camfil

HEALTHCARE FACILITIES

Improving indoor air quality for a safe healthcare environment.

CLEAN AIR SOLUTIONS

WHAT'S IMPORTANT NOW?

Only Camfil can deliver value in all four categories.

REDUCE OPERATIONAL COSTS

Camfil can turn your air filter operation into a money-making machine.

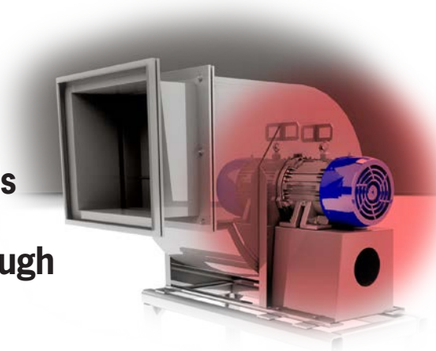
Cost has become the dominant factor in purchasing and no operational expense item is exempt. Camfil, the world leader in air filtration technology for every application in healthcare, has a solution for managing the new, "Cost is King" reality we face. At its heart: a solid, proven strategy for achieving the air quality levels needed, while delivering significant and immediate savings in four critical areas:

- Direct dollar savings in HVAC energy costs.
- Reduced risk of hospital-acquired infections (HAI), and reduced risk of associated financial penalties as prescribed under the new Centers for Medicare and Medicaid Services (CMMS) healthcare law.
- 50% or more annual reduction in filter waste sent to landfills, reducing disposal costs and in accordance with sustainability initiatives.
- Reduced facility labor costs related to the associated tasks involved with transporting, changing and disposing of filters.

The Camfil healthcare strategy is centered on value: delivering the best, proven solutions for each individual environment, so that unnecessary risks, particularly those that involve hospital-acquired infections, are eliminated.

> *"If our competitors' filters were free, the hidden costs associated with energy, disposal and labor would make their cost of ownership three to four times that of Camfil filters."*

For every $1 a hospital spends on air filtration, it spends $7 on fan energy to push air through those filters.



ENERGY SAVINGS
NEW OPPORTUNITIES
Significant and Immediate Reductions

The third-largest energy cost item in a healthcare environment is the fan energy needed to move air through the heating and air conditioning systems.

Air filtration is a large component of energy cost because filters, by nature, create resistance to airflow. This forces the air distribution fans to work harder and use more energy. So, the question becomes, "Is it possible to achieve optimum filtration in each area of the facility, maintain rated efficiency through the life of each filter, and reduce energy costs?"

In fact, it's possible to accomplish this, and much more. Camfil's 5-Star premium filters are engineered to significantly and immediately reduce HVAC energy expenditures while maintaining high contaminant removal performance and requiring less frequent change-outs.

Selecting the proper filter based on average lifetime resistance to airflow and the filter's ability to maintain rated efficiency can save a facility 50% of its HVAC fan energy costs.

The baseline comparison is with the minimal-performance products typically purchased on a first-cost basis.

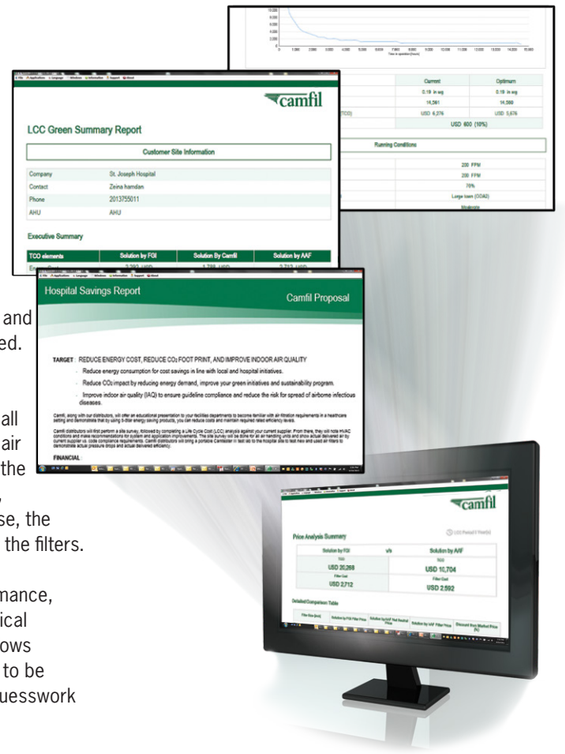
This 50% annual savings is a documented metric achieved in healthcare environments by Camfil's 30/30® Dual 9 and Durafil® ES air filters, two of the many filter technologies described later in this brochure.

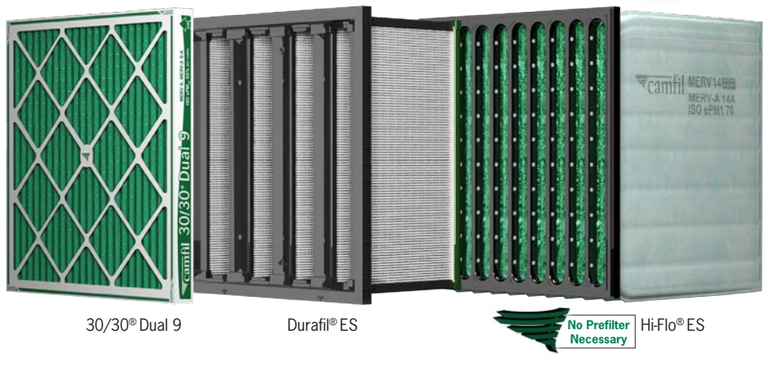
Documentation for this savings was generated by Life Cycle Cost (LCC) analysis and validated by real-world testing. This powerful modeling software factors in multiple conditions specific to each installation, including hours of operation, utility rates, air contaminants, fan efficiency, labor and more.

Since its inception, LCC has helped thousands of healthcare facilities and other institutions around the world reduce both total energy expense and peak demand, by objectively comparing filters from all manufacturers, and identifying the most appropriate filter for each area. In short, LCC software allows filter selections and change-out points to be optimized.

LCC calculates the total cost of ownership (TCO), which includes all of the expenses associated with air filtration – the cost of the filters, the labor to install and remove them, filter disposal costs, and of course, the energy used to move air through the filters.

TCO is based on real-life performance, rather than simplistic mathematical charting. Most importantly, it allows discussions of filter alternatives to be based on science, rather than guesswork – or hope.





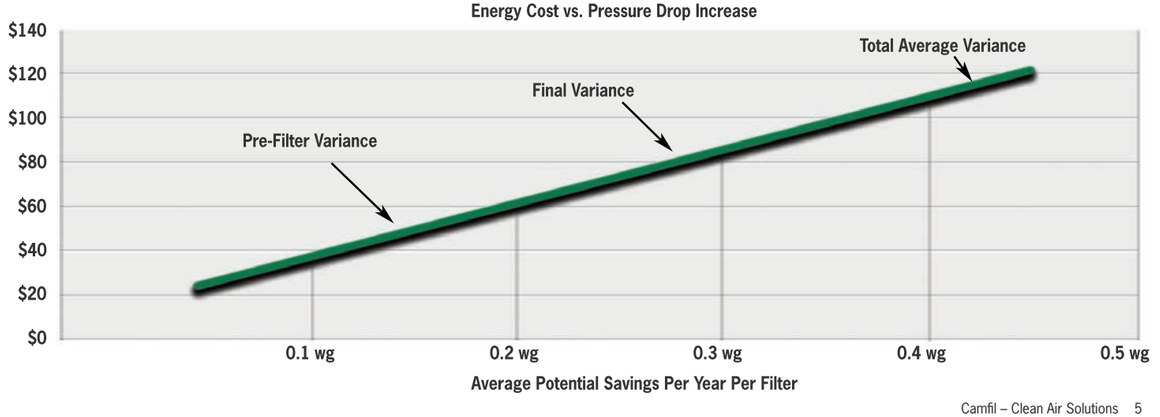
30/30® Dual 9 Durafil® ES Hi-Flo® ES

QUANTIFYING ENERGY SAVINGS
IN YOUR FACILITY

Lowering a filter's resistance to airflow is one of the most effective and measurable ways to immediately reduce the total energy used by your HVAC system.

For every tenth of an inch of resistance saved, a facility can expect to save approximately $28 per year in energy costs per full-size filter opening.

> *"With Camfil, savings of 0.5" of static pressure is common with multi-stage filtrations systems typically found in hospitals."*



HOSPITAL-ACQUIRED
INFECTION RISK OVERVIEW
The cost in lives and liability

Approximately one in 25 patients in U.S. hospitals is diagnosed with one or more infections associated with hospital care. This figure does not include all healthcare settings. Many of the serious cases are caused by antibiotic-resistant (AR) bacteria which could lead to sepsis or death.

One-third of hospital-acquired infections are judged preventable. The Committee to Reduce Infection Deaths (RID) reports that as many as 92 percent of deaths from hospital infections could have been prevented.

Camfil can provide a more comfortable environment for patients and staff, while lowering the total life cycle costs of filtration as well. Camfil's 5-Star premium air filters are recognized for top-level performance in four critical areas important to healthcare facilities: energy savings, air quality, waste reduction, and environmental impact.

> *"The Centers for Medicare and Medicaid Services are no longer reimbursing for the extra costs of treating patients for hospital-acquired infections that reasonably could have been prevented."*

SUSTAINABLE PRODUCTS
SUSTAINABLE COST SAVINGS

Sweeping environmental consciousness gained traction roughly 25 years ago and has since become a dynamic force. When fully realized, it became apparent that hospital energy consumption, waste, and greenhouse emissions could be dramatically reduced.

Hospitals, like other facilities, express the values of the owners and the community. LEED® certification for healthcare has become a laudable goal for new facilities, as well as existing hospitals that have served their communities for decades.

Let's begin at ground level.

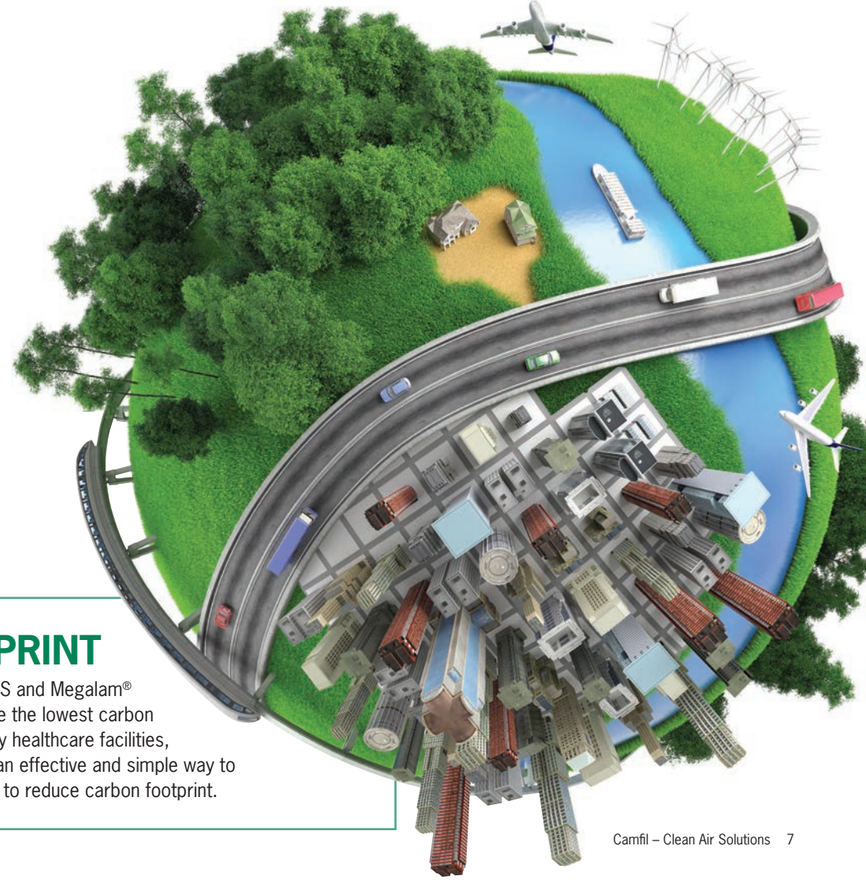
Disposal costs for red-bagged waste can top $480 per ton or more – 19 times the cost of ordinary solid waste. Regulations in effect in many areas of the country demand that air filters used in medical facilities – high-efficiency filters and even simple pleated panel filters in some areas – must be red-bagged. This is arguably unfair, but only a few states allow a less-costly classification, and the landfills are clearly in charge. To them, this is revenue, pure and simple. And as many landfills approach capacity or close, their ability to raise costs will only increase.

Given this reality, there is a compelling incentive to reduce the volume of solid waste heading for landfills – to use green thinking for meaningful source reduction.

Source reduction is a guiding principle for Camfil's green filter technology. During a two-year period, a hospital using Camfil's 5-Star premium air filters can reduce the number of filters sent to the landfill by 56%.

Disposal and labor to change filters are huge, but reducible, costs. Costs that can be reduced more quickly than perhaps any other line item on a hospital's budget while giving the hospital bragging rights on an issue that every patient, every board member, and every community and political leader, cares about and has interest.

> *"During a two-year period, a hospital using Camfil's 5-Star premium air filters can reduce the number of filters it sends to the landfill by 56%."*



CARBON FOOTPRINT

Camfil's 30/30® Dual 9, Durafil® ES and Megalam® HEPA terminal panel air filters have the lowest carbon footprints in the industry. For many healthcare facilities, the Camfil premium air filters are an effective and simple way to comply with facility-wide initiatives to reduce carbon footprint.

DO MORE WITH LESS

"Do more with less" is the mantra that resonates throughout every healthcare facility today. It has become a catch-phrase for penny-pinching, and a call for people to work harder with fewer resources. The origin of this common phrase, however, was to allow new tools to make work easier.

Budget cuts are on everyone's mind, and one effective strategy for managing this reality is by choosing critical products by their true life cycle costs – what they cost, with all factors considered, compared to alternatives, over time.

Camfil has developed a family of air filtration products for every area of every healthcare environment with this principle in mind. The air filters have engineered filtration solutions that satisfy every important healthcare requirement:

- Energy savings
- Performance at rated efficiency throughout the life of the filter
- Low frequency of change-outs
- Low labor and waste disposal

The 5-Star premium air filters described in the pages that follow illustrate, in detail, how the filters deliver the advantages and present an intelligent alternative to the low-end commodity products pushed by many manufacturers and buying groups.

Camfil's many healthcare case studies prove the depth of knowledge and experience behind the development of intelligent, cost-efficient filtration solutions for medical facilities.

> *"To 'do more with less,' choose critical air filtration products based on true life cycle costs."*

The exhortation to "do more with less" has never been louder than it is today. But by understanding its original meaning – to let technology – new tools – lighten the burden, we think America's hospitals, and their patients, administrators, and purchasing professionals, will all breathe easier.

GPOs AND PROVEN RESULTS

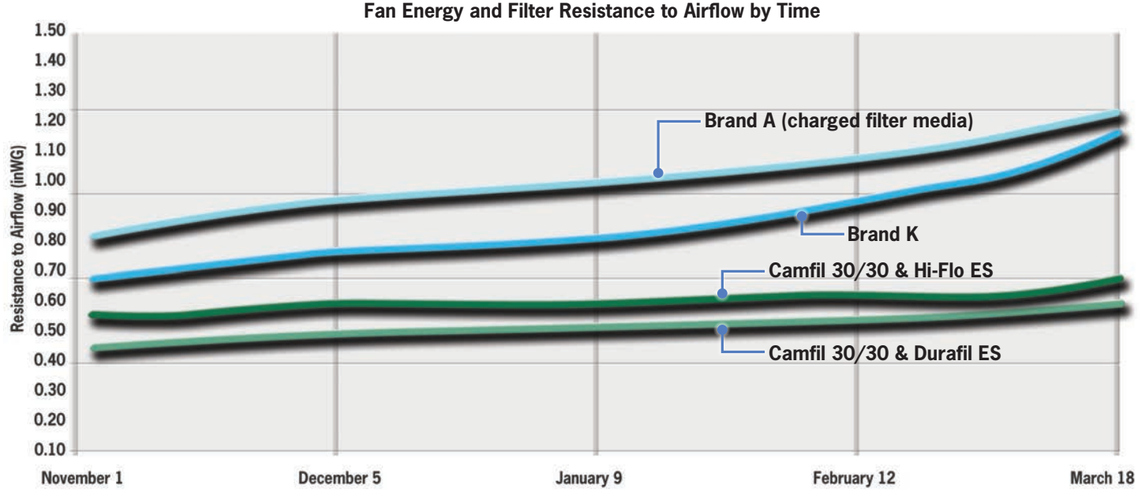
Group Purchasing Organizations (GPO) are entities that negotiate contracts with healthcare manufacturers, distributors, and other suppliers, to purvey purchasing power over product selections, volume, and costs. Camfil is currently working with several GPOs. In each case, Camfil is on contract because of strong commitment and knowledge of total cost of ownership (TCO) and proven ability to reduce overall cost. Moreover, Camfil clean air solutions have proven to improve overall air quality!

TESTS PROVE IT

Camfil air filters reduce fan energy costs for hospitals by **40%** to **50%**.

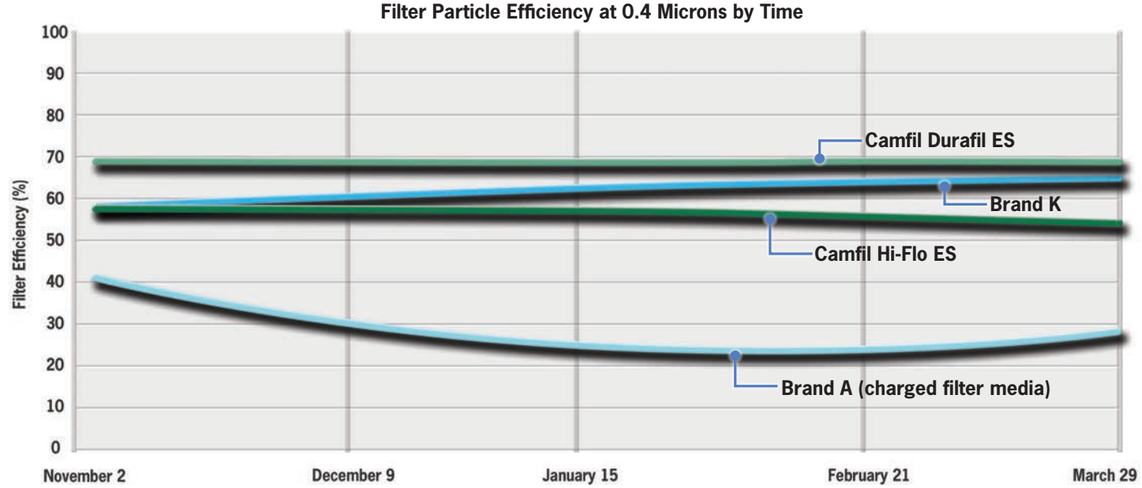
The charts below represent actual results from a case study performed at the Texas Medical Center in Houston, Texas.

Fan Energy and Filter Resistance to Airflow by Time



The area under the air filter loading curves is proportional to energy spend.

Filter Particle Efficiency at 0.4 Microns by Time



The performance chart reveals the top three filters all maintain particle efficiency, while Brand A (charged filter media) does not.

THE FIRST STEP:
COMMON AREA FILTRATION

Meeting the minimum filtration standard, along with the proper number of air changes for the space, significantly reduces the incidence of nosocomial transfer. Table D-1 ASHRAE 170-2021 defines the minimum filtration requirements by space type for healthcare facilities. The Addendum states that, "Where listed, MERV rating is assumed to be non-degrading."

According to ASHE, MERV-A ratings based on the test described in Appendix J of the 52.2 standard "… more accurately predict filter efficiency over time so hospitals and design engineers should require MERV-A ratings when ordering or specifying filters."

In order to comply with the intent of ASHRAE 170 minimum requirements and to ensure safety in healthcare environments, Camfil recommends that facility directors insist on MERV-A values and request that a corresponding test report be supplied with every quotation.

INFORMATIVE APPENDIX D Recommended Filter Efficiencies by Space Type
As published in ASHRAE Standard 170-2021
Spaces in Table 7-1, 8-1, and 9-1 of this standard have filter efficiencies assigned based on Table D-1. This table is provided to allow users to understand the intent of the filter assignments and make engineering judgments on spaces not specifically named in the standard.

Level	Space Category	Filter Efficiency Recommendations (a) (b)
I	• Primarily exhausted space (e.g., restrooms, janitorial rooms) • Any human-occupied space • Any room, inpatient or outpatient, where a patient stays less than six hours including waiting rooms • Laboratories • Resident rooms in assisted living or hospice • Storage of packaged sterile material, clean linen, or pharmaceuticals[c] • Treatment rooms, endoscopy procedure room • Dirty side of decontamination process	MERV-8 (equivalent to ASHRAE 62.1 or Standard 62.2)
II	• Inpatient spaces, including medical-surgical, airborne isolation[d] • Special exam room for suspect airborne cases, emergency department exam rooms[e] • Resident room in a skilled nursing area • Workroom for packing of sterile materials • CT or MRI procedure, interventional radiology (including biopsy), or bronchoscopy • ER procedure or trauma room	MERV-14[f,g]
III	• Operating room[h]	MERV-16[f]
IV	• Operating room designated for orthopedic, transplants, neurosurgery, or dedicated burn unit procedures • Protective environments, including burn units	HEPA

Notes:
a. ***Where listed, MERV rating is assumed to be non-degrading.***
b. Transfer air due to differences in pressure between spaces may be unfiltered.
c. Pharmacy compounding spaces are not covered in this table. Follow USP 795, USP 797, or USP 800 as applicable (see Section 11 references.)
d. Does not include recirculated air. Air recirculated in an A11 room requires HEPA filters.
e. Air from spaces where suspected airborne cases may be treated or examined should be filtered at level II prior to re-circulation to other spaces. If exhausted supply air filtration may be level I.
f. Minimum MERV rating of the highest efficiency filter in the air stream.
g. Filter efficiency if supply air is used: not intended to exclude natural ventilation if otherwise allowed.
h. An optional risk assessment, conducted with the user group, may indicate a need to increase from Level III to Level IV.

Always require that a Certificate of Conformance be included with every HEPA filter to demonstrate conformance to standards and limit possible future liabilities.

HEPA filters are specified for air supplies serving protective environment rooms, Airborne Infection Isolation (AII) rooms, and wound intensive care rooms. Camfil recommends HEPA filters in all areas where patients being treated have a high susceptibility to infection.

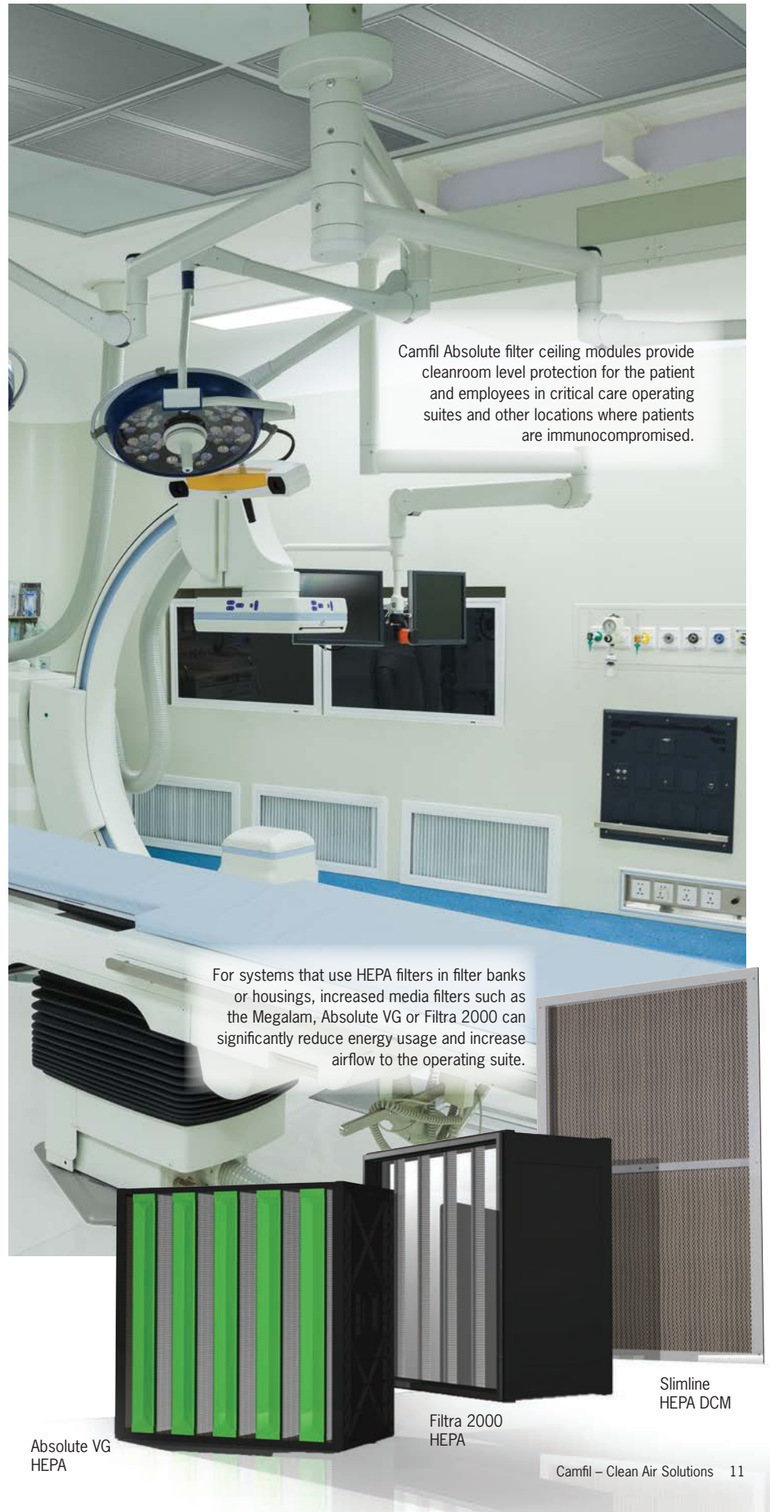
HEPA filters are also specified for discharge air from fume hoods or safety cabinets in which infectious or radioactive materials are processed. The filter system should be designed to permit safe removal, disposal, and replacement of contaminated filters.

A HEPA filter, by definition, has an efficiency of at least 99.97% when tested on particles 0.3 micron in size. The key word is "tested." A HEPA filter must be tested and certified by the manufacturer as to efficiency, rated airflow, and resistance to airflow.

The phrase "true HEPA" is a commonly used, but not an actual, technical term. However, a fair definition which should be accepted by all is: A true HEPA filter is one that has been individually tested to either the accepted IEST Recommended Practice for HEPA filters or ISO 29463. A true HEPA filter is one labeled with the individual scan test for that actual filter – no batch testing, not estimates based on component test, but the tested performance for each specific filter.

The Certificate of Conformance includes complete testing data and ensures that the manufacturer has built the product to the required specifications. This certificate will eliminate vendors that would skip this important step, and those that "batch test," rather than individually test each filter.

Certificates of Conformance for each filter should be kept on file for evidence should liabilities arise and to support documentation for facility audits.



SPECIAL CONCERNS:

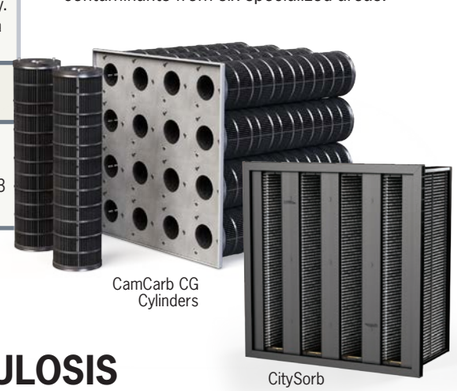
Addressing Gaseous Contaminants with Molecular Filtration

Molecular Filtration Recommendations for Healthcare USA	
Application Area	**Camfil Recommendation**
Animal labs	Acid-impregnated carbon CEX003B1 (for ammonia odors). LGX048 media for applications involving animal feed sterilization (autoclave).
Diesel odor HVAC intakes from loading docks and from periodic emergency power generator testing and operation, construction equipment rooms	CityCarb or CitySorb DP with 201 grade carbon if there is a physical space limitation. Canisters containing LGX048 activated carbon if space allows and increased service life is a factor. Include Camfil Farr 30/30 and MERV-13 Durafil ES for capture of the fine particulates associated with combustion odors.
In vitro fertilization labs (IVF)	One stage of CEX003 or LGX048 carbon and a second stage of CamPure 9 potassium permanganate. De-rated systems with contact times >0.2 seconds may be applied for increased capacity. CamCarb CG or CM are generally recommended for longer life at a higher capture efficiency.
Morgue	Two stages of CamCarb CG or CM or CamCarb PG. First bank should contain LGX048 followed by a bank containing CamPure 9.
Medivac helipads adjacent to rooftops and air intakes adjacent to loading docks	CityCarb or CitySorb DP 201 if there is a physical space limitation. Canisters containing LGX048 activated carbon if space allows and increased service life is a factor. Include Camfil Farr 30/30 and MERV-13 Durafil ES for fine particulates associated with combustion odors.

Medical facilities contend with numerous substances that produce odors and gaseous contaminants. Gaseous contaminants can also be introduced from outside or from hospital processes, or from loading docks.

Many areas are susceptible to unacceptably high levels of ozone which has an adverse effect on patients.

This chart shows the air filtration that will be effective for removing gaseous contaminants from six specialized areas.



CamCarb CG Cylinders

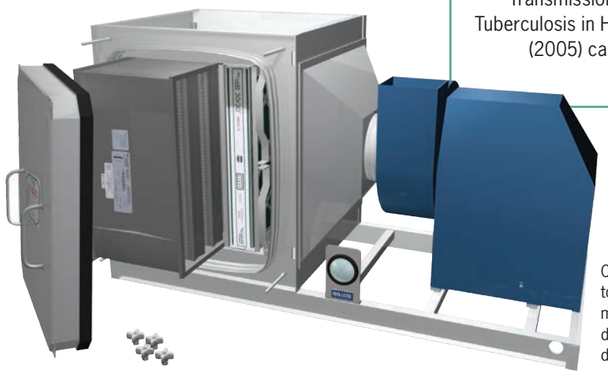
CitySorb

CONTROL OF MYCOBACTERIUM TUBERCULOSIS

Some key points relative to air filtration include:

- Patient and treatment rooms should be under negative pressure to prevent droplet nuclei from transferring to other areas, including adjoining interior rooms.
- 100% exhaust to atmosphere is needed, possibly through a HEPA filter, if exhaust is within 30 ft. of human habitation areas, or other means of reintroduction back into the building (windows, vents, doors, etc.).
- Containment housings and filtration equipment are required in some states – consult Camfil product sheets 3401/3402/3409.

CDC's Guidelines for Preventing the Transmission of Mycobacterium Tuberculosis in Healthcare Settings, (2005) can be downloaded at www.cdc.gov.



Complete dedicated systems to address critical areas that may include bag-in/bag-out design to protect employees during filter change.

PHARMACEUTICALS

CLEANROOM CLASS LEVELS

In pharmaceutical preparation and storage areas, improved air quality is a critical factor to ensure that the possibility of contamination is controlled. Various cognizant authorities recommend cleanroom class levels for these areas. In areas requiring sterile practices, cleanroom level ISO 5 is recommended. ISO 5 is an environment that has 100 particles 0.5 or larger per cubic foot of air. For adjacent areas used for measuring, weighing, mixing and other non-sterile manipulations ISO Class 8 is recommended (100,000 particles 0.5 or larger per cubic foot of air).

The Camfil Pharmaseal® housing terminal is designed specifically for pharmaceutical applications. Constructed of fully-welded aluminum or stainless steel, it houses Camfil standard Megalam HEPA or Absolute® filters to ensure clean space performance for the preparation of pharmaceutical components. Adjustments for airflow, ports for testing, and the ability to change filters are all available from the room side for service convenience.

Pharmaseal Hood

HEPA FILTER

Service Life

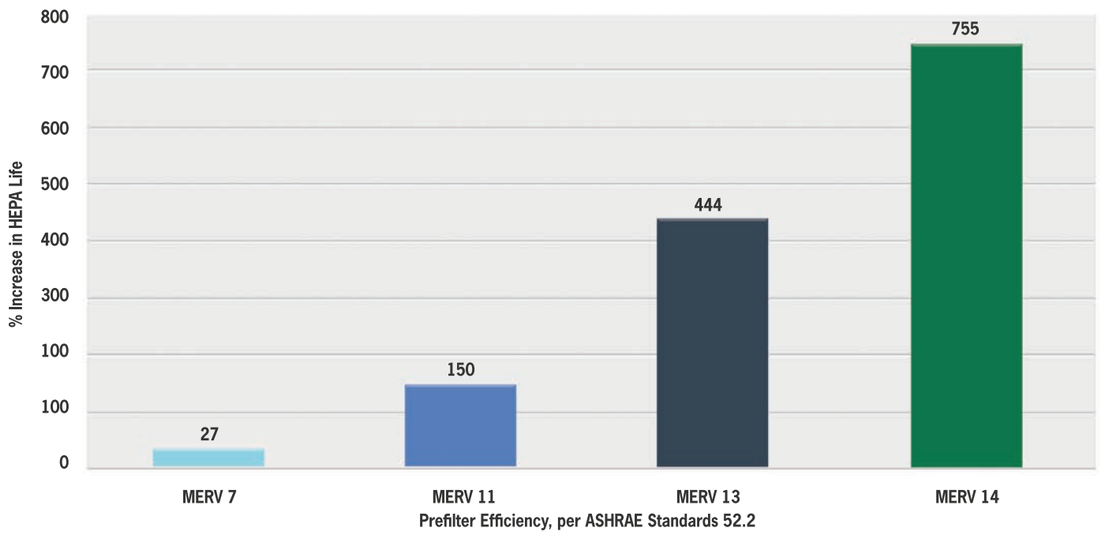
Initial considerations concerning the service of HEPA filtration relate to minimizing pressure drop within the HVAC system for energy conservation, and extending the life of the HEPA filters. The Prefilter Efficiency chart below shows the typical life extensions of HEPA filtration when various levels of ASHRAE prefilters are used.

When the life cycle cost of the HEPA is considered, MERV-13 or MERV-14 ASHRAE prefiltration is the norm. A 5-micron size particle looks like a boulder to HEPA filtration media. The microfine glass fibers that make up the media of the HEPA filter have an operating fiber diameter of 0.67 micron. Large particles can block a relatively expansive area of the filter, increasing pressure drop prematurely and reducing the effectiveness and life of the filter.

Frames

HEPA filters are available in a variety of frames, including aluminum, plastic, galvanized or galvanneal steel, stainless steel, wood and particle board. When a wooden framed filter expands or contracts with the rise and fall of moisture-laden air, the integrity of the filter seal may be compromised.

If HEPA filters with wood or particle board frames are used in HVAC systems, gasketing integrity, filter enclosure integrity, and gasketing torque compression should be checked every eight weeks.



The tasks involved in changing HEPA filters, such as removing existing filters, ensuring the integrity of the holding mechanism, mounting the new units, certifying performance, and disposing of the old filters, add to the expense of a replacement HEPA filter. The chart shows the increase in life with various selected prefilters. Camfil recommends that HEPA filters be protected from high loading with higher efficiency prefilters. If a total cost of ownership maintenance program is implemented, this methodology can also produce substantial energy savings.

INFECTION SOURCES AND

The Importance of Air Changes

With the increased use of managed care and incentives for outpatient care, hospitals have a concentrated population of seriously ill patients. Many are also immunosuppressed or being prescribed antibiotics which can encourage the evolution of drug-resistant pathogens.

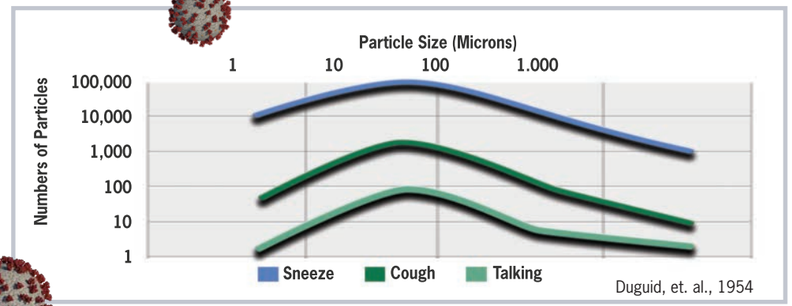
These factors, along with lapses in sanitation protocols and the mobility of medical staff (which provides a pathway for pathogens to spread), further confound a healthcare institution's best efforts to prevent hospital-acquired infection.

See page 19 for a table that describes minimum air filtration requirements for new construction in medical facilities as prescribed by ASHRAE 170-2021 and the Facilities Guideline Institute (FGI).

"A medical facility's first line of defense against infections transfer is its filtration system."

Air Changes	Time (Minutes) Required for Removal	
	99% Efficiency	99.9% Efficiency
2	**138**	**207**
4	**69**	**104**
6	46	69
8	**35**	**52**
10	28	41
12	23	35
15	18	28
20	**14**	**21**
50	**6**	**8**

Bold listings denote frequently cited air changes per hour for patient-care areas. Moving the air through the filtration system is as important as filter efficiency.



Duguid, et. al., 1954

Microorganisms Associated with Airborne Transmission

Numerous Reports in Healthcare Facilities	Fungi	Bacteria	Viruses
Atypical, occasional report	Aspergillus spp. + Mucorales (Rhizopus spp.)	Mycobacterium tuberculosis	Measles (rubeola) virus Varicella-zoster virus
Airborne in nature; Airborne transmission in healthcare settings not described	Acremonium spp. Fusarium spp. Pseudoallescheria boydii Scedosporium spp. Sporothrix cyanescens	Acinetobacter spp. Bacillus spp. Brucella spp. Staphylococcus aureus Group A streptococcus	Smallpox virus (variola) Influenza viruses Respiratory syncytial virus Adenoviruses Norwalk-like virus
Under investigation	Coccidioides immitis Cryptococcus spp. Histoplasma capsulatum	Coxiella burnetii (Q fever)	Hantaviruses Lassa virus SARS Covid 19 virus Marburg virus Ebola virus Crimean-congo virus

Chart shows the microorganisms associated with airborne transmission.

CAMFIL FILTRATION RECOMMENDATIONS

Specific Hospital Areas

Wound Intensive Care (Burn Unit)
- MERV-9A Prefilter
- MERV-14A Final*
- HEPA Terminal Filtration @ Outlets

Airborne Infection Isolation (All) Rooms
- MERV-9A Prefilter
- MERV-14A Final*
- HEPA Terminal Filtration @ Outlets

Environmental Contaminants
- MERV-9A
- MERV-14A
- Molecular Filters

General Patient Rooms
- MERV-9A
- MERV-14A

Air Intakes Adjacent to Helipad
- MERV-9A
- MERV-14A
- Molecular Filters

Surgery/Operating Suites
- MERV-9A Prefilter
- MERV-16A Final
- HEPA Terminal Filtration

Pediatric Care
- MERV-9A
- MERV-14A

Cesarean Delivery Room
- MERV-9A Prefilter
- MERV-16A Final
- HEPA Terminal Filtration

Imaging Rooms
- Class 1 - MERV-9A
- Class 2 - MERV-14A Final
- Class 3 - MERV-16A Final

Waiting Rooms
- MERV-9A
- MERV-14A

Emergency Room/Ambulance Delivery
- MERV-9A
- MERV-14A
- Molecular Filters

Common Rooms
- MERV-9A
- MERV-14A
- Molecular Filters

Air Intakes Adjacent to Loading Docks
- MERV-9A
- MERV-14A
- Molecular Filters

Pharmacy
- MERV-9A Prefilter
- HEPA Terminal Filtration

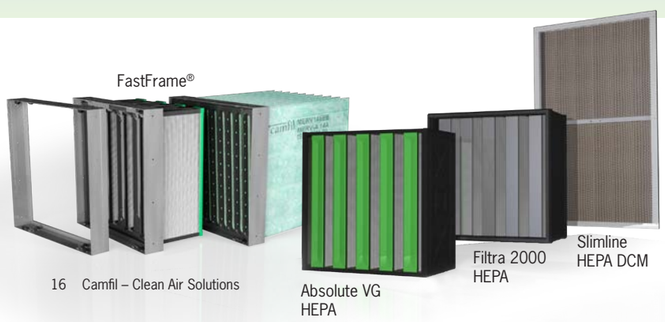
Laundries/Maintenance
- MERV-9A

Morgue
- MERV-9A
- MERV-14A
- Molecular Filters

All filter recommendations meet the required MERV per Standard 52.2-2017 and the corresponding value of MERV-A when evaluated per the procedure in Appendix J of the same standard. Molecular filters are tested per ASHRAE 145.2 and ISO10121 to validate performance under realistic operating conditions.

In the near future, The United States Pharmacopoeia General Chapter 797 will likely become the standard of care for achieving ISO Cleanliness levels in pharmaceutical preparation areas. As of this writing, ten states require full or partial compliance, with others slated to follow.

Camfil has the products to elevate your pharmaceutical preparation area to ISO Cleanliness levels, while also generating substantial benefits in terms of HVAC-related energy costs.



HEALTHCARE INDUSTRY RECOMMENDATIONS

Referenced in standards or guidelines as published by cognizant authorities. Camfil recommends that the air filters also have matching MERV-A values per ASHRAE Standard 52.2 to ensure lifetime efficiency of the installed product.*

Function of Space Inpatient Facilities	Pressure Relationship To Adjacent Areas	Minimum Outdoor ach	Minimum Total ach	All Room Air Exhausted Directly to Outdoors	Air Recirculated by Means of Room Units	Unoccupied Turndown	Minimum Filter Efficiencies	Design Relative Humidity %	Design Temperature
NURSING UNITS AND OTHER PATIENT CARE AREAS									
All anteroom	(e)	NR	10	Yes	No	Yes	MERV-8	NR	NR
Emergency department public waiting area	Negative	2	12	Yes	NR	Yes		Max 65	70–75/21–24
Emergency service triage area	Negative	2	12	Yes	NR	Yes		Max 60	70–75/21–24
Nourishment area or room	NR	NR	2	NR	NR	Yes		NR	NR
Nursery workroom	NR	2	6	NR	No	Yes		Max 60	72–78/22–26
Radiology waiting rooms	Negative	3	12	Yes	NR	Yes		Max 60	70–75/21–24
Sterile processing room	NR	3	6	NR	No	Yes		NR	NR
Treatment room	NR	3	6	NR	NR	Yes		20-60	70–75/21–24
Procedure room	Positive	3	15	NR	No	Yes	MERV-14	20-60	70–75/21–24
Seclusion room	NR	3	4	NR	NR	Yes		Max 60	70–75/21–24
Cesarean delivery room	Positive	4	20	NR	No	Yes	MERV-16	20-60	68–75/20–24
Operating room	Positive	4	20	NR	No	Yes		20-60	68–75/20–24
Operating/surgical cystoscopic rooms	Positive	4	20	NR	No	Yes		20-60	68–75/20–24
Combination All/PE anteroom	(e)	NR	10	Yes	No	No	HEPA	NR	NR
PE anteroom	(e)	NR	10	NR	No	No		NR	NR
Wound intensive care (burn unit)	Positive	3	6	NR	No	Yes		40-60	70–75/21–24
BEHAVIORAL AND MENTAL HEALTH FACILITIES									
Patient bedroom, resident room	NR	2	2	NR	NR	Yes	MERV-14	NR	NR
Seclusion room	NR	4	2	NR	NR	Yes		NR	NR
SURGERY AND EMERGENCY DEPARTMENT									
ED public waiting area	Negative	2	12	Yes	NR	NA	MERV-8	Max 65	70–75/21–24
Triage	Negative	2	12	Yes	NR	NA		Max 60	70–75/21–24
Procedure room	Positive	3	15	NR	No	NA	MERV-14	20–60	70–75/21–24
Trauma room (crisis or shock)	Positive	3	15	NR	No	NA		20–60	70–75/21–24
Delivery (Caesarean)	Positive	4	20	NR	No	NA	MERV-16	20–60	68–75/20–24
Operating room	Positive	4	20	NR	No	NA		20–60	68–75/20–24
DIAGNOSTIC AND TREATMENT									
Bronchoscopy	Negative	2	12	Yes	No	NA	MERV-14	NR	68–73/20–23
Class 3 imaging room	Positive	4	20	NR	No	NA	MERV-16	20–60	68–75/20–24
PE anteroom	(e)	NR	10	NR	No	NA	HEPA	NR	NR
Protective environment room	Positive	2	12	NR	No	NA		Max 60	70–75/21–24
NURSING HOMES									
Resident living/activity/dining	NR	4	4	NR	NR	Yes	MERV-14	Max 60	70–78/21–29
Resident room	NR	2	2	NR	NR	Yes		Max 60	70–78/21–29
All room	Negative	2	12	Yes	No	Yes		Max 60	70–78/21–29
HOSPICE FACILITIES									
All room	Negative	2	12	Yes	No	Yes	MERV-14	Max 60	70–75/21–24
All anteroom	(e)	NR	10	Yes	No	Yes	MERV-8	Max 60	NR
Resident room	NR	2	2	NR	NR	Yes		Max 60	70–75/21–24
ASSISTED LIVING FACILITIES									
Resident room	NR	NR	NR	NR	NR	Yes	MERV-8	NR	70–78/21–29
Medication room	NR	2	4	NR	NR	Yes		Max 60	70–75/21–24
Food preparation center	NR	2	10	NR	No	Yes		NR	72–78/22–26
Hazardous waste storage	Negative	2	10	Yes	No	No		NR	NR

FRAMES AND HOUSINGS
ELIMINATING BYPASS

Frames and Housing

A filter is only as effective as its holding mechanism. Deficient holding frames, or housings that have gaps or leak paths around the filter, can severely reduce filter performance.

A 1/4-inch gap around a 24-inch by 24-inch prefilter equates to 18% air bypass or the equivalent of a 3-inch hole in the middle of the filter. A gap around a high-efficiency filter is even worse.

Camfil housings and frames include the highest quality gasketing material to ensure that all of the air moving through the system is treated by the air filters. Camfil GlidePack MultiTrack housings are guaranteed less than 1/4 of 1% leakage at standard operating pressure.

Gasketing

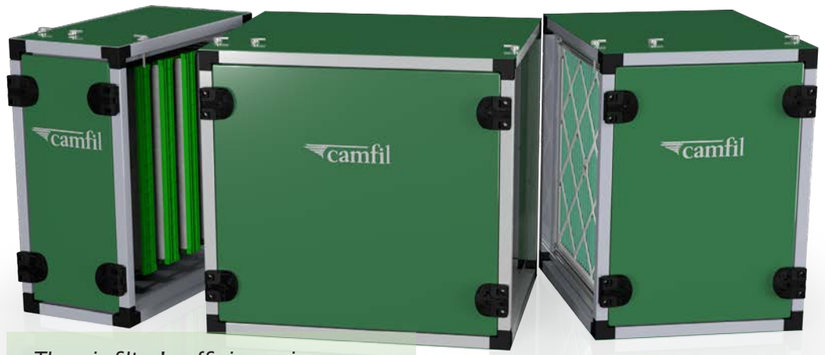
The HEPA filter should be aligned properly, assuring that the gasketing, when compressed, will seal all surfaces from air bypass. The filter sealing mechanism should compress the gasketing material to 50% of its original depth.

Camfil HEPA filters include a unique poured-in-place seamless gasket that prevents leaks through gasketing junctures as found in competitive filters. (Seamless corner shown in photo to the right.)

In systems using crank-type housings, torque adjustment should be checked with each filter change. Where a fluid sealing method is used, the knife-edge should uniformly penetrate half the depth of the sealant.

GlidePack®

GlidePack®MultiTrack



The air filter's efficiency is only as good as the filter housing.

Camfil's GlidePack® MultiTrack air bypass is

Less than 1/4 of 1 %

Hi-Flo® ES with FastFrame

Poured-In-Place Seamless Gasket

FastFrame

INFECTION CONTROL
REFERENCE GUIDE

The SARS-CoV-2 particle size has a range from .06 microns to .14 microns. But the virus attaches itself to aerosol droplets generated by breathing, talking, and coughing that are generally around 1 micron is size. If airborne at that size, at least 90% of these particles would be captured by a MERV-14A filter.

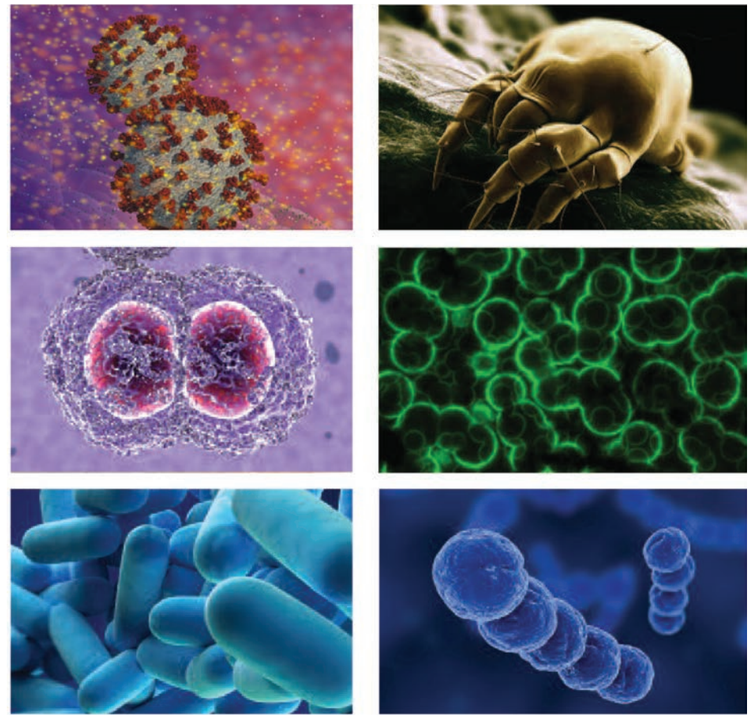
Staphylococcus aureus has a diameter of 0.8 micron to 1.0 micron. An air filter, having an efficiency of MERV-14, when rated under ASHRAE Standard 52.2, will remove more than 90% of the contaminant.

Tuberculosis has a diameter of 0.2 micron to 0.5 micron and a rod length of 1.0 micron to 4.0 microns. Although an ASHRAE MERV-14 filter should, in all probability, remove at least 90% of the contaminant, assurance can only be provided through the use of HEPA filtration.

Tuberculosis contaminant that approaches the media on a perpendicular may penetrate the filter based upon its diameter of 0.2 to 0.5 micron. HEPA filtration should be strongly considered in areas servicing tuberculosis patients. Filter selection should include consideration of the size and type of contaminant to be captured.

Aspergillus is easily removed by MERV-14 level filtration.

Airborne transmission occurs by dissemination of either airborne droplet nuclei (small-particle residue 5-micron or smaller in size of evaporated droplets containing microorganisms that remain suspended in the air for long periods of time), or dust particles containing the infectious agent.



Microorganisms carried this way can be dispersed widely by air currents and may be inhaled by a susceptible host within the same room or over a longer distance, depending on environmental factors. Therefore, special air handling and ventilation are required to prevent airborne transmission.

Legionella, Mycobacterium tuberculosis and the rubeola and varicella viruses are also of concern.

Room air cleanliness is always a function of filter efficiency and the number of air changes. The risks from many nosocomial maladies are significantly lessened with a MERV-14 filter. Viruses and other sub-micron contaminants cluster and often adhere to larger items that easily become airborne such as skin flakes. Many are removed from the airstream when the larger particles are captured by the filter.

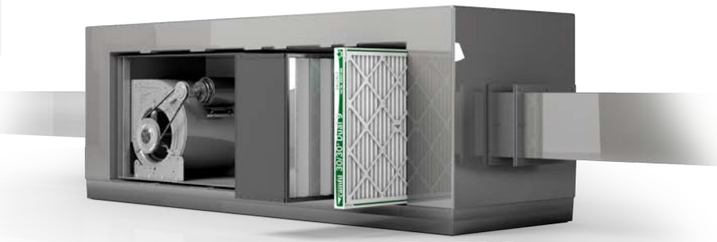
The chart on page 15 notes the time required to obtain a desired removal efficiency (99% and 99.9% listed). This removal efficiency is just a factor of moving air through the filters so the filters can do what they were designed to do; remove particles from the airstream.

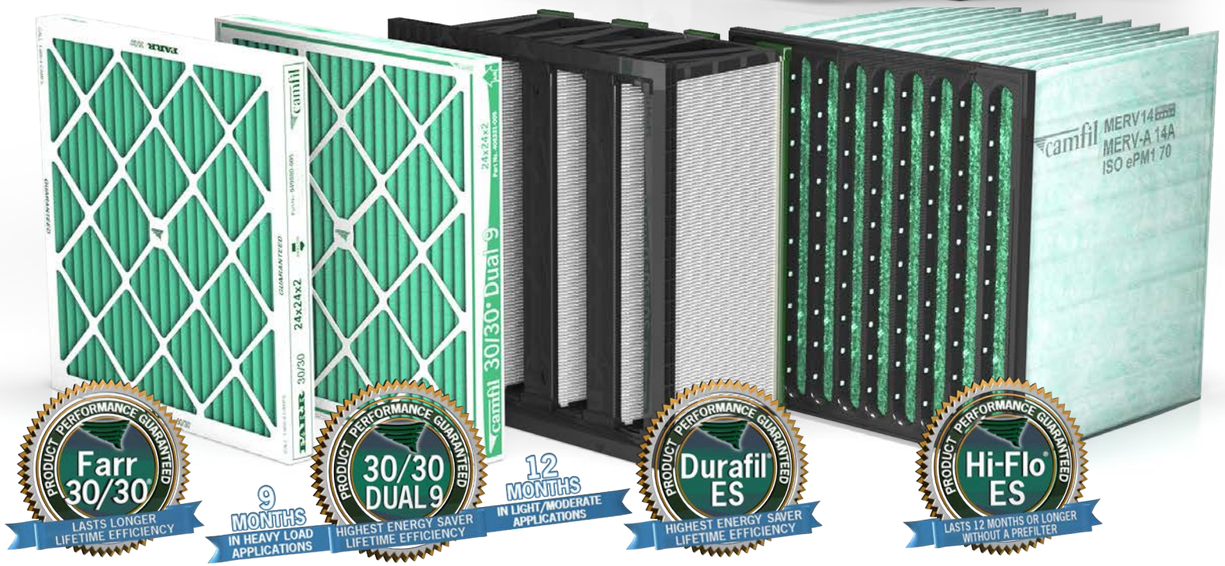
Operating suites are designed with airflows of 15 air changes per hour or more. Some ultra-critical care suites have air changes of 30-50 per hour.

CAMFIL 5-STAR SOLUTIONS

5-Star ECI Rating

Camfil air filters are rated as 5-Star filters through the Energy Cost Index (ECI) program. Based upon a five-star scale, the Energy Cost Index is an indicator of what a filter will cost over its lifetime. The best rating – five stars – indicates that the filter is the most energy-efficient, longest lasting filter available.





Farr 30/30®

With its industry-leading 5-Star ECI Rating, the Camfil Farr 30/30 sets the standard for medium-efficiency air filtration. When used as a prefilter, a stand-alone HVAC filter, or as the main filter in custom air conditioning units, the Farr 30/30 will remove nuisance dusts and staining particles, and increase the life of downstream final filters by removing contaminants that shorten the life of final filters. Using a mechanical efficiency to provide MERV-8 and MERV-8A performance levels, the Farr 30/30 will maintain its efficiency throughout the life of the filter.

30/30® Dual 9

Dual 9 is a breakthrough product where every component has been engineered to deliver the highest level of continuous particle removal, with the lowest energy consumption and longest service life. The Dual 9 comes with dual but equal MERV ratings (MERV-9 and MERV-9A), dual-layered gradient density media and dual performance guarantee options of 9 or 12 months.

Durafil® ES

The Durafil ES offers high-efficiency particle removal down to the sub-micron particle range to protect the most sensitive manufacturing processes and electromechanical equipment from contamination. Its fine fiber media maintains efficiency throughout the life of the filter, and its increased media area ensures maintained low-pressure drop and longer filter life. The Durafil ES can save 40% or more in energy expenditures when compared to competitive products.

Hi-Flo® ES

The Hi-Flo ES uses a Camfil-exclusive high loft microfine fiber media to capture particles down to the sub-micron particle range. The Hi-Flo ES may be used as the only filter in a single-stage system eliminating pressure drop and service requirements associated with two-stage filtration systems that require a prefilter. Available in MERV-11, MERV-13, MERV-14 and MERV-15, its MERV and relative MERV-A testing values are equivalent ensuring that performance is maintained throughout filter life.

Molecular Air Cleaners

The primary focus of Camfil molecular air cleaners is the removal of odors and gases from your facility. These units can deal with many issues including formaldehyde, peracetic acid and general odors.

City M
City M is a plug-and-play air cleaner configured with HEPA and molecular filter cartridges and is ideal for small spaces.

CC500-VHU
The Camfil CC500-VHU can direct up to 500 cubic feet of air per minute through a 99.99% HEPA filter as an in-room recirculation air purifier or can be configured to exhaust HEPA filtered air in negatively pressurized isolation areas.

CamCleaner 1000V
CC1000V is a versatile air cleaner that can be configured with ASHRAE-certified particulate filters and the appropriate CamCarb CG cylinders to address gases such as: VOCs, hydrogen peroxide, paracetic acid, ozone, formaldehyde, ammonia, nitrogen dioxide, sulfur dioxide.

CamCleaner 400
The CC400 air cleaner can be configured with CamCarb molecular filters and ASHRAE-certified particulate filters and is the ideal solution for applications with restricted space. It is also easy to adapt to ducts and diffusers for concealed installation.

Camfil – a global leader in air filters and clean air solutions.

For more than half a century, Camfil has been helping people breathe cleaner air. As a leading manufacturer of premium clean air solutions, we provide commercial and industrial systems for air filtration and air pollution control that improve worker and equipment productivity, minimize energy use, and benefit human health and the environment. We firmly believe that the best solutions for our customers are the best solutions for our planet, too. That's why every step of the way – from design to delivery and across the product life cycle – we consider the impact of what we do on people and on the world around us. Through a fresh approach to problem-solving, innovative design, precise process control, and a strong customer focus we aim to conserve more, use less, and find better ways – so we can all breathe easier.

The Camfil Group is headquartered in Stockholm, Sweden, and has 31 manufacturing sites, six R&D centers, local sales offices in 35+ countries, and 5,200 employees and growing. We proudly serve and support customers in a wide variety of industries and in communities across the world. To discover how Camfil USA can help you to protect people, processes, and the environment, visit us at www.camfil.us.

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