

# COMPACT-FILTER

Essentials



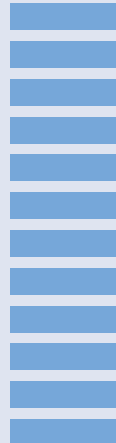
Your partner for filtration technology

## AMBIENT AIR AREA OF APPLICATION

Compact filters are designed for the sophisticated fine dust filtration of supply air, which consists mainly of ambient air.

Ambient air always includes particulate and molecular additions, such as solid or liquid aerosols, microorganisms and gases. Atmospheric aerosol components are classified into the following sizes:

|                           |  |
|---------------------------|--|
| Coarse dust particles:    | Diameter $> 2,5 \mu\text{m}$                 |
| Fine dust particles:      | Diameter $0,1 \mu\text{m} - 2,5 \mu\text{m}$ |
| Suspended dust particles: | Diameter $< 0,1 \mu\text{m}$                 |
| Gases:                    | Molecules / Atoms                            |



Coarse dust particles represent the predominant content ( $> 95\%$ ) of the volume and the mass of atmospheric aerosols. With reference to the number of overall particles, they are of subordinate importance ( $< 2\%$ ). They sediment near the point of origin due to their relatively high weight. Many coarse dust particles are substances of natural origin, where the human filter system in the respiratory tract has evolved to deal with them, and it does so effectively.

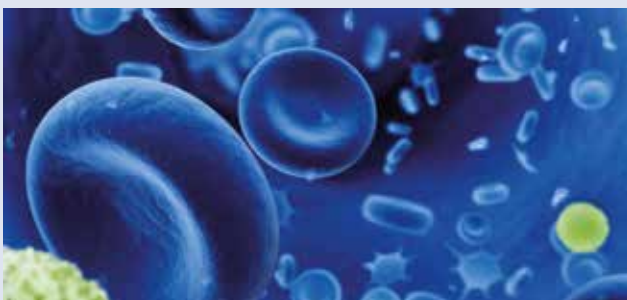
Fine dust and suspended dust particles represent a volume and mass fraction of  $< 5\%$  of the entire atmospheric particle collective. Their particle number fraction, on the other hand, is more than 98% of all atmospheric particles. Due to their small dimensions, they are often transported over wide areas by natural air movement. The contamination of the ambient air with this particle type is therefore strongly dependent on location (urban, maritime or rural zones).

The air exchange, the geographic elevation, as well as the respective season, represent further influences.

## DANGERS THROUGH FINE DUST POLLUTION

In urban population centers, fine dust and suspended dust particles occur which are mainly of civilization related (anthropological) origin. They come mostly from combustion processes (e.g. vehicle traffic, heating plants), as well as industrial processes (e.g. production, power generation).

Such particles tend to agglomeration and form large, jagged surfaces with high adsorption potential for gases, liquids and biogenic substances (e.g. microorganisms).



As a result of the addition processes of pollutants (e.g. heavy metals, hydrocarbons, pesticides, plasticizer, flame-retardants, bacteria, viruses), the hazard potential for persons of these already toxic fine dust and suspended dust particles is increased by a multiple.

Furthermore, toxic ultrafine dusts penetrate into the organism almost unobstructed, since the human defense has not been able to develop any effective protective barrier against this. Ultrafine dust in the respiration organs can lead to respiratory tract infections, such as bronchitis, asthma or carcinomas. Suspended dust particles smaller than 0.1 µm can advance far more deeply into the human organism and pass the alveolus and cellular membrane. In the bloodstream they are frequently triggers for cardiovascular illnesses.

The causes and effects described have been documented by the World Health Organization (WHO) in its global air quality guidelines and substantiated by numerous studies. Based on this, the WHO recommends air quality values that are intended to ensure air that is safe for human health. These values serve as an important guideline for the design of filters.

*Table 1: An extract of recommended air quality guideline (AQG) levels acc. to WHO*

| Pollutant                        | Averaging time | AQG level            |
|----------------------------------|----------------|----------------------|
| Particles PM <sub>2,5</sub>      | annual         | 5 µg/m <sup>3</sup>  |
| Particles PM <sub>10</sub>       | annual         | 15 µg/m <sup>3</sup> |
| Ozone O <sub>3</sub>             | Peak season*   | 60 µg/m <sup>3</sup> |
| Nitrogen Dioxide NO <sub>2</sub> | annual         | 10 µg/m <sup>3</sup> |
| Sulfur Dioxide SO <sub>2</sub>   | 24-hour        | 40 µg/m <sup>3</sup> |

*\*Average of the six consecutive months of the year with the highest O<sub>3</sub> concentration.*

## FINE DUST FILTRATION WITH COMPACT-FILTERS

Persons in urban population centers spend only approx. three percent of their time daily in the open air. As a result of technical progress and global climate change, the room air is processed in many cases through ventilation and air conditioning systems. The increased air changes associated with that, in combination with emissions through non-suitable air filters, lead to an increase of the contamination in the rooms supplied.

As a result of modern filter systems coordinated with each other, the room air can be protected against

contamination through fine dust with its described hazardous potential.

Compact filters indicate a special, design-related performance capability with respect to the deposit of ultrafine particles. The significant feature of compact filters is the structure of pleated microfiber nonwoven, which is stabilized through an applied hot-melt spacer. The filter packets formed in this way are sealed into a V-shaped frame system, which has a surrounding 25 mm flange profile section.

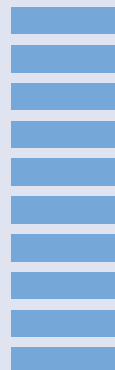
*Table 2: Compact filter series by application area*

| Pollutant                                     | Recommended Compact Filter                    | Classification Standard | Filter Classes   |
|---|---|-------------------------|--|
| Coarse dust particles: Diameter > 2,5 µm      | RELIM VRK                                     | DIN EN ISO 16890-1      | ISO ePM10 50%  |
| Fine dust particles: Diameter 0,1 µm - 2,5 µm | RELIM VRK<br>RELIM VRK ETA                    | DIN EN ISO 16890-1      | ISO ePM1 55-80%<br>ISO ePM1 65-85%   |
| Suspended dust particles: Diameter < 0,1 µm   | FLUWID VSK R<br>FLUWID VSK S                  | DIN EN 1822-1           | E11<br>H13   |
| Gases   | Activated Carbon Filter -<br>COMPOSORB VAK 85 | ISO 10121-3             | NO <sub>2</sub> - LD 85<br>O <sub>3</sub> - HD 85<br>SO <sub>2</sub> - LD 75<br>Toluol - MD 90 |





As a result of the pleating, a comparatively large filter area with high stability results, which opens up special fields of application to compact filters. In particular, this construction design is used where high nominal airflow rates, large stability and high separation capacity are involved, for example in gas turbines, off-shore plants or for the protection of high-quality applications in cleanroom technology.



The installation orientation of compact filters is as desired, and the flow direction can be selected according to the requirement. Thus the maintenance side is freely definable. As a result of the surrounding flange frame, these easily-inserted filters can be installed simply in standard installation frame systems.

At half the depth of conventional pocket filters, compact filters provide more than twice the filter surface area. A high separation capacity with low differential pressure level results from this. As a result of the stable, inherently-stiff construction design, they are particularly suitable for modern airflow variable system designs. The release of fiber fractions of the filter media (shedding effect) is almost excluded with compact filters.

In combination with suitable upstream filters, they can also generate a considerable energy-saving potential with respect to traditional filter systems.

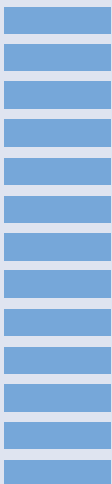


## KALTHOFF COMPACT-FILTER SERIES

The KALTHOFF compact filter series are characterized in particular by the capability to offer solutions for the entire range of requirements. Whether the primary issues are the highest mechanical rigidity, very high air capacity or a compact filter construction design which is responsive to economic considerations, these series offer a well thought out solution for all demands. The concept of all series is based on the interaction of a uniform high efficiency with moderate pressure loss rise. This is achieved through the processing of high-quality filter media on modern manufacturing plants,

with manufacturing methodology which is media-specifically optimized. The KALTHOFF INTERMELT process provides for a maximum of free filter area in this case, because it generates optimal pleating geometry and guarantees open structures with high levels of stability. Innovative filters, which are characterized by high cost-effectiveness and comprehensive operational safety, result from this technology. Kalthoff compact filters are setting new standards here.

## SAFETY




The employment of environmentally-protective and sustainable production procedures over the entire added-value chain, as well as the selection of safe and tested materials, are an important pillar of our company philosophy. The sanitary harmlessness of the products enjoys a high place value. Therefore RELIM composite micro spunbonds consist of pure, chemically-inert, organic fibrous materials. The fibers are bonded thermally, moisture-resistant in every form and free from binding agents. Neither CFC's nor other chlorinated compounds are employed, and the use of bleaching and coloring agents is dispensed with. Their employment in highly-

sensitive areas of the pharmaceutical or food industry is possible without any restrictions.

The micro-glass-fiber papers used in the FLUWID VSK series also fulfill the certification criteria for employment in the pharmaceutical and medical-technical sectors.

According to the regulations of EN 15423 (fire protection of ventilating systems), air filters must be authorized according to EN 13501. Kalthoff compact filters satisfy this requirement and correspond to class E (normally flammable).

## HYGIENE



In order to adapt to the requirements for a special hygienic standard, only non-hazardous polymers are used in our RELIM VRK series. Long, flexible polymer chains create a strong bond that prevents individual fibers from breaking and being released. Pollutants are permanently bound in the medium, which does not provide a breeding ground for

microorganisms such as bacteria or viruses. This is particularly important in areas with the highest demands on hygiene, such as the packaging and filling of foodstuffs, in medical technology, in the pharmaceuticals industry or in hospitals.



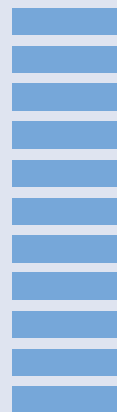
## RELIM VRK BLUE LINE



The VRK Blue Line industrial series is designed for the highest demands on the mechanical strength and stability, with high efficiency (e.g. in gas turbines).

The filter packs are completely sealed in the plastic casing, therefore the filter can be extremely high mechanically charged. The burst pressure drop of this construction is far above 3000 Pa.

As a result of the employment of the fully-synthetic Kalthoff RELIM filter media, the filter is immune without limit to the action of moisture, and is therefore usable in applications with permanently high humidity.

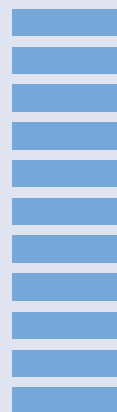


## RELIM VRK BLACK LINE



With the VRK Black Line series, the main features of the Blue Line version, such as RELIM filter media, 2-component sealant and plastic casing, are realized.

The sealant compounds and technology are adapted to employment in HVAC conditions.

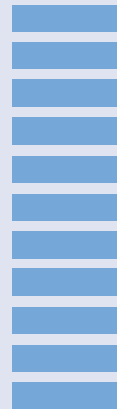


## RELIM VRK ETA



The Kalthoff RELIM VRK ETA compact filter is the product with the highest technical performance in the fine dust range. In addition to the high filter efficiency of the RELIM VRK series, the RELIM VRK ETA has a significantly lower pressure difference. This is achieved by a further developed filter medium and an optimized design of the compact filter.

The filter reduces the energy consumption of the system and meets high demands in terms of sustainability and operating costs. The mechanical stability and safety of the product remain fully intact.



## FLUWID VSK

The FLUWID VSK series is characterized by a close-pleated, one-layer, homogenously structured micro-glass-fiber paper, and is adjusted to high airflow rates by means of the Kalthoff INTERMELT process. The optimized pleat packs guarantee low pressure drop and constantly high filter efficiency. The pleat packs are completely sealed into the plastic frame.

The FLUWID VSK version targets applications in which very large airflow rates are processed, and the filter is exposed to somewhat low levels of mechanical charging and moisture influence.



## FLUWID VSK R AND FLUWID VSK S

The FLUWID VSK R and FLUWID VSK S series meet particularly high filtration efficiency requirements. The filtration performance of the filters is significantly higher compared to fine dust filters. The FLUWID VSK R is classified in filter class E11 and the FLUWID VSK S in class H13 in accordance with DIN EN 1822-1.

The high-quality filter media must be protected against mechanical loads and are designed for use in multi-stage systems. The plastic frame with flange enables use in standard mounting frames for fine dust filters. The weight is significantly reduced compared to HEPA filters with metal or wooden frames.



## ACTIVATED CARBON FILTER COMPOSORB VAK 85

The hybrid filter medium of the AK filter COMPOSORB VAK 85 combines the efficient separation of particles and harmful gases. Open-pored activated carbon is firmly integrated into the filter media and separates molecular pollutants, while a fine dust medium subsequently separates solid and liquid particles from the air flow.

The filter, which is sealed on all sides, was developed for commercially available air conditioning systems and is designed for a correspondingly high nominal air flow rate. The use of pre-filters is recommended to ensure that the activated carbon functions properly and to increase its service life.

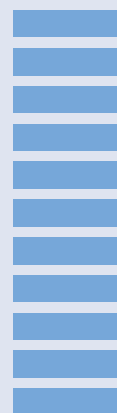




## QUALITY

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 consistently, high product quality of all Kalthoff air filters.

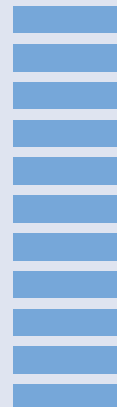


## OUR PRODUCTS - COMPACT, EFFICIENT

The synthetic filter media of our RELIM VRK series are based on the composite nonwoven preferred by Kalthoff. The synthetic micro-spunbond of electrically-uncharged, organic synthetic fibers has been adapted especially to the filtration of fine dusts.



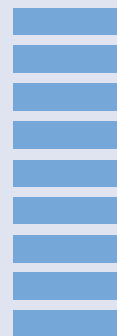
The filter media is extremely robust and moisture proof, and has a large dust-holding capacity with low initial pressure drop. Kalthoff composite filter media therefore have a high uniform efficiency with moderate pressure drop rise. In combination with modern technology, considerable operating cost reductions can be realized.



## 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 fulfill further demands on valuable logistics, such as e.g. customer and/or object-related labeling and packaging with just in time delivery.



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