Saving Energy with Viledon Air Filters

viledon®

Freudenberg
Filtration Technologies

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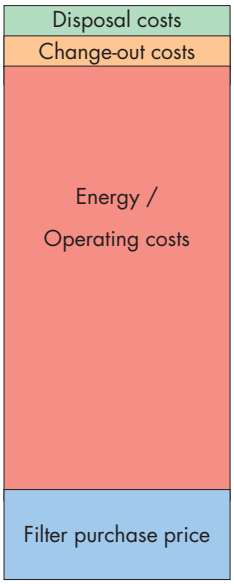
Cost-efficient air filtration always pays off

Saving energy – but how?

The words „saving energy" are on everyone's lips nowadays. Prices for the fossil fuels gas and oil have more than doubled since 2000. And consequently the electricity prices in the European Union have increased by about 30 % (source: Eurostat). In the future, successful companies will more than ever be using energy with maximized efficiency, enabling them to achieve cost advantages and a competitive edge on what are now globalised markets, and reduce their dependence on imported energy sources. Not only will they cut their costs, but trading with CO_2 certificates will open up fresh avenues for actual income. The German national mix is based on CO_2 emissions of 0.59 kg/kWh. And not least, economical use of energy can help to limit climate change.

Many of the measures designed to achieve energy savings entail capital investment in new equipment, e.g. replacing engines, fans, etc. But there are also major potentials for savings in areas where at first sight no one would expect them: 20 % of the electricity used in industrial and commercial applications is in fact used to operate fans and indoor climate control (HVAC) systems. Energy consumption by ventilation and air-conditioning equipment totals 40 % of the total energy requirement in office buildings, and in cleanrooms as much as 80 %. A substantial proportion of the energy consumed by HVAC systems is attributable to their pressure drops; air filters can account for up to 50 % of the total pressure drops in HVAC systems. So here are some sizeable potentials for savings, ones that can be tackled with exceptionally simple methods. A life-cycle cost (LCC) study shows that 70 to 80 % of the total costs for air filters are accounted for by the energy costs they cause. Only 20 to 30 % are expended on the filter price, filter changes and filter disposal. We have developed a special LCC software package, enabling us to compute which filters are best to use and when the optimum time to change them has arrived. We'll be pleased to advise you!

E (kWh)	energy consumed
$\dot{V}$ (m³/s)	volume flow
$\overline{\Delta p}$ (Pa)	average pressure drop at filters over time
η	fan efficiency
t (h)	time



Typical distribution of overall filter costs (LCC)

Energy savings – made easy!

Air filters aren't all the same, you know: even if the Filter Class is identical among different makes, it doesn't mean that all the characteristics relevant to actual are also identical. In terms of pressure drop, particularly, there are major differences. An air filter's pressure drop increase begins slowly at first when the filter is new, and then progressively speeds up until the maximum dust storage capacity has been reached. The fan in an HVAC system consumes electrical energy during operation in order to overcome the filter's resistance, for example. In the case of variable-speed fans, energy consumption will continually increase as a consequence of the air filters' pressure drop. The energy consumed by fans is calculated as follows:

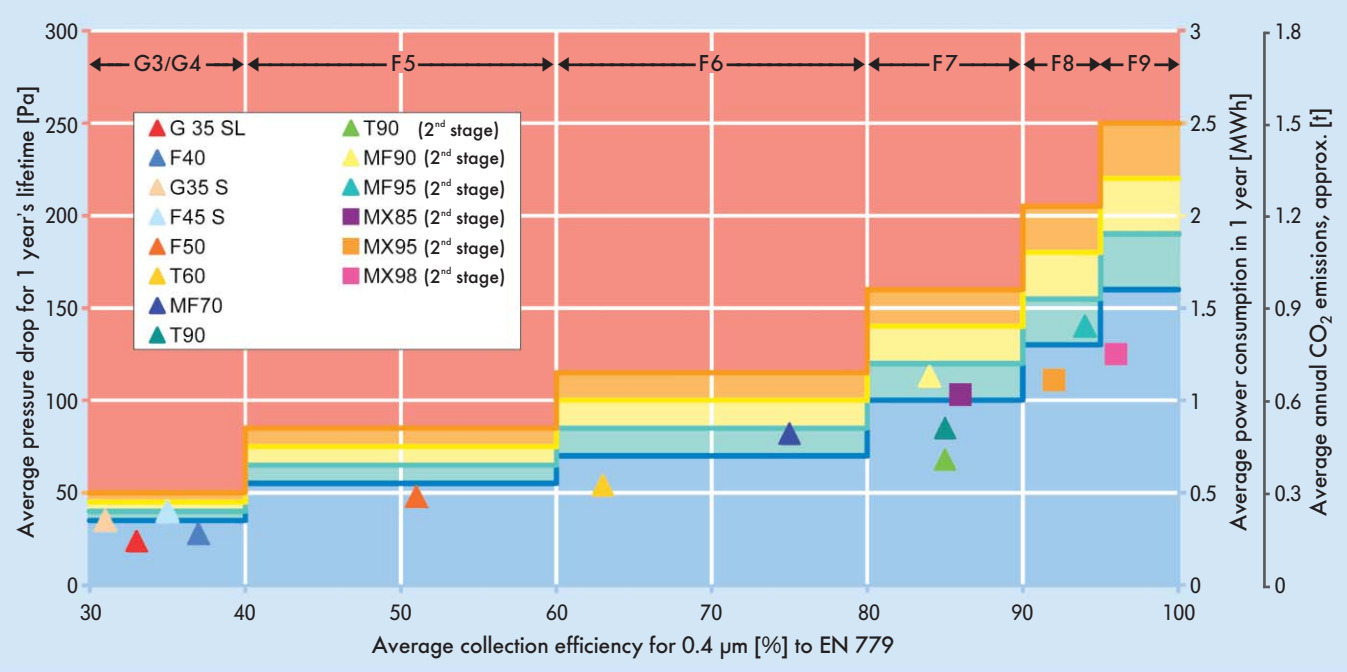
$$E = \frac{\dot{V} \times \overline{\Delta p} \times t}{\eta \times 1000}$$

A reduction of 10 Pa in a filter's average pressure drop will correspondingly lower the energy consumption of the variable-speed fan, and given a normal volume flow of 3,400 m³/h will result in cost savings of about € 20 per filter over the course of a year (8,500 operating hours). So it makes good sense to categorize filters not only by their Filter Classes according to EN 779 but also in terms of **Energy-Efficiency Classes**. This makes it easier to choose the most favourable filter in terms of energy economy. Meticulous cleaning and maintenance of HVAC systems, combined with optimum replacement intervals, will create additional cost advantages. The Viledon filterCair filter service program will provide you with the appropriate can-do support.

Energy-Efficiency Classes for air filters

To facilitate comparisons between different air filters, we have developed a new Energy-Efficiency Class concept, whose ratings correlate the Filter Class to EN 779 and the temporally averaged pressure drop (see diagram top right).
The average pressure drop is computed using the pressure drop progression over time up to a defined dust loading with a standardized test dust. The loading with this test dust realistically reflects the behaviour of air filters in actual operation. The dust loadings for the first and

Energy-Efficiency Classes make it easier for you to choose ...



Energy efficiency for Viledon air filters of Filter Classes G3 to F9 in the first or second filter stage ($\dot{V}$ =3,400 m³/h)

second filter stages are in line with the average concentrations of airborne dust in Germany (Source: German Federal Environmental Agency) and the customary air flow of 3,400 m³/h per filter.
This means air filters, taking due account of their installation situation in the first or second filter stage, can be specifically assigned to Energy-Efficiency Classes from 1 to 5 for the Filter Class concerned, with Class 1 indicating a particularly energy-economical behaviour and Class 5 a particularly wasteful model.
The diagram above and the table below show the energy classifications for our energy-efficient Viledon Compact pocket filters and MaxiPleat cassette filters in Filter Classes G3 to F9 in conformity with EN 779.

Life-cycle costs: let us compute ...
The Viledon Compact F50 pocket filter meets the requirements of Filter Class F5 and EE-Class 1 with an average pressure drop of 48 Pa. Compared to a conventional Class F5 pocket filter in EE Class 3 with an average pressure drop of 70 Pa, this gives a pressure drop advantage of 22 Pa in favor of the F50. Extrapolated for an entire year, this results in cost savings of approximately € 40 per Filter.

Energy-Efficiency Classes	Filter Classes to EN 779 and pressure drop ranges						
	G 3	G 4	F 5	F 6	F 7	F 8	F 9
EE Class 1	0-35 Pa: **G 35 SL**	0-35 Pa: **F 40**	0-55 Pa: **F 50**	0-70 Pa: **T 60**	0-100 Pa: **T 90, T 90***	0-130 Pa: **MX 95***	0-160 Pa: **MX 98***
EE Class 2	35-40 Pa: **G 35 S**	35-40 Pa: **F 45 S**	55-65 Pa	70-85 Pa: **MF 70**	100-120 Pa **MX 85*** **MF 90***	130-155 Pa: **MF 95***	160-190 Pa
EE Class 3	40-45 Pa	40-45 Pa	65-75 Pa	85-100 Pa	120-140 Pa	155-180 Pa	190-220 Pa
EE Class 4	45-50 Pa	45-50 Pa	75-85 Pa	100-115 Pa	140-160 Pa	180-205 Pa	220-250 Pa
EE Class 5	50-… Pa	50-… Pa	85-… Pa	115-… Pa	160-… Pa	205-… Pa	250-… Pa

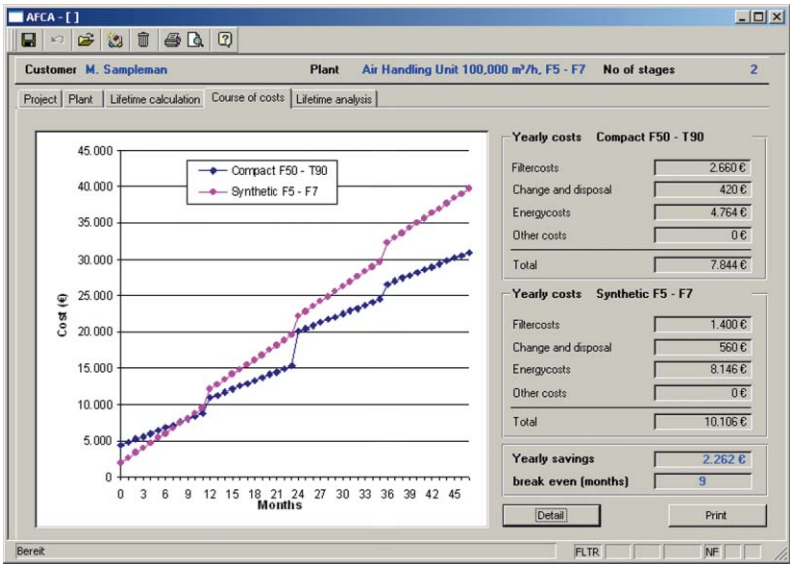
The particularly energy-efficient Viledon Compact pocket filters and MaxiPleat cassette filters

** Installed in the 2nd filter stage with Class F5 prefiltration*

$\dot{V}$ =3,400 m³/h

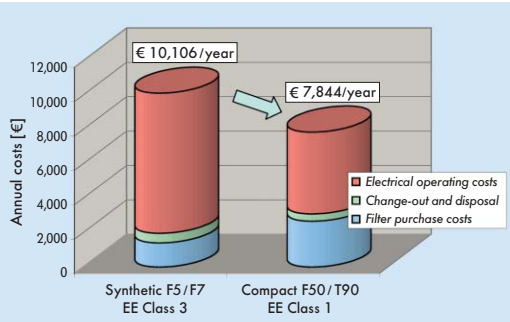
… because our field-proven energy-savers are mathematically recommended!

We use our software package specifically developed for computing life-cycle costs, to determine for you in detail the filtration costs incurred in your ventilation systems (see graphic on the right).
For this purpose, the purchase costs for filters, the costs of change-out and disposal, and the specific electrical operating costs for the filters are also factored in and computed for a defined time period.
When determining the specific electrical operating costs for the air filters, we factor in not only the individual pressure drop trends for the various makes of filter involved, but also the systems' efficiencies and their electricity costs. Practical experience repeatedly shows that the electrical operating costs account for an unexpectedly substantial portion of the total, and that energy-efficient air filters from EE Classes 1 and 2, like our Viledon Compact pocket filters and MaxiPleat cassette filters, enable the overall costs of filtration to be often dramatically reduced.



Detailed computation of life-cycle costs for a 2-stage filter system

An example:
Operating the filters in a frequency-controlled intake air system running at 100,000 m³/h and featuring two pocket filter stages of Classes F5 and F7 costs more than € 10,000 a year, given commercially available, synthetic filter types of EE Class 3. The annual purchase costs for these filters come to only approx. € 1,400; plus an estimated € 560 for change-out and disposal. The lion's share of the operating costs, however, at more than € 8,000, are the electrical operating costs – that's more than 80 %! The cause here lies in the relatively high initial pressure drops and the relatively small dust storage capacities of the filters used. The filters' resistances swiftly increase when loaded with the customary atmospheric dust concentrations; the filters are energy-inefficient.



Example: 100,000 m³/h system, two filter stages, F5/F7

When using energy-efficient air filters of EE-Class 1, such as our Viledon Compact F 50 (Filter Class F5) and T 90 (Filter Class F7), almost € 3,400 a year in energy costs can be saved (see graphic above). This is achieved thanks to the significantly reduced filter resistances and a substantially more favourable pressure drop development over the operational lifetime. A decision that will pay off! Given total savings of almost € 2,300 a year, the Viledon Compact pocket filters will pay for themselves within 9 short months, and you'll be doing the environment a favour into the bargain.
The advantage of the extended lifetime achievable with these filters has in this example not been fully factored in: if the Viledon Compact F 50s in the first stage are operated over a period of two years, for example, the total savings are almost € 3,000 a year. That's almost 30 % of the original operating costs.
As you can see: it's well worthwhile taking a long hard look at the figures. We'll be pleased to do this for you, taking due account of your own very specific situational requirements.


Compact T 90 pocket filter


MaxiPleat cassette filter

Viledon filters: in a class of their own for verifiable energy-efficiency

Compact F 50 pocket filter

EUROVENT
CERTIFIED PERFORMANCE
AIR FILTERS
CLASS F5-F9

CERTIFIED
DIN EN ISO 9001
QUALITY SYSTEM
Reg. No. 1420

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The energy consumption of the fan motors in two identical air recirculation systems, each rated at 93,600 m^3/h, in a refrigerated warehouse for confectionery in England was measured and recorded over a period of one month. Both systems are fitted with frequency converters and can be separately controlled. During this period, the two systems were run at the same, constant volume flows. The existing filter configuration, comprising prefilter panels of Class G4 and pocket filters of Class F5 in the one system (new filters were installed for the trial), was compared to a single-stage configuration comprising Viledon Compact F50 pocket filters (Class F5) in the second system. The data from the building management software and the eTracker measuring instrument installed by the Viledon team were used to determine the energy costs for each of the systems during the trial period.

The result:
The data from the building management software and the Viledon team's energy measuring instrument have demonstrated with impressive finality that thanks to the lower pressure drop exhibited by the Viledon Compact F50 pocket filter in comparison to the existing filter configuration energy savings of 14.5 % could be achieved. By virtue of its unique, progressive media structure and its superlative product quality, it can be anticipated that the same useful lifetime will be reached by the Viledon Compact F50 pocket filter as with the existing two-stage filter system.

The savings outlined here are illustrative for a central air recirculation system, and can in the example be achieved year after year, without any additional investment required.

The potential savings may vary considerably between applications, and will have to be verified in each individual case. We'll be pleased to advise you!

Control cabinet with an eTracker measuring instrument connected up

The display of the eTracker measuring instrument

The figures given are mean values subject to tolerances due to the normal production fluctuations.
Our explicit written confirmation is always required for the correctness and applicability of the information involved in any particular case. Subject to technical alterations.

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