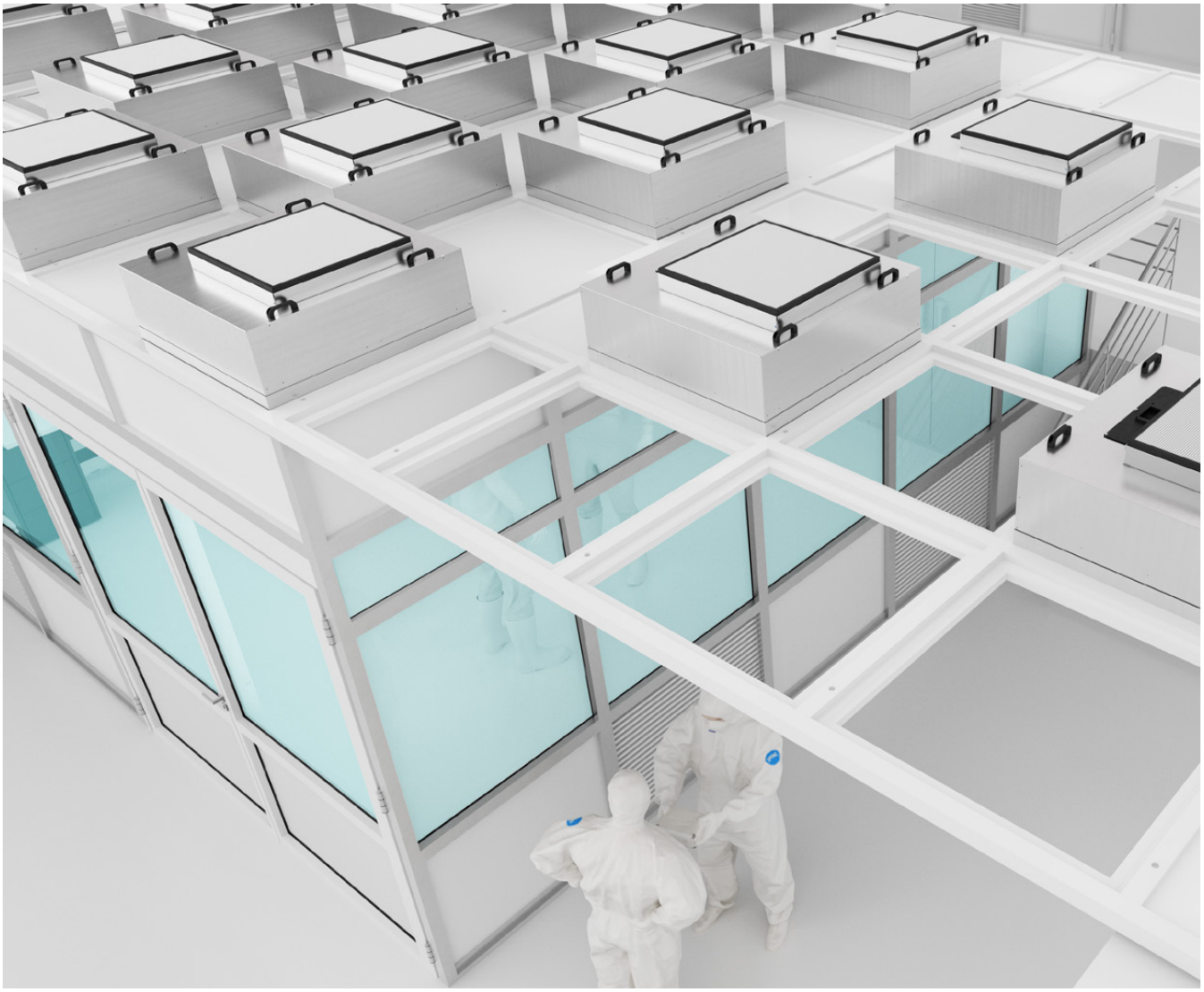
Nanoclass FFU: High purity elements for cleanrooms



Leadership in Filtration

MANN+HUMMEL

Nanoclass FFU

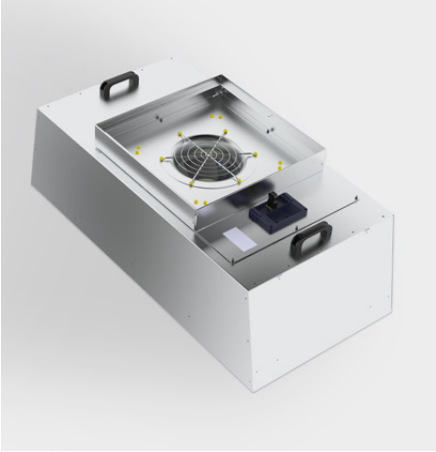
THE ALL-IN-ONE SOLUTION IN A LEAGUE OF ITS OWN

Combining best-in-class energy consumption and noise output with the reliability and filtration performance you would expect from a MANN+HUMMEL product, Nanoclass FFU offers simply unmatched performance.

And, with a range of filter fan units—each with a variety of different filter options—Nanoclass FFU is not just the wise choice, it's the easy choice too.

Why choose Nanoclass FFU?

- All-round solution—housing, HEPA filter, fan and control system
- Modular and lightweight for faster installation with less disruption
- Energy efficient for lower, eco-friendly running costs
- Flexible and adaptable to meet the needs of agile production lines
- Low noise emissions
- An economically better investment than ducted supply air systems
- Available with or without an integrated prefiltration stage
- Available with optional cooling system
- Final filter installation from the cleanroom or plenum side
- Ideal for creating micro clean air zones for work spaces or process cabinets



Together with the cleanroom community, we developed Nanoclass FFU to meet the highest of requirements—with installations in place around the globe.

Designed to perform, built to last!

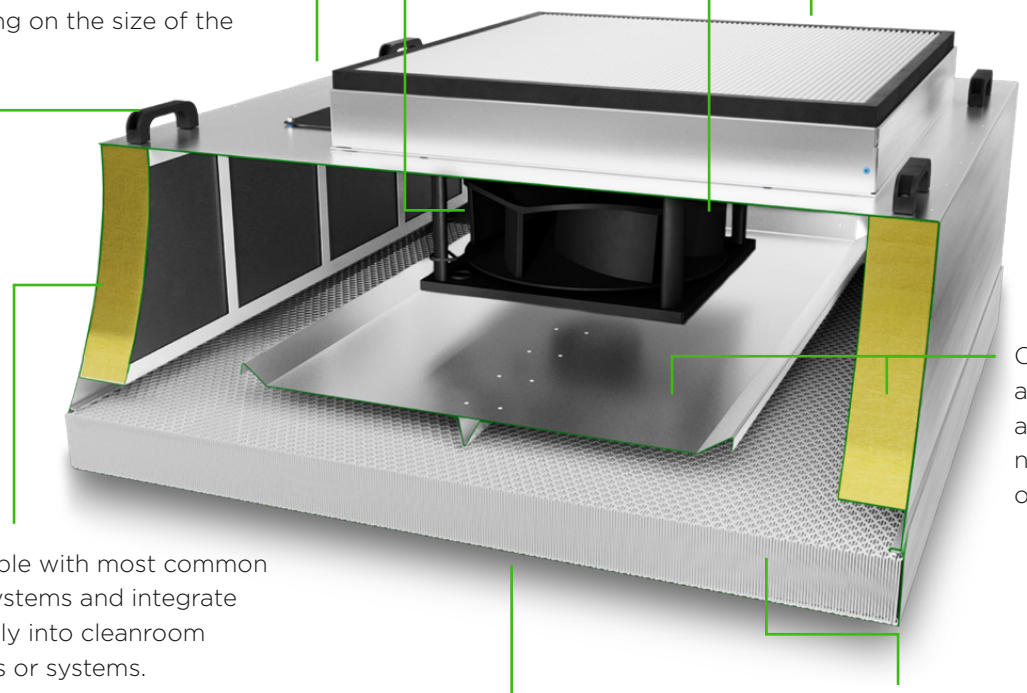
Made from 1.5 mm thick untreated aluminum. Other thicknesses and materials—such as stainless steel and powder coatings (e.g. RAL9010)—are also available.

Proven, energy-efficient drives that are made in Germany and use modern, backward-curved EC centrifugal fans

System control is via MODBUS-RTU interface and 0–10 V analog input, or MODBUS-RTU units with DCI (daisy chain interface) function for auto-addressing

Available with various coarse and fine dust prefilters, and/or high performance molecular filters

For easy handling, each unit has two or four handles on top, depending on the size of the housing.



Optimized air flow and integrated sound absorbers ensure low noise emissions at all operating points

Compatible with most common ceiling systems and integrate seamlessly into cleanroom machines or systems.

Available in the six common grid sizes 0606, 0609, 0612, 0909, 0912 and 1212.

Equipped with high quality HEPA or ULPA filters in classes H14 – U17 (to EN 1822), which can be changed change from above or below

Energy saving to protect your budget

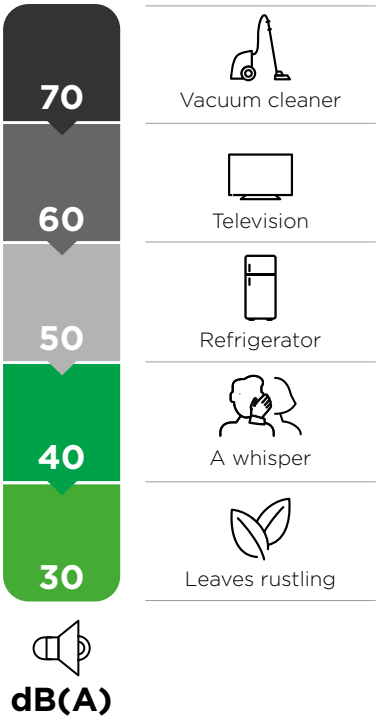
Your process reliability is our top priority. But we also know that energy is a significant part of the total cost of ownership of an air filtration system. That is why we have designed the Nanoclass FFU to offer unrivalled energy efficiency.

Offering up to 20% lower energy consumption and CO_2 footprint than comparable products, Nanoclass FFU boasts a number of features that can help cut your energy bill.

The integrated fan is powered by the latest energy-efficient drives to reduce the electrical demand of each unit. All filter options feature low pressure drops to minimize the air flow resistance. And the flexible control modules enable you to power your filter fan system as and when you need it.

Whisper-quiet performance

A quiet hum can quickly turn into an annoying drone—particularly in working spaces. All Nanoclass FFUs feature an extremely low sound output for unobtrusive performance.



A commonly-held belief is that filter fan units can be noisy, which makes them unsuitable for use in groups or anywhere except small applications.

Indeed, some FFUs can be noisy. But Nanoclass FFU offers the quietest performance on the market.

So much so, that several of our filter fan units can even be used in combination in sound-sensitive areas.

*Grid size 0612, ePM10 50% and HEPA H14, 0.45 m/s at 1.5 m

Nanoclass FFU Eco
39.5 dB(A)*

Nanoclass FFU Select
44 dB(A)*

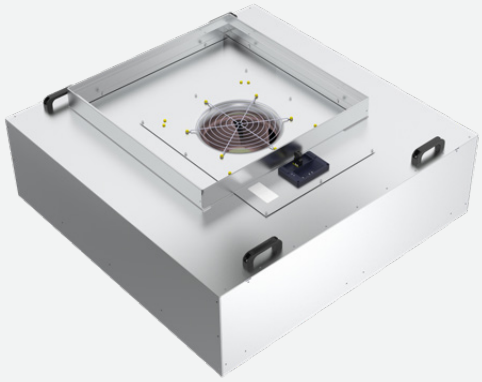
A small change can make a big difference

Noise emissions are not linear, so even a slight increase in the decibel level can feel like a significant rise.

+3 dBA – corresponds to doubling the *sound intensity*
+6 dBA – feels like quadrupling the *sound intensity*
+10 dBA – has the sensation of doubling the *volume*

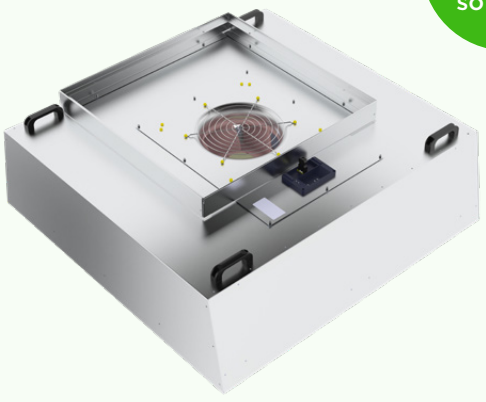
The Nanoclass FFU range

Nanoclass FFU Access
Budget-friendly performance



Nanoclass FFU Select
Reliable and well-proven in the field

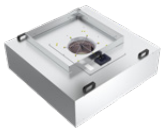
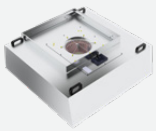
Market-leading solution



Nanoclass FFU Eco
Unrivalled performance - best in class for energy efficiency and low noise levels

Nanoclass FFU RSI
Room-side installation

Technical overview

Nanoclass FFU	Dimensions mm	Weight kg	Energy cons. W	Sound pressure* dB(A)	Protection class	Voltage V	Frequency Hz	Power max. W	Current max. A
	562 x 1162 x 335	17.5	141	47	IP20 / IP55	1 - 220-277V	50/60	315	1.37
Access	1162 x 1162 x 335	22	238	52					
	562 x 1162 x 350	20.5	95	44	IP20 / IP55	1 - 220-277V	50/60	500	2.2
Select	1162 x 1162 x 350	29.5	220	51					
	562 x 1162 x 350	19.5	72	39.5	IP20 / IP55	1 - 220-277V	50/60	500	2.2
Eco	1162 x 1162 x 350	28.5	170	43					
	562 x 1162 x 350	22	95	47	IP20 / IP55	1 - 220-277V	50/60	500	2.2
RSI	1162 x 1162 x 350	31	220	52					

Testing Parameters: prefilter – ePM10 50%, main filter – HEPA H14
*Distance 1.5 m after HEPA

Nanoclass FFU Access

For budget-friendly performance

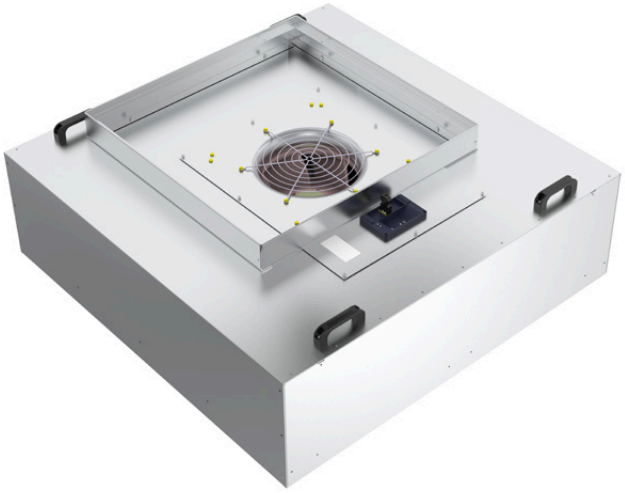
- Standard dimensions for high-runner grid sizes
- Other dimensions availabe
- Provided with and without a prefilter frame
- Very light weight
- Moderate energy consumption and noise emissions
- Designed with focus on price-driven applications

Grid size	Dimensions (mm)			Prefilter frame (mm)			Connection & control	Weight (kg)	Air volume (m^3/h)	Noise emissions (dBA)*
	W	H	D	W	H	D	MODBUS RTU			
1212	1162 1132	1162 1132	320 300	750	750	80	✓	22 21.5	2220	52
0612	562 532	1162 1132	300 300	500	500	80	✓	17.5 17	1100	48

*ePM10 50% prefilter and H14 main filter with 0.45 m/s air velocity at 1.5 m below HEPA

Nanoclass FFU Select

MADE IN GERMANY



For proven and reliable perfomance

- Dimensions for all standard grid sizes
- Other dimensions availabe
- Provided with and without a prefilter frame
- Light weight filter fan unit
- Available for digital (Modbus RTU) and analog (0-10V) control
- Modbus DCI available
- Low energy consumption
- Lowest noise emission in it's class
- Designed for long-lasting and stable performance

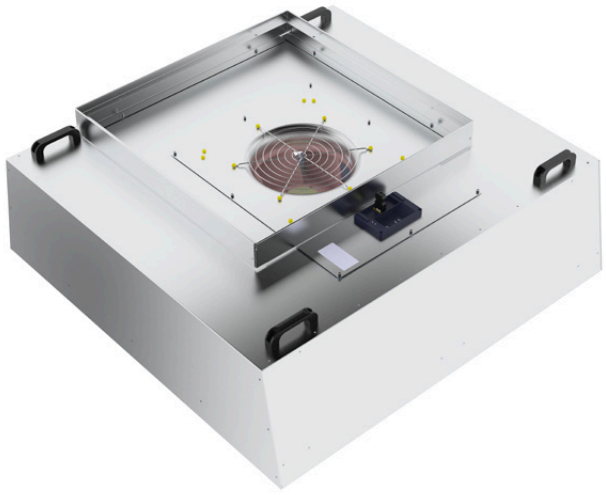
Grid size	Dimensions (mm)			Prefilter frame (mm)			Connection & control		Weight (kg)	Air volume (m³/h)	Noise emissions (dBA)*
	W	H	D	W	H	D	MODBUS RTU/0-10V	Wieland plug			
1212	1162 1132	1162 1132	350 350	750	750	80	✓	Included	29.5 29	2220	51
0912	862 832	1162 1132	350 350	750	750	80	✓	Included	26 25.5	1650	47
0909	862 832	862 832	350 350	500	500	80	✓	Included	22.5 22	1230	45
0612	562 532	1162 1132	350 350	500	500	80	✓	Included	20.5 20	1100	44
0609	562 532	862 832	350 350	500	500	80	✓	Included	18 17.5	800	45
0606	562 532	562 532	350 350	380	450	80	✓	Included	12.5 12	530	47

*ePM10 50% and HEPA H14, 0.45 m/s at 1.5 m

Nanoclass FFU Eco

Patented

MADE IN GERMANY



For simply unmatched performance

- Market-leading for performance, energy efficiency and noise level
- 20% lower energy consumption and CO_2 footprint
- Dimensions for all standard grid sizes
- Other dimensions availabe
- Provided with and without a prefilter frame
- Light weight
- Available for digital (Modbus RTU) and analog (0-10V) control
- Best-in-class noise emissions
- Designed for the highest performance standards
- Patented solution

Grid size	Dimensions (mm)			Prefilter frame (mm)			Connection & control		Weight (kg)	Air volume (m³/h)	Noise emissions (dBA)*
	W	H	D	W	H	D	MODBUS 0–10V	Wieland plug			
1212	1162 1132	1162 1132	350 350	750	750	80	✓	Included	28.5 28	2220	43
0912	862 832	1162 1132	350 350	750	750	80	✓	Included	25 24.5	1650	42
0909	862 832	862 832	350 350	500	500	80	✓	Included	21.5 21	1230	41
0612	562 532	1162 1132	350 350	500	500	80	✓	Included	19.5 19	1100	39.5
0609	562 532	862 832	350 350	500	500	80	✓	Included	17 16	800	41
0606	562 532	562 532	350 350	380	450	80	✓	Included	11.5 11	530	43

*ePM10 50% and HEPA H14, 0.45 m/s at 1.5 m

Nanoclass FFU RSI

Patented

MADE IN GERMANY

For room-side installation

- Standard dimensions for high-runner grid sizes
- Other dimensions availabe
- Provided with and without a prefilter frame
- Light weight
- Available for digital (Modbus RTU) and analog (0-10V) control
- Low energy consumption
- Low noise emissions
- Designed for efficient and reliable cleanroom side installations and replacements
- Patented solution

Grid size	Dimensions (mm)			Prefilter frame (mm)			Connection & control		Weight (kg)	Air volume (m³/h)	Noise emissions (dBA)*
	W	H	D	W	H	D	MODBUS 0–10V	Wieland plug			
1212	1162 1132	1162 1132	350 350	750	750	80	✓	Included	31 30.5	2220	51
0612	562 532	1162 1132	350 350	500	500	80	✓	Included	22 21.5	1100	44

*ePM10 50% and HEPA H14, 0.45 m/s at 1.5 m

Final filtration that's guaranteed leak free

THE HIGHEST POSSIBLE STANDARDS AND SAFETY

Nanoclass FFU is equipped with high quality HEPA or ULPA filter elements that offer high filtration efficiencies from class H14 to U17 (according to EN 1822).

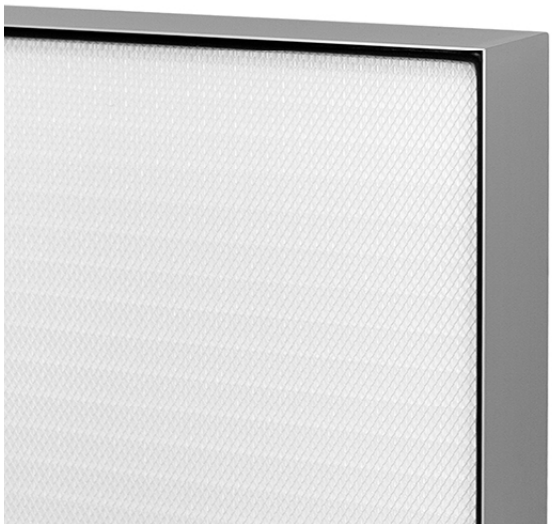
To ensure zero leakage and smooth commissioning, each of our HEPA and ULPA filters is factory tested according to all applicable standards.

As an alternative to the traditional glass fiber media, ePTFE HEPA and ULPA filters with extremely low initial pressure drop performance can be specified as an option.

Each product in the Nanoclass Square Eco range features a microglass paper medium that's minipleated, and fixed into a rigid and robust aluminum frame.

Primary filter options

At the heart of every Nanoclass FFU lies its primary filter. Two options are available—a knife-edge filter for changing from above and a gel-seal product for room-side replacement.



Nanoclass Square Eco KE

Access	Select	Eco	RSI
✓	✓	✓	✓

With its integral knife edge, Nanoclass Square Eco KE ensures a perfect seal between filter and housing everytime.

Nanoclass Square Eco TC

Access	Select	Eco	RSI
✓	✓	✓	○

Nanoclass Square Eco TC features a fluid-gel gasket recessed into its aluminum frame. This gasket enables a leak-free seal when changing the filter from the room side. This solution works in combination with an adapter frame—the room side change frame (RSC) is an extruded aluminium frame.

Room-side change for FFU Access/Eco/Select

In-room filter replacement eliminates lengthy cleanroom shutdowns and the need to work within the ceiling system above.

The RSC adaptor frame makes it possible to change the primary HEPA filter from the cleanroom side in the Access, Select and Eco models.

The RSC adaptor frame is installed on the ceiling grid and the Nanoclass FFU is then simply placed on top. Both parts are installed once from the ceiling side and enable the final filter to be changed from within the cleanroom, instead of from above.

This allows maintenance to be completed with less disruption, and enables cleanroom operations to resume more quickly – minimizing productivity loss.

Prefiltration that's right for any environment

PREFILTER'S PERFECT FOR CLEANROOM

Although prefilters play a supporting role—protecting more expensive final filters from becoming damaged by larger particulate—they can still have a significant impact on the efficiency and the total cost of ownership of the FFU system as a whole.

That's why we have selected a range of prefilters that offer the perfect balance between high filtration efficiency and low pressure drop.

And, to ensure that our prefilters provide the right type of protection, Nanoclass FFU can be fitted with coarse or fine dust prefilters, or even a molecular filtration stage for targeting gaseous contaminants.

We've selected prefilters that are ideal for use in cleanroom environments—with features like zero-shedding filter media, and frames that are resistant to oxidization and moisture.

Airborne molecular contamination (AMC)

WHAT IS AMC?

AMC appears in the form of gases, vapors or aerosols. The chemical nature can be organic, inorganic, or mixed. It plays an increasingly important role in cleanroom processes.

AMC can be detrimental to many processes, people, and products, causing corrosion, condensation, contamination of the final product, odors and health hazards.

SOURCES OF AMC

AMC arises from an almost endless and often unexpected range of sources. Key sources include:

People	Outdoor air	Manufacturing processes	Accidental spillage	Solvents: cleaning, lithography
Outgassing of equipment and materials	Emissions from process equipment	Contamination across production areas	Storage areas for chemicals and materials	Wet cleaning, wet and dry-etching processes

Types of AMC

TYPICAL GASES (DERIVED FROM THE WORK OF THE GASES GLOBAL TECHNICAL COMMITTEE)

Acids	Bases	Condensables*	Dopants	Metals**	
▪ Hydrofluoric acid (HF) ▪ Sulfuric acid (H_2SO_4) ▪ Hydrochloric acid (HCl) ▪ Nitric acid (HNO_3) ▪ Phosphoric acid (H_3PO_4) ▪ Hydrobromic acid (HBr)	▪ Ammonia ▪ N-Methyl-2-pyrrolidone (NMP) ▪ Triethylamine (TEA) ▪ Trimethylamine (TMA) ▪ Tetramethylammonium-hydroxide (TMAH) ▪ Cyclohexylamine ▪ Diethylaminoethanol ▪ Methylamine ▪ Dimethylamine ▪ Morpholine	▪ Silicones (from sealants, O-rings, lubricants) ▪ Hydrocarbon ▪ Plasticizers ▪ (from floor tiles, vinyl materials, gloves)	▪ Boron (usually as boric acid) ▪ Phosphorous (usually as organophosphates) ▪ Arsenic (usually as arsenates)	▪ Al ▪ Cu ▪ W ▪ Li ▪ Na ▪ K ▪ Mn ▪ Mg ▪ Co ▪ Cr ▪ Pb ▪ Mo ▪ Ni	▪ Sn ▪ Zn ▪ V ▪ Ti ▪ Zr ▪ Hf ▪ Bi ▪ Nb ▪ Sr ▪ In ▪ Ge ▪ La

*Condensables as defined by SEMI (boiling point >150 °C)

**Not in metallic form, but as volatile chemical compounds

CLASSIFICATION OF AMC ACCORDING TO SEMI F21-1016

SEMI F21-1016 classifies microelectronics clean environments in respect of their molecular contaminant levels. The classification provides a consistent way of establishing acceptable levels of various molecular contaminant groups. The following groups are classified: Acids (MA), Bases (MB), Condensables (MC), Dopants (MD) and Metals (MM).

Effective protection against airborne molecular contaminants is essential for both product yields and process safety.

Prefilter options

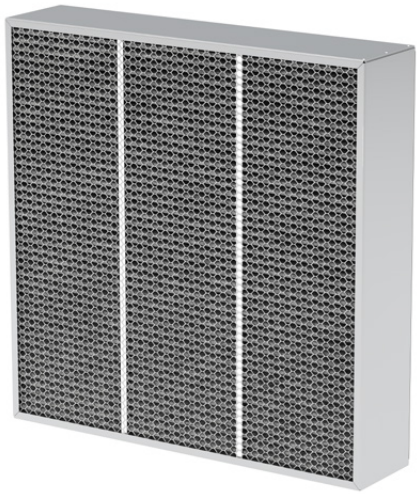
All Nanoclass FFU versions are available with any prefilter type—so you can configure the ideal solution for you.

Airpanel Select FZL
Particle filtration – Coarse 70%

A pleated, synthetic filter medium with hotmelt spacers ensures that Airpanel Select FZL can deliver the reliability needed for cleanroom applications.

Airpanel Eco S
Fine dust filter – ePM10 50%

With a large, synthetic filter media packed into its rigid plastic frame, Airpanel Eco S combines a long service life with zero risk of fiber shedding—perfect for the demands of cleanrooms.



Carboactiv Panel
Molecular filter

Molecular filter panels for cleanroom ceilings, fan filter units, mini-environments or process equipment. Panels features low outgassing and high cleanliness.

Filter technical data

NANOCLASS FFU FINAL FILTERS

Grid size	FFU dimensions (mm)			Ceiling-change dimensions (mm) Nanoclass Square Eco KE			Room-side dimensions (mm) Adaptor frame			Nanoclass Square Eco TC		
	W	H	D	W	H	D	W	H	D	W	H	D
1212	1162	1162	350	1170	1170	86	1170	1170	109	1135	1135	80
	1132	1132	350	1140	1140	86	1140	1140	109	1105	1105	80
0912	862	1162	350	870	1170	86	870	1170	109	835	1135	80
	832	1132	350	840	1140	86	840	1140	109	805	1105	80
0909	862	862	350	870	870	86	870	870	109	835	835	80
	832	832	350	840	840	86	840	840	109	805	805	80
0612	562	1162	350	570	1170	86	570	1170	109	535	1135	80
	532	1132	350	540	1140	86	540	1140	109	505	1105	80
0609	562	862	350	570	870	86	570	870	109	535	835	80
	532	832	350	540	840	86	540	840	109	505	805	80
0606	562	562	350	570	570	86	570	570	109	535	535	80
	532	532	350	540	540	86	540	540	109	505	505	80

NANOCLASS FFU PREFILTERS

Grid size	FFU dimensions (mm)			Prefilter dimensions (mm) Airpanel Select FZL			Airpanel Eco S			Carboactiv Panel FFU		
	W	H	D	W	H	D	W	H	D	W	H	D
1212	1162	1162	350	740	740	46	740	740	48	740	740	165
	1132	1132	350									
0912	862	1162	350	740	740	46	740	740	48	740	740	165
	832	1132	350									
0909	862	862	350	490	490	46	490	490	48	490	490	165
	832	832	350									
0612	562	1162	350	490	490	46	490	490	48	490	490	165
	532	1132	350									
0609	562	862	350	490	490	46	490	490	48	490	490	165
	532	832	350									
0606	562	562	350	370	440	46	370	440	48	370	440	165
	532	532	350									

Control for any installation

A central control unit enables simple yet precise management of your Nanoclass FFU system—whether you have one or several hundred units.

ACF300

- Maximum of 250 FFUs organized in eight groups
- Facility, group and individual operational modes
- Standby clock-calendar
- Six digital inputs and six digital outputs
- Four password-protected user modes
- Two analog inputs for pressure, temperature, humidity, or air flow sensors
- Ethernet interface
- Remote control from PC or mobile phone
- Remote access to logged sensor data
- BMS interface via Modbus TCP

ACC8

- Display graphics customized for each application
- Controls/monitors FFUs, sensors, actuators, and remote (room) displays
- Four levels of hierarchial control:
  - Overall facility
  - Rooms / groups
  - Workgroups (eg, workbenches, laminar flow stations)
  - Individual nodes (FFUs, sensors, actuators and remote displays)

The filtration experts MANN+HUMMEL

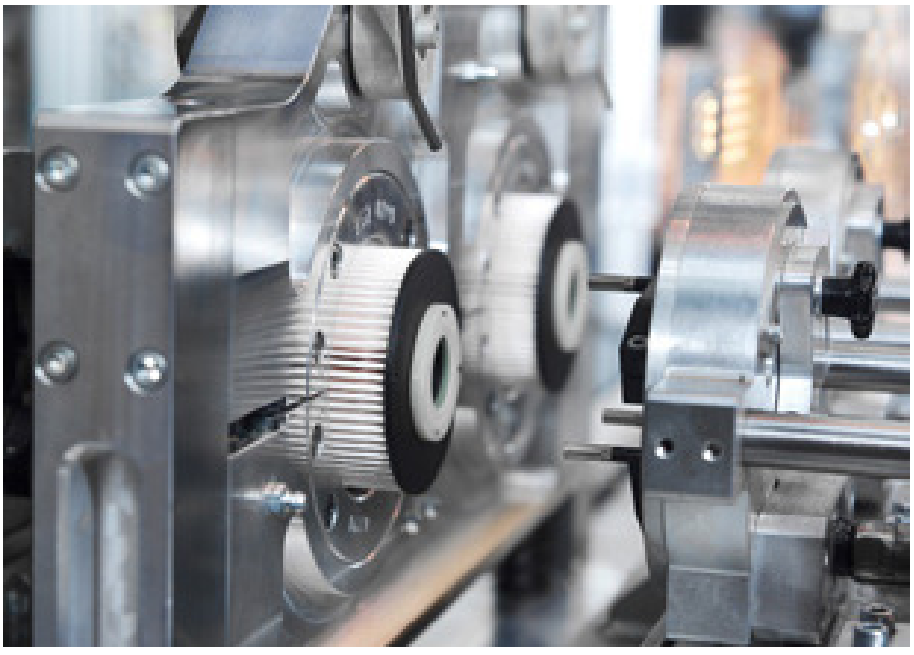
TWENTY SIX

With every second that ticks by, another 26 filters roll off the MANN+HUMMEL production lines. And that is part of what makes us a world leader in filtration.

But it is our commitment to quality and innovation too. Of the 22,000 people we employ worldwide, over 1,000 work in our R&D department.

That means we are at the front when it comes to finding new ways to improve air quality or deliver it more efficiently – which can be seen in the more than 3,000 patents that we have registered.

And when it comes to delivering excellent service, we are always close at hand, with more than 80 locations across the world.



MANN+HUMMEL has been a filtration specialist for more than 80 years. Leadership in Filtration is what drives us.

THE CLEANROOM SPECIALISTS

From an air filtration perspective, the most challenging contaminants to capture are those that are microscopic in size, but also present a risk to human health, expensive equipment or sensitive products. That's because both the difficulty and the risk of failure are high.

For more than 60 years, our filters have been in service in cleanrooms around the world – protecting people, processes and the wider environment from some of the most dangerous viruses, substances and other contaminants known to man. We've used this expertise to develop a range of filter fan units that you can count on to deliver the protection and performance that you need.

Cleanroom classes

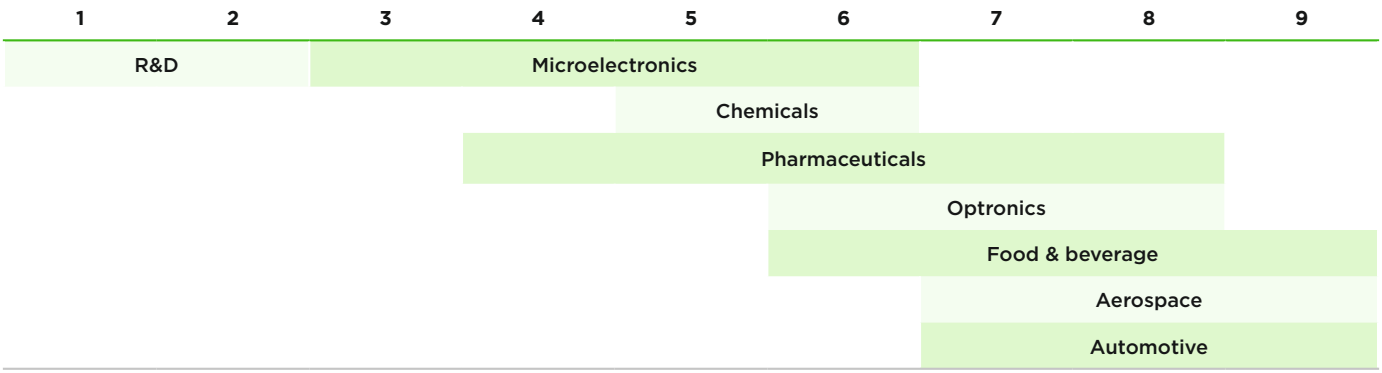
CLEAN ZONE FLEXIBILITY

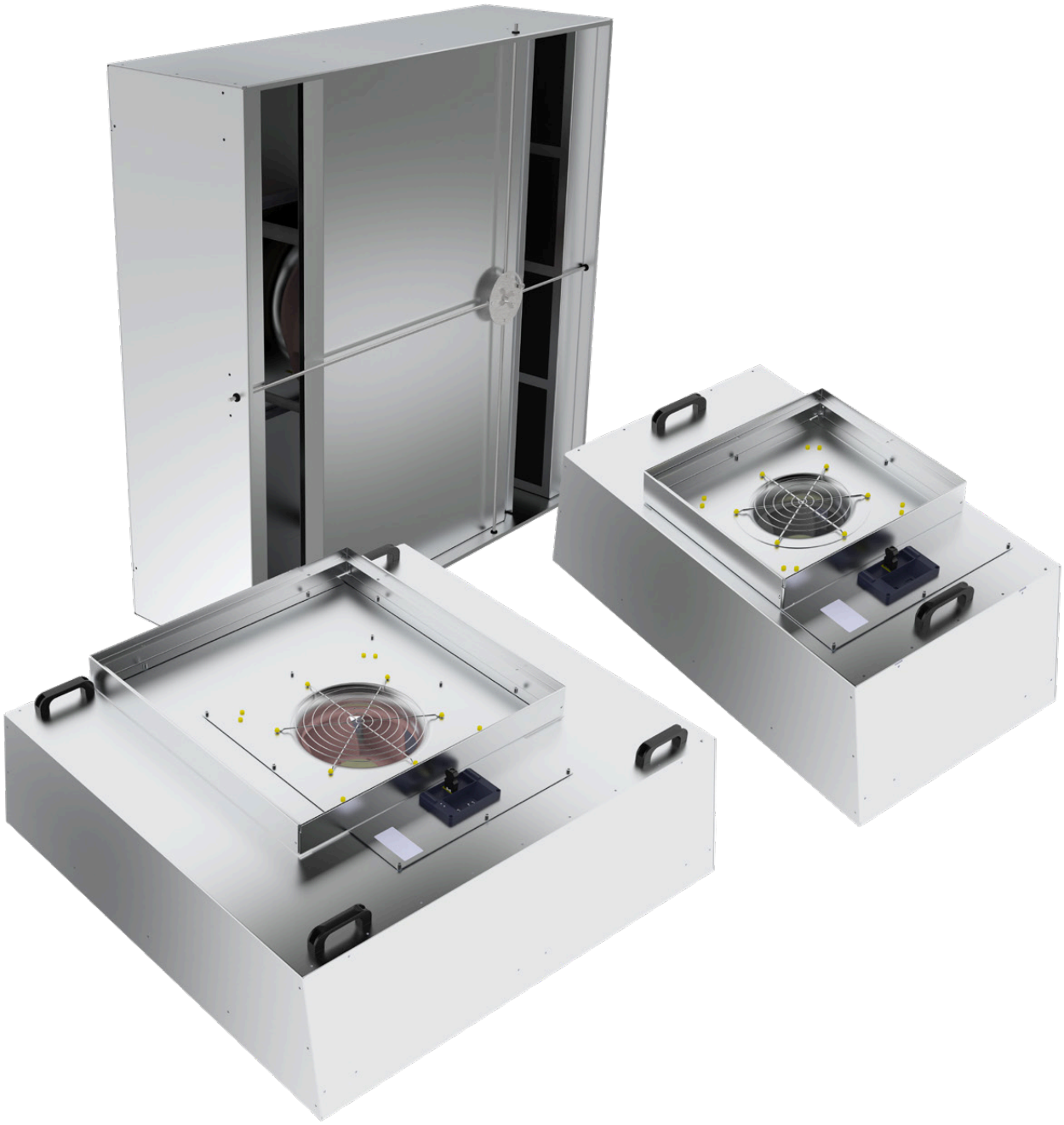
ISO 14644-1 is the international standard for classifying air cleanliness in cleanrooms and controlled environments. As each Nanoclass FFU can be controlled individually or as part of an overall system, it is possible to configure different zones within a cleanroom of different ISO classes—enabling greater production and operational flexibility.

Class EN ISO 14644-1	Max. Allowed Concentrations (µm/m³)		
	0.1 µm	0.5 µm	1 µm
1	10		
2	100		
3	1,000	35	
4	10,000	352	83
5	100,000	3,520	832
6	1,000,000	35,200	8,320
7		352,000	83,200
8		3,520,000	832,000
9		35,520,000	8,320,000

GMP Class	Hibernation	Operation
	0.5 µm	5 µm
A	3,520	3,520
B	35,200	352,000
C	352,000	3,500,000
D	3,520,000	N/A

CLEANROOM CLASSES IN DIFFERENT INDUSTRIES





Leadership in Filtration

MANN+HUMMEL