



## Care222® UV Light Disinfection\* Technology: Frequently Asked Questions

### 1. What is the agreement between Acuity Brands and Ushio America?

The strategic alliance agreement between Acuity Brands and Ushio America, Inc. (Ushio) grants Acuity Brands exclusive rights in North America to incorporate Ushio's Care222® far-UVC disinfection module into luminaires that will be installed and operated in spaces when they are occupied and unoccupied. Acuity Brands also has non-exclusive rights to use the Care222 far-UVC disinfection module worldwide (except Asia) for lighting and other uses.

### 2. What does Ushio America manufacture?

Ushio America is a vertically integrated solutions company for lighting systems and components utilizing: xenon short arc, lasers, ultra-high-pressure UV lamps, excimer, metal halide, LEDs (specialty sensing and general illumination), halogen, fluorescent, and miniature incandescent lamps. Ushio products serve semiconductor, printed circuit, video projection, cinema, medical, life sciences, UV curing, germicidal, horticulture, landscaping, graphic arts, flashlight, scientific, medical, infra-red heating, lamp and laser drivers, systems and services, and numerous other applications. Established in 1967 as a subsidiary of Ushio Inc., in Tokyo, Japan, Ushio America offers a full spectrum of over 2,500 products and services to its customers. <http://www.ushio.com>

### 3. What is the Care222 far-UVC disinfection module?

The Care222 far-UVC disinfection module is a krypton-chlorine excimer lamp that operates in the photobiological ultraviolet spectral band known as UVC and employs a short pass filter to remove all but a narrow band of 222 nanometer (nm) UV light, which is capable of inactivating viruses and bacteria on indoor surfaces in occupied and unoccupied spaces.

### 4. What is an excimer lamp?

Excimer lamps are a source of UV light and an arc discharge light source with a special chamber filled with noble gas, completely mercury-free and without electrodes. The Care222 excimer lamp technology allows for a lower temperature operation compared to other conventional lamps and fast on/off times with no-warm-up required.

### 5. What is different about the Care222 far-UVC disinfection module for use in the reduction of pathogens on surfaces and why is the filter important?

Results from laboratory testing and clinical studies<sup>1-6</sup> suggest that the filtered 222nm far-UVC light emitted from the Care222 far-UVC disinfection module can significantly reduce pathogens on surfaces without posing a health risk to human skin or eyes when used with appropriate parameters because it minimally penetrates into the biologically

sensitive nucleus of human cells. Yet, the 222nm wavelength easily penetrates and inactivates a wide range of pathogens (99.9% in 24 hours for studied pathogens)<sup>1-6</sup>, including bacteria and viruses, because of their microscopic dimensions. The short pass filter removes UV wavelengths that would be potentially harmful to human skin and eyes.

**6. What type of bacteria/viruses does Care222 technology inactivate?**

The Care222 far-UVC disinfection modules are effective against a wide range of bacterial and viral pathogens (99.9% in 24 hours for studied pathogens)<sup>1-6</sup>. Effectiveness against SARS-CoV-2, the cause of COVID-19, is currently under study at Columbia University. Because tests of the 222nm disinfection technology against this virus have not been completed, it is not possible to say with certainty that the 222nm wavelength will inactivate this pathogen. However, the 222nm disinfection technology has been shown in another study by Columbia University, which is currently under review by *Scientific Reports* and pending publication, to have the ability to inactivate seasonal coronaviruses that have a viral structure similar to SARS-CoV-2. Additionally, preliminary data from the ongoing Columbia University study for SARS-CoV-2 suggests results will be similar to those found for seasonal coronavirus. Once the definitive SARS-CoV-2 study results are published, we will update this response.

**7. How does 222nm far-UVC light inactivate pathogens?**

The 222nm far-UVC light penetrates the outer layers of the pathogen structure to render it harmless. With bacteria, DNA is disrupted. With viruses, RNA is disrupted. In both cases, vital functions are disrupted, stopping the ability of the pathogen to replicate.

**8. Any limitations in terms of surfaces on which Care222 technology can be used?**

Any inanimate surface that can be directly irradiated can benefit from the pathogen reduction provided by 222nm far-UVC light. Acuity Brands luminaires featuring Care222 technology are not for medical uses.

**9. Why can 222nm far-UVC light be used in occupied spaces?**

Because 222nm far-UVC light can be effective against wide range of bacterial and viral pathogens (99.9% in 24 hours for studied pathogens) in relatively low doses<sup>1-6</sup>, it can be used in occupied spaces and still fall within current safety guidelines for human occupancy, as established by the American Conference of Governmental Industrial Hygienists (ACGIH®).

The ACGIH is a charitable scientific organization dedicated to advancing occupational and environmental health. As part of its mission it reviews published, peer-reviewed scientific literature to determine safe levels of exposure to various chemical and physical agents found in the workplace. ACGIH has published guidelines for the level of UV exposure that a typical worker can be exposed to without adverse health effects. The levels of exposure in the guidelines are quantified as Threshold Limit Values, or TLVs. These TLVs have been adopted into safety standards worldwide, from bodies such as the American National Standards Institute (ANSI), the International Electrotechnical Commission (IEC), and the International Commission on Illumination (CIE).

## **10. What is potentially harmful about other germicidal UV wavelengths?**

ACGIH establishes safety guidelines for levels of exposure for all germicidal UV wavelengths. Certain wavelengths more easily penetrate the biologically sensitive nucleus of human cells and more deeply penetrate tissues than at 222nm, potentially causing short- and long-term damage. Eyes and skin are more sensitive to longer wavelengths in the UVC range (above 225nm to 280nm) and in the shorter UVB wavelengths (280 to 303nm). Above 303nm and into the UVA range, eyes and skin are less sensitive.

## **11. Do other germicidal lamps do the same thing?**

Filtered excimer lamps using 222nm far-UVC light require relatively small doses of radiant energy to effectively inactivate bacterial and viral pathogens (99.9% in 24 hours for studied pathogens) while also avoiding damaging penetration of eye and skin cells<sup>1-6</sup>. While effective at inactivating bacteria and viruses, the 254-274nm range of UV wavelengths requires application of somewhat higher doses than the 222nm UV wavelength does to achieve equivalent reductions in levels of active bacteria and virus for most pathogens<sup>1-6</sup>. In addition, the 254-274nm wavelength range is not safe for direct view exposure under the ACGIH guidelines.

Lamps generating 254-274nm UV wavelengths can be used in upper air germicidal UV applications for occupied spaces when properly designed and maintained to mitigate the health hazards of direct exposure. Systems with these lamps have also been historically used to disinfect spaces when they are unoccupied or in applications that avoid human exposure such as in air handling equipment or water filtration systems. While acceptable for use in occupied spaces, lamps in the 405-430nm UV wavelength range are effective against a range of bacterial pathogens at significantly higher doses than required with the 254-274nm UV wavelengths, but are not as effective against viruses as lamps with lower-range UVC wavelengths<sup>1-6</sup>.

## **12. How will the Care222 far-UVC disinfection module be used in luminaires (and why in lighting)?**

Because lighting is necessary for occupied spaces, integrating Care222 far-UVC disinfection modules into lighting systems where reduction of pathogens is desired makes practical sense. Using luminaires as a delivery system allows facilities to take advantage of locations where power is already distributed. This enables the disinfection technology to be added as a layer of functionality to necessary illumination using the luminaire's intelligent control capabilities. Acuity Brands plans to seamlessly incorporate the Care222 far-UVC disinfection modules in familiar luminaires from its lighting brands such as Mark Architectural Lighting™, Lithonia Lighting®, Healthcare Lighting®, and others.

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3. A. N. Edwards, S. T. Karim, R. A. Pascual, L.M. Jowhar, S. E. Anderson, and S. M. McBride, "Chemical and stress resistances of clostridium difficile spores and vegetative cells," *Front. Microbiol.*, vol. 7, no. OCT, pp. 1-13, 2016.
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5. J. C. Doultree, J. D. Druce, C. J. Birch, D. S. Bowden, and J. A. Marshall, "Inactivation of feline calicivirus, a Norwalk virus surrogate," *J. Hosp. Infect.*, vol. 41, no. 1, pp. 51-57, 1999.
6. Ushio, Inc. Laboratory Studies.

*\*All references to "disinfection" are referring generally to the reduction of pathogenic bioburden and are not intended to refer to any specific definition of the term as may be used for other purposes by the U.S. Food and Drug Administration or the U.S. Environmental Protection Agency. The disinfection technology as incorporated in Acuity Brands products is not for use as or for medical devices.*

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