PALL Aerospace

Subject: Bacterial and Virus Removal Efficiency of Pall HEPA Cabin Air Filters

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In response to recent inquires, Pall Aerospace has prepared the enclosed information to assist airline personnel and other interested parties in understanding the effectiveness of the aircraft cabin air filters manufactured by Pall Aerospace in preventing the spread of viruses and bacteria through an aircraft cabin environment.

One of the functions of the Pall HEPA cabin air recirculation filters is to reduce the risk of infection and illnesses among passengers and crew by removing dust, mold spores, bacteria and viruses from the recirculated air that passes through the cabin air system. Most bacteria are larger than 0.1 micron, while viruses range from about 0.01 to 0.2 micron in size, although they may cluster or attach to larger particles. The current industry accepted definition of HEPA cabin air filters is that they be able to demonstrate a minimum efficiency of 99.97% when tested using a DOP challenge or 99.99% when tested with a sodium flame challenge.[1]

Following standard practices used in the healthcare and pharmaceutical industries, Pall has employed the services of an independent testing laboratory to perform challenges of its HEPA cabin air filters using the bacteria Brevundimonas diminuta, with a diameter of 0.3 microns, and Bacillus Subtilis with a diameter of 0.7 microns. The bacterial removal efficiency of the Pall Aerospace product has been measured to be greater than 99.999%. Similarly, when challenged with the MS2 Coliphage virus with a size of 0.023 microns, the virus removal efficiency has been measured to be greater than 99.9995%.

Please note that the MS2 coliphage virus is approximately 4 to 6 times smaller than the corona virus which scientists believe is the cause of the *Severe Acute Respiratory Syndrome (SARS)* disease, approximately 4 to 6 times smaller than the swine influenza virus A(H1N1) and approximately 4 times smaller than the H5N1 virus responsible for the Avian Flu.[2]

Since the demonstrated effectiveness of a Pall cabin air filter in capturing and retaining these viruses is greater than 99.9995% this ensures that the airlines using Pall cabin air filters are using the best available technology for filtering the recirculated air on board their aircraft.

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 (>80%) and a source of nutrition (protein, sugar) to survive. The conditions typically found in the aircraft recirculation system are 10-15% relative humidity and lack a source of nutrition. Similarly, viruses need to invade live cells to survive and these are not present in the recirculated cabin air or on the filter. As such, the viability of viruses and bacteria once captured on the cabin air filter is minimal.

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] The corona virus particles are approximately 0.08 to 0.16 microns in size, the H5N1 virus particles are approximately 0.1 micron in size, and the A(H1N1) virus particles are approximately 0.08 to 0.12 microns (80 to 120nm) in size.

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