Sincerus™ Linear UV Air Purification System

Performance Summary

Armstrong®
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Executive Summary

Sincerus™ Linear UV Air Purification System is a stand-alone air purification system that includes UVC bulbs and a MERV 5 particulate filter for safe, unobtrusive in-room air purification. Easily installed in the ceiling for a variety of new construction and retrofit applications, Sincerus™ provides 100 CFM circulation of indoor air to protect building occupants from airborne pathogens.

The superior performance of Sincerus™ provides a high level of air cleaning, leading to a reduction in the risk of airborne infection in any indoor environment. The Sincerus™ system performance was evaluated in terms of the removal rates of common airborne harmful contaminants and allergens.

At the nominal design airflow of 100 CFM, and with a MERV 5 filter and two 55W UV bulbs with 17W of UV output each, the Sincerus™ system provides removal rates of 99.9%.

Unobtrusive operation also makes this unit suitable for commercial, office, healthcare, education, or retail environment.

Introduction

Sincerus™ is a UV air purification and particulate filtration system with a linear configuration, minimizing its visible profile and offering compatibility with modern architectural designs.

It is intended to clean the air and neutralize harmful contaminants and allergens in a wide array of indoor environments. The system includes 2 ultraviolet (UV) bulbs, a MERV 5 particulate filter, and a fan that recirculates air locally at 100 CFM. such as in a hallway, waiting area or office space. Baffles within the system ensure that no hazardous levels of UV light escapes into the nearby occupied space. The system is designed to be non-disturbing in operation while delivering air of the highest purity, with neutralization rates approaching 100 percent. Targeted microorganisms include bacteria, fungi and viruses. This report summarizes the predicted performance of the unit in terms of UV dose and overall neutralization or kill rates of microbes.

System Description

The Sincerus system is a six-inch by eight-foot linear configuration that includes UV bulbs, fans, filter, light baffles, and a UV irradiation chamber. Air is drawn into the unit, which is filtered and purified before being exhausted back into the occupied space. The MERV 5 filter is included to prevent dust from collecting on the UV bulbs in addition to removing a percentage of airborne contaminants. There are four ways to incorporate the Sincerus system in a ceiling: on-center or offset layouts, within a TECHZONE™ layout, and in drywall or AcoustiBuilt® ceiling systems.

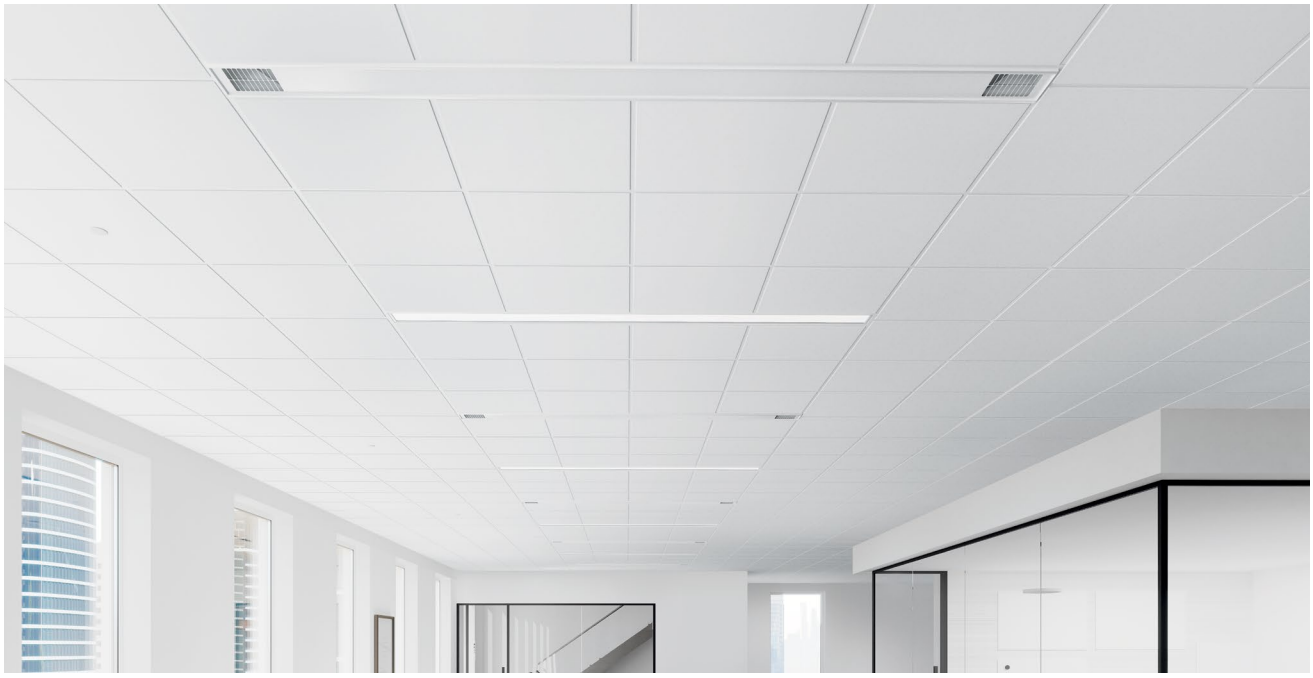

Figure 1 shows a partially-exploded view of the major components of the system.

Figure 2 shows the internal arrangement of the UV irradiation chamber, including the UV lamps and the fans at the outlet. The irradiation chamber is lined with reflective materials to increase the total irradiance.

The properties of the reflective material were provided in the manufacturer's documents. The reflectivity of the specialty coated surface is over 90% in the targeted UVC spectrum. The nominal airflow is 100 CFM with an air velocity of approximately 835 fpm. The UV exposure time at this velocity is approximately 0.26 seconds.

Ambient Noise Level

One of the design criteria for Sincerus™ is that it be unobtrusive in the occupied space. Sincerus was laboratory tested in accordance with ANSI/ASA S12.51-2012/ISO 3741:2010, "Nationally Adopted International Standard (NAIS Standard) Acoustics – Determination of sound power levels of noise sources using sound pressure – Precision method for reverberation rooms. The reference sound source used for these tests was a calibrated Bruel & Kjaer Type 4204, which conforms to the above standard. The samples were also tested in accordance with AHAM AC-2 2006(R2016) "Method for Sound Testing of Portable Household Electric Room Air Cleaners". The sones were calculated in accordance with AHAM AC-2. Sound pressure levels were calculated in accordance with ISO 11203:1995 "Acoustics – Noise emitted by machinery and equipment – Determination of emission sound pressure levels at a work station and at other specified positions from the sound power level". Each sample was operated for a minimum of 15 minutes prior to test. in accordance with ANSI/ASA S12.51-2012/ISO 3741:2010.

TABLE 1: SHOWS THE CALCULATED SOUND PRESSURE LEVELS PER ISO 11203

Distance from Unit (meters)	Ceiling Height	Sound Pressure, dBA re 20uPa
0.75	~ 8ft	60.8
1.00	~ 9ft	59.0
1.35	~ 10ft	57.0
2.00	~ 12ft	54.2

Sincerus™ Efficacy Testing Procedures

A Natural Decay (control) run is performed by aspiration of a microbial suspension into a test chamber. Samples are taken at prescribed intervals (see Test Result Tables), onto suitable agar plates per the organism, with use of a BioStage Standard Impactor. A Test Run is performed with use of the same steps, except the test unit is activated following aspiration of the microbial suspension. All samples are incubated and enumerated, accounting for positive-hole correction of the impactor and standard deviation. A percent reduction value is obtained with use of the enumeration data, by comparison of the Natural Decay to the Test Run.

TABLE 2: E. COLI TESTING

Unit Test Setting: Device On Fan High				
Run	Time (minute)	Raw Plate Count (C/PFU)	Corrected Values with Standard Deviation	Reduction (%)
Natural Decay Run	0	TNTC	2117.9	
	15	TNTC	2117.9	
	30	TNTC	2117.9	
	45	TNTC	2117.9	
	60	TNTC	2117.9	
	75	TNTC	2117.9	
	90	TNTC	2117.9	
	105	TNTC	2117.9	
	120	TNTC	2117.9	
Unit Test Run	0	TNTC	3138.1	No Reduction
	15	TNTC	3138.1	No Reduction
	30	199	286.2	>90
	45	19	20.1	>99
	60	4	4.1	>99
	75	<1	1.1	99.9
	90	<1	1.0	99.9
	105	<1	1.0	99.9
	120	<1	1.0	99.9

TABLE 3: PENICILLIUM CITRINUM TESTING

Unit Test Setting: Device On Fan High				
Run	Time (minute)	Raw Plate Count (C/PFU)	Corrected Values with Standard Deviation	Reduction (%)
Natural Decay Run	0	TNTC	2117.9	
	15	TNTC	2117.9	
	30	TNTC	2117.9	
	45	TNTC	2117.9	
	60	TNTC	2117.9	
	75	TNTC	2117.9	
	90	TNTC	2117.9	
	105	TNTC	2117.9	
	120	TNTC	2117.9	
Unit Test Run	0	TNTC	3138.1	No Reduction
	15	TNTC	3138.1	No Reduction
	30	138	175.6	>90
	45	55	61.3	>90
	60	18	19.0	>99
	75	11	11.5	>99
	90	5	7.0	>99
	105	<1	1.0	99.9
	120	<1	1.0	99.9

TABLE 4: PHIX174 TESTING

Unit Test Setting: Device On Fan High				
Run	Time (minute)	Raw Plate Count (C/PFU)	Corrected Values with Standard Deviation	Reduction (%)
Natural Decay Run	0	TNTC	2117.9	
	15	TNTC	2117.9	
	30	TNTC	2117.9	
	45	TNTC	2117.9	
	60	TNTC	2117.9	
	75	TNTC	2117.9	
	90	TNTC	2117.9	
	105	TNTC	2117.9	
	120	TNTC	2117.9	
Unit Test Run	0	TNTC	3138.1	No Reduction
	15	TNTC	3138.1	No Reduction
	30	TNTC	3138.1	No Reduction
	45	95	112.4	>90
	60	38	41.4	>90
	75	9	9.4	>99
	90	6	6.2	>99
	105	3	3.1	99.9
	120	<1	1.0	99.9

Summary and Discussion of Analysis Results

The analysis presented herein indicates that Sincerus™ will produce high removal rates of harmful contanminants including bacteria, fungi, and viruses. With a total of 34W of UV output, a MERV 5 filter and an airflow rate of 100 CFM, Sincerus will produce average removal rates of 99.9%.

References and Bibliography

Kowalski, W. J., W. P. Bahnfleth, T. S. Whittam (1999). "Filtration of Airborne Microorganisms: Modeling and prediction." ASHRAE Transactions 105(2), 4-17. http://www.engr.psu.edu/ae/wjk/fom.html.

Kowalski, W. J., and Bahnfleth, W. P. (2000). "UVGI Design Basics for Air and Surface Disinfection." HPAC 72(1), 100-110.

Kowalski, W. J., and Bahnfleth, W. P. (2004). "Proposed Standards and Guidelines for UVGI Air Disinfection." IUVA News 6(1), 20-25.

Kowalski, W. J., Bahnfleth, W. P., and Mistrick, R. G. (2005). "A specular model for UVGI air disinfection systems." IUVA News 7(1), 19-26.

Kowalski, W. J. (2006). Aerobiological Engineering Handbook: A Guide to Airborne Disease Control Technologies. McGraw-Hill, New York.

Kowalski, W. J. (2007). "Air-Treatment Systems for Controlling Hospital-Acquired Infections." HPAC Engineering 79(1), 28-48.

Kowalski, W. J. (2009). Ultraviolet Germicidal Irradiation Handbook: UVGI for Air and Surface Disinfection. Springer, New York.

Kowalski, W. J. (2011). Hospital Airborne Infection Control. Taylor & Francis/CRC Press, New York.

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