HEPA & ULPA - Filter Descriptions

Filter group	Filter Class	Filter Separation Efficiency				Measuring Method (test aerosol, standard)
		Average Separation Efficiency A_m	Average Separation Efficiency E_m	Total	Local [1]	
Coarse G[6]	G1	$50 \le A_m < 65$				Synthetic dust test PN-EN 779-2005
	G2	$65 \le A_m < 80$				
	G3	$80 \le A_m < 90$				
	G4	$90 \le A_m$				
FINE F[7]	F5		$40 \le E_m < 60$			Aerosol test DEHS Separation Efficiency measured for particles of 0.4 µm size PN-EN 779-2005
	F6		$60 \le E_m < 80$			
	F7		$80 \le E_m < 90$			
	F8		$90 \le E_m < 95$			
	F9		$95 \le E_m$			
HEPA H[4]	H10			85	-	Numerical efficiency defined for the size of the most penetrating particles of the aerosol test DEHS2, DOP3 or paraffin oil mist PN-EN 1882 - 5 2002
	H11			95	-	
	H12			99.5	97.5	
	H13			99.95	99.75	
	H14			99.995	99.975	
ULPA U[5]	U15			99.9995	99.9975	
	U16			99.99995	99.99975	
	U17			99.999995	99.9999	
Filter classification related to efficiency						

As described in the Clean Rooms paragraph, the correct classification of the rooms is achieved if proper filtration is combined with correct air recirculation and diffused distribution. If one of these conditions is not fulfilled the overall result will be below expectation and validation could be problematic.

Furthermore a correct balance of the overpressure is essential. Consequently, the air escaped through leaks etc., must be replaced with fresh air which must be equal or above the amount required by the personnel working in the clean room.

Below you can find a table where room classification, air recirculation and filters sequence are related.

For more information refer to manufacturers brochures.

Filter sequences for classified cleanrooms

ISO Class	Clean room Class F.S. 209	Air Recirculation (Vol/h)	Pre Filter	Bag Filter 1	Bag Filter 2	HEPA Filter	ULPA Filter	Ceiling air distribution %
3	1	360 - 600	G4	F8		H12	U17	90 - 100
4	10	300 - 540	G4	F8		H10	U16	90 - 100
5	100	240 - 480	G4	F7	F9		U15	20 - 50
6	1000	40 - 120	G3	F7	F9		U14	10 - 20
7	10000	20 - 40	G3	F6	F8		U14	10 - 20
8	100000	10 - 20	G3	F6	F8	H12		5 - 10

Brief description and recommendations for the adequate use of filters

Filter group	Level of filtration	Examples of separated particles material	Recommendation for application of air filters
G Filter for coarse dust particles Efficient for particles ≥ 10 µm EN 779	G1 G2	• Leaves • Insects • Textile fibres • Sand • Flying ash • Mist • Hair	• Only for simplest application (e.g. protection against insects)
	G3 G4	• Flower pollen • Pollen • Fog	• Waste air from painting boxes and kitchens • Protection against the pollution of air conditioning and compact instruments (e.g. window air conditioning fans) • Pre - filters for filtration classes F7 and F8 (necessary only for heavy polluted input air) • Pre filters and circulation filters for public protection equipment

Brief description and recommendations for adequate use of filters

Filter group	Level of filtration	Examples of separated particles material	Recommendation for application of air filters
F **Filters for fine dust.** **Efficient for particles ≥ 1 µm** **EN 779**	F5	• Spores • Cement dust • Particles creating stain or dust sedimentation	• Entering filters for the areas with low demand (e.g. workshops, storage rooms, garages) • Pre-filters for filtration class F8 and F9.
	F6	• Bacterium • Embryo on the carrying parts	• Entering filters for the areas with low demand (e.g. selling areas, specific production areas) • Pre-filters for filtration class F9 and H10 • Filters for waste air from heat exchangers etc.
	F7 F8	• Accumulated carbon dust • Dust going through lungs	• Circulating filters in air conditioning • End filters in air conditioning e.g. shops, offices and specific production areas. • Pre filters for filtration classes H11 and H12.
	F8 F9	• Tobacco smoke • Metal oxide smoke (soarer fractions) • Oil smoke	• End filters in air conditioning with high efficiency requirements , e.g. offices, workshops, telecommunication centres, laboratories etc. • Outside air equipment in hospitals • Digital phone exchanges • Pre-filters for filtration classes H13 and H14 • Pre-filters for absorbable filters (e.g. filters with active carbon) • Pre-filters in pharmacy
H **Filters for micro partcles.** **Efficient for particles ≥ 0,01 µm** **EN 1822**	H10 H11	• Embryos • Tobacco smoke • Smoke of metal oxide • Swirl on the carrying particles • Carbon dust	• End filters for areas with very high requiremants (e.g. laboratories and hospitals) • End filters for “clean areas”, classes ≥ ISO 7 in pharmacy, food and light industry
	H12 H13	• Oil smoke in the initial stage • Aerosol micro particles • Radioactive aerosol	• End filters for hospitals with high demands but without requirements for leakage tests • End filters for food electronics, pharmacy and foil industry • Filters for waste air in nuclear systems • End filters for “clean area” classes ≥ ISO 5 • End filters in public protection equipment
	H14	• Aerosol micro particles • Swirl	• End filters for “clean areas” classes ≥ ISO 4 • End filters for pharmacies, hospitals with high requirements and severe rules for leakage tests

Brief description and recommendations for the adequate use of filters

Filter group	Level of filtration	Examples of separated particles material	Recommendation for application of air filters
U **Filters for micro particles** **EN 1822**	U15 U16 U17	Aerosol micro particles	• End filters for "clean areas", classes ≥ IS0 3 • End filters for "clean areas", classes ≥ IS0 2 • End filters for "clean areas", classes ≥ IS0 1
A **Filters with active coal**	Active coal (not impregnated coal)	• Light volatile hydrocarbon VOC'S • Asphalt, tar and petrol and kerosene fume • Solvent fume • Body civilisation and hospital smell • Food, kitchen and rotting smell	• Catching smells at airports, offices and public buildings, hotels and hospitals. • Decreasing the syndrome of "sick buildings" • Input filtration in microelectronics • Removing the harmful gases from recirculating air
The filtration of gases	Impregnated active coal	• Acid spot gases • SO_2, $S0_4$, NO_2, NO_x • HCl, H_2SO_4, H_2S, HF, Cl_2	• Input filtration for control centres (e.g. in airports) • Input and circulating filters for air exchange in agressive conditions. • Computer areas • Input and circulating filters for microelectronics
Not standardized	Impregnated active coal	• Amine • NH_3, NH_4 • NMP, HMDS	• End filters for hospitals with high demands but without requirements for leakage tests • End filters for food. electronics, pharmacies and foil industry • Filters for waste air in nuclear systems • End filters for "clean area" classes ≥ ISO 5 • End filters in public protection equipment