MANN+HUMMEL
Air filtration for Cleanrooms

Leadership in Filtration

MANN+HUMMEL

More than 40 years of experience in cleanroom technology

THE PIONEERS FOR AIR FILTRATION IN CLEANROOMS

Our close connection to cleanroom technology dates back to the LUWA company, which was the first European filter manufacturer to already develop cleanroom solutions in the early 1980s for the pharmaceutical industry. Among other things, filters and components for cleanroom technology were designed, which are still proving their relevance in contamination control today. The so-called N-cell or the CG distributor should also be highlighted, for example. These products are in daily use around the world and meet the highest requirements in terms of product and process safety. In 2014, the successor to LUWA became part of the MANN+HUMMEL Group, along with this expertise, competence and know-how.

Since the acquisition of Jack Filter from Steindorf in Austria in 2017, MANN+HUMMEL also has the most modern HEPA filter production facility in Europe. This is supplemented by a state-of-the-art laboratory for testing and developing HEPA and ULPA filters in accordance with the European standard EN 1822 and the global standard ISO 29463.

In the production at this location are processed conventional micro fiberglass media and ePTFE membrane media of the latest generation. High-technology products from this site are used by the global market leaders in microelectronics and other high-tech industries.

Data and facts about the Steindorf production site:

Floor space 3,500 m², of which 2,100 m² is production space

Testing of filters in class 6 cleanrooms according to ISO 14644

Logistics center with extensive high-bay warehouse

Scan test facility at the MANN+HUMMEL plant in Steindorf/A

Filter production at the MANN+HUMMEL plant in Steindorf/A

Leading technology – proven worldwide in operating theatres

TESTED IN CLEANROOMS - OPTIMIZED FOR OPERATING THEATRES

MANN+HUMMEL is a specialist for ceiling systems with low turbulence displacement flow (TAV). For more than 40 years we have been working on the reduction of germ contamination as well as the highest possible purity of the room air while maintaining the required comfort criteria in operating theatres, preparation rooms and intensive care units. In this field, innovations such as the round surgical ceiling have enabled market-leading cleanroom technologies to be established in the world's leading hospitals.

Our customer-specific solutions, product solutions and more than 5,000 references worldwide make us one of the leading suppliers of operation control systems in the world. The close cooperation with the innovators and technology leaders in medical technology as well as the constant exchange of information in the worldwide standardization committees enables our customers to work with the latest state of the art.

In addition to such hospital-typical applications, we have further developed this technology for medical-related areas and also offer special solutions for these uses. This way, our customers – including many world market leaders – benefit when contamination control is required in highly critical value chains.

In order to share our gained experience, we have entered numerous cooperation agreements with leading universities and suppliers of operating technology. This way, for example, we can always guarantee our customers a competent exchange of experience and demonstrate our innovative solutions on site.

THANKS TO OUR YEARS OF EXPERIENCE, WE CAN OFFER OUR CUSTOMERS THE FOLLOWING CLEANROOM SERVICES:

- Complete installation of TAV ceiling systems and customized laminar flow systems
- Measurement and adjustment of all ventilation parameters: air velocity, temperature, humidity, room pressure and sound pressure level Cleanroom classification EN ISO 14644-1
- Pressure loss measurements
- Microbiological germ count determinations in the air and on surfaces
- Flow visualization
- Leakage test with test aerosol (DEHS test) as per EN ISO 14644-3
- Acceptance measurements of TAV ceiling systems according to all valid standards:
- protection degree measurements
- turbulence measurement as per DIN 1946-4, SWKI VA 105-01
- protection zone measurement as per ÖNORM H6020
- raster measurement as per HTM 03-01
- recovery time measurement (recovery test) as per EN ISO 14644-3

TAV ceiling system Optima CG-P/Optima CG-N

The best solution for the greatest air purity

HEPA (High Efficiency Particle Air-filter) and ULPA (Ultra-Low Penetrating Air-filter) filters are used whenever the highest requirements for contamination control in sensitive rooms have to be met. MANN+HUMMEL offers an extensive product portfolio for this. Each filter from filter class H 13 is individually tested – specifically, on the basis of EN 1822 or ISO 29463.

These high-performance filters are primarily used to separate finest air impurities such as aerosols, toxic dusts or microbial contaminants. An overview of the filter groups and classes is provided in the following table.

GROUP	CLASS	TYPICAL CONTAMINANTS	TYPICAL APPLICATION
E EPA Filters EN 1822	E10	Microorganisms, germs, bacteria, tobacco smoke, metal oxide smoke, oil vapor and soot in the nascence	Final filters for rooms with increased requirements (e.g. for production rooms) Pre-filters for cleanrooms in the pharmaceutical and food industry, optics, precision engineering
	E11		
	E12		
H HEPA Filters EN 1822	H13	Particles from combustion processes, radioactive suspended matter, suspended dust or particulate matter, microorganisms, viruses, proteins	Final filters for production rooms for food, electronics, pharmaceutical, optical and film industries, final filters for cleanrooms, pre-filters for higher class cleanrooms, final filters for hospital areas with the highest requirements (operating rooms), exhaust air filters in nuclear plants
	H14		
U ULPA Filters EN 1822	U15	Suspended particulate matter	Final filters for cleanrooms
	U16		
	U17		

MANN+HUMMEL OFFERS THE RIGHT SOLUTION FOR EVERY APPLICATION

Protection against particulate contamination in, among others:


Semi-conductor manufacture


Optical and laser technology


Hospital applications


Pharmaceutical and medical technology

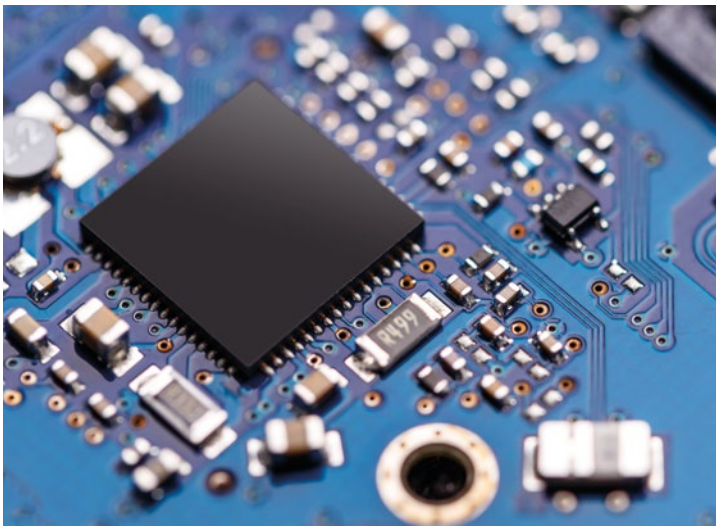

Bio technology


Food and beverage industry


Satellite technology


Nano coating and nano technology

Our years of experience in many sensitive areas of cleanroom technology allows us to offer tailor-made, customer-specific solutions. Furthermore, you can rely on our own service technicians at numerous different sites throughout Europe to carry out standard cleanroom inspections and related services.



EN 1822:2019 Classification of HEPA filters

QUALITY ASSURANCE OF EPA, HEPA AND ULPA FILTERS (HEPA FILTERS)

EN 1822:2019 is based on the latest particle measurement technology and automated methods for determining the separation efficiency and consists of 5 parts. It is the basis for ISO 29463, which is the global standard today. In contrast to this, EN 1822 does not provide for a PAO aerosol photometer test, among other things because it applies up to 1,000 times higher quantities of test aerosol to the filter to be tested and thus causes micro-contamination. The standard determines and evaluates the separation efficiency and thus the efficiency of HEPA filters in 5 steps/parts. The filter is assigned to the respective filter class using the results from the determination of the local separation efficiency (section 4) and the integral separation efficiency (section 5).

EN 1822:2019
This European filter test standard is our basis for testing and classifying HEPA filters.

Part 1 CLASSIFICATION, PERFORMANCE TESTING AND LABELING

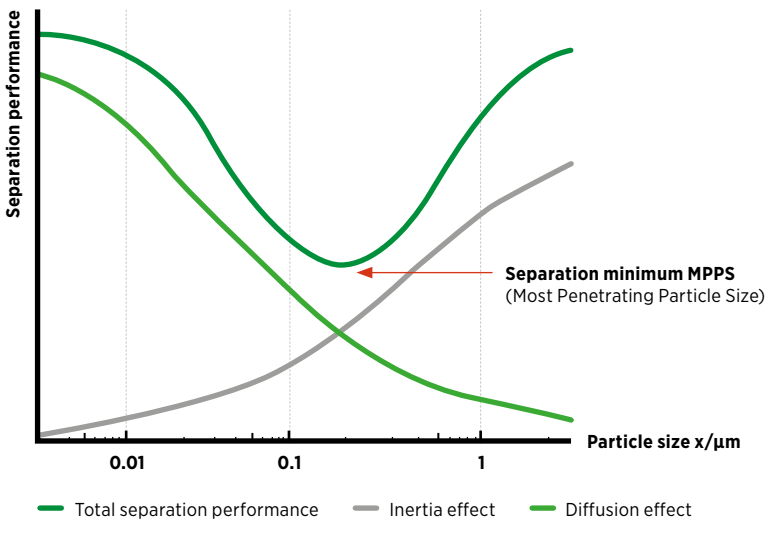
Group E: EPA filter – Efficient Particulate Air-filter (high-performance particulate filter)
Group H: HEPA filter – high efficiency particular air-filter
Group U: ULPA Filter - ultra low penetration air filter

Part 2 AEROSOL PRODUCTION, MEASURING DEVICES, PARTICLE COUNTING

This part describes the conditions of the test as well as the aerosol generators to be used, the particle measurement technology and the statistical methods for evaluating the counting results.

Part 3 TESTING OF THE PLAN FILTER MEDIUM (MPPS DETERMINATION)

Part 3 describes the determination of the fractional separation performance and the determination of the particle size with the poorest separation performance of the flat filter media MPPS (Most Penetrating Particle Size). For this purpose, the filter medium is flowed through at the nominal inflow velocity later specified in the filter and a test aerosol is applied to it. Partial flows of the test aerosol are taken from the upstream and downstream side of the filter sample. By means of a particle counting procedure, the particle concentrations contained therein are determined and the fractional separation efficiency curve is obtained. The particle size at which the fractional efficiency curve reaches its minimum is called MPPS.
The separation efficiency of the HEPA filter is then tested at this point, its weakest point in terms of efficiency. This is the only way to obtain statistically safe values so that even the highest filter classes can be assessed precisely.



Part 4 LEAK TEST OF THE FILTER ELEMENT (SCAN TEST)

This section covers testing the filter for leakage. Leaks can be caused by defects in the filter media, improper sealing of the pleat pack with the frame, or irregularities while handling the parts. Due to the expected high separation efficiency of HEPA filters, even the smallest leaks that are barely visible to the naked eye lead to excessive particle concentrations locally.

For testing, the filter element is installed in a test stand without leaks in an automated procedure (scan test) and then subjected to a test aerosol DEHS (di-ethylhexyl sebacate) at nominal volume flow. The mean particle size of the aerosol must be within the range of the MPPS.
The downstream side of the filter is traced by means of probes on mobile computer-controlled linear axes.

The local aerosol concentrations are measured at each point on the clean air side. In this manner, the local degree of penetration is determined. If the aerosol concentration does not exceed the required limit values at any point, the filter is considered to be leak-free. The necessity of determining the local individual efficiency thus implies the necessity of individual testing of each filter element from filter class H13.

HEPA filter element during the scan test

LEAK TESTING OF FILTER ELEMENTS - EN 1822-1:2019 PART 7.5.2.1

Filters in groups H and U must be leak-tested using one of the following procedures: A) Reference scan test, B) oil-thread test for filter classes H13 and H14 or C) separation efficiency leak test for particle sizes 0.3 - 0.5 µm. If the reference scan procedure cannot be carried out because the design of the filter causes high turbulence in the air flow (filters with aluminum separators, V-shaped or cylindrical filters etc.), the oil-thread test is usually used to verify the absence of leaks. However, this may exclusively be used for filter classes H 13 and H 14.

Filter class as per EN 1822	Filter class as per ISO 29483	Integral value		Local value	
		Efficiency [%]	Penetration [%]	Efficiency [%]	Penetration [%]
E10		≥ 85	≤ 15		
E11	**ISO 15 E**	≥ 95	≤ 5		
	ISO 20 E	≥ 99	≥ 1		
E12	**ISO 25 E**	≥ 99.5	≤ 0.5		
	ISO 30 E	≥ 99.9	≤ 0.7		
H13	**ISO 35 H**	≥ 99.95	≤ 0.05	≥ 99.75	≤ 0.25
	ISO 40 H	≥ 99.99	≤ 0.01	≥ 99.95	≤ 0.05
H14	**ISO 45 H**	≥ 99.995	≤ 0.005	≥ 99.975	≤ 0.025
	ISO 50 U	≥ 99.999	≤ 0.001	≥ 99.995	≤ 0.005
U15	**ISO 55 U**	≥ 99.9995	≤ 0.0005	≥ 99.9975	≤ 0.0025
	ISO 60 U	≥ 99.9999	≤ 0.0001	≥ 99.9995	≤ 0.0005
U16	**ISO 65 U**	≥ 99.99995	≤ 0.00005	≥ 99.99975	≤ 0.00025
	ISO 70 U	≥ 99.99999	≤ 0.00001	≥ 99.9999	≤ 0.0001
U17	**ISO 75 U**	≥ 99.999995	≤ 0.000005		

Part 5 SEPARATION DEGREE TEST OF THE FILTER ELEMENT

Part 5 describes the determination of the integral filter separation efficiency. Usually, this value is represented by the mean value of the local single effect grade measure in part 4. Alternatively, a single measurement with fixed sampling probes is permissible.

Cleanroom technology for highest efficiency

NANO CLASS SQUARE

EPA, HEPA and ULPA filters with mini pleated filter media.

Final filter for cleanrooms and clean work tables. For the separation of viruses, bacteria, toxic dust and aerosols.

9 Products in this group **E** **H** **U**

NANO CLASS SQUARE PER FLANGE HT

EPA Filters for operating temperature up to 120 °C. Ideal for use as a final filter in applications that require a high degree of safety.

4 Products in this group **E**

NANO CLASS CUBE N

EPA, HEPA and ULPA filters with mini pleated media panels.

High-efficiency filters for terminal outlets in ventilation and cleanroom systems with high air throughput.

3 Products in this group **E** **H**

NANO CLASS CUBE N PRO ATEX

HEPA filtration for process filtration in HVAC and cleanroom systems with high air volumes.

Compliant with the ATEX directive 2014/34/EU for explosive atmospheres, certified according to EN 13501-1:2010 in flammability class E and droplet formation class d0.

3 Products in this group **E** **H**

NANO CLASS CUBE

EPA-, HEPA- and ULPA filters with fixed, compact frames.

Preliminary or primary filtration for cleanroom systems. Final stage filtration for gas turbine power plants.

5 Products in this group **E** **H**

Cleanroom technology for highest efficiency

NANO CLASS DEEP PLEAT

Powerful EPA, HEPA and ULPA filters.

Designed for supply, circulating and exhaust air in cleanroom settings.

1 Product in this group **E** **H**

NANO CLASS TUBE

Cylindrical EPA, HEPA and ULPA filters.

Filtration of bacteria, viruses or general impurities in air, compressed air or gases.

1 Product in this group **H**

OPERATING THEATRE SYSTEMS

Ceilings with a laminar flow for operating theatres.

To reduce contamination and postoperative infections in hospitals and medical centers.

5 Products in this group

NANOCLASS WEDGE

Conical EPA, HEPA and ULPA filters.

Pre- and final filtration in HVAC and cleanroom systems.

1 Product in this group **E** **H**

FILTRASEPT HOUSING

Provides air filtration and distribution in one unit.

Multiple sizes and combinations. Low construction height.

Leakage test with test aerosol according to ISO 14644-3 and measurement of pressure drop from room side.

1 Product in this group

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