



Donaldson
FILTRATION SOLUTIONS

Chemical Filtration: Core Technology of the Donaldson Air Purification System

Boeing and Airbus each forecast that air travel will grow by 150% or more in coming decades, reaching 12.8 billion to 13.8 billion revenue passenger kilometers in 2031 from 5.1 billion in 2011. Airlines are competing for that increasing traffic with jetliners that offer more comfort and efficiency and reduced environmental impact. Cabin air quality is a key factor in the comfort of passengers and crew members. It also is of growing interest for the flying public, the media, politicians and regulators.

Donaldson, the world's leader in filtration solutions and technologies, offers an unsurpassed ability to improve cabin air quality with its Air Purification System (APS™). APS removes not only dust and other particulates but odors and gaseous irritants. Boeing recognizes this performance, selecting APS for its ultra-efficient 787 Dreamliner. APS is customizable, making it an economical option for retrofit on existing aircraft as well as for new installations.

The Core Technology

The APS' innovative technology combines a carbon-based chemical filter with a High Efficiency Particulate Air (HEPA) filter, which is currently in service on most commercial aircraft. The HEPA filter traps more than 99.97 percent of airborne particles of the most penetrating size (0.3 micron), but it cannot remove gaseous contaminants from cabin air. The APS chemical filter does that, using a process called gas-phase adsorption to capture gas molecules on its surface (rather than absorbing them in its interior). The APS removes those gases without creating ozone

and irritating byproducts that other systems may create. Simple to maintain, APS filters can be changed without tools or complicated procedures. The system has no moving parts and requires no power. It is exceptionally reliable.

Donaldson APS Advantages

- Removes Gaseous Irritants and Particulates (Including Biological Particles)
- Low Cost
- Easily Installed (New and Retrofit) and Maintained
- High Reliability – No Moving Parts
- No Power Requirement
- No Chemical Byproducts

Cabin Air Quality: A Growing Concern

More people are flying. According to Boeing and Airbus, growing middle classes in emerging markets (Asia, the Middle East and Africa) spur passenger increases, as does intense airline competition in established markets (North America and Europe). New commercial aircraft permit flights of longer distances and durations. Safety advances erase traditional concerns about flying. These and other factors increase the focus on in-flight comfort. In a jetliner cabin's unique environment – high occupant density, low relative humidity, low air pressure – even small amounts of airborne irritants can decrease passenger and crew member comfort significantly. HEPA filters effectively remove particulates such as dust, sand, allergens, bacteria and viruses from cabin air. But removing the odors of bodies, food, beverages,

personal-care products, and typical aircraft interiors and operations present a challenge. Such odors in flight provoke scrutiny from the media, politicians and regulators, often prompting calls for intensified investigation, monitoring and control and raising the risk of increased costs for airlines and passengers.

Meeting the Challenge

The Donaldson APS™ helps aircraft operators meet the challenge of odors and gaseous irritants in cabin air, providing superior air purification without compromise. Its innovative combination of technologies outperforms cabin air systems that rely solely on HEPA filters. The APS does not incur the drawbacks – added weight, power and maintenance requirements and irritating byproducts – of filtration technologies like Temperature Swing Adsorption (TSA), Pressure Swing Adsorption (PSA), Ultra Violet Photocatalytic Oxidation (UVPCO) and Cold Plasma. The APS HEPA filter becomes more efficient at removing particulates over time and the carbon-based chemical filter – consumed slowly as it removes gaseous contaminants – performs well should contamination spike.

Independent Analysis

As part of its introduction to service, the Donaldson APS™ was subjected to extensive testing. The Technical University of Denmark (DTU) conducted a two-year evaluation comparing the APS with photocatalytic oxidation (PCO) systems. The DTU analyzed live subjects' assessments of cabin comfort in simulated flights of up to 11 hours using a three-row mockup of a Boeing 767 cabin. Mass spectrometry checked the presence of gaseous contaminants during the tests. The DTU study concluded that Donaldson's APS "avoided the major problems" identified with PCO units, including the generation of unacceptable levels of acetaldehyde under certain conditions, and "gave the best overall performance."

To learn more about Donaldson Aerospace & Defense, visit www.DonaldsonAerospace-Defense.com.

About Donaldson Aerospace & Defense

Donaldson's Aerospace & Defense Group is a leading worldwide provider of filtration systems for the aerospace and defense industry. Our filtration solutions protect fixed wing aircraft, rotorcraft, military ground vehicles, electronic equipment, space vehicles, missiles, military shipboard systems and amphibious vehicles. We are committed to advancing filtration technology, providing quality products and prompt customer service. Our group serves customers from sales, engineering and manufacturing locations around the world.

About Donaldson Company

Donaldson is a leading worldwide provider of filtration systems that improve people's lives, enhance our Customers' equipment performance and protect our environment. We are a technology-driven Company committed to satisfying our Customers' needs for filtration solutions through innovative research and development, application expertise and global presence. Our approximately 13,000 employees contribute to the Company's success by supporting our Customers at our more than 140 sales, manufacturing and distribution locations around the world.

Donaldson is a member of the S&P MidCap 400 and Russell 1000 indices, and our shares trade on the NYSE under the symbol DCI.

Additional information is available at www.donaldson.com.