

# CUSTOMER INFORMATION

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## TEST METHODS FOR EPA/HEPA/ULPA\* FILTERS – EN 1822 AND ISO 29463

When the very highest levels of air purity are required – for example, in cleanrooms for the pharma or food industries, or in hospital operating theatres – EPA, HEPA and ULPA filters are the solution. In Europe, these filters are subject to classification according to EN 1822 for filtration efficiency and zero leakage. HEPA and ULPA filters are also subject to individual tests. The international standard ISO 29463 is based on European standard EN 1822 and will probably replace this standard in the future. Both standards are based on the latest particle counting methods.



### Part 1: classification, performance testing and labelling

EPA/HEPA/ULPA filter classification is based on values for local particle collection efficiencies (local values) and integral efficiency (integral value). Each is assessed on the basis of the most penetrating particle size (MPPS). For the classification of EPA filters, a leak testing is

not possible and not necessary. Therefore, no local values as leak detection limits are given for this group.

### Part 2: aerosol production, measuring equipment and particle-count statistics

This section of the standard includes the definition of measuring instru-

ments and aerosol generators, and sets out the statistical basis for evaluating low-level particle counts.

\* EPA: Efficient Particulate Air filter (E 10 to E 12 as well as ISO 15 E to ISO 30 E);  
HEPA: High Efficiency Particulate Air filter (H 13 to H 14 as well as ISO 35 H to ISO 50 H);  
ULPA: Ultra Low Penetration Air filter (U 15 to U 17 as well as ISO 55 U to ISO 75 U)

GROUP	FILTER CLASS		INTEGRAL VALUE		LOCAL VALUE	
	DIN EN 1822	ISO 29463	Filtration efficiency in the MPPS in %	Penetration in the MPPS in %	Filtration efficiency in the MPPS in %	Penetration in the MPPS in %
EPA	E 10	–	≥ 85	≤ 15	–	–
	E 11	ISO 15 E	≥ 95	≤ 5	–	–
	–	ISO 20 E	≥ 99	≤ 1	–	–
	E 12	ISO 25 E	≥ 99.5	≤ 0.5	–	–
	–	ISO 30 E	≥ 99.9	≤ 0.1	–	–
HEPA	H 13	ISO 35 H	≥ 99.95	≤ 0.05	≥ 99.75	≤ 0.25
	–	ISO 40 H	≥ 99.99	≤ 0.01	≥ 99.95	≤ 0.05
	H 14	ISO 45 H	≥ 99.995	≤ 0.005	≥ 99.975	≤ 0.025
	–	ISO 50 H	≥ 99.999	≤ 0.001	≥ 99.995	≤ 0.005
ULPA	U 15	ISO 55 U	≥ 99.9995	≤ 0.0005	≥ 99.9975	≤ 0.0025
	–	ISO 60 U	≥ 99.9999	≤ 0.0001	≥ 99.9995	≤ 0.0005
	U 16	ISO 65 U	≥ 99.99995	≤ 0.00005	≥ 99.99975	≤ 0.00025
	–	ISO 70 U	≥ 99.99999	≤ 0.00001	≥ 99.9999	≤ 0.0001
	U 17	ISO 75 U	≥ 99.999995	≤ 0.000005	≥ 99.9999	≤ 0.0001

Classification of EPA/HEPA/ULPA filters according to DIN EN 1822 and ISO 29463

### Part 3: determining the minimum of the efficiency

Part 3 of the standards describes the testing of fractional collection efficiencies and the determination of the particle size for which the efficiency is a minimum (MPPS) of the flat sheet filter medium.

Method: Samples of the filter medium are subjected to a defined air flow, to which a test aerosol is added. Partial flows of the test aerosol are sampled upstream and downstream of the test specimen and the particle number concentrations are measured using particle count methods. From these results, the fractional collection efficiency curve can be plotted and the particle size with the highest penetration can be determined, which is known as the Most Penetrating Particle Size (MPPS). These results are depending on the filter medium and the air velocity, and hence have to be determined product specific.

### Part 4: leak test

Part 4 of the standards governs the testing of the leak-proof qualities of the filter elements. Irregularities in filter medium production, in the seal between the filter medium and the frame or any tiny leaks in the material itself can lead to local increases in penetration and corresponding increases in local particle concentrations on the clean-air side. For this reason, HEPA and ULPA filters (classes H13 to U17 as well as ISO 35 H to ISO 75 U) are individually leak-tested.

To test the filter element, it is subjected to a constant airflow from an aerosol with an average particle size which corresponds to the hardest particle size to capture (MPPS). Using movable probes, local particle concentrations are measured on the downstream side, which give together with the particle concentrations measured on the upstream side the results for the local penetration and the local collection efficiencies, respectively. If the local penetration values stay within the limits set out in the standard for each individual filter class, the filter can be classified as leak-free. As part of this process, pressure loss is also measured for each filter element.

For HEPA filters (classes H13 to H14 as well as ISO 35 H to ISO 50 H), the leak test can also be achieved using an oil thread leak test (see right).

If the test is successful, the test report will certify the filter's leak-free status and also its integral particle collection efficiencies. The filter will then receive an individual identification number.

Unlike HEPA/ULPA filters, EPA filters are not tested individually. EPA filters are subject to a type test, in which collection efficiencies are determined as an average of certain random tests as part of the quality control.

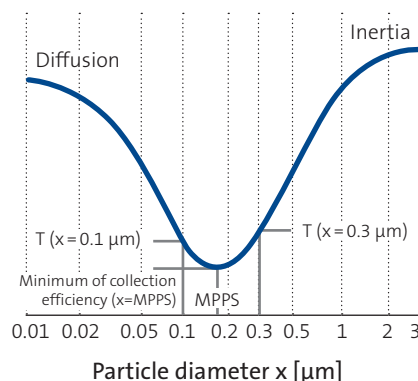
### Part 5: determination of integral efficiency

This section of the standards defines the integral collection efficiency for the filter element as a whole. Typically, this value is calculated by averaging the local results achieved in Part 4. Alternatively, the integral collection efficiency can be determined via the single point measurement of a fixed sampling probe.

Alongside the previously determined leak-proofing test, the integral collection efficiency is used to classify the filter element according to the table of filter classes given in part 1 of the standard. This is certified in the test report.

### Typical fractional collection efficiency curve of a nonwoven filter media

Fractional collection efficiency  $T(x)$  [%]



MPPS: Most Penetrating Particle Size  $\triangle$   
Minimum efficiency level

[See Part 3](#)

### Appendix A: oil thread leak test (normative)

For leak testing of filters class H13 to H14 as well as ISO 35 H to ISO 50 H, the oil thread leak test can be used as an alternative to the scanning process. This test also functions as the reference test for filters that, due to their construction, cannot be tested using the scanning process. In the oil penetration test, the filter element is placed horizontally on a diffuser and sealed. An oil droplet aerosol is then used to optically show the leak-free characteristics of the filter.

[See Part 4](#)

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