AUVS Air Sterilization System Design Takes Advantage of the New ASHRAE 241 Guidance

"Requirements for Equivalent Clean Airflow Rate – Standard 241 breaks new ground by setting requirements for equivalent clean airflow rate, the flow rate of pathogen-free airflow into occupied areas of a building that would have the same effect as the total of outdoor air, filtration of indoor air, and air disinfection by technologies such as germicidal ultraviolet light.

General Description

AUVS has developed the only commercial version of an air sterilization system originally developed for Homeland Security. The commercial AUVS air system is designed for hospitals, schools, offices, manufacturing facilities, and federal and state institutions.

The system AUVS technology has been installed in the Pentagon and recognized by ASHRAE for its effectiveness. EPA testing of the AUVS technology for Homeland Security with the targeted pathogens achieved over 99.9% pathogen sterilization in a single pass.

The AUVS commercial air sterilization system (BP3131) is available in two models, both with open protocol for integration with building management systems:

1. **In-Duct System**
   - Designed for installation in the HVAC return line, this model operates in a temperature-controlled environment with available maintenance access.
   - A larger percentage of air in the return runs of the HVAC can be disinfected and recirculated without incurring additional energy costs for climatization, heating, or cooling.
   - Multiple passes of return air through the BP3131 will enhance the levels of disinfection.
   - Independently lab tested; effective in return air up to 4000 CFM, 500 FPM for the most common airborne pathogens.
2. **Stand-Alone AUVS air Model BP3131SA upper air sterilization**
   - This version functions as an upper-air disinfection chamber. It features a built-in 2000 CFM fan and MERV 8 filtration. It is suitable for large areas with high ceilings that cannot accommodate an in-duct solution.
   - This model can be installed using a wall-mounting rack, and it is connected to a standard 120V outlet.

Product Applications and Energy Savings BP3131 installed in the return HVAC ductwork

IAQ Improvement savings UVC disinfection versus high levels of filtration

- Per an EPA study, switching to a MERV 13 filter used to lower infection rates will increase operational costs by $1.60 to $2.00 per square foot. For example, a 10,000-foot area can cost $16,000 to $20,000 of additional energy and associated carbon output to use a MERV 13 filtration solution at 76% effectiveness.
- The additional cost can be eliminated using existing filtration, as the BP3131 disinfects viruses and bacteria with 99.9%+ effectiveness at $1000 energy cost per year.
- A facility's HVAC energy can account for 40% to 50% of its total energy expenditure. For example, recirculating an additional 20% of the return air using BP3131 to kill airborne pathogens could provide energy savings of 8% to 10% by eliminating the climatization costs of using fresh air.

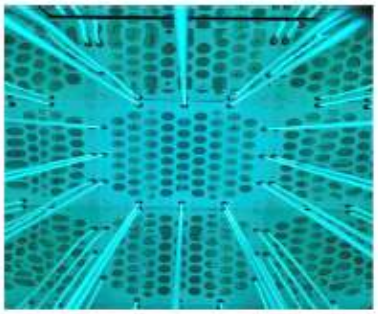
Infection Reduction Management Mode, IRMM

- The installation of BP3131 in facilities that cannot replace their air handler systems due to constraints such as time, capital expense, or asbestos can enhance indoor air quality (IAQ) without necessitating additional very high-efficiency filtration to meet air recirculation requirements.
- New construction and renovations: The BP3131 meets the new ASHRAE 241 standards, utilizing UVC-disinfected air as a substitute for fresh air or high-MERV-filtered air.

- IRMM: Infection Reduction Management Mode: According to ASHRAE 241, a pandemic preparedness plan should aim to increase CFM per occupant beyond the design ventilation to mitigate the risk of transmission. Integrated with building management, the BP3131s can be activated during high occupancy to achieve this increase.

AUVS BP3131: Professionally designed UVC air disinfection/sterilization chamber

- This method requires a professionally designed, modular system, it can provide excellent airborne pathogen disinfection using encapsulated UVC light sources that do not generate Ozone.
- As a specifically designed unit, the manufacturer can confirm disinfection capabilities via 3rd party laboratory testing and confirmation
- The air baffle system mixes the air before entering the disinfection chamber to ensure the sterilization of airborne pathogens.
- A reflective chamber constructed of special materials designed to efficiently reflect UV energy is used to contain the energy and allow it to be reflected many times within the chamber. This configuration can significantly increase the irradiance in the chamber. Multiple reflections within the chamber lead to a much more uniform distribution of UV energy.
- The open software protocol allows communication with building management systems to schedule operation and warn of performance issues.



The BP3131 Specifications

BioProtector 3131 General Specifications	
Overall Dimensions	68"L x 41"W x 36"H
Weight	130 lbs. w/o optional Fan
Light Source	Mercury Germicidal Encapsulated UV Lamps (12)
Wavelength	>85% Output 254nm
Average Lamp Life	10,000 hours
Airflow Volume	Laboratory testing at 2,000 CFM, 300 FPM

BP3131 Electrical Specifications & Cost to Operate

Input Voltage (VAC)	Input Power (Watts)	Line Current (Amps)	Power Factor (Pf)##	Ballast Factor (Bf)#	Run Time Hours Per Day (Est.)	kWh	cents/kWH*	BP3131 cost / month (30 Days)	BP3131 Annual Cost
120	1693.8	14.17	0.99	0.97	14	23.71	$ 0.118	$ 83.731	$ 1,004.776
230	1660.8	7.31	0.96	0.97	14	23.25	$ 0.118	$ 82.100	$ 985.200
277	1644.0	6.15	0.90	0.97	14	23.02	$ 0.118	$ 81.269	$ 975.234

Definitions:

Ballast Factor measures how "efficiently" a ballast uses its power. Expressed as a percentage, 0% to 100%, power factor is the ratio of power used by a ballast compared to the total power supplied by the utility

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*Energy cost based on US average commercial sector as of 7-2022 per eia

BP3131 Calculated Results Per Lab Testing

1. Measured Irradiation, Calculated Transit time & Calculated Dose

AIR FLOW (CFM)	1000	2000	3000	4000	5000	6000
MEASURED IRRADIATION (mW/cm2)	14.7	14.7	14.7	14.7	14.7	14.7
AVERAGE FLOW VELOCITY (FT/MIN)	149.8	299.7	449.6	599.4	749.2	899.1
FRACTION OPEN AREA OF ENDS	0.35	0.35	0.35	0.35	0.35	0.35
ESTIMATED PRESSURE DROP (IWG)	0.03	0.12	0.26	0.47	0.73	1.06
AVERAGE RESIDENCE TIME (SEC)	2.00	1.00	0.67	0.50	0.40	0.33
AVERAGE DOSE (mJ/cm2)	29.43	14.72	9.81	7.36	6.89	4.91

CALCULATED SINGLE PASS KILL IN FLOWING AIR- BP3131 - 2000 CFM (DOSE = 14.7 mJ/cm²)

Microorganism	Type	Measured D-Value[1] (mJ/cm²)	Reference	Calculated Kill (logs)	Calculated Kill (%)	Comment/Illness
Bacillus anthracis	Bacteria	4.51	Sharp (1939)	3.3	99.94	Anthrax
Bacillus subtilis	Bacteria	7.1	Rentschler,et al (1941)	2.1	99.15	
Escherichia coli	Bacteria	0.612	Sharp 1940	24.0	>>99.9999	
Legionella pneumophila	Bacteria	1.12	Gilpin 1984	13.1	>>99.9999	Legionellosis
Salmonella typhi	Bacteria	2.1	Sharp 1938	7.0	>99.9999	
Pseudomonas aeruginosa	Bacteria	0.4	Sharp 1940	36.8	>>99.9999	
Serratia marcescens	Bacteria	2.4	Rentschler et al 1941	6.1	>99.9999	
Shigella paradysenteriae	Bacteria	1.7	Sharp 1938	8.6	>99.9999	
Staphylococcus albus	Bacteria	1.8	Sharp 1938	8.2	>99.9999	
Staphylococcus aureus	Bacteria	0.662	Sharp 1939	22.2	>>99.9999	MRSA
Staphylococcus hemolyticus	Bacteria	2.15	Sharp 1938	6.8	>99.9999	
Streptococcus lactis	Bacteria	6.22	Rentschler et al 1941	2.4	>99.9999	
Mycobacterium tuberculosis	Bacteria	0.487	Riley 1976	30.2	>>99.9999	Tuberculosis
Adenovirus	Virus	4.2	Jensen 1964	3.5	99.97	
Vaccinia	Virus	1.5	Jensen 1964	9.8	>99.9999	
Coxsackievirus	Virus	2.1	Jensen 1964	7.0	>99.9999	
Influenza A	Virus	1.9	Jensen 1964	7.7	>99.9999	Influenza
SARS-CoV-2[2]	Virus	4.17	Inagaki 2020	3.5	99.97	Covid 19/SARS
SARS-CoV-2[3]	Virus	1.23	Bianco 2020	12.0	>>99.9999	Covid 19/SARS

Notes:

1. D-Value = Measured Dose required for 1-log reduction (in Air unless noted)
2. Tests in vitro
3. Tests on surface

2. Disinfection Performance at 2000 CFM

- Air Velocity: 300+ ft./min.
- Exposure Time: 1.0 sec.
- Single Pass Dose: 14.7 mJ/cm²
- Measured Disinfection Test Results with BP3131 at 2000 CFM:
  - Staphylococcus aureus: 5.1 Logs (99.999%)
  - MS-2 bacteriophage test virus: 3.55 Logs (99.97%)

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