

HEALTHCARE FACILITY FILTRATION

What does ASHRAE Recommend?

This article addresses air filtration requirements for operating rooms (ORs) and Protective Environment (PE) rooms as outlined in current ASHRAE standards and handbooks¹.

ASHRAE Standard 170, 2008, provides direction for minimum filter efficiencies in Table 6-1:

- Filter Bank #1²:
 - Located upstream of heating & cooling coils to assure mixed air is filtered
 - Space designation –
 - Class B & C surgery (MERV 7)
 - PE rooms (MERV 7)
 - Class A surgery (MERV 13³)
- Filter Bank #2²:
 - Located downstream of all wet air cooling coils and supply fan(s)
 - Protection against filter bypass
 - Space designation –
 - Class B & C surgery (MERV 14)
 - PE rooms (MERV 17⁴)

While no mention is made of HEPA filtration in Standard 170 for Class B & C ORs, most engineers specify HEPA filters either at the air handler, at the terminal units, or at the point-of-delivery.

Additional guidance regarding PE rooms can be found in Chapter 8 of the 2011 ASHRAE Handbook under *AIR QUALITY, Air Filters* on page 8.2:

"HEPA filters should be used on air supplies serving preventative environment rooms for clinical treatment of patients with high susceptibility to infection due to leukemia, burns, bone marrow transplant, or human immunodeficiency virus (HIV)."

The Handbook goes on to state that:

"Some health care facilities may also choose (or be required) to apply HEPA filters to the exhaust originating from airborne infectious isolation rooms."

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1 Written based on Standards and handbooks in effect as of October 2011
2 Also applicable to other space designations
3 Allows pre-filters to reduce maintenance on filters with efficiencies higher than MERV 7
4 Allows MERV 14 providing that MERV 17 tertiary terminal filters are provided for these spaces



Figure 1
ASHRAE Standard 170, 2008
2011 ASHRAE Handbook

ASHRAE Standard 170, 2008, "Ventilation of Health Care Facilities" and the 2011 ASHRAE Handbook offer ventilation design guidance within the health care facilities. With over 10,000 OR integrated ceiling ventilation systems installed, Precision Air Products has the experience and expertise to assist with your OR layouts and diffuser sizing / selection. Contact your local representative and ask about Precision Air Products No-Fee Engineering Assist:

<http://www.precisionairproducts.com/live/ServiceTeam1.aspx>

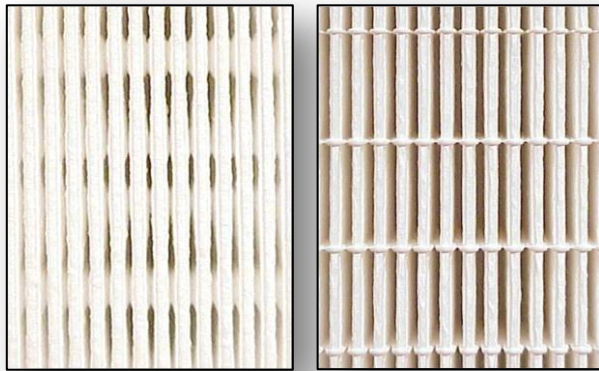
What Does ASHRAE Recommend (Continued)

Further information on operating room filtration can be found in Section 8, Table 1 of the 2011 ASHRAE Handbook. It recommends point-of-delivery HEPA filtration for:

- Orthopedic operating rooms
- Bone marrow transplant operating rooms
- Organ transplant operating rooms

Owner input can be particularly useful for these types of spaces. Since each of the ORs listed above represents higher risks for surgical site infections (SSI), surgeons often require significantly higher air changes to thoroughly scrub the air for a more sterile environment, helping to remove airborne contaminants as quickly and as efficiently as possible.

Don't forget to consult your local Authorities Having Jurisdiction (AHJ). They can help you understand where their requirements exceed best, or recommended practice as offered by ASHRAE and other guiding bodies.



Dimple-Pleated Media

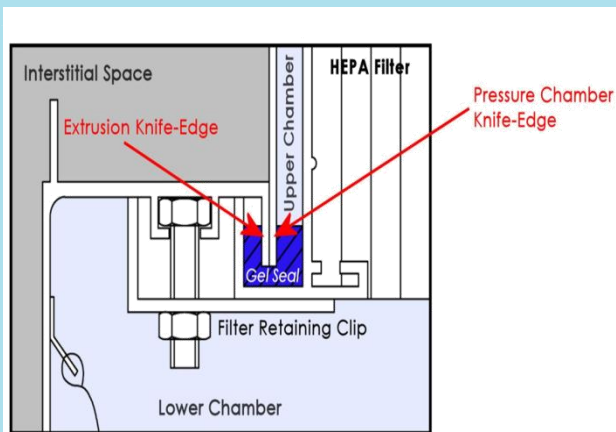
Thermoplastic Pleating

Figure 2
Filter Pleating Methods

For more information about the HEPA-Vent DS, or for updated guide specifications, please contact your local Precision Air Products representative:

<http://www.precisionairproducts.com/live/ServiceTeam1.aspx>

Figure 3
HEPA-Vent DS Knife-Edge Graphic



OR HEPA Diffusers

What's Not Covered by the Standards

For applications requiring diffusers with point-of-delivery HEPA filters, you may want to consider the following:

- Diffuser construction:
 - Protection against filter bypass when the upper chamber is pressurized
 - Critical seam length⁵
- The HEPA filter:
 - The potential for media shedding due to media-to-media contact common with dimple pleating
 - Gel formulation & cured strength; manufacture's history of "reversion" or "blooming"⁶
 - Testing methodology
- Likelihood of media contamination and damage due to blood splatter or when cleaning the diffuser faceplate

HEPA-Vent DS

The diffuser matters. Precision Air Products' HEPA-Vent DS is unmatched for HEPA diffuser applications: (see Figure 3)

- Dual protections:
 - Two knife-edges eliminate the potential for bypass
 - Back-welded & sealed pressure chamber eliminates unwanted interstitial pathways that might otherwise result in contaminants being drawn into the OR above the patient
- Dramatically reduced critical seam length:
 - Up to 80% less than competitive 2'x4' diffusers
 - Up to 50% less than competitive 2'x2' diffusers
- Camfil Farr Megalam[®] HEPA filters:
 - Strong / rigid media pack with no media-to-media contact and no media shedding
 - Superior gel formulation with no history of "reversion" or "blooming"
 - 100% testing to 99.99% efficiency against 0.2-0.3 μm & 0.1-0.2 μm particle sizes; traceable; worst case result shown on labels affixed to every filter
- Unsurpassed laminar performance

⁵ Critical seam length can be defined as the amount of mating surfaces or penetrations that must be sealed within the HEPA diffuser. Keeping critical seam length as short as possible lessens the potential for future interstitial pathways that could draw contaminants into the OR.

⁶ "Reversion" occurs when cured gel liquefies, jeopardizing the seal and drips from the gel cup into the OR. "Blooming" results from incomplete gel formulation where pieces of the uncured gel come to the surface.