49 instead of 9 Filter Classes – The Air Filter Standard ISO 16890 in an Overview.

As early as December 2016, the new air filter standard, ISO 16890, has applied. Instead of the previous 9 filter classes, 49 should now realistically render information about the true effect of filters.

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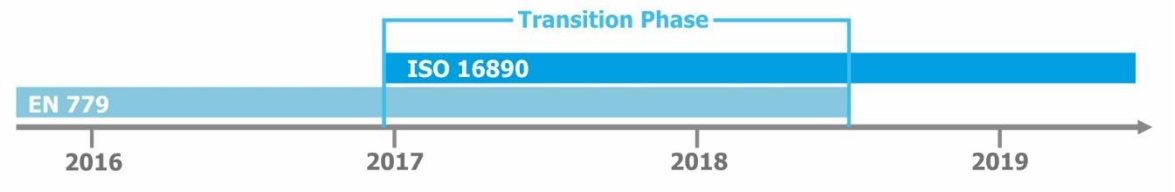
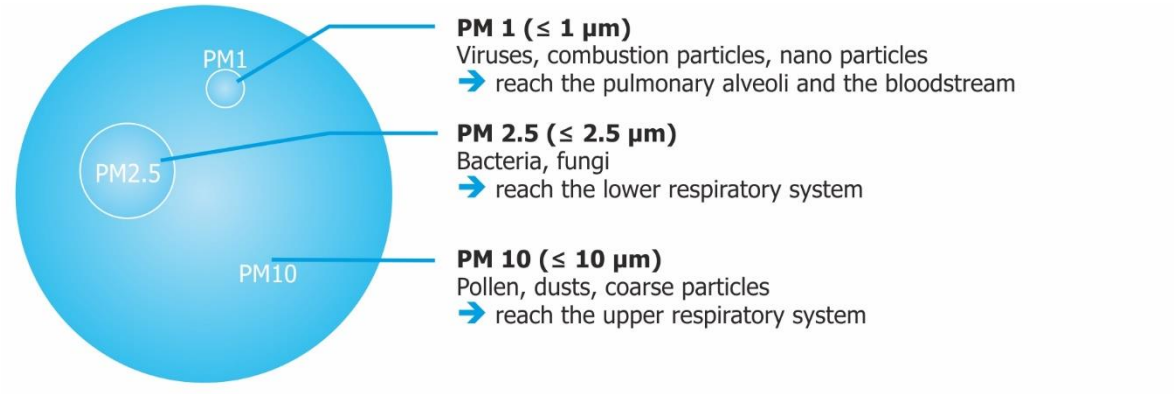
The New Filter Standard ISO 16890

In December 2016, the ISO 16890 standard became effective in order to globally regulate the various standards such as EN 779 or ASHRAE 52.2.
Particularly affected are the filter types belonging to the groups G, M and F. A lead time of 18 months was given for the conversion to the new ISO-standards, resulting in the fact that the EN 779 as well as ISO 16890 shall both be valid up to mid 2018.



Causes and Advantages of the New Approach

Various studies, amongst others, those initiated by the World Health Organisation (WHO), are engaged with the impacts of fine dust to human health.
The results are clear. Air pollution and especially the small particles in the air are harmful to health and in part, lead to fatal respiratory and cardiovascular diseases. These particles are categorized in different PM-classes, namely PM1 (aerodynamic diameter ≤ 1 µm), PM2.5 (≤ 2.5 µm) und PM10 (≤ 10 µm). The abbreviation PM means "Particulate Matter", e.g. fine dust.



ISO 16890 in an Overview

The EN 779 standard does not take the air's fine dust pollution into consideration; instead only the filter's degree of efficiency concerning 0.4 µm-sized particles. However, this does not meet the true requirements.
On the contrary, the ISO 16890 observes three areas of different particle sizes and thus, is more realistic. The test results therefore render a better conclusion concerning the filter's actual performance during real operation.

Definitions for the determination of the filter-performance: ePMx and ePMx, min

ePMx	ePMx,min
Fine Dust-Separation Efficiency	Minimum Fine Dust-Separation Efficiency
Three categories PM1 (0.3 µm up to 1 µm), ePM2.5 (0.3 µm up to 2.5 µm) and ePM10 (0.3 µm up to 10 µm) describe the particle size area that the separation efficiency is based on.	This value refers to the minimum fine dust-separation efficiency in the categories PM1 or PM2.5. To determine this value, the filter's separation efficiency in an electrostatically discharged condition is examined.

New Classification
The filters are classified into four groups. Decisive for the classification is the separation efficiency within the different fine dust-area size ranges (≤ 1 µm, ≤ 2.5 µm as well as ≤ 10 µm).

Filter Groups ISO 16890	Required minimum performance			Reference value for the determination of the filter performance
	ePM1, min	ePM2.5, min	ePM10	
ISO ePM1	≥ 50 %			ePM1
ISO ePM2.5		≥ 50 %		ePM2.5
ISO ePM10			≥ 50 %	ePM10
ISO Coarse			< 50%	Initial separation efficiency

The percent rates after designation of the filter groups are between the ISO ePMx groups and the ISO Coarse groups are incomparable, as they do not refer to an identical reference value.

ISO ePM1 70%

Performance specification of the filter includes the area PM 1 (0.3 - 1 µm).

The average of the minimum separation efficiency and initial separation efficiency lies between 70% and <75% (rounded off in full 5%-steps).
The minimum separation efficiency is at least 50%.

ISO ePM10 85%

Performance specification of the filter includes the area PM 10 (0.3 – 10 µm).

The separation efficiency lies between 85% and <90% (rounded off in full 5%-steps).

ISO Coarse 95%

Fine Dust-Separation Efficiency in the area PM 10 (0.3-10 µm) does not reach the 50%-limit. Therefore, the dust load will be measured.

The initial separation efficiency lies between 95% and <100% (rounded off in full 5%-steps).

The following chart allows an overview of the new filter classes. The classification of the previous filter classes F7, F8, etc. is meant to only serve as a guideline.

Classification Chart							
PM1		PM2,5		PM10		Coarse	
ISO ePM1 95% ISO ePM1 90% ISO ePM1 85% ISO ePM1 80%	F9	ISO ePM2,5 95% ISO ePM2,5 90% ISO ePM2,5 85% ISO ePM2,5 80% ISO ePM2,5 75% ISO ePM2,5 70% ISO ePM2,5 65%	F7	ISO ePM10 95% ISO ePM10 90% ISO ePM10 85% ISO ePM10 80% ISO ePM10 75% ISO ePM10 70% ISO ePM10 65%	M6	ISO Coarse 95% ISO Coarse 90% ISO Coarse 85% ISO Coarse 80% ISO Coarse 75% ISO Coarse 70% ISO Coarse 65% ISO Coarse 60%	G4
ISO ePM1 75% ISO ePM1 70%	F8						
ISO ePM1 65% ISO ePM1 60% ISO ePM1 55% ISO ePM1 50%	F7	ISO ePM2,5 60% ISO ePM2,5 55% ISO ePM2,5 50%	M6	ISO ePM10 60% ISO ePM10 55% ISO ePM10 50%	M5	ISO Coarse 55% ISO Coarse 50% ISO Coarse 45%	G3
						ISO Coarse 40% ISO Coarse 35% ISO Coarse 30%	G2
At least 50% separation efficiency in untreated as well as discharged condition.		At least 50% separation efficiency in untreated as well as discharged condition.		At least 50% separation efficiency in untreated condition. No requirements concerning discharged condition.		No requirements concerning discharged condition.	
Fine Filter		Medium Filter				Coarse Filter	

A direct classification of a filter type according to EN 779 to a filter type of the ISO 16890 is not automatically possible. The recommendations from the VDI and filter manufacturers are similar; they do, however, deviate from one another.

Not all previous F7-filters achieve minimum fine dust-separation efficiency ≥ 50% in the area PM1 and therefore, cannot automatically be assigned into the ePM1-Class. An F7-filter can be replaced by an ISO ePM1 50% as well as by an ISO ePM2.5 65%.

The following three examples illustrate the classification's claim concerning the respective filter's performance:

- ISO ePM1 85%
- The filter's separation efficiency towards the particle ≤1 µm lies between 85% and <90%.
- ISO Coarse 60%:
- The filter's initial separation efficiency lies between 60% and <65%.
- ISO ePM10 95%:
- This filter isn't more powerful than an ISO ePM1 85%-filter, as the percent value refers to various particle sizes.

ISO 16890 in practice

When comparing two filters, one must initially take the filter group into consideration and only after that, the separation efficiency's percentage. A comparison of two filters is only logical within one filter group.

An exemplary comparison of two filters that, according to the standard EN 779, could both be assigned to the class F7, displays the changes brought by ISO 16890.

Examined particle size	PM1 [0.3 µm – 1 µm]		PM2,5 [0.3 µm – 2.5 µm]		PM10 [0.3 µm – 10 µm]
Separation Efficiency	**ePM1, min**	**ePM1**	**ePM2.5, min**	**ePM2.5**	**ePM10**
Test Result Test Filter 1, F7	45%	59%	56%	68%	89%
	➔ Evaluation: ISO ePM2,5 65%				
Test Result Test Filter 2, F7	55%	62%	65%	72%	91%
	➔ Evaluation: ISO ePM1 60%				

Test Filter 1
This F7-filter shall be evaluated with ISO ePM2.5 65% (ePM2.5: 68%; rounding off in 5%-steps).

The test filter 1 will not be designated as ISO ePM1, although the separation efficiency ePM1 lies at a 59% average. To belong to the filter group ISO ePM1, the separation efficiency must also reach 50% or more in a discharged condition. This is not the case.

Results Test Filter 2
This F7-filter shall be evaluated with ISO ePM1 60% (ePM1: 62%; rounding off in 5%-steps).

The test results in a discharged condition lie at 55% and thus, over 50%.
Therefore, in the case of particles hazard to one's health in size up to 1µm, the filter is more effective than test filter 1.

Summary of the filter comparison
According to EN 779 standard, both F7-filters belong to the group of fine filters.
In accordance with ISO 16890, both filters will be assigned to different classes.
The efficiency towards PM1-particles, in reference to test filter 1, is relatively low in a discharged condition. However, these particle sizes are the most dangerous for one's health and very widely spread in cities. Thus, the test filter 2, for example in office space or business areas, should clearly be chosen above test filter 1.

Forecast

The EN 779 standard, including the previously common filter classes such as M5 or F7, is valid up to mid 2018.
As of that period of time, only ISO 16890 shall be valid.

Up to now, numerous standards and guidelines have contextually referred to the EN 779. In the future, these will be oriented to ISO 16890. Updates of these standards prior to mid 2018 will, with certainty, already refer to ISO 16890 and no longer to EN 779.
Therefore, it is recommended to work with this standard as early as possible, as this topic will surely be relevant prior to EN 779's replacement in mid 2018.

Furthermore, it can be expected that the definition of a fine filter will be changed and increased in reference to the performance requirements. In the event that the separation efficiency of particles smaller than 1 µm should become relevant for the definition of a fine filter, the demands on previous fine filters will also increase.
According to the VDI's recommendation, at least one filter of the class ISO ePM1 must be used in the final stage. Therefore, the filter class ISO ePM1 counts as a minimum requirement for fine filters.
In regard to room air quality, this development should be welcomed as with the increased demands on filter, the quality of the room air also increases.

With robatherm, you're always on the safe side
The conversion to ISO 16890 and the connected number of 49 instead of the previous 9 filter classes does indeed cause uncertainty as well as the need for clarification. Especially the fact that previous filter classes could not automatically be assigned to a new class, could evoke discussions during the transition phase.
As a premium manufacturer, robatherm feels the responsibility of intensively engaging itself in this subject matter and to meet the upcoming questions with compact information.
Our experienced staff is looking forward to advising you in regard to which filter classes appear most useful for your specific application.

In addition, robatherm's premium-strategy follows the mission statement that people all over the world should be provided with the desired, best room air possible.
Therefore, ISO 16890 and its connected stricter interpretation of filter quality, in reference to room air quality, should definitely be deemed positive.

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