



MANN+HUMMEL  
Filter Cube



# The Challenge

## Polluted Air in Cities

Worldwide, many cities struggle with air pollution, as traffic and industries produce high concentrations of fine dust and nitrogen dioxide. In Germany and other countries, the exceedances of limit values - in particular that of nitrogen dioxide - are a constant source of discussion. Even driving bans are being put under consideration. In high traffic areas or places with large emissions and low air exchange, the exposure is especially high and the effect on human health is harmful.

This applies, for example, to busy streets and subway stations. People with respiratory illnesses, the elderly or children should not be exposed to high concentrations of particulate matter or nitrogen dioxide. Surrounding yourself with clean air is a quality of life necessity. In places where people are studying, working, shopping or spending their free time, it is important to be surrounded by clean air.



## Inhalable Dust Particles

### **Inhalable dust particles**

Particle diameter  $> 10 \mu\text{m}$   
Penetrate the nasal cavities and trachea

### **Fine dust $\text{PM}_{10}$**

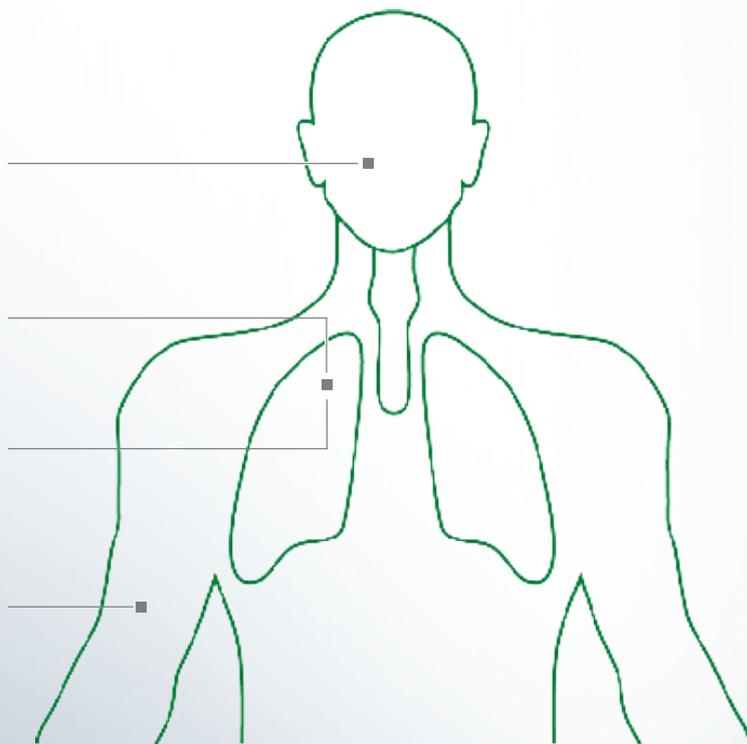
Particle diameter  $\leq 10 \mu\text{m}$   
Penetrate bronchia

### **Fine dust $\text{PM}_{2.5}$**

Particle diameter  $\leq 2,5 \mu\text{m}$   
Penetrates into the deepest regions  
of the lungs

### **Fine dust $\text{PM}_1$**

Particle diameter  $\leq 1 \mu\text{m}$   
Penetrate bloodstream



# The Solution

## The Filter Cube Provides Clean Air



### EFFICIENT AIR FILTRATION

From the drawn-in air, MANN+HUMMEL's filter cube binds more than 80 percent of the particulate matter and  $\text{NO}_2$ . The essence of this technology is the newly developed combi-filter which contains a highly effective filter layer for particles and activated carbon layers that adsorb  $\text{NO}_2$ . Through its large surface, this extremely porous activated carbon-media is incredibly efficient in absorbing  $\text{NO}_2$ . This technology is defined by a particularly low pressure drop which cleanses the air effectively with very low energy input. Thanks to their modular design, the Filter Cubes can be built into a filter column. One filter column with three Filter Cubes (Filter Cube III) purifies  $14,500 \text{ m}^3$  of air per hour.

### ALMOST 80 YEARS OF EXPERIENCE IN FILTRATION

MANN+HUMMEL knows its way around the purification of air. For many decades now, it has been a top company in designing filters used in vehicles and buildings. Now we are using our "Filtration know-how" to reduce the amount of air pollution in particularly affected areas. The Filter Cube reduces the pollution levels on site and thus contributes to the protection of human health. The concentration of particulate matter and nitrogen dioxide can be scaled down through the filter columns directly. The technology can also be integrated into billboards for bus stops or train stations.

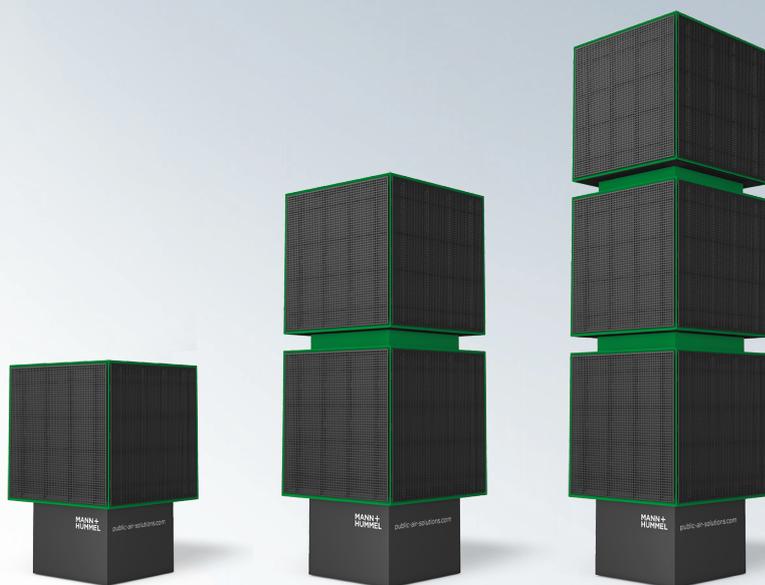
## Design and Function

### EASY MAINTENANCE AND SERVICE

For changing the filter elements no tooling is necessary. The filter elements can simply be pulled out and the new ones are slid back along a guiding rail like a drawer.

Highly developed combi-filter elements for particles and  $\text{NO}_2$

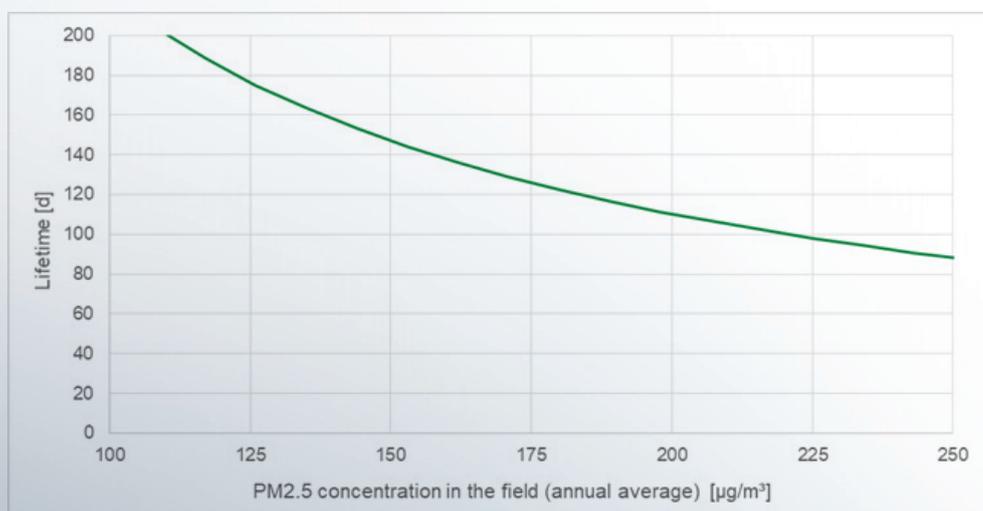




Standard color grey - an individual design is possible

	Filter Cube I	Filter Cube II	Filter Cube III
<b>Output at NO<sub>2</sub>- and PM-separation</b>			
Air flow rate (duty point)	4.833 m <sup>3</sup> /h	9.666 m <sup>3</sup> /h	14.500 m <sup>3</sup> /h
Nominal voltage rate	400 VAC (3~)	400 VAC (3~)	400 VAC (3~)
Electrical power (duty point)	500 W	1.000 W	1.500 W
Electrical power (max.)	1.000 W	2.000 W	3.000 W
Separation rate NO <sub>2</sub>	80 %	80 %	80 %
Separation rate PM <sub>10</sub>	87 %	87 %	87 %
Separation rate PM <sub>2.5</sub>	62 %	62 %	62 %
<b>Overall Data</b>			
Estimated weight of one column	372 kg	668 kg	1000 kg
Dimensions (l x b x h)	94 cm x 94 cm x 144cm	94 cm x 94 cm x 248 cm	94 cm x 94 cm x 360 cm
Sound intensity dB (A)	< 66 dB *	< 69 dB *	< 71 dB *

\* Sound pressure 1 m away from the output side



Charts: Data are for orientation only and must be confirmed by measurements at the respective place of use.

# The Implementation Exemplary Process

The first step is the investigation of the surrounding area where the Filter Cubes will be placed. Then calculations are made by our experts at MANN+HUMMEL in order to carry out the project. They check where the particulate matter and NO<sub>2</sub> concentration is highest and how many Filter Cubes are needed according to that data. Afterwards, the local conditions are examined more closely and reasonable locations are selected for the Filter Cubes. With the help of a simulation, these plans are then checked by an independent engineering office.

A Filter Cube requires 1 m<sup>2</sup> of space and access to electricity. Depending on the location and customer requirements, a foundation and a data connection can be included. After the preparation of the infrastructure has been completed on site, the installation of the systems can begin. The finished filtration unit can be switched on and off instantly via remote access. This allows the impact of this procedure to be measured and tracked under consistent conditions. Depending on requirements and customer requests, we also take care of the maintenance of the filter system.



# Intelligent System Architecture

The Filter Cubes are equipped with an intelligent mechatronic system architecture. Available sensors record air and weather data as well as the pollution level. These data are transferred to a cloud where they are merged and analysed. The filter system is set up to control itself depending on operating and environmental boundary conditions.

However, the operator can also control the units via remote control and access the system if required.

This intelligent system architecture ensures that the Filter Cubes run extremely energy efficient as the fans work only when the pollution levels hit a certain threshold.



