly contained in paints, the adsorption capacity is approximately 20% of the weight of the activated carbon (which means that each 40-kg cell is able to entrap approximately 8 kg of solvent).

Adsorption is a physical phenomenon whereby a solid substance (ADSORBENT) fixes another substance (ADSORBATE) on its surface.

The method of choice must take into account the effective adsorption capacity of the activated carbon for the various substances.

The table gives a list of various substances with the indications on the adsorption capacity of the activated carbon.

For each of these substances is indicated in what percentage 1 kg of activated carbon is saturated.

Acetaldehyde*	3	Isopropyl alcohol	1		
Amyl acetate	1	Methyl alcohol	2	Camphor	1
Butyl acetate	1	Propyl alcohol	1	Deteriorated paper	1
Cellulose acetate	1	n-valeraldehyde*	1	Tar	1
Methyl acetate	2	Amines*	3	Hydrogen cyanide	2
Isopropyl acetate	1	Ammonia*	3	Cyclohexane	1
Vinegar	1	Acetic anhydride	1	Cyclohexanol	1
Acetone	2	Carbon dioxide	3	Cyclohexanone	1
Acetic acid	1	Sulphur dioxide*	1	Cyclohexene	1
Carbonic acid	1	Aniline	1	Chloride	2
Formic acid	2	Antiseptic	1	Chlorobenzene	1
Lactic acid	1	Food flavourings	1	Chloroprene	1
Nitric acid*	2	Asphalt, fumes	1	Chloroform	1
Palmitic acid	1			Chloronitropropane	1
Propionic acid	1	Benzene	1	Chloropicrin	1
Sulphuric acid	1	Petrol	1	Butyl chloride	1
Uric acid	1	Nitrogen dioxide	1	Hydrogen chloride*	2
Valeric acid	1	Carbon disulphide	1	Chloromethane	2
Methyl acrylate	1	Bromine	1	Methylene chloride	1
Acrylonitrile	1	Hydrogen bromide	3	Propyl chloride	1
Acrolein*	2	Methyl bromide	2	Liquid fuels	1
Adhesives	1	Butadiene	2	Creosol	1
Amyl alcohol	1	Butane	3	Creosote	1
Butanol	1	Methyl ethyl ketone	1		
Ethanol	1	Butylene	3	Decane	1

Detergents	1	Diesel fumes	1	Sewage odours*	1
Dichlorobenzene	1	Cigarette smoke	1	Liquor odours	1
Dichlorodifluoromethane	1	Paint fumes	1	Butchery odours	2
Ethylene chloride	1			Hospital odours	1
Dichloroethylene	1	Corrosive gases*	2	Fish odours	1
Dichloronitroethane	1	Toxic gases*	1	Odours from putrefaction	1
Dichloropropane	1	Rubber	2	Ethylene oxide	3
Ethylene dichloride	1			Mesityl oxide	1
Diethyl ketone	1	Hydrogen	4	Ozone	1
N,N-dimethylaniline	1	Iodine	1		
Dimethyl sulphate	1	Hydrogen iodide*	2	Pentane	2
1,4-dioxane	1			Pentanone	1
Dipropyl ketone	1	Kerosene	1	Perchloroethylene	1
				Pesticides	1
Hexylene	2	Lubricants and oils	1	Pyridine	1
Ethane	4			Propane	3
Ether	2	Menthol	1	Propyl acetate	1
Amyl ether	1	Mercaptans	1	Propylene*	3
Butyl ether	1	Methane	4	Propyl mercaptan	1
Methyl ether	2	Methylcellulose	1	Propionaldehyde	2
Isopropyl ether	1	Methyl cyclohexane	1	Resins	1
Propyl ether	1	Methyl cyclohexanone	1		
Ethyl acetate	1	Methyl cyclohexanol	1	Hydrogen sulphide	2
Ethyl acrylate	1	Methyl ethyl ketone	1	sym-tetrachloroethane	1
Ethyl benzene	1	Chlorobenzene	1	Tetrachloroethylene	1
Ethyl bromide	1	Styrene monomer	1	Toluene	1
Ethyl chloride	2	Carbon monoxide	4	Turpentine	1
Ethylene*	4	Naphthalene	1	Trichloroethane	1
Ethyl formate	2	Nicotine	1	Trichloroethylene	1
Ethyl mercaptan	2	Nitrobenzenes	1	Sulphur trioxide*	2
Ethyl silicate	1	Nitroethane	1		
		Nitroglycerin	1	Urea	1
Phenol	1	Nitromethane	1		
Fertilizers	1	Nitropropane	1	Mercury vapours*	2
Hydrogen fluoride*	3	Nitrotoluene	1		
Formaldehyde	2	Nonane	1	Xylene	1
Methyl formate	2				
Phosgene	2	Body odours	1		
Fruit	1	Fuel odours	1		
Fumes	1	Cooking odours	1		

The adsorption of the activated carbon for the substances indicated is expressed via index numbers having the following meaning:

- 1 - High adsorption capacity: 1 kg of activated carbon adsorbs on average 20% of its own weight.
- 2 - Good adsorption capacity: 1 kg of activated carbon adsorbs 10% of its own weight.
- 3 - Poor adsorption capacity: the use of activated carbon can prove sufficient only in particular conditions.
- 4 - Negligible adsorption capacity: the activated carbon cannot be used with substances of this class.

* Indicates that the activated carbon must be impregnated with other substances; hence, the activated carbon supplied standard in our assemblies is not suitable.

MAINTENANCE

Maintenance intervals: these cannot be estimated beforehand in that they depend on:

- System capacity
- Concentration and type of pollutant
- Daily use of system

Maintenance should be carried out when the following occur:

- Considerable decrease in system capacity
- Warnings coming from special pressure switches mounted on the filter, which are appropriately set and are equipped with optical and acoustic alarms (see "Optionals").

Maintenance procedures

•Clean

The PRECLEAN and SMOCLEAN filters can be taken out once the side inspection door is removed (see position on general table) by loosening the fastening knobs.

The filters should first be shaken manually and then blown clean with compressed air. The PRECLEAN filter is also washable; instead, the SMOCLEAN filter cannot be regenerated.

The filters are to be replaced when the cleaning operation is not able to restore the original level of permeability and efficiency.

•Carbo

The saturation level of the activated carbon cannot be detected by instruments like pressure switches, but only by sophisticated and costly analysers mounted on the outlet, which are able to trace certain given substances.

In practice, for systems of small or modest dimensions, proceed as follows:

- Assess the duration of the activated carbon on the basis of a theoretical calculation (refer to the tables, values of concentration at intake, if these are available, and duration of daily operation of the system).

In this way, it is possible to plan replacements.

- Apart from the fact that the need for replacement of the activated carbon can obviously be estimated from a higher level of smell in the emissions, another method consists in weighing the activated-carbon cartridges, considering them to be exhausted when the increase in weight is around the percentages previously indicated.

Indicative frequency of inspections for application on welding fumes:

PRECLEAN:	every two weeks
SMOCLEAN:	once a month; replacement every six months
CARBOCLEAN:	weigh the cartridges once a month

• Disposal of filters

The filter, including the activated carbon, must be disposed of as special refuse by specialised firms.

• Toxic and harmful substances

To change the filters, the filtering diaphragms must be taken out. Consequently, it is necessary to handle filters containing a lot of dust. Handle them with care and put them immediately into sealed containers.

Optionals and accessories

• Differential pressure detector

To keep the head loss of the CORAL **CLEAN** filter under control, the filter can be equipped with:

- 1) Differential pressure gauge
- 2) Differential pressure switch

1) Differential pressure gauge

The pressure gauge is connected upstream and downstream of the filter. This makes it possible to identify the conditions of clogging (Fig. 1).

2) Differential pressure switch

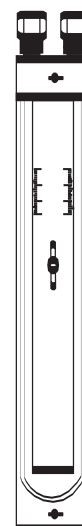


Fig. 1

Either of two versions can be supplied:

- 1) Simplified version with a switching function when a set pressure-drop value is reached
- 2) Version that offers the possibility of activating optical and acoustic alarms and remote switches, which interfaces with control units.

The work range of the pressure switch is between 0 and 150 mm of H₂O (Fig. 2).

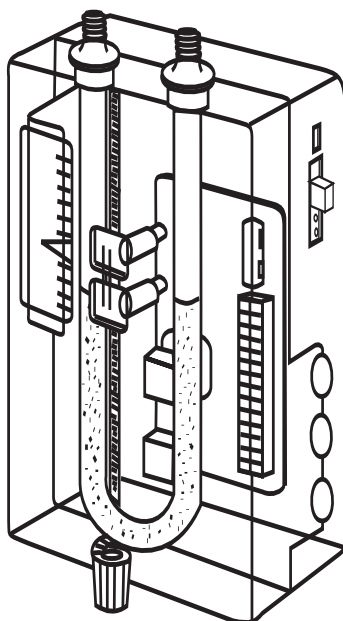


Fig. 2

• **Technical data**

Pressure range:	0 -1 500 Pa
Supply voltage and frequency:	220/240 Vac - 50 Hz