

A Comparison of UVC Disinfection Methods

In the wake of Covid19, the market has been flooded with a multitude of different UVC devices, most promising to disinfect 99.9% of germs. These advertising claims capitalize on the consumer's (and professional's) lack of understanding of this complex and relatively new field of science. We hope to inform and educate consumers and professional alike.

Quick View Summary

Sanilume is an upper room air UVC fixture that sends powerful UVC energy to the upper areas of a room, safely above people's heads. This form of UVC device is **widely acknowledged as the most efficient method of eliminating airborne pathogens**. According to a study¹, a Leading Brand fixture has the highest performance of any upper room GUV fixture with published **actual** UVC output data (manufacturers are not required to report this). We will use this to compare the most important fixture criteria:

UPPER ROOM GUV FIXTURE BRAND	ACTUAL UVC OUTPUT (W)	EQUIVALENT AIR CHANGES/HR*	AIR HANDLING CFH	ADJUSTABLE APERTURE	COVERAGE SQ. FT.	OZONE FREE	WARRANTY YEARS
Leading Brand	0.9818	3.9	0	NO	100	YES	3
SANILUME SL36-75	2.12-7	31.6	25,000	YES	400	YES	5/3

*400 SQ Ft Room Size / 9.8 ft Ceiling, Sanilume Aperture Set For 3.92W UVC Output. "Leading Brand" data extrapolated for a 400 SQ Ft Room Size / 9.8 ft Ceiling.

UVC Disinfection Device Comparison

General Use of UVC Light

UVC has been used for over 100 years to inactivate (kill) pathogens. Given the correct dosage (intensity x time) UVC will inactivate nearly any living microbe: viruses, funguses, bacteria etc. This is indisputable documented science.

Surface Disinfection Units

"While UVGI is an excellent surface disinfectant, it does not penetrate surfaces and cannot disinfect soiled surfaces. The inability of the UV radiant energy to reach shadowed recesses of surfaces or to penetrate coverings like dust and other matter may negatively affect

¹ Rudnick, SN, First, MW, Sears, T, Vincent, RL, Brickner, PW, Ngai, PY, Zhang, J, Levin, RL, Chin, K, Rahn, RO, Miller, SL, Nardell, EA. Spatial distribution of fluence rate from upper-room ultraviolet germicidal irradiation: experimental validation of a computer-aided design tool. HVAC&R Research 2012; 18: 774-794.

disinfection. For these reasons, UVGI is typically used as a supplemental control measure for disinfection”²

“A 2005 published study concluded that UVGI lamps (for surface disinfection) could have some effect on the spread of infectious respiratory diseases, but there was inadequate evidence to support recommending its wide use”³

“The CDC recognizes that UVGI (for surface disinfection) has several potential applications but also has limitations and possible safety issues”^{4 5 6}

HVAC In-Duct

“When UV is used in ducts, although it ensures that recirculated air does not have viable pathogens, it unfortunately does relatively little to prevent person-to-person transmission in a room where both an infectious source and other susceptible persons share the same air. For effective interruption of transmission, air disinfection has to occur in the same room where transmission is occurring. Some manufacturers of these systems have also made claims of reduced incidence of health care-associated infections (HAIs) with the use of UVGI in AHUs. To date, however, there is little, if any, supportive evidence in the peer-reviewed scientific literature. **Our assessment of the available literature indicates claims of reduced HAIs from AHU-installed UVGI in health care facilities remain unfounded.**”^{7 8}

Portable Room Air Purifiers

An air purifier on the ground physically cannot efficiently pull all the room air into it efficiently, or at all. Remember, the air needs to pass through the purifier to work: “Portable air cleaners can be placed in rooms where there is a risk of transmission but moving large volumes of air through any device is difficult, limited by the clean-air delivery rate of the portable air cleaner. Often when the clean air delivery rate is converted to equivalent ACH, the result is a disappointing 1 to 2 ACH, far too little to effectively prevent transmission”⁹.

² Illuminatiion Engineering Society, Photobiological Commission CR20-2-V1a, Technology Farhad Memarzadeh, PhD, PE, Russell N. Olmsted, MPH, CIC, and Judene M. Bartley, MS, MPH, CIC Bethesda, Maryland; Ann Arbor, Michigan; and Beverly Hills, Michigan

³ Lee T, Jordan NN, Sanchez JL, Gaydos JC. Selected nonvaccine interventions to prevent infectious acute respiratory disease. *Am J Prev Med.* 2005;28(3):305-16.

* Rudnick, SN, First, MW, Sears, T, Vincent, RL, Brickner, PW, Ngai, PY, Zhang, J, Levin, RL, Chin, K, Rahn, RO, Miller, SL, Nardell, EA. Spatial distribution of fluence rate from upper-room ultraviolet germicidal irradiation: experimental validation of a computer-aided design tool. *HVAC&R Research* 2012; 18: 774–794.

⁴ Sehulster L, Chinn RYW. Guidelines for environmental infection control in healthcare facilities – Recommendations of the Centers for Disease Control and the Healthcare Infection Control Practices Advisory Committee (HICPAC). 2003;52(RR10):1-42.

⁵ Jensen PA, Lambert LA, Lademarco MF, Ridzon R. 2005. Guidelines for preventing the transmission of *Mycobacterium tuberculosis* in health-care settings, 2005. *Morbid Mortal Weekly Rep.* 2005;54(RR17):1-141.

⁶ Centers for Disease Control and Prevention; and National Institute for Occupational Safety and Health. Environmental Control for Tuberculosis: Basic Upper-Room Ultraviolet Germicidal Irradiation Guidelines for Healthcare Settings. Washington, DC: Department of Health and Human Services; 2009.

⁷ Illuminatiion Engineering Society, Photobiological Commission CR20-2-V1

⁸ Technology Farhad Memarzadeh, PhD, PE, Russell N. Olmsted, MPH, CIC, and Judene M. Bartley, MS, MPH, CIC Bethesda, Maryland; Ann Arbor, Michigan; and Beverly Hills, Michigan

⁹ Illuminatiion Engineering Society, Photobiological Commission CR20-2-V1a

Upper Room Air UVC Fixtures

Scientists worldwide (ASHRAE 2019¹⁰, IES¹¹, CDC¹²etc.) acknowledge the effectiveness of this method of pathogen elimination. This is why Sanilume has chosen to use, innovate and approve this UVC method.

The safety of the air we breathe in room is dependent on the number of full room air changes per hour (ACH) of fresh, non contaminated air available for people to breathe. An “equivalent air change” (eACH) is the elimination of pathogens in the air by disinfection of the air rather than replacement of the air. This is equally as effective. Here is an approximate comparison for a 400 sq. ft room with 9.8 ft ceilings:

- | | |
|--|-----------|
| 1. Portable Room Air Purifiers ¹³ : | .5 eACH |
| 2. In-Duct HVAC Units ¹⁴ : | 6 eACH |
| 3. Standard Upper Room Air GUV ¹⁵ | 5 eACH |
| 4. Sanilume Upper Room Air GUV | 31+ eACH* |

*400 SQ Ft Room Size / 9.8 ft Ceiling, Sanilume Aperture Set For 3.92W UVC Output

What Makes Sanilume Better #1: UVC Output

“UVC output is the most important factor to consider when evaluating the effectiveness of an upper room GUV luminaire, which will determine the luminaire's efficacy against airborne microorganisms”¹⁶ “A “Leading Brand” is one of the most efficient commercial GUV luminaires currently available for which luminaire output and lower room safety results have been published”¹⁷

Source type	Lamp UV-C output ^a	Luminaire UV-C output	Luminaire UV-C efficiency (luminaire output/lamp UV-C output)
Atlantic Hvacaire	8.5 W	0.471 W	5.54%
Leading Brand	22 W	0.523 W	2.38%
Lumalier corner	11 W	0.134 W	1.22%
Cooper GAC GUV	18W	.298W	1%
Sanilume SL36-75	23W	2.124W - 6.978W	9.2% to 30%

¹⁰ 2019 ASHRAE Handbook

¹¹ Illuminatiion Engineering Society, Photobiological Commission CR20-2-V1

¹² DHHS (NIOSH) Publication Number 2009-105

¹³ Illuminatiion Engineering Society, Photobiological Commission CR20-2-V1

¹⁴ DHHS (NIOSH) Publication Number 2009-105, Illuminatiion Engineering Society, Photobiological Commission CR20-2-V1

¹⁵ Jelden KC, Gibbs SG, Smith PW, Schwedhelm MM, Iwen PC, Beam EL, Hayes AK, Mar4on N, Kratochvil CJ, Boulter KC, et al. Nebraska Biocontainment Unit patient discharge and environmental decontamination after Ebola care. Amer J Infect Control. 2015;43(3):203-5.

Rudnick, SN, First, MW, Sears, T, Vincent, RL, Brickner, PW, Ngai, PY, Zhang, J, Levin, RL, Chin, K, Rahn, RO, Miller, SL, Nardell, EA. Spatial distribution of fluence rate from upper-room ultraviolet germicidal irradiation: experimental validation of a computer-aided design tool. HVAC&R Research 2012; 18: 774–794.

¹⁶ Rudnick, SN, First, MW. Fundamental factors affecting upper-room ultraviolet germicidal irradiation – Part II. Predicting effectiveness. Journal of Occupational and Environmental Hygiene 2007; 4: 352–362.

¹⁷ Rudnick, SN, First, MW, Sears, T, Vincent, RL, Brickner, PW, Ngai, PY, Zhang, J, Levin, RL, Chin, K, Rahn, RO, Miller, SL, Nardell, EA. Spatial distribution of fluence rate from upper-room ultraviolet germicidal irradiation: experimental validation of a computer-aided design tool. HVAC&R Research 2012; 18: 774–794.

What Makes Sanilume Better #2: Airflow & Air Mixing

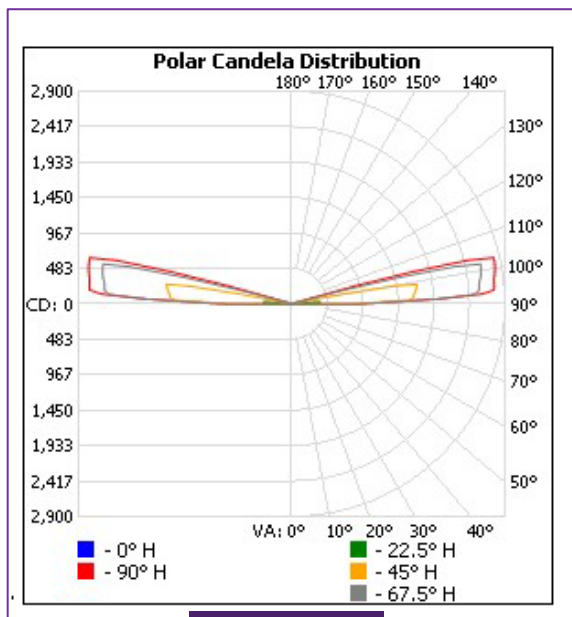
Using patent pending technology, Sanilume is the only upper room UV fixture on the market to incorporate air moving. Next to UVC output, air mixing is the next most important factor on the efficacy of pathogen elimination. If the air containing the pathogens does not come into contact with the UVC energy, then no pathogen reduction will occur. Sanilume moves approx. 25,000 cubic feet of air through the fixture and also into the UVC energy beam that is spread across the room. This creates another 16 eACH on top of the 15.6 eACH created by the UVC energy alone, **for a total of 31.6 ACH** (400 sq. ft. room, 9.8 ft ceilings). This makes Sanilume approx. 10 times more efficient at eliminating pathogens as the Leading Brand as published¹⁸

As ceiling heights become higher, Sanilume can increase its UVC output. **Here is the same 400 sq. ft. room with 12 ft ceilings:**

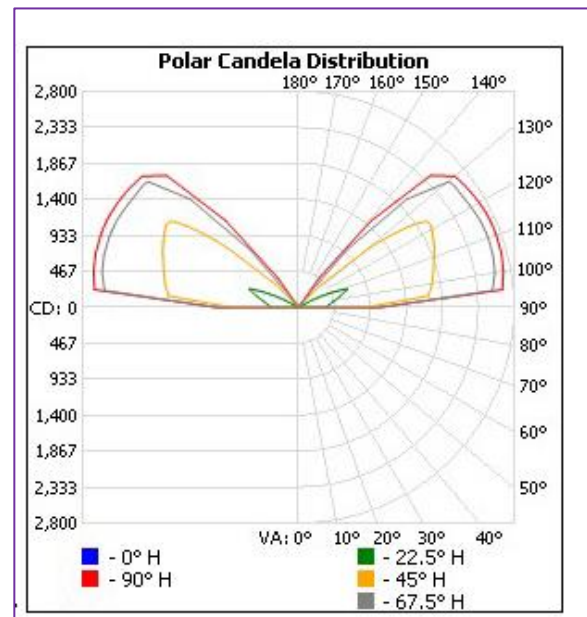
Leading Brand: 3.19 eACH
Sanilume SL36-75: 63.2 eACH (highest aperture setting)

What Makes Sanilume Better #3: Adjustable Aperture

Traditional upper room UV fixtures have fixed louvers which provide a fixed UVC distribution and output level. With our patented adjustable aperture, our fixtures can be adjusted on site to increase the amount and distribution of UVC energy in higher ceiling spaces. This allows Sanilume to provide approx. 2.2W of UVC energy to low ceiling height rooms, and up to 4 times that amount for rooms with high ceilings.



**Set For 8 Ft.
Ceilings**



**Set For High
Ceilings**

¹⁸ Rudnick, SN, First, MW, Sears, T, Vincent, RL, Brickner, PW, Ngai, PY, Zhang, J, Levin, RL, Chin, K, Rahn, RO, Miller, SL, Nardell, EA. Spatial distribution of fluence rate from upper-room ultraviolet germicidal irradiation: experimental validation of a computer-aided design tool. HVAC&R Research 2012; 18: 774-794.