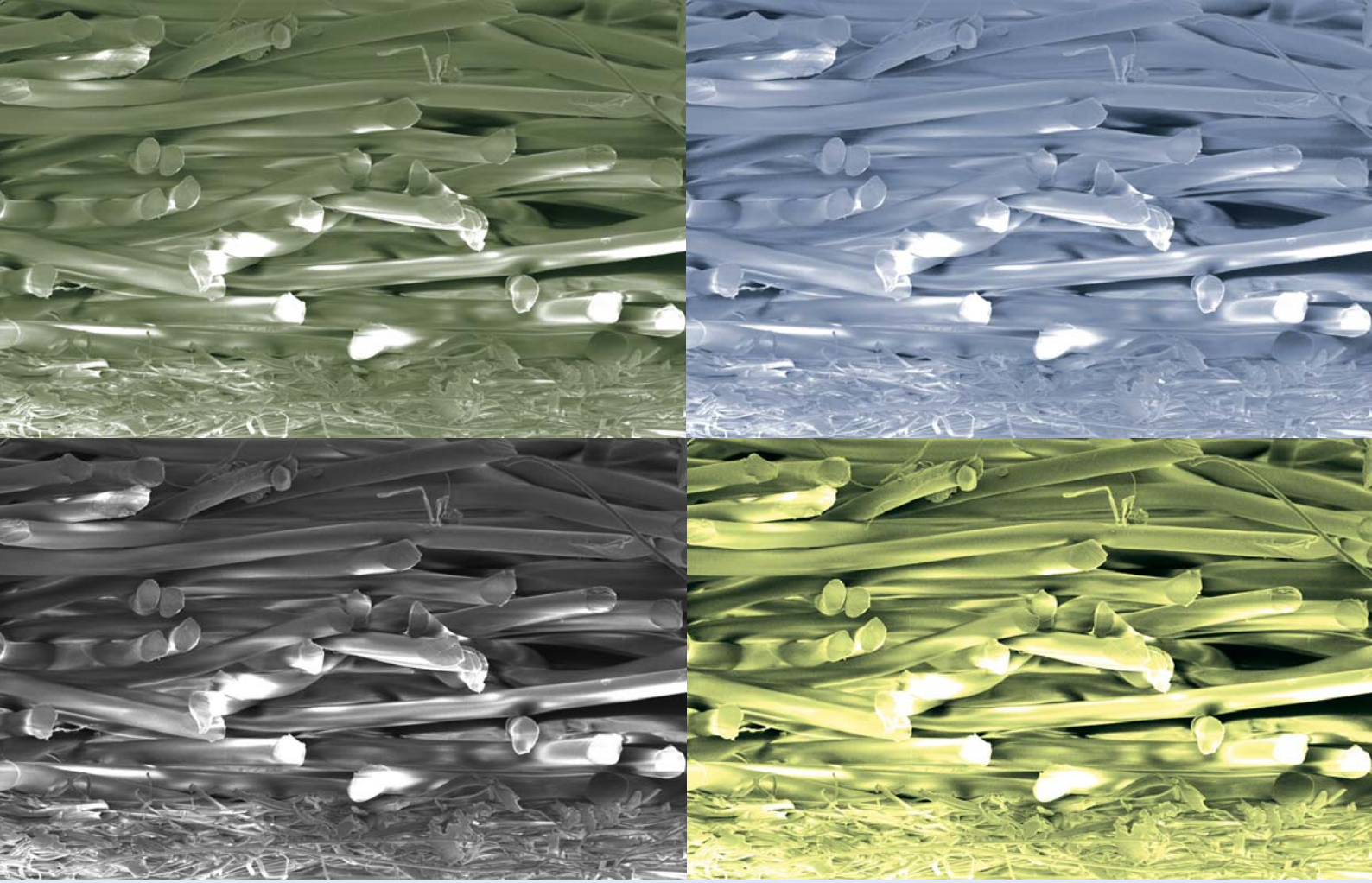


POCKET-FILTER

Essentials

Kalthoff®

Your partner for filter technology

APPLICATION INDOOR AIR HYGIENE

Bag-type filters are widespread products for the filtration of outdoor air in ventilation and air-conditioning systems. They are required in order to remove atmospheric components of the ambient air. As a result, they achieve a hygienically clean operating state of the ventilating and air-conditioning systems and the rooms supplied with air.

Ambient air includes a widely-distributed spectrum of particles (liquid and solid), as well as gaseous components with different chemical, physical and biological properties. A differentiation is made here between particles of natural origin and particles of civilizing (anthropological) origin. Here it depends on the extent to which toxicity can exist for humans.

A further feature is the fineness of the particles which extends from the nano-range (approx. 0.01 µm) to the millimetre range (1000 µm). It has been identified that through the fineness alone, particularly in case of the ultra-fine nano-particles, a harmful effect on human health exists. In ventilating and air-conditioning systems the effect is especially critical, since large fresh air volumes are moved for the supply of persons, and harmful additions are transported directly to the person. In addition, deposited particles in system aggregates, in combination with high air humidity levels – called plant fouling – lead to hygienic impairment through biological growth, propagation and dying.

Since 1989 the VDI 6022 "Hygiene requirements for ventilation and air-conditioning systems and -units" has existed, which regulates the employment, requirements, properties and change cycles of air filters in ventilating and air-conditioning systems.

In addition, EN 13779 has existed since 2008, which stipulates the validity of these regulations in the EU region. As well as this, air qualities of outdoor air (ODA) and indoor air (IDA) are first defined as a function of which certain filter qualities are stipulated (see table 1).

Recommended filter classes	Indoor Air Quality			
Outdoor Air Quality	IDA 1 (high)	IDA 2 (medium)	IDA 3 (moderate)	IDA 4 (low)
ODA 1 (pure air)	F9	F8	F7	M5
ODA 2 (dust + gases)	F7+F9	M5+F8	M5+F7	M5+M6
ODA 3 (very high conc.)	F7+GAF+F9	F7+GAF+F9	M5+F7	M5+M6

Table 1: Minimum filter classes

THE FILTER TEST STANDARD EN 779

The filter test standard EN 779 exists in order to enable the evaluation of air filters for ventilating and air-conditioning systems in their employment in the real filtering system and to enable the qualifying of filter classes. In this case it involves a laboratory testing method which subjects air filters to test aerosols in order to determine the particle separation.

Filter Class acc. to EN 779	Average arrestance A_m (synthetic dust)	Average efficiency E_m (DEHS-Aerosol @0,4 µm)	Minimun efficiency E_{min} (DEHS-Aerosol @0,4 µm) after IPA treatment
G1	$A_m < 65\%$	–	–
G2	$65\% \le A_m < 80\%$	–	–
G3	$80\% \le A_m < 90\%$	–	–
G4	$90\% \le A_m$	–	–
M5	–	$40\% \le E_m < 60\%$	–
M6	–	$60\% \le E_m < 80\%$	–
F7	–	$80\% \le E_m < 90\%$	$35\% \le E_{min}$
F8	–	$90\% \le E_m < 95\%$	$55\% \le E_{min}$
F9	–	$95\% \le E_m$	$70\% \le E_{min}$

Table 2: Filter classes according to EN 779:2012

In addition, a dust application occurs (akin to artificial ageing) in order to determine the influence on the particle deposition, as well as the pressure drop of an air filter subject to dust deposition.

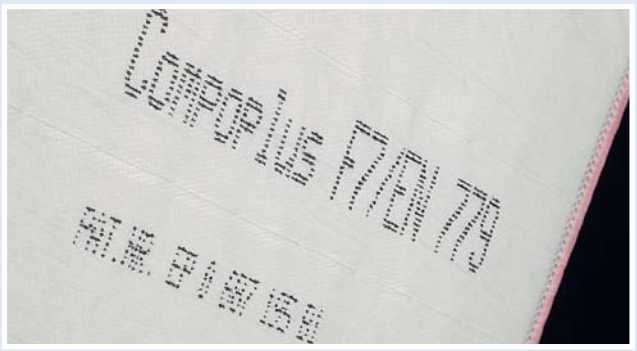
On the basis of the determined arrestance and efficiency values the EN 779:2012 defines the associated filter classes.

In the coarse dust filter classes G1 - G4, the average gravimetric arrestance is referred to which results from the step-by-step dust charging with ASHRAE standard filter-testing dust up to a pressure drop of 250 Pa by means of weighing.

In the case of the media filters M5 and M6 (designations new since 2012), the test filter is tested regarding its efficiency using a 0.4 µm fine oil aerosol (DEHS). The average efficiency results in turn through the step-by-step dust charging with ASHRAE standard filter-testing dust up to a pressure drop of 450 Pa with averaging of the efficiency values obtained.

Kalthoff EN779 filter test rig

Since 2012 the fine dust filters F7 to F9 have been evaluated not only according to the method for the M-filters according to average efficiencies but also according to their so-called minimum efficiency levels.



Kalthoff filter pockets with label- and colour coding

These minimum efficiency levels are obtained with the aid of the so-called IPA-test, where a filter media sample is immersed in liquid isopropanol (IPA) and then dried.

This washing process leads to an outflow of freely-movable electrostatic charges from the fibre surface and should simulate the filtration characteristics which can be expected under extremely critical real application conditions.

FILTER MEDIA MADE OF MICROGLASS FIBRES

If the required properties of deep-bed filter media are considered, nonwoven of microglass fibres technically represent the almost ideal material and have therefore been employed since the 1970's.

However, scientists determined in the 1990's that under certain conditions microglass fibres have a carcinogenic effect on living organisms. This is due to the properties of microfine brittle fibres which break easily and can be verified as shedding from the air filter into the supply air. Via the respiratory organs they reach the living organism and similar to spear tips they can remain in the body cells for a very long time.

Harmful

A danger of tumours arising has been verified in animal testing, so that microglass fibres are mostly classified according to the Deutsche Gefahrstoffverordnung (direction on hazardous materials) TRGS 905 "Carcinogenic materials" into category 3. Category 3 includes the carcinogenic substances with an extended half-life, i.e. substances in the human organism dissolving within a predefined period to 50% of their original number. The actual TRGS 905 (2010) does not give a definite statement concerning the classification of microglass fibres with a short half-life less than 40 days. However, it is assumed that the carcinogenic potential versus fibres with extended in-vivo stability is lower.

HEPA glass fibre media

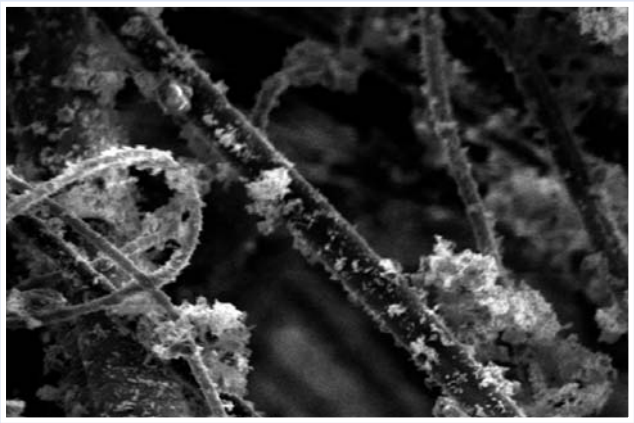
It is the company philosophy of Kalthoff to generally avoid the employment of deep-bed filters made of microglass fibres, since we see the basic concept of room air hygiene being compromised by the utilization of potentially hazardous substances.

Fibre structure of microglass media

Kalthoff composite media are therefore generally fully-synthetic and free of microglass fibres and also of additions. In this way we make our contribution to responsibility in the product and product safety areas, according to state-of-the-art knowledge and technology.

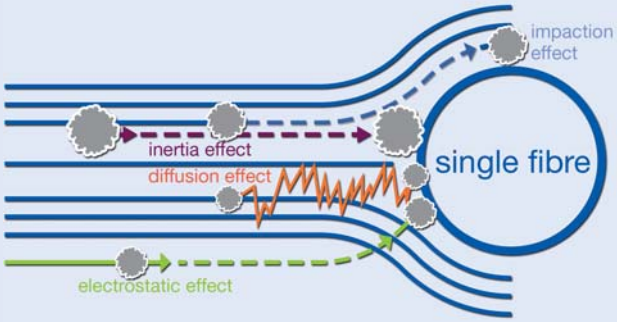
THE PRINCIPLE OF DEPTH FILTRATION

Pocket filters basically work according to the deep-bed filter principle. Particles are deposited in the depth of the filter media on air-circulated fibres according to impact probability. For this reason deep-bed filter media must always be very porous to enable the admission of fine and coarse particles into the depth of the media. Furthermore, a more voluminous open-pore structure facilitates the deposition of maximum quantities of deposited particles without the resistance due to the air flow of the deep-bed filter increasing considerably. In this sense a porous, voluminous, fibre structure is important at all times in order to generate a low aerodynamic resistance (pressure drop).



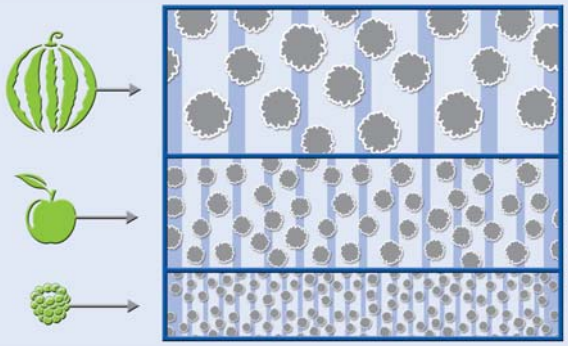
Fibre structure with separated particles

A further important feature of deep-bed filter media is the fibre diameter. With decreasing fibre diameter the probability of the separation of particles is increased considerably. If the finest particles of 0.4 µm should be separated out to a large degree, for purely physical reasons fibre diameters must be smaller than 3 µm, where the finer they are the more effective they are.



Separating mechanism at single fibre

A third valuable property of deep-bed filter media is represented by its electrostatic charge, which also mostly favours the separation of fine dust. Its disadvantage is its effect whereby fibre electrostatic charging is almost always unstable under the influence of humidity. In this case fibre charges continuously flow off and the filter media loses a part of its effect little by little. Pocket filters, which are mostly employed in the ventilating and air-conditioning system for several months, become increasingly more inefficient and can possibly no longer satisfy the requirements placed on their filter class.



Progressive depth filtration by means of patented Kalthoff Compoplus® filter media

In summary, the optimal pocket filter media has porous, voluminous filter layers of the most microfine fibres possible, which favourably may carry additional electrostatic surface charges. But even without these charges reliable separation values can be guaranteed.

To manufacture such filter media exactly is technically very demanding, however, not impossible as the success of Kalthoff composite nonwoven has proved over many years. However, quality and performance have their price, knowing well that it is always possible to structure a product a little more cheaply and with less performance.

Since 1993 Kalthoff has processed composite nonwoven in its Multifold fine dust pocket filters made of electrically-uncharged, organic, synthetic fibres in a patented structure (EP 0 687 195 B1). We have developed these products further under the brand name Compoplus® according to the requirements of EN 779:2012.

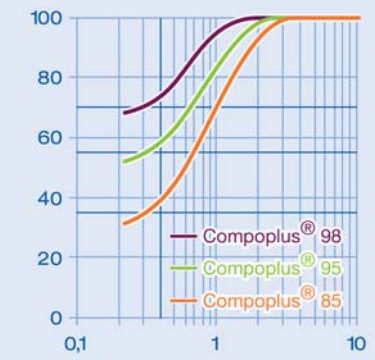
COMPOPLUS® FOR PERFECT FILTRATION

Compoplus® filter media separate out the finest dusts far better and furthermore they have very favourable pressure drops.

The Compoplus® filter layer structure is progressive. Both the fibre distances as well as the fibre diameters decrease in the direction of the clean-air side. The coarse particles are first held back on the dust-air side, then with increasing depth of filter layer the fine particles are also held back more and more until the necessary air purity is achieved. The entire filter media is used very economically by this gradual deposition.

Compoplus® pocket filter welding unit

For the highly effective filter layers, we have developed special ultra-fine meltblown nonwovens. These indicate a significantly increased separation capacity with respect to the finest dusts. This has been achieved by lowering the mean fibre diameter from previously approx. 2.5 µm to below 1 µm. Due to this measure the effective fibre surface will increase by approx. 150% in future and the efficiencies with respect to 0.4 µm particles will increase considerably. Furthermore, volume and uniformity of the nonwoven were improved, so that more room is available for the dust storage.



Minimum efficiencies of Compoplus® filter media according to EN779:2012

PRODUCT SAFETY

As well as filtration performance and cost-effectiveness, the criteria of product safety also play an important role

- Compoplus® performs mechanically and the separation is also stable with increased temperatures and air humidity levels.
- Compoplus® filter fibres are soft and elastic. They do not break and are not blown from the filter surface.
- Compoplus® filter media are water-repellent. The danger of moisture deposition is conceivably small.
- Compoplus® filter media consist of pure, chemically-inert, organic material. They are free of binding agents and they are pure white. A metabolism through microorganisms in accordance with VDI 6022 is not possible, verified by ILT Hygiene Certification.
- Compoplus® filter media are normally flammable and satisfy the fire class "E" in accordance with DIN EN 13501, verified by Currenta in-flammability tests.

MULTIFOLD — PROVED AND MULTIFACETED

Multifold pocket filters are offered in 7 different filter classes (G3 to F9), where different filter media and converting procedures are employed.

For the Multifold coarse dust filters T 25 and T 35 (filter class G3 and G4) and media filter TC 60 (filter class M5), we process thermally-bonded, synthetic microfibres with progressive layer structure on modern stitching systems with welding technologies.

Compoplus® pocket filter stitching unit

In case of the Multifold media filters TCC 65 (filter class M6) multi-layer, patented Kalthoff composite nonwoven (Pat. No. EP 0687 195 B1) is used, in case of the Multifold fine dust filters TCC 85, TCC 95 and TCC 98 (filter classes F7, F8 and F9), patented COMPOPLUS® nonwoven is used.

The industrial versions TC 65, TC 85, TC 95 and TC 98 (filter classes M6, F7, F8 and F9) are provided with particularly high dust-storage capabilities and lifetimes by the employment of a special voluminous pre-filter material.

All processing technologies guarantee maximum possible quality, security and productivity.

In addition, Multifold pocket filters are offered in different types, which are basically differentiated in the frame construction. Numerous special versions are part of everyday filter use.

MULTIFOLD TYPES TQ/TCCQ

- Galvanized sheet steel frame
- Welded filter pack fixed jointed on metal bars with the frame
- M/F filters with thread-shaped spacers
- Spacers and outer contours running conical over the bag length

TYPES TCKU/TCCKU AND TCKUS/TCCKUS

- Black plastic frame of recycled polymer (TCKUS/TCCKUS)
- Blue reinforced plastic frame of pure polymer (TCKU/TCCKU)
- Welded filter pack fixed jointed on wood or plastic bars with the frame
- M/F filters with thread-shaped spacers
- Spacers and outer contours running conical over the bag length

MULTIFOLD TYPE TCC

- Galvanized, reinforced sheet steel frame, with flow profiles
- Separately inserted single pockets jointed with interior frames, dismountable construction
- M/F filter with thread-shaped spacers
- Spacers and outer contours running conical over the bag length

MULTIFOLD TYPE TC

- Galvanized, reinforced sheet steel frame, with flow profiles
- Separately inserted single pockets jointed with interior frames, dismountable construction
- M/F filter with thread-shaped spacers
- Spacers and outer contours running conical over the bag length
- Filter media in rugged industrial design with particularly high dust storage capacity

QUALITY

Compliance with the high performance level is checked regularly during individual production stages and in the laboratory. As a result, we guarantee our customers the durable, high product quality of all Kalthoff air filters. In addition, there are test certificates from independent institutes available, which additionally serve to verify the certificates of compliance.

SERVICE

Our extensive filter stock enables a short-term delivery service for many usual standard products, which is optimally supported by our own vehicles.

In addition, we fulfil further demands on valuable logistics, such as e.g. customer- and/or object-related labelling and packaging, just in time delivery.

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