■ CUSTOMER INFORMATION

EN 779:2012 compact

EN 779: 2012

The new filter classification standard in overview

In Europe and many other countries in the world, the coarse and fine dust filters used in air-conditioning and ventilation systems are usually selected in accordance with the classification described in the EN 779 standard entitled "Particulate air filters for general ventilation". The methodology described in this standard is based on a laboratory test procedure, with the aim of achieving reproducible and comparable results. However, since the test aerosols and test dusts used will not usually resemble the air pollutants that an air filter is exposed to in actual operation, the results of the laboratory tests are transferable to actual applications only with very restricted relevance.

The EN 779 has been in force as a European standard since April 2012 in a new, revised version. The most significant change from the previous version is the introduction of minimum efficiencies for Classes F7 to F9 and the renaming of Classes F5 and F6 as M5 and M6. The introduction of these minimum efficiencies is an important step forward in filter standardization, and constitutes a milestone in the filter industry, in its thrust for higher quality standards, and thus for improved protection of both man and machine.

The test is performed on a filter element of standard size (see EN 15805), suitable for installation in a rectangular duct measuring 610 mm x 610 mm – with a test volume flow between 0.24 m^3/s (850 m^3/h) and 1.5 m^3/s (5400 m^3/h). Since a filter's operational behavior is crucially dependent on the volume flow in operation, the filter classes and all other test results from the test performed in accordance with EN 779 always relate only to the test volume flow specified in each case. The principal results of the test are:

- Gravimetric arrestance efficiency for synthetic dust
- Efficiency: corresponds to the number-referenced fractional collection efficiency for 0.4 µm particles of the synthetic test aerosol
- Pressure drop
- Dust holding capacity for synthetic dust

The test procedure laid down in DIN EN 779 is shown in diagrammatic form in Figure 1.

Viledon® MaxiPleat cassette filter

Viledon® Compact pocket filter

Coarse dust filters are classified by their average arrestance (Am) in relation to the synthetic ASHRAE dust. A final filter installed on the downstream side of the filter being tested is weighed before and after the dust has been fed in. The increase in mass measured at the final filter corresponds to the mass of dust that has penetrated through the filter being assessed. The difference from the total mass of dust fed corresponds to the mass of dust arrested in the filter being tested. This is put in relation to the mass originally fed in, whereupon the average (gravimetric) arrestance of the test filter is calculated. Fine dust filters are classified in accordance with their average efficiencies (Em). For this purpose, between the individual dust loading stages (see Fig. 1), the filter element is exposed to a synthetic droplet aerosol, and the particle number concentrations are measured before and after the filter. The efficiency is calculated from the difference between the two concentrations – referenced to the concentration of 0.4 μm particles measured on the upstream side. Following the test, the average efficiency is calculated as an integral mean value of the individual efficiencies determined as a function of the dust loading.

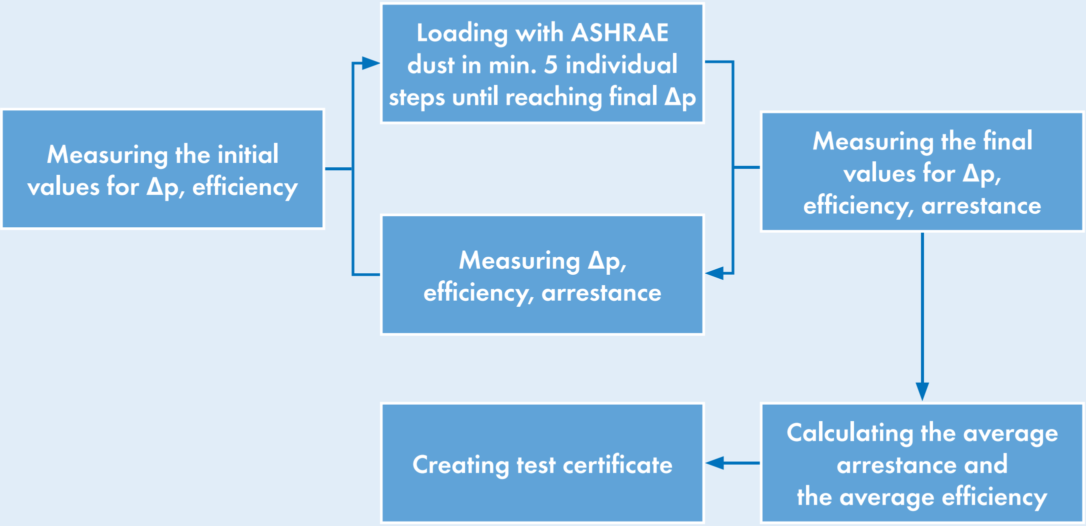

Fig. 1: Diagram oftest procedure as specified in DIN EN 779

The DIN EN 779:2012 in overview

	Previous EN 779	New EN 779	Average arrestance [%]	Average efficiency [%]	Minimum efficiency (IPA treated) [%]
Coarse dust filter	G 1	G 1	$A_m < 65$	–	–
	G 2	G 2	$65 \le A_m < 80$	–	–
	G 3	G 3	$80 \le A_m < 90$	–	–
	G 4	G 4	$90 \le A_m$	–	–
Fine dust filter	F 5	M 5	–	$40 \le E_m < 60$	–
	F 6	M 6	–	$60 \le E_m < 80$	–
	F 7	F 7	–	$80 \le E_m < 90$	35
	F 8	F 8	–	$90 \le E_m < 95$	55
	F 9	F 9	–	$95 \le E_m$	70

🟦 = New in EN 779:2012

Table 1: Classification of standard air filters in accordance with their filtering performance as defined in EN 779; final pressure drop for the classification is 250 Pa for coarse dust filters, 450 Pa for fine dust filters.

Besides the purely mechanical filtering effect, the use of what are called electret media, i.e. media with passive electrostatic charges on the fibers, constitutes an option for increasing a filter's collection efficiency in the initial state or for particular critical particle sizes above and beyond the minimum requirements, without causing increased flow resistance and a concomitant pressure drop – i.e., the air is filtered with minimum expenditure of energy. Under certain operating conditions, e.g. at high humidity levels, or if the filter is exposed to very fine particles from combustion processes or to oil mist, the effect of electrostatic charges can, for example, be influenced by discharge phenomena or shielding of the charges in such a way that a filter's efficiency decreases over the course of operation. If there is sufficient dust present in the air being filtered, this effect is compensated for by the increase in (mechanical) efficiency due to dust storage.

Unfortunately, some competitors on the market are offering products whose arrestance performance is based almost entirely on the electret effect, and which thus purport to achieve arrestance performance levels that in actual practice are not sustainedly reached. For this reason, back in 2002 an additional testing method was incorporated in the EN 779, designed to assess to what degree a filter's efficiency is attributable to electrostatic charges on the fibers.

In the new, revised version of the standard, this method has also been incorporated in the filter classification. For this purpose, a media sample is immersed in isopropanol, then dried again, and the fractional collection efficiency is determined for particles measuring 0.4 µm. The aim of treating the media sample with isopropanol is to neutralize all electrostatic charges on the fibers. The "Minimum Efficiency" corresponds to the lowest value of all efficiencies measured during the test (efficiencies of the filter element before, during and after dust feed-in and efficiency of the media sample treated with isopropanol). The efficiencies and arrestance values measured are used to assign the air filters tested to a particular filter class in accordance with the table above.

The introduction of the new minimum efficiencies into the classification of high-arrestance fine filters prevents low-performing coarse filters getting onto the market that through high electrostatic charging alone feign high fine filter efficiencies which after only a brief period of operation can no longer be achieved in actual practice. The standard thus poses significantly more stringent requirements, resulting in improved operational dependability and a high overall standard of quality for the user.

But: where there's light, there's also shadow. The new test procedure is performed only on a small media sample, and therefore does not assess the quality of the overall assembly configuration, which may be much more determinant for the filter's performance than the question of whether a medium is carrying an electrostatic charge, and if so, how much. In addition, this method undervalues the filter as a whole, since it does not factor in the increase in efficiency simultaneously effected in actual practice by dust storage. Moreover, isopropanol may also chemically attack the media structure, and thus either falsify the measured values or render the filter medium totally unusable (see Fig. 2).

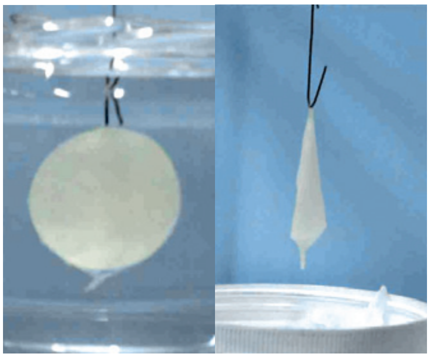

Fig. 2: Sample of an organic-synthetic filter medium during and after treatment with isopropanol.

With the standardized test procedure specified in EN 779, reproducible and comparable results for air filters can be achieved in the laboratory. Despite the general acceptance of EN 779, this standard's test procedures as briefly described above exhibit certain weaknesses. One significant disadvantage of these filter testing methods is that they do not permit any statements whatsoever to be arrived at on the efficacy of a filter for specific particle sizes. Another disadvantage is that the synthetic test dust used (ASHRAE dust) will usually not correspond to the atmospheric dust in the actual application concerned, so that dust-loaded filters behave differently in the laboratory test compared to actual use. However, the composition of actual atmospheric dust depends on many different parameters, such as the location involved, air temperature and humidity, and weather conditions, so that entirely different operating behavior can result for one and the same filter element in actual use, depending on the places and times involved.

Glass-fiber pocket filters release microscopically small fiber fragments that are respirable and have long been suspected to being deleterious to human health. These and other phenomena are grouped together under the term "shedding". This constitutes a further weakness in the standard. Shedding is admittedly mentioned in the standard for informational purposes, but a measuring procedure is not described, let alone a method for evaluating such effects within the filter classification.