

# SOLUTION SUPPORT DOCUMENT

## BACTERIAL AND VIRUS REMOVAL EFFICIENCY OF PALL HEPA CABIN AIR FILTERS

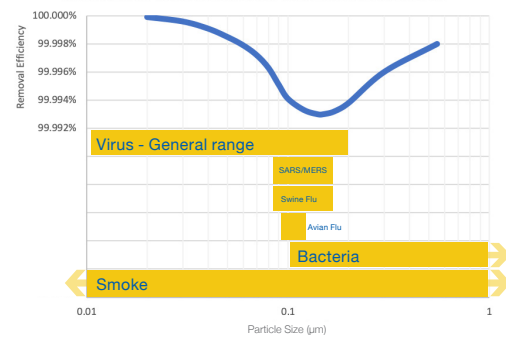
What is a HEPA cabin air filter? In the Aerospace industry, the current accepted definition of HEPA cabin air filters is a minimum removal efficiency of 99.97% when tested using a DOP challenge or 99.99% when tested with a sodium flame challenge.<sup>1</sup>

How effective are the Pall filters in removing bacteria and viruses? An independent test laboratory<sup>2</sup> has tested<sup>3</sup> Pall cabin air filter elements using two different bacteria; Brevundimonas diminuta and Bacillus subtilis and results show that the bacterial removal efficiency of the Pall cabin air filters is greater than 99.999%. Similarly, when challenged with the MS2 Coliphage virus, the virus removal efficiency of the Pall cabin air filters is also greater than 99.999%.

Viruses can typically range from 0.01 to 0.2 micron in size, although they may cluster or attach to larger particles.

DESCRIPTION	TYPE	VIRUS APPROXIMATE SIZE	MIN. REMOVAL EFFICIENCY
SARS	Corona Virus	0.08 to 0.16 microns	99.993%
MERS-CoV	Corona Virus	0.08 to 0.16 microns	
Swine Flu	A(H1N1) Virus	0.08 to 0.12 microns	
Avian Flu	A(H5N1) and A(H7N9) virus	~0.1 microns	

Fig. 1 Filtration Efficiency vs Particle Size  
(media used on Pall Aerospace Cabin Air Filters for Airbus Applications)



The microbial capture performance results featured in this document apply to all Pall cabin air recirculation filters. With a virus removal efficiency greater than 99.999% airlines selecting Pall are therefore using the best available technology for filtering the recirculated air on board aircraft.

Why cabin air filters do not need an anti-microbial treatment? In free air, most microbes die within a few minutes. Once captured by the filter media, the survival rate of microorganisms in the aircraft environment is very low. Most bacteria require high humidity and a source of nutrition to survive. The conditions typically found in the aircraft recirculation system are 10-15% relative humidity and lack of a source of nutrition.

Is there a danger to maintenance personnel by removing used cabin air filters? There is no more risk involved in replacing a cabin air filter than carrying out general maintenance on any aircraft part that has been in service for a number of years. Maintenance staff should wear the same personal protective equipment as for other aircraft maintenance tasks which require protection against dust, and per the local regulations. The used HEPA filter should be placed and sealed in a plastic bag. A specific biohazard bag is not required for disposal of the HEPA filter in most jurisdictions.

Notes:

- 1 The DOP test specified by Boeing consists of challenging the filter with an aerosol mist of DOP (dioctyl phthalate) droplets having a mean size of 0.3 microns. The sodium flame test specified by Airbus consists of challenging the filter with an aerosol mist of sodium chloride particles having a mean size of 0.58 microns. The removal efficiency is calculated by measuring the particle concentrations upstream and downstream of the filter element being tested.
- 2 Centre for Applied Microbiology & Research (CAMR), now known as Public Health England.
- 3 Testing performed on full size filter elements at their rated air flow, not just samples of the flat sheet filter media.

**Pall Corporation**  
Pall Aerospace

US: New Port Richey, FL  
telephone: +1 727-849-9999  
toll free US: +1 800-933-3111

UK: Portsmouth  
telephone: +44 (0)23 9233 8000  
email: aerospace@pall.com

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VISIT [aerospace.pall.com](http://aerospace.pall.com)

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