

Measuring Real Life ISO 16890



ISO International Standards Organization issues a new standard for filter testing and rating



ISO coarse – filters allocated to this range capture less than 50% of PM10 particles.



PM10 – Refers to the particle size fraction in the range from 0,3 µm up to 10 µm.



PM2,5 – Refers to the particle size fraction in the range from 0,3 µm up to 2,5 µm.



PM1 – Refers to the particle size fraction in the range from 0,3 µm up to 1 µm.

The precise definition of PM10, PM2,5 and PM1 is quite complex and not simple to measure. Public authorities, like the US EPA or the German Federal Environmental Agency (Umweltbundesamt), increasingly use in their publications the simpler denotation of PM10 as being the particle size fraction less or equal to 10 µm. Since this deviation to the above-mentioned complex “official” definition does not have a significant impact on a filter elements particle removal efficiency, the ISO 16890 documents refer to this simplified definition of PM10, PM2,5 and PM1.

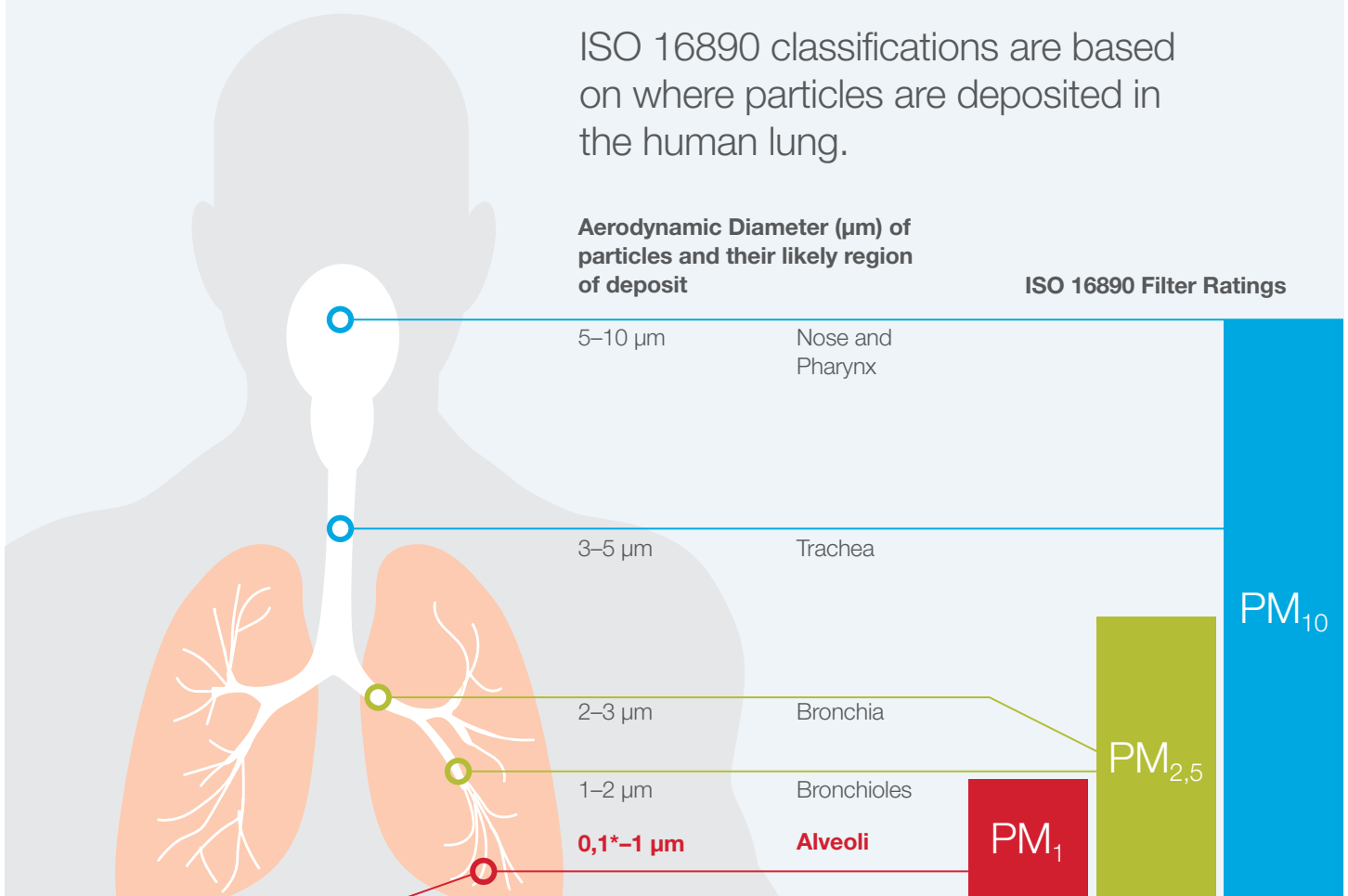
More Than Logic – ISO 16890 Measures Reality!

The world’s leading health-related organizations consider PM10, PM2,5 and PM1 fine dust fractions as the most important and dangerous for humans. Their official documentation to the public always refers to these PM levels.



It is more than logic that filter test methods and classifications follow this approach to demonstrate filtration performance towards the most harmful fine dusts.

ISO 16890 classifications are based on where particles are deposited in the human lung.



PM₁ – The Smaller the More Dangerous!

A variety of studies are focusing on the health effects of PM1 particles:

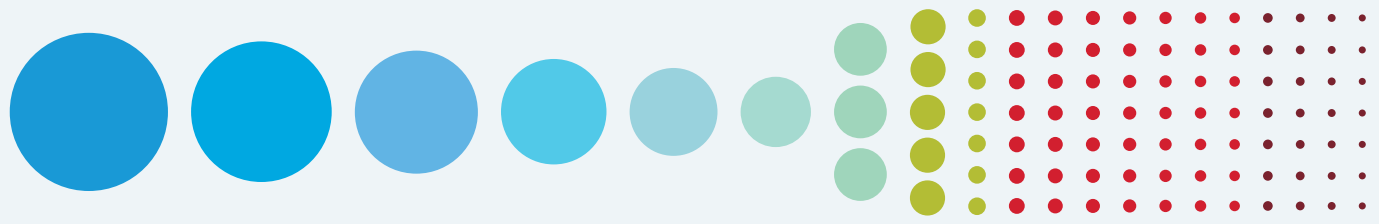
“ Particles smaller or equal to 1 micron in diameter are small enough to find their way through the cell membranes of the alveoli into the human blood stream. ”

“ Fine particles in the air measuring between 0,25 to 0,5 microns in diameter have a closer relationship to human health, especially an increased risk of cardiovascular diseases. ”

“ Smaller particles in the body can harm the regulation of the human nervous system. ”

Due to their Harmfulness, Permanence, and Frequency, Particles Smaller or Equal to 1µm need the Most Attention!

The lighter and smaller a particle is, the longer it stays in the air.



The main difference between EN779 and the ISO 16890



According to **EN779** filter test procedures are considering only particles in the size of 0,4 µm

According to **ISO 16890** filter test procedures are considering the range from 10 µm–0,3 µm

ISO 16890 Testing and Classification Procedure

Step 1	Step 2	Step 3	Step 4	Step 5	Step 6										
<p>Filter efficiency is measured on 0,3 to 10 µm of the clean (not conditioned) filter.</p>	<p>The filter is conditioned in an isopropanol vapor atmosphere to eliminate electrostatic charge.</p>	<p>Filter efficiency is measured again on 0,3 to 10 µm – now of the conditioned filter.</p>	<p>Actual efficiency per PM size is calculated as the average of the conditioned and the unconditioned filter.</p> <p>Important: For a certain PM classification, the filter needs to show a minimum efficiency of 50% for the unconditioned and the conditioned filter.</p>	<p>Values are allocated to ISO groups.</p> <table border="1"> <thead> <tr> <th>ISO Efficiency</th> <th>Size Range, µm</th> </tr> </thead> <tbody> <tr> <td>coarse</td> <td>> 10</td> </tr> <tr> <td>ePM10</td> <td>0,3 ≤ x ≤ 10</td> </tr> <tr> <td>ePM2,5</td> <td>0,3 ≤ x ≤ 2,5</td> </tr> <tr> <td>ePM1</td> <td>0,3 ≤ x ≤ 1</td> </tr> </tbody> </table> <p>For ISO coarse filters Initial Gravity Arrestance is measured by loading the filter with synthetic test dust. This step is voluntary for filters classified as ePM10, ePM2,5 or ePM1.</p>	ISO Efficiency	Size Range, µm	coarse	> 10	ePM10	0,3 ≤ x ≤ 10	ePM2,5	0,3 ≤ x ≤ 2,5	ePM1	0,3 ≤ x ≤ 1	<p>The reporting value for the filter is the combination of the selected ISO group and the efficiency value measured for this group – always rounded down in 5% steps.</p>
ISO Efficiency	Size Range, µm														
coarse	> 10														
ePM10	0,3 ≤ x ≤ 10														
ePM2,5	0,3 ≤ x ≤ 2,5														
ePM1	0,3 ≤ x ≤ 1														

Example:

A filter shows the following average efficiency values:

Efficiency class	Value
ISO ePM ₁₀	89%
ISO ePM _{2,5}	63%
ISO ePM ₁	49%

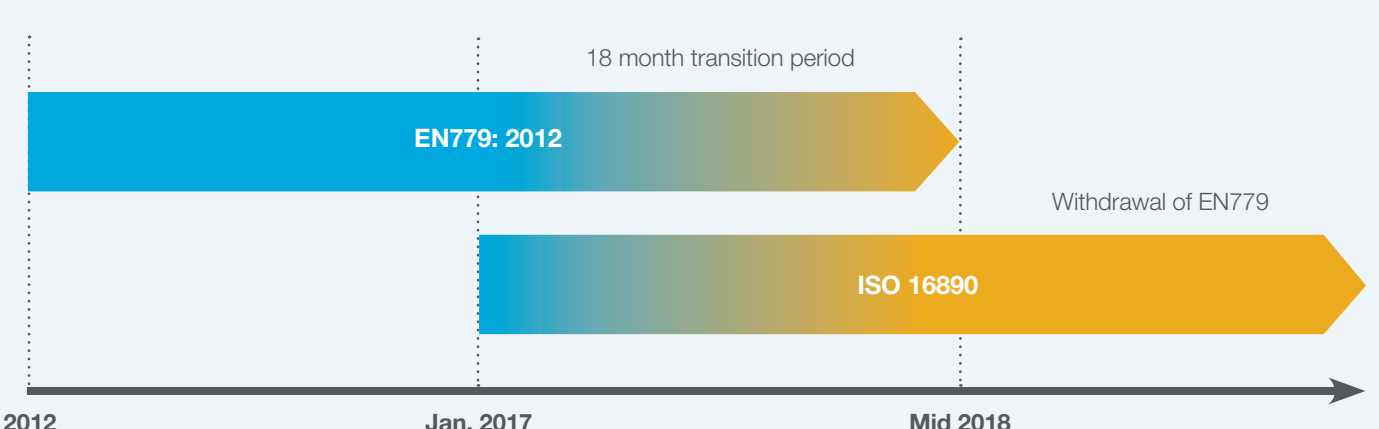
- Minimum efficiency of 50% is achieved for ISO ePM10 and ISO ePM2,5 – but only 49% for ISO ePM1, which is not fulfilled.
- Possible ISO groups are therefore ISO ePM2,5 and ISO ePM10
- If, for example, ISO ePM2,5 group is selected, value of 63% is rounded down to 60%.

As a result, the filter is classified as:

Classification
ISO ePM_{2,5} 60%

Meaning this filter is able to capture 60% of the particles smaller or equal to 2,5 micron!

ISO 16890 Timeline



Efficiency



Current Standard vs. ISO 16890

Filter	PART NUMBER	DIMENSION (mm) W x H x D	FILTER AREA (m ²)	NUMBER OF POCKETS OR V	NOMINAL AIRFLOW (m ³ /h)	DHC acc. EN779 (g)	EN779:2012 Classification	INITIAL dp (Pa)	ENERGY RATING	ISO 16890 CLASSIFICATION	ePM1 (%)	ePM2,5 (%)	ePM10 (%)
											ePM1 (%)	ePM2,5 (%)	ePM10 (%)
AmAir® 500	42-5100-4001	595 x 595 x 95	2,4	-	3 400	75	M5	145	E	ePM10 70 %	20	35	74
DriPak® BASE GF M5	51-2110-0625	592 x 592 x 635	5,0	6	3 400	675	M5	55	D	ePM10 55 %	23	32	59
DriPak® BASE GF M6	51-2210-0625	592 x 592 x 635	5,0	6	3 400	675	M6	60	C	ePM10 60 %	25	34	64
DriPak® BASE GF F7	51-2310-0825	592 x 592 x 635	6,7	8	3 400	575	F7	115	C	ePM1 60 %	61	65	86
DriPak® BASE GF F8	51-2410-0825	592 x 592 x 635	6,7	8	3 400	350	F8	165	D	ePM1 80 %	83	81	92
DriPak® BASE SF M5	51-3110-0625	592 x 592 x 635	5,0	6	3 400	225	M5	75	E	ePM10 50 %	28	36	53
DriPak® BASE SF M6	51-3210-0625	592 x 592 x 635	5,0	6	3 400	675	M6	65	E	ePM10 55 %	33	40	56
DriPak® BASE SF F7	54-3410-0824	592 x 592 x 610	6,2	8	3 400	175	F7	150	E	ePM2,5 50 %	48	54	80
DriPak® GX M5	51-1510-0825	592 x 592 x 640	5,9	8	3 400	875	M5	50	B	ePM10 60 %	24	33	64
DriPak® GX M6	51-1610-0825	592 x 592 x 640	5,9	8	3 400	725	M6	59	C	ePM10 70 %	26	35	74
DriPak® GX F7	51-1710-1025	592 x 592 x 640	7,3	10	3 400	725	F7	80	B	ePM1 65 %	69	77	92
DriPak® GX F9	51-1910-1025	592 x 592 x 640	7,3	10	3 400	600	F9	165	C	ePM1 90 %	94	96	99
DriPak® SX M5	51-4510-0824	592 x 592 x 610	5,7	8	3 400	150	M5	65	E	ePM10 50 %	30	38	54
DriPak® SX M6	51-4610-0824	592 x 592 x 610	5,7	8	3 400	225	M6	65	E	ePM10 55 %	36	44	59
DriPak® SX F7	51-4718-1025	592 x 592 x 640	7,3	10	3 400	225	F7	110	C	ePM2,5 65 %	58	69	90
DriPak® NX F7	51-9110-1025	592 x 592 x 640	7,3	10	3 400	1 000	F7	65	A+	ePM2,5 50 %	47	54	85
DriPak® NX F9	51-9318-1025	592 x 592 x 640	7,3	10	3 400	500	F9	120	A	ePM1 80 %	84	90	97
VariCel® ECOPAK VEP6	25-5672-2201	592 x 592 x 98	11,4	-	3 400	250	M6	125	E	ePM10 70 %	28	42	71
VariCel® ECOPAK VEP7	25-6672-2201	592 x 592 x 98	11,4	-	3 400	250	F7	155	E	ePM1 55 %	59	66	88
VariCel® ECOPAK VEP8	25-7672-2201	592 x 592 x 98	11,4	-	3 400	175	F8	180	D	ePM1 65 %	68	76	90
VariCel® ECOPAK VEP9	25-8672-2201	592 x 592 x 98	11,4	-	3 400	150	F9	215	D	ePM1 80 %	81	86	94
VariCel® HT VHT6SF	20-5286-0065	592 x 592 x 292	12,5	-	3 400	450	M6	140	E	ePM10 70 %	28	42	71
VariCel® HT VHT7SF	20-6286-0065	592 x 592 x 292	12,5	-	3 400	350	F7	180	D	ePM1 50 %	54	64	82
VariCel® HT VHT8SF	20-7286-0065	592 x 592 x 292	12,5	-	3 400	275	F8	190	D	ePM1 65 %	68	76	90
VariCel® HT VXLHT6SF	20-5387-4202	592 x 592 x 292	13,4	-	3 400	425	M6	130	E	ePM10 70 %	28	42	71
VariCel® HT VXLHT7SF	20-6387-4202	592 x 592 x 292	13,4	-	3 400	375	F7	150	D	ePM1 50 %	54	64	82
VariCel® HT VXLHT8SF	20-8387-4202	592 x 592 x 292	13,4	-	3 400	275	F8	170	D	ePM1 65 %	68	76	90
VariCel® M-PAK VM6S	27-6220-0065	592 x 592 x 292	9,6	-	3 400	275	M6	110	E	ePM10 70 %	28	42	71
VariCel® M-PAK VM7S	27-7220-0065	592 x 592 x 292	9,6	-	3 400	150	F7	140	E	ePM1 55 %	59	66	88
VariCel® M-PAK VM8S	27-8220-0065	592 x 592 x 292	11,8	-	3 400	200	F8	150	C	ePM1 65 %	68	76	90
VariCel® M-PAK VM9S	27-9110-0015	592 x 592 x 149	11,8	-	3 400	150	F9	190	D	ePM1 80 %	82	86	94
VariCel® V6S	28-5100-0065	592 x 592 x 292	9,3	-	3 400	250	M6	120	E	ePM10 70 %	28	42	71
VariCel® V7S	20-6100-0065	592 x 592 x 292	9,3	-	3 400	175	F7	140	E	ePM1 50 %	54	64	82
VariCel® V8S	28-7100-0065	592 x 592 x 292	9,3	-	3 400	225	F8	150	D	ePM1 65 %	68	76	90
VariCel® VVXL-6	22-5240-0065	592 x 592 x 292	14,5	4	3 400	575	M6	65	C	ePM10 70 %	33	44	74
VariCel® VVXL-9	22-6240-0065	592 x 592 x 292	14,5	4	3 400	475	F7	75	B	ePM1 55 %	57	67	88
VariCel® VVXL-10	22-7240-0065	592 x 592 x 292	14,5	4	3 400	425	F8	95	B	ePM1 75 %	77	83	94
VariCel® VVXL-11	22-8240-0065	592 x 592 x 292	14,5	4	3 400	400	F9	120	B	ePM1 85 %	86	90	96
VariCel® VVXLE -9	22-6244-1065	592 x 592 x 292	17,8	4	3 400	575	F7	70	A	ePM1 50 %	54	64	86
VariCel® VVXLE-10	22-7244-1065	592 x 592 x 292	17,8	4	3 400	550	F8	85	A	ePM1 70 %	71	72	88
VariCel® VVXLE-11	22-8244-1065	592 x 592 x 292	17,8	4	3 400	550	F9	100	A+	ePM1 80 %	84	89	96

Until December 31st 2017 filtration efficiency values are certified according to EN779. From January 1st 2018 filtration efficiency values are certified according to ISO 16890.