

Hospital Guide to Air Filtration



The hospital presents a complex set of environments, each with its own unique air filtration needs. Choosing the right filtration system is of critical importance. Flanders Precisionaire has over 50 years experience dealing with critical air filtration requirements. We also have a complete array of the state-of-the art products hospitals need to provide air that's safer and healthier for both patients and hospital employees. Flanders Precisionaire is a world leader in the air filtration industry.

What are typical contaminants in a hospital?

Bacteria: Although an operating room or laboratory may appear to be clean, the number of bacteria depends on various factors. In general, the concentration of airborne bacteria in any office is a balance between the rate of bacteria release by occupants and the rate of removal by the ventilation system. In recirculating systems, filters must remove these bacteria before they reenter the hospital.

Pollen grains are one of the reproductive cells of plants. They are not pathogenic, but can cause allergic rhinitis (allergic reactions such as sinus inflammation, eye irritation, etc.) and asthma.

as they are usually much larger than 15 micrometres in diameter. High quality filtration media will immediately capture all pollen grains.

Dusts: Normal atmospheric dust is comprised of soil particles, combustion soot and organic debris and normally is not pathogenic in the levels found in hospitals. However, dust particles can act as carriers and sources of nutrition for microorganisms.

Fungal Spores: Fungi include many hundreds of different organisms that help plants decay, most of which can be allergens. A few can cause serious infection and death. Fungi are a serious concern as they produce airborne spores for reproduction. Fungal Spores can be broken down into two classifications:

Yeasts remain spherical during reproduction and form colonies of round cells.

Molds reproduce into what is called a mycelium. The mycelium is what people normally see when food goes bad, i.e. gray fuzzy clumps.

Viruses are too small (<0.1 micrometre) for reliable removal by filter technology current at this printing. Even HEPA filters. But filter technology continues to advance, so check with Flanders Precisionaire for latest developments in this area.

dust



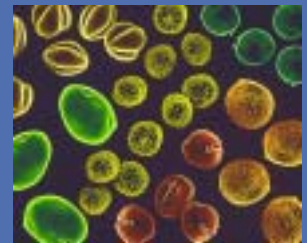
fungal mycelium with spores



bacteria



allergenic pollen

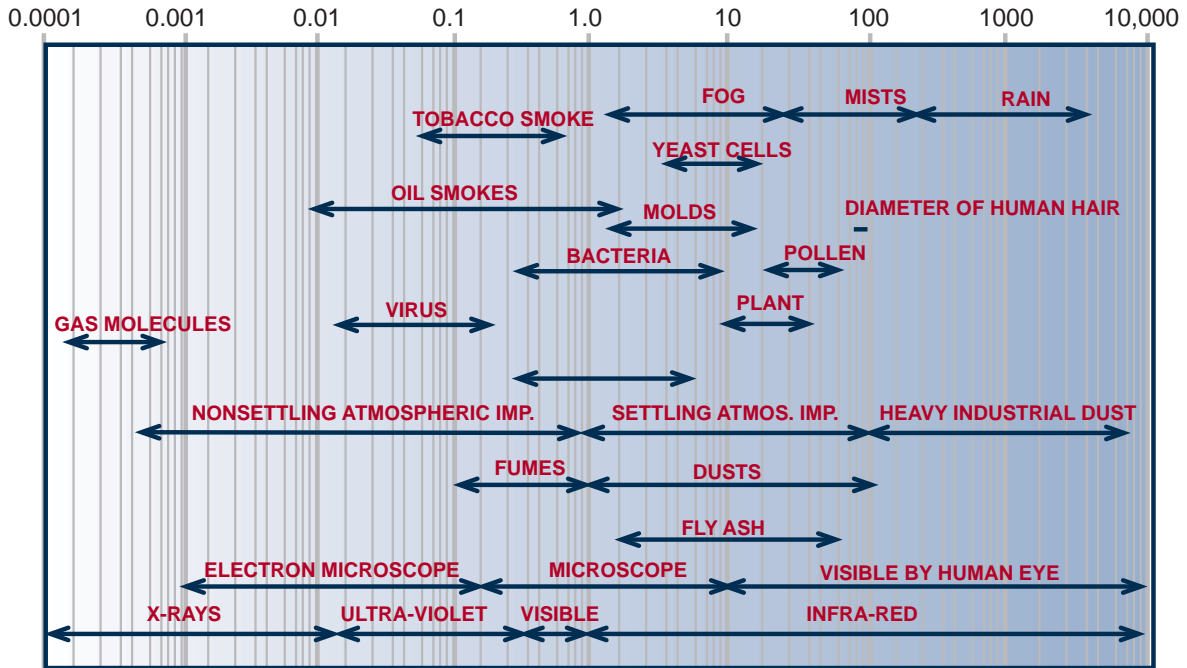


Photomicrography by Dennis Kunkel, University of Hawaii

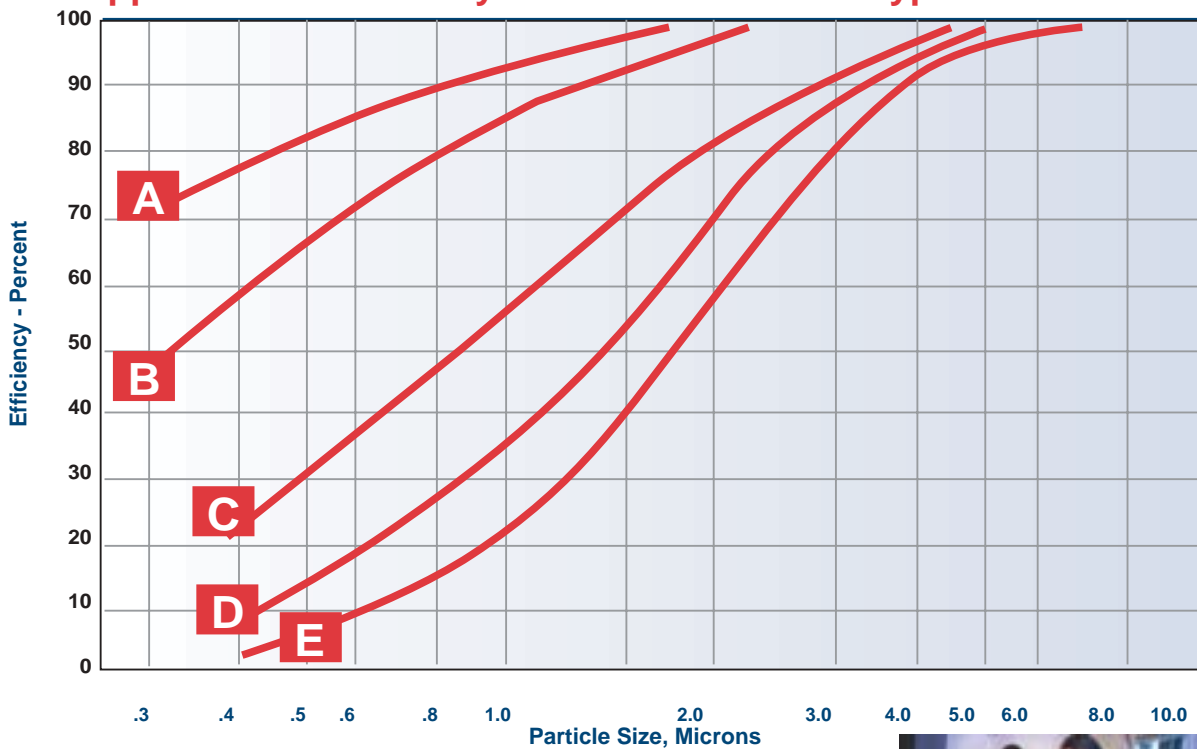
Pollen grains are relatively easy to remove

Airborne contaminants fall within particle size ranges. Different filters offer varying degrees of effectiveness on each of these different particle sizes.

Relative Size Chart of Common Air Contaminants (Shown in micrometres)



Approximate Efficiency vs. Particle Size for Typical Air Filters



- A** 90-95% Efficiency: Superflow V, Rigi Pleat, Precisioncell, Precisioncell 2
- B** 80-85% Efficiency: Superflow V, Rigi Pleat, Precisioncell, Precisioncell 2
- C** 60-65% Efficiency: Superflow V, Rigi Pleat, Precisioncell, Precisioncell 2
- D** 40-45% Efficiency: PrecisionPak, Rigi Pleat
- E** 25-30% Efficiency: Pre Pleat



**Uniform Mechanical Code
Air Filtration Requirements for General Hospitals**

Area	Requirements:	Applicable Precisionaire Filters
Sensitive areas: Operating rooms, nurseries, isolation rooms, delivery rooms, intensive care rooms, recovery rooms, laboratory media preparation rooms and recirculated central air systems serving other hospital areas.	Equip with a minimum of 2 filter banks. Bank #1 shall be located upstream of the conditioning equipment and shall have an average efficiency of at least 25%. Bank #2 shall be located downstream of the supply fan and all cooling and humidification equipment shall have an average efficiency of at least 90%.	Bank #1: Pre Pleat 40 Precision Pak 50% Bank #2: Rigi Pleat 95% PrecisionCell 95% Econocell 2 95% Superflow V 95% Precision Pak 95%
Central air handling systems with 100% outside air (any unit requiring ductwork on the supply or inlet side and serving more than one room.	Central systems using 100% outdoor air and serving other than sensitive areas shall be provided with after filters with an average efficiency of at least 80% (Bank #2 downstream. Bank #1 shall be 25%).	Bank #1: Pre Pleat 40 Precision Pak 50% Bank #2: Rigi Pleat 85% PrecisionCell 85% Econocell 2 85% Superflow V 85%
Exhausts from all laboratory hoods in which infectious or radioactive materials are processed.	Use 99% efficient filters on 0.3 micrometre particle based upon the DOP (Diocetyl Phthalate) test method. Frames should be dimensioned accurately and an airtight seal is essential.	99.97% DOP HEPA
Media transfer rooms.	Filters with 90% efficiency shall be installed in air supply system at its entrance to the media transfer room.	Precision Pak 95% Rigi Pleat 95% PrecisionCell 95% Econocell 2 95% Superflow V 95%
Kitchen and dining rooms.	Air from the dining areas may be used to ventilate the food preparation areas only after it has passed through a filter with 80% efficiency.	Precision Pak 85% Rigi Pleat 85% PrecisionCell 85% Econocell 2 85% Superflow V 85%

Title 22: Social Security
Chapter 1: General Acute Care Hospitals
Section 70839: Air Filters

Division 4: Environmental Health
Article 8: Physical Plant

- A. The licensee shall be responsible for regular inspection, cleaning and replacement of all filters installed in heating, air conditioning and ventilation systems, as necessary to maintain the systems in normal operating condition. The efficiency of the replacement filters shall be equal to the efficiency rating of the replaced filters.
- B. A written record of inspection, cleaning or replacement, including static pressure drop shall be regularly maintained and available for inspection. The record shall include a description of the filters originally installed, the American Society of Heating Refrigeration and Air Conditioning Engineers (ASHRAE) atmospheric dust spot test efficiency rating and the criteria established by the manufacturer or supplier to determine when replacement or cleaning is necessary.
- C. Following filter replacement or cleaning, the installation shall be usually inspected for torn media and bypass in filter frames by means of a flashlight or equivalent, both with fans in operation and stopped. Tears in filter media and bypass in filter frames shall be eliminated in accordance with the manufacturer's directions and as required by the department.
- D. Where filter maintenance is performed by an equivalent service company, a certification shall be provided to the licensee that the requirements listed in Section 70839 (a) and (b) have been accommodated.
- E. If filter maintenance as required in Section (a) and (b) is performed by employees of the hospital, a written record shall be maintained by the licensee.

ASHRAE 62-1989 Ventilation Standard



Health Care	CFM Per Person
Patient Rooms	25
Operating Rooms	30
Recovery Room	15
Intensive Care	15
Physical Therapy	15

Pressure Relationships and Ventilation of Certain Hospital Areas

Area Designation	Air Balance Relationship to Adjacent Areas	Minimum Air Changes if 100% O.S.A.	Conditioned Air Not 100% O.S.A.		All Air Exhausted Directly To Outdoors	Air May Be Recirculated Within Room Without Special Designation Filters
			Minimum Air Changes of Outdoor Air Per Hour	Minimum Total Air Changes Per Hour		
Operating Room	P	12*	5	20	-	No
Emergency Operating Room	P	12*	5	20	-	No
Patient holding/Prep	E	6	2	6	-	No
Delivery Room	P	12*	5	20	-	No
Nursery	P	8*	3	12	-	No
Recovery	E	6*	2	6	Yes	NA
Intensive Coronary Care	P	6	2	6	-	No
Patient Room	E	2	2	4	-	Yes
Patient area corridor	E	2	2	4	-	Yes
Labor/Delivery/Recovery	E	2	2	4	-	No
Isolation room	E	6	2	6	Yes	NA
Isolation anteroom	E	6	2	6	Yes	NA
Treatment, trauma, endoscopy and examination rooms	E	6	2	6	-	No
X-ray Fluoroscopy room	N	6	2	6	Yes	NA
X-ray treatment room	E	6	2	6	-	Yes
Physical therapy and hydrotherapy	N	6	2	6	-	Yes
Soiled workroom (utility room)	N	4	2	10	Yes	NA
Clean workroom	P	4	2	6	-	Yes
Autopsy and darkroom	N	8	2	12	Yes	NA
Toilet room	N	-	-	10	Yes	NA
Bedpan Room	N	-	-	10	Yes	NA
Bathroom	N	-	-	10	Yes	NA
Janitor's closet	N	-	-	10	Yes	NA
Sterilizer equipment room	N	-	-	10	Yes	NA
Linen and trach chute rooms	N	-	-	10	Yes	NA
Laboratory, general	N	6	2	6	-	Yes
Lab, media transfer	P	4	2	4	-	No
Food prep centers	E	10	2	10	Yes	NA
Dining Room	E	10	2	10	-	Yes
Dishwashing room	N	-	-	10	Yes	NA
Dietary Day Storage	E	-	-	2	-	Yes
Laundry, general (clean and dirty)	E	10	2	10	Yes	NA
Soiled linen sorting and storage	N	-	-	10	Yes	NA
Clean linen storage	P	2	2	2	-	Yes
Anesthesia storage	E	8	-	8	Yes	NA
Central medical and surgical supply; Soiled or decontamination room	N	4	2	4	Yes	NA
Clean workroom	P	4	2	4	-	Yes
Unsterile supply	E	2	2	2	-	Yes
Pharmacy, medicine room	P	2	2	4	-	-

P = Positive E = Equal
N = Negative NA - Not applicable

* 90% Efficiency filters (2 filter beds)

Source: 1991 Uniform Mechanical Code