MANN+HUMMEL PicoFlex®
The new compact air cleaner for highest requirements

PicoFlex®– an intelligent solution

The new developments from leading manufacturers of construction and agricultural machinery around the world show various trends which have a large influence on previous solutions for the filtration of engine air.

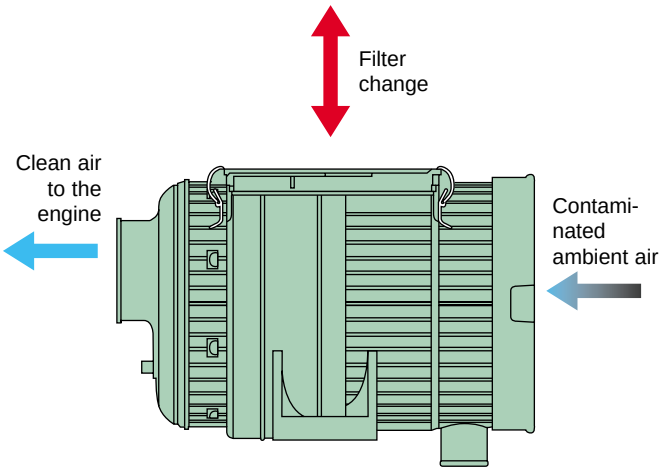
On the one hand there is a need for ever higher performance air cleaners since
- the desire for higher engine performance – especially also for compact units – will continue. This results in a higher air requirement for the engine.
- compliance with future emission regulations will necessitate even higher air throughput in the engine.

On the other hand the designer is constantly given less installation space to work with, for example, because
- intercoolers have become standard for many machines.
- many vehicles are equipped with air conditioning with components which take up a considerable amount of space.
- the requirement for the ultra compact and light vehicles with an improved overview for the designer represents a constant challenge.

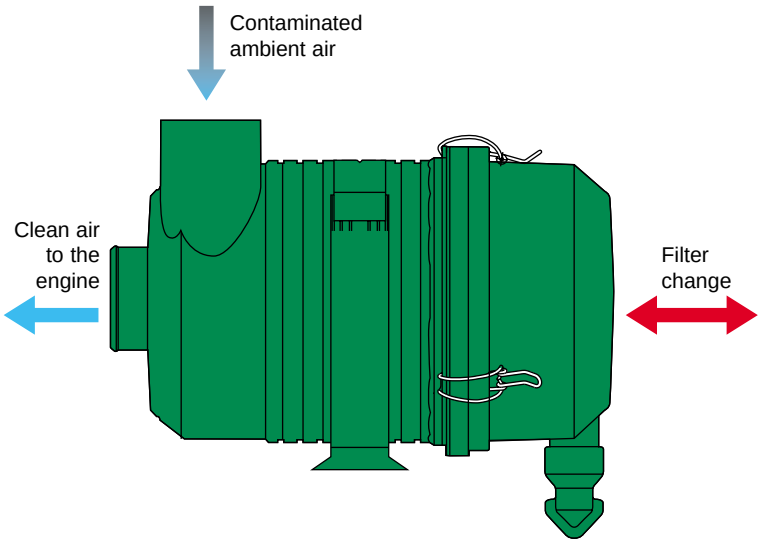
The newly developed PicoFlex® air cleaner series from MANN+HUMMEL takes into account current and future market requirements for **increased air throughput with less installation space**. This innovative filter technology is packed in a robust polyamide housing reinforced with fibreglass and is the ideal solution for demanding applications. The first product MANN+HUMMEL will launch from this series is the PicoFlex® 7 (corresponding to a nominal flow rate of 7 m³/min). Further sizes will follow shortly.

The advantages at a glance:
- less space requirement through compact design
- long service life through highly efficient multi-cyclone block pre-separator and CompacPlus® filter element (patent pending)
- highest operational reliability through main element with axial seal and additional secondary filter element with radial seal
- especially easy to service through side access to the filter element, which does not require removal of air pipes
- completely new installation possibilities through inline air path
- easy monitoring of dirt level through integrated connection for service switch
- simple possibility to clean the multi-cyclone block through central screw fitting
- environmentally acceptable disposal possibility through metal-free filter elements (fully incinerable)
- problem-free adaptation to other units through variable installation positions
- quick first fitting through a number of fixing methods

The new inline concept

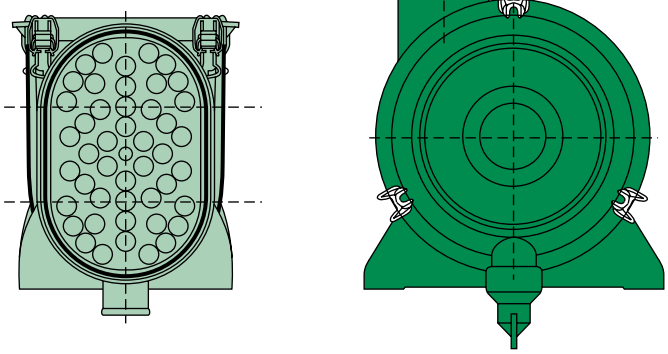


The flow path of the new **PicoFlex®** air cleaner



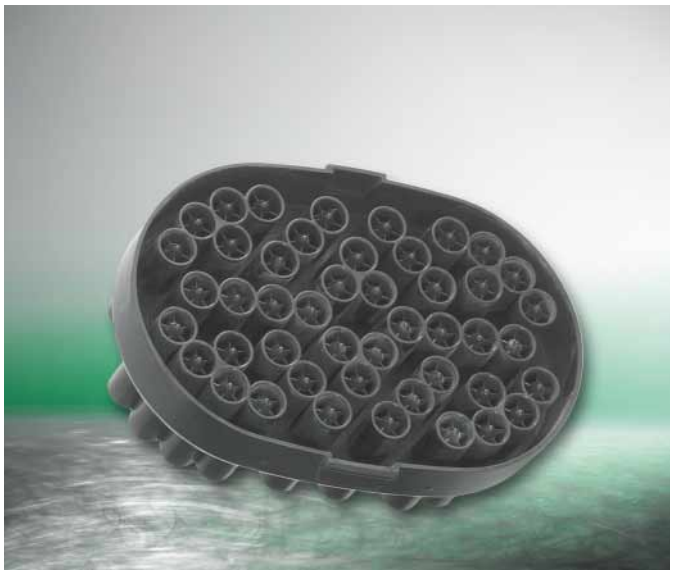
Flow path of a conventional air cleaner

An air cleaner for small envelopes



A size comparison with a filter having a conventional design and comparable service life shows that PicoFlex® saves valuable installation space.

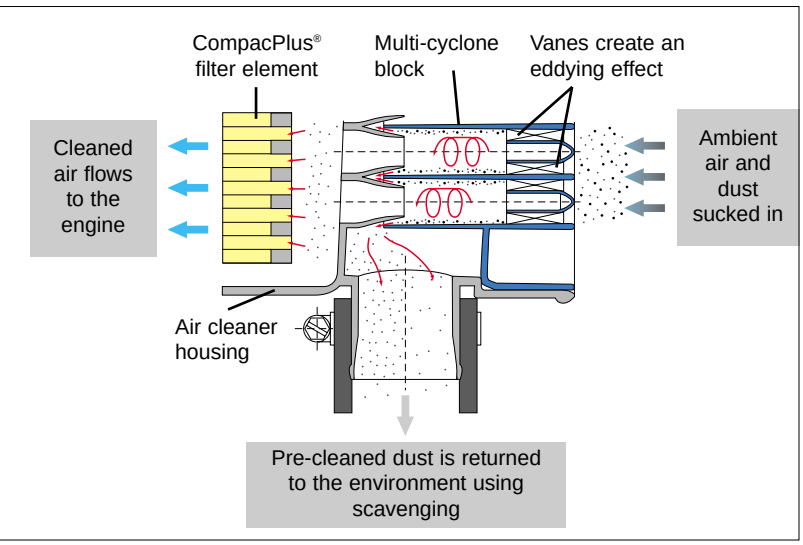
Pre-separation



PicoFlex® Multi-cyclone block

The higher the efficiency of the pre-separator, the longer the filter service life. Therefore the filter element is changed less often – an advantage which has a direct influence on the running costs of the machine.

The best and most technically demanding solution is achieved through the parallel connection of small, individual pre-separation cells in a multi-cell separator, a so-called multi-cyclone block. The MANN+HUMMEL multi-cyclone block (patend pending) in the PicoFlex® with its 46 pre-separation cells is an example of superb filtration en-gineering with an efficiency of more than 95%. Compared with a conventional standard two-stage filter with a pre-separation efficiency of 85% the dust separation with the PicoFlex® multi-cyclone block is 3 times more effective.



The basic principle of the cyclone technology is to make the inflowing air rotate and eddy by means of an appropriate device. In the PicoFlex® this is achieved with vanes which are found respectively at the entrance to the pre-separation cell. The rotation of the air and the resulting centrifugal forces force the dust outwards to the cell wall where it concentrates. Only the clean air flowing in the middle reaches the actual filter element whereas the air on the cell wall with the dust is returned to the environment using scavenging.

Dust load of the main element depending on the filter type (with a dust weight of 1000 g)

Single stage air cleaner:
η = 0%: 1000 g on the element

Two stage air cleaner:
η = 85%: 150 g on the element

PicoFlex®:
η = 95%: 50 g on the element

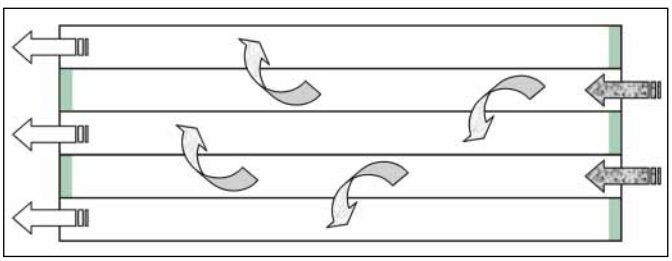
η = pre-separation efficiency

CompacPlus® filter element

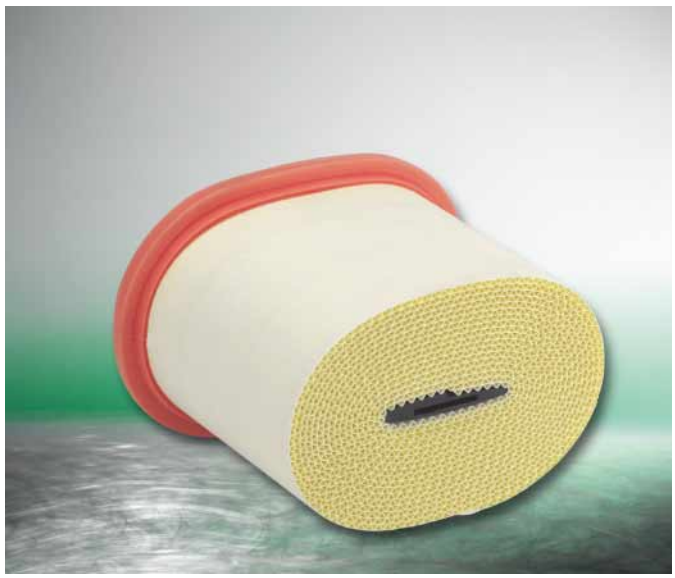
CompacPlus® filter element

The key component of the PicoFlex® from MANN+HUMMEL is the newly developed CompacPlus® filter element which has a patent pending. In comparison to a conventional filter element the CompacPlus® filter element has 50% more filter surface area with the same installation space. This is made possible by a special design with alternately closed filter channels. A further advantage of the PicoFlex® is the linear flow path made possible by an inline design which enables completely new installation possibilities.

This environmentally friendly filter element is metal-free and is therefore fully incinerable. The element frame is reused so that only the filter insert with its integrated seal has to be changed. The PicoFlex® thus helps to conserve resources.

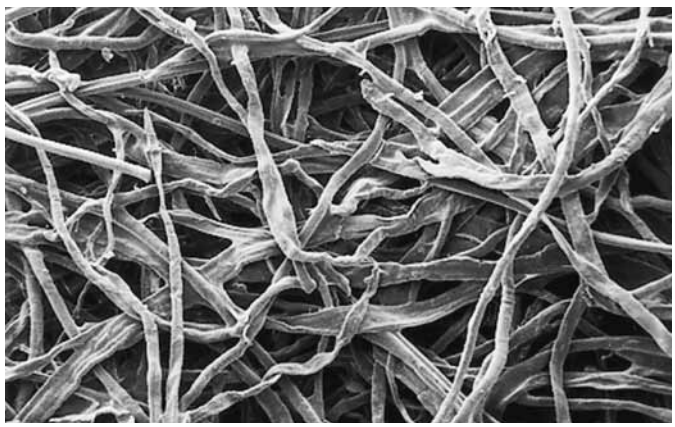


The principle of alternately closed filter channels



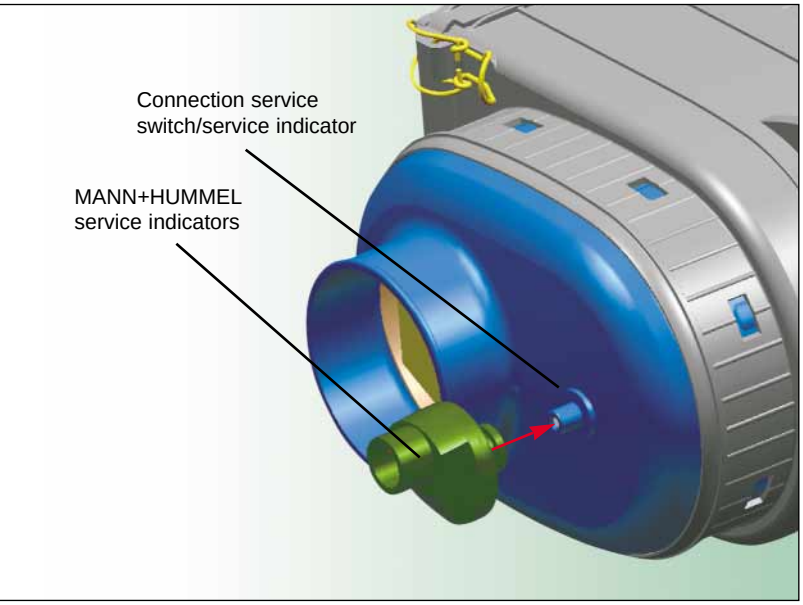
The special filter medium developed for the CompacPlus® filter element from MANN+HUMMEL with its separation efficiency of more than 99.98% (ISO 5011, SAE-C) enables excellent engine protection together with a high specific dust capacity. The CompacPlus® can thereby achieve an above-average service life and this helps to reduce the running costs on your machine.

These advantages – together with proven MANN+HUMMEL quality – guarantee you reliability, economy and a long life for your machine.



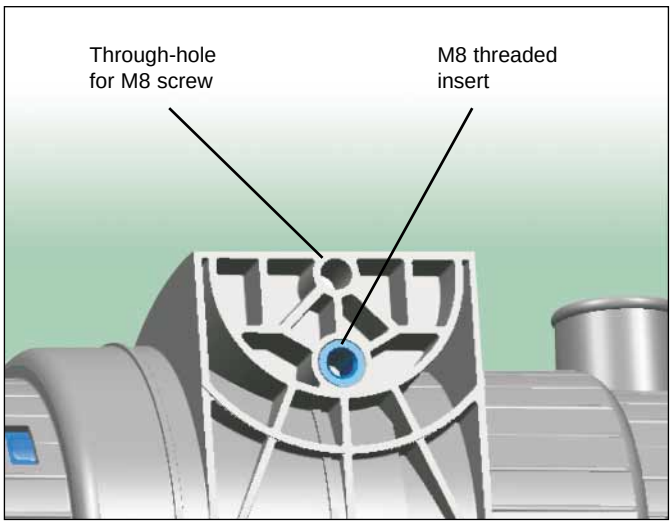
A microscope scan of the **CompacPlus®** filter medium

Details



Service switch connection
The PicoFlex® has a threaded connection M10x1 for a service switch or indicator directly integrated in the filter housing. Further parts are not required. We recommend the use of a MANN+HUMMEL service switch or indicator to monitor the dirt level.
If a service switch is not used, the connection is sealed to be dust-tight with the supplied protection cover.

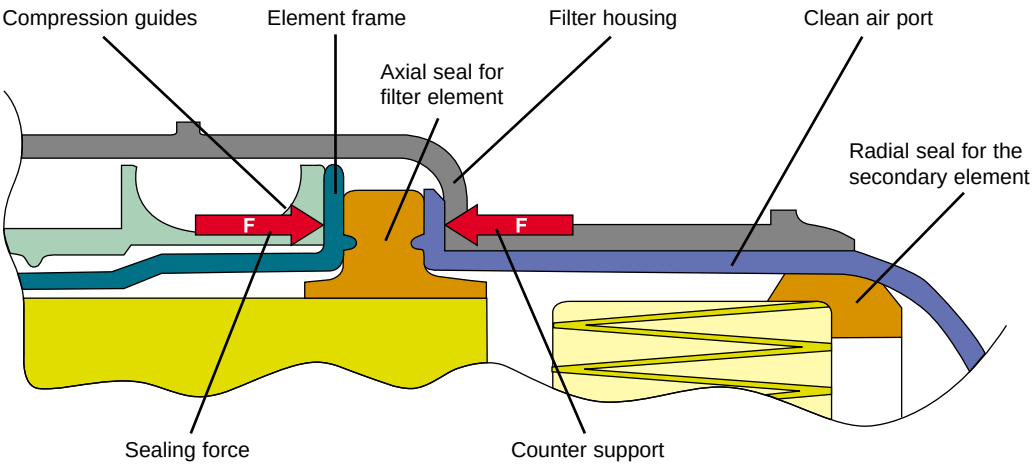
Fixing
Fixing to the bracket can be made using the through-hole or also using an M8 threaded insert. This removes the need for washers and nuts and the first fitting of the filter to the vehicle can be accelerated considerably.



Secondary element
The PicoFlex® is equipped with a separate secondary element so that the cleaner can also perfectly protect the engine while servicing the main element.
This secondary element is perfectly placed for the flow behind the main element and has its own radial seal for the housing. This prevents the ingress of dirt in the intake system even when the main element is removed or damaged through inappropriate handling. The PicoFlex® secondary element is also metal-free and is therefore fully incinerable.

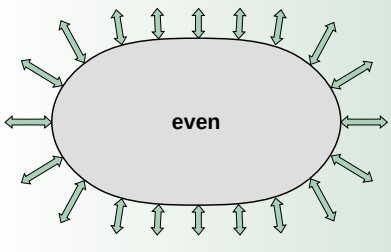
Sealing technology

Extensive tests have shown that an axial seal is the best and most reliable solution for sealing the CompacPlus® filter element.
This is especially true when the element is removed from the housing on the side.

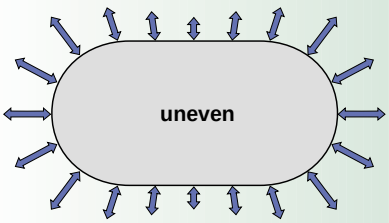


The axial sealing for the CompacPlus® on the PicoFlex® is implemented through compression guides on the cover. When the cover closes these compression guides compress the specially developed PUR seal (patent pending) between the element frame and the clean air port of the filter which functions as a counter support. Specially shaped ribs on the element frame and clean air port serve to enable a lasting secure sealing effect which is not sensitive to extreme vibration or temperatures.

Due to the installation situation, an radial seal was selected for sealing the secondary element. Tests have shown that good results are achieved when the seal contact is curved at each position. In contrast to the race track design with flat surfaces, an even distribution of the sealing force is possible and therefore a secure sealing without leakage.



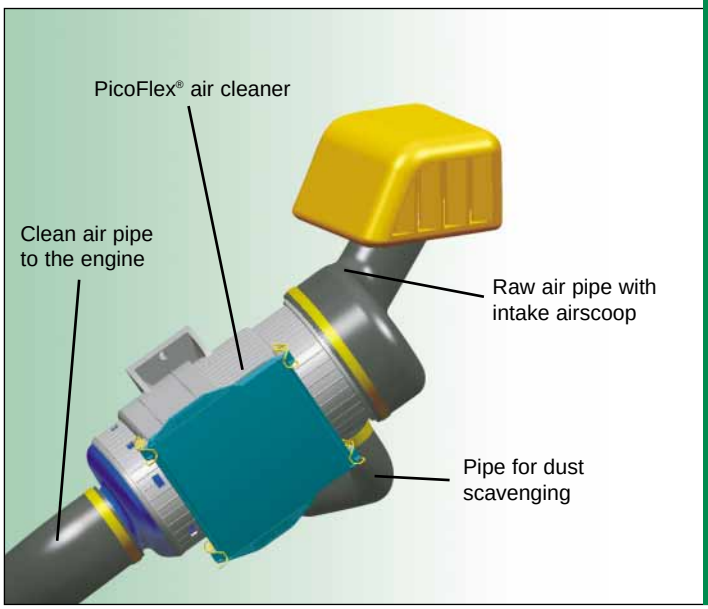
even distribution of the radial sealing force with the secondary element **PicoFlex®**



uneven distribution of the radial sealing force with race track design

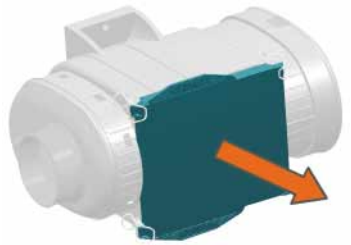
Installation and maintenance

An important objective during development of the PicoFlex® was to achieve a simple and reliable filter service. This lead to the clear requirement that replacing an element should not require the dismantling of any pipes. Since an air cleaner system often has a raw air pipe, MANN+HUMMEL has developed a servicing concept (patent pending) for the side removal of the elements which ideally exploits the inline design.

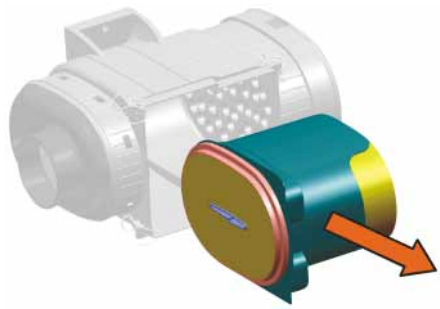


Example of a filtration system with **PicoFlex®**

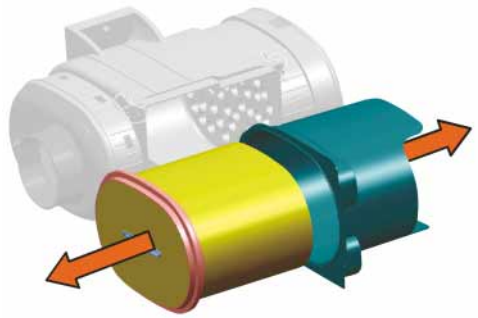
Changing the filter element



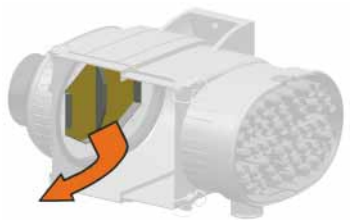
Step 1
First of all the cover is opened and removed.



Step 2
Then the element frame is taken out together with the CompacPlus® filter element.



Step 3
The CompacPlus® filter element is removed from the frame and then disposed of according to the environmental regulations. The frame is re-used.

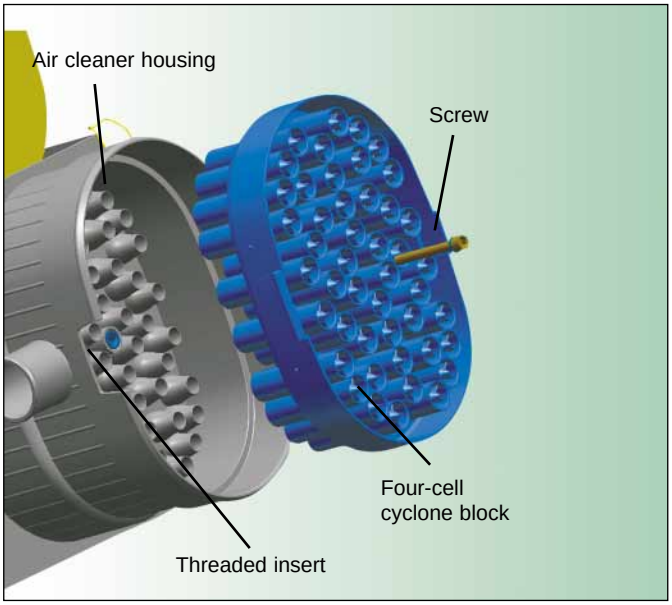


Step 4
The secondary element is pulled out using the integrated handle and also disposed of according to the environmental regulations.

The frequency the element is changed greatly depends on the respective application conditions and is determined by the machine producer. However, we recommend changing the main element at least once per year and the secondary element every two years. This is the only way to ensure the full performance of the air cleaner system while offering perfect protection for your engine.

In some circumstances intensive use in very dusty environments may require a more frequent change of the filter element. We recommend using a MANN+HUMMEL service switch or indicator to monitor the dirt level in the system.

Installation and maintenance

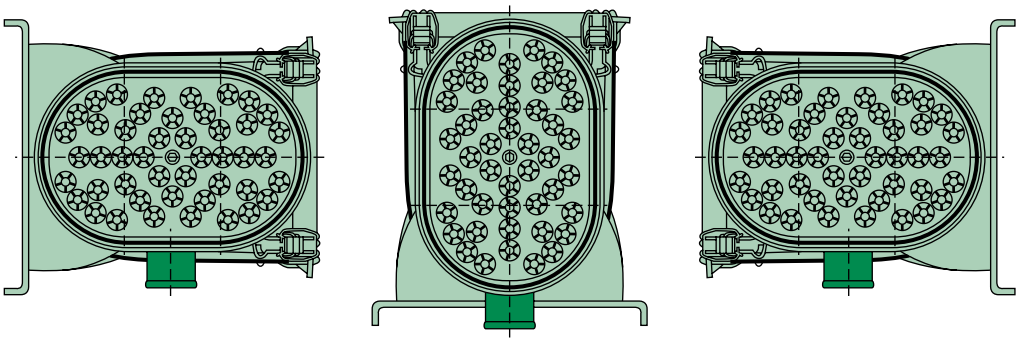


Servicing the pre-separator

If particularly unfavourable application conditions occur (e.g. simultaneous ingress of large amounts of dust particles and water) and the pre-separator does block, then it can be easily and quickly serviced: After unscrewing the central holding screw the cyclone block is removed from the housing and cleaned either with compressed air or by washing out.

Installation positions

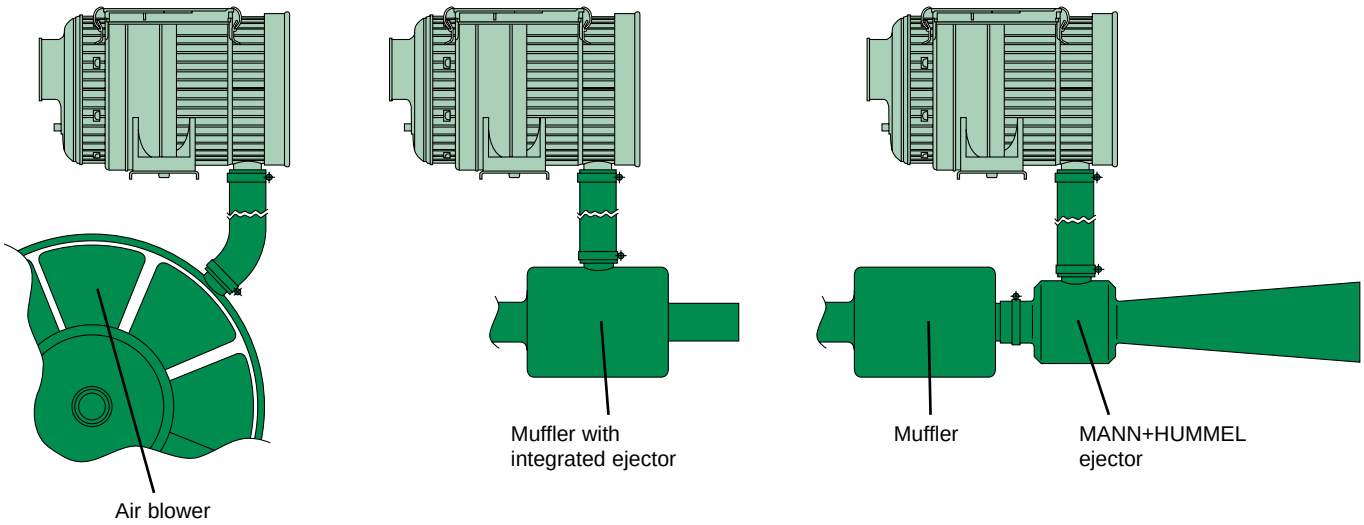
In order to ensure ideal dust discharge in varying positions, the PicoFlex® is available with three different orientation directions for the dust scavenging connection. The best separation efficiency is achieved when the dust discharge port is pointed downwards. If the direction deviation of the dust discharge to the vertical is more than 45°, the next port position should be used.



Continuous scavenging

The following pictures show various possibilities how to realise dust removal through scavenging.

To guarantee reliable, problem-free running of the PicoFlex® it is necessary to continuously scavenge the pre-separator of the air cleaner.
This removes the pre-cleaned dust from the pre-separator and avoids deposits building up which otherwise lead to a considerable reduction in efficiency and service life.
The condition for reliable dust scavenging is a negative pressure of at least 8 mbar via the pre-separator with a nominal volume flow of the filter (7 m³/min). To determine the required total negative pressure, the pipe resistance values of the raw air pipe and scavenging pipe must also be added. In case of uncertainty we recommend measurement of the actual negative pressure.

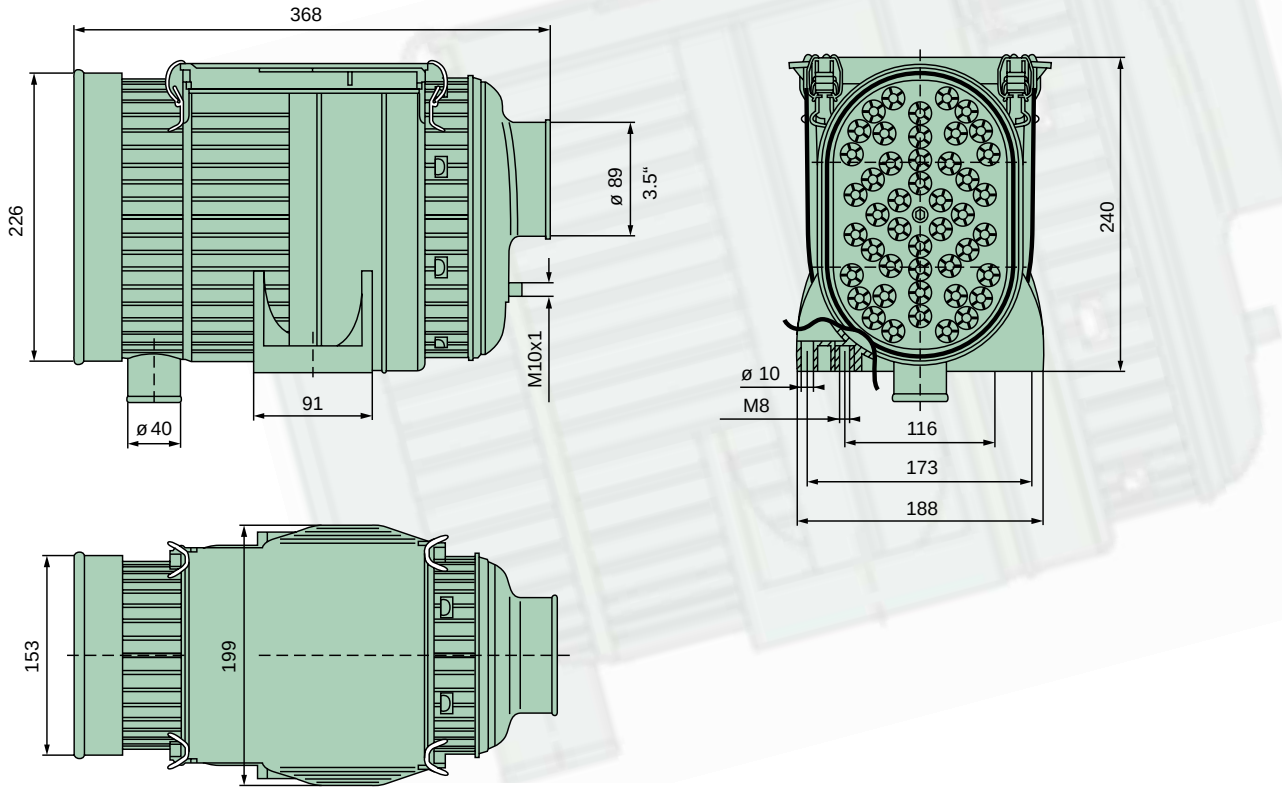


Scavenging using a blower
There is a possibility to use the engine cooling fan for the scavenging if the negative pressure generated is at least 8 mbar. In general this is the case with modern cooling fans which at the present time generate a negative pressure of up to 20 mbar. Alternatively, the use of a special suction fan is possible, for example mechanically driven using a V-belt or electrically driven.

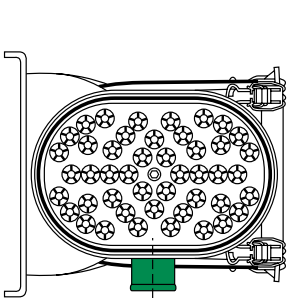
Scavenging with an integrated ejector
A frequently used and space-saving alternative is to use an exhaust ejector in the muffler of the exhaust pipe to eject the pre-cleaned dust back into the environment together with the exhaust fumes from the engine.

Scavenging with retrofitted MANN ejector
The scavenging can be realised easily using the proven MANN+HUMMEL ejectors which are installed downstream from the muffler. The integrated venturi tube generates the required negative pressure. A pipe connects the PicoFlex® to the ejector and the separated dust is blown out of the exhaust pipe. When using exhaust ejectors care should be taken that the permissible exhaust back pressure is not exceeded.

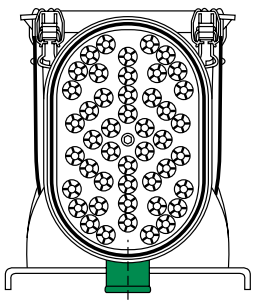
PicoFlex® Specifications



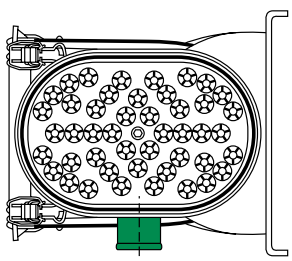
Nominal volume flow	7 m³/min
Initial resistance	30 mbar
Laboratory service life (ISO 5011)	14.5 hours
Application temperature range	-30 °C zo +100 °C, for short periods up to +120 °C
Housing material	PA 6 GF 30
Scavenging required for dust discharge	



Picture 1



Picture 2



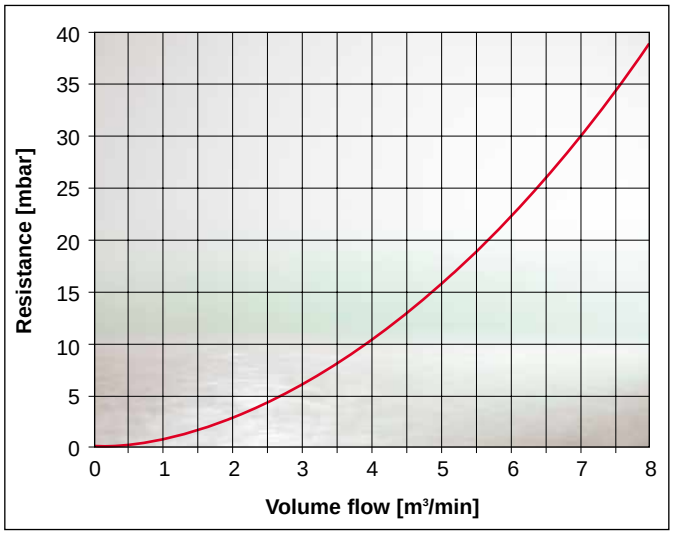
Picture 3

Picture	Order number Filter with secondary element	Order number Filter without secondary element	Order number CompacPlus® filter element	Order number Secondary element
1	45 210 95 910	45 210 95 913	C 23 210	CF 2135
2	45 210 95 911	45 210 95 914		
3	45 210 95 912	45 210 95 915		

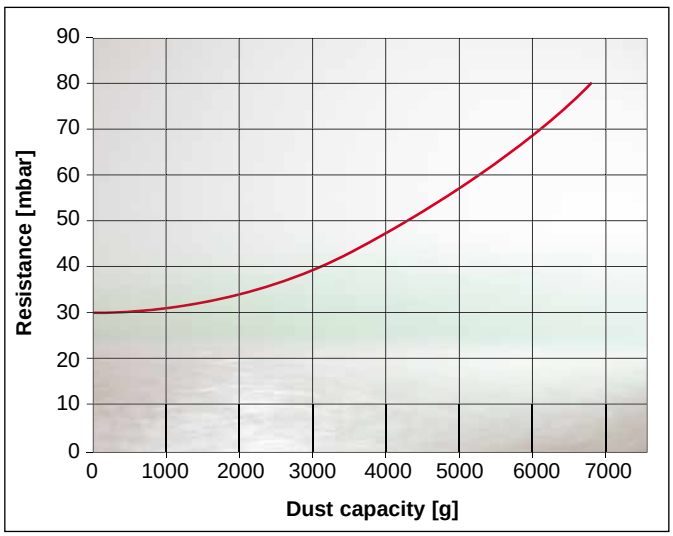
Characteristic curves ...

... with secondary element ...

... for the flow according ISO 5011

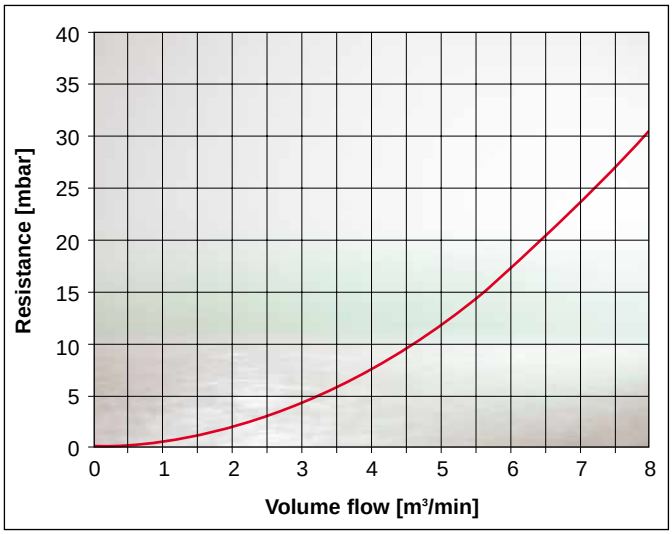


... for the dust capacity according ISO 5011

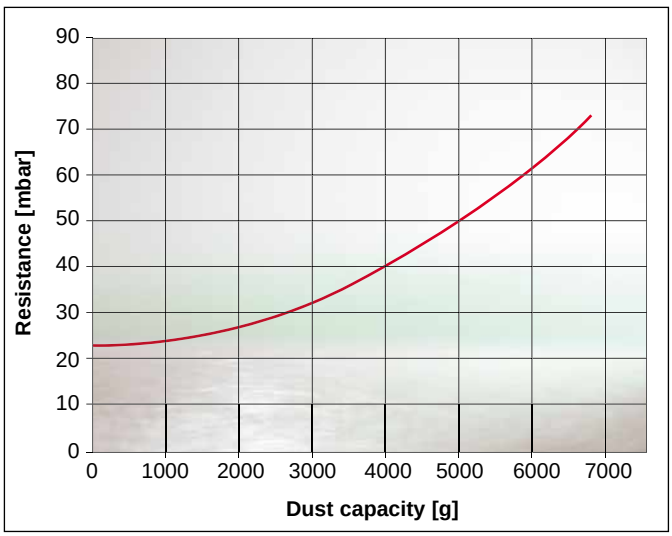


... without secondary element ...

... for the flow according ISO 5011



... for the dust capacity according ISO 5011



The MANN+HUMMEL Group

The MANN+HUMMEL group operates worldwide with 8,800 employees at 41 company locations around the world. The company develops, produces and distributes highly developed automotive components such as air cleaner systems and intake systems, liquid filter systems and cabin filters as well as filter elements for the servicing and repair of vehicles. Products manufactured also include industrial filters, filter systems and material handling devices for use in the fields of mechanical engineering, process technology and industrial production. MANN+HUMMEL customers operate in many fields with the emphasis on series production in the automobile industry.

Automotive OEM Division

Air filter systems

- Air filter, systems and components
- Air pipework components
- Crankcase venting systems and components
- Broadband silencer
- Symposer

Intake systems

- Intake systems and modules
- Components for swirl and tumble control
- Secondary-air charger

Fluid filter systems

- Oil filter and oil filter systems
- Centrifugal oil filters
- Fuel filter and fuel filter systems

Other important subsystems and engine-relevant components

- Cylinder head covers
- Engine compartment covers
- Fluid container
- Technical plastic components for the engine compartment

Filter elements and Systems for Industry and Trade Division

Filters for motor vehicles

- Filter elements for air and liquids
- Cabin filters
- Air-drying boxes
- Cooling-water filters
- Spin-on oil filters and fuel filters
- Elements for oil-aerosol separators

Industrial Filters

- Air and liquid filters and components for industrial engines, construction and agricultural machinery, compressors, vacuum pumps and mechanical industry
- Cabin filters
- Air-oil separators

Industrial Systems and Components Division

ProTec

- Systems and equipment for material handling and materials processing in the plastic, rubber, recycling and chemical industries

HYDROMATION

- Systems and equipment for the filtration of machining liquids in mechanical production
- Chip handling systems and chip transport systems

MANN+HUMMEL GMBH, Industrial Filters Business Unit
67346 Speyer, Germany, Telephone 0049 (0) 6232 53-80, Fax 0049 (0) 6232 53-88 99
E-mail: if.info@mann-hummel.com, www.mann-hummel.com

19 941 20 401 en 1003 Printed in Germany