

Advisory Note

A Service to A.G. Coombs Group Clients.

Ultraviolet Germicidal Irradiation for HVAC Applications

Appropriate use of ultraviolet germicidal irradiation in HVAC systems has been proven as an effective inactivation method for mould, bacteria and viruses, reducing the source of Healthcare Associated Infections and a reduction of airborne microorganisms. This Advisory Note provides a basic understanding of UVGI and its applications.

Ultraviolet energy is electromagnetic radiation with a wavelength shorter than that of visible light. The UV spectrum is classed into three main categories;

- + **UV-A** mostly absorbed through sunlight, is a long wavelength between 315-400nm.
- + **UV-B** commonly responsible for skin reddening and skin cancer is a medium wavelength of 280-315nm.
- + **UV-C** is the short wavelength of 100-280nm which has the ability to kill or inactivate micro-organisms.

Ultraviolet Germicidal Irradiation (UVGI) systems typically consist of UV lamps which produce UV-C radiation. The lamps are fairly similar to fluorescent lighting and usually have a ballast device and / or electronic units to operate. The lamps contain a small quantity of mercury or mercury amalgam and emit Ultraviolet Light with a wavelength of 254nm. This is close to the optimal wavelength required to damage and disrupt DNA in organisms. When using the lamps there are a number of safety aspects that need to be adhered to, ensuring that the emitted light is not in direct contact with humans.

The effectiveness of the devices relies on the dose of radiation delivered to a given body of air. The dose rate is determined by a combination of intensity of the light and time of exposure. It is also known that these devices are more effective against some organisms than others. The devices can be used to assist with reducing the levels of viruses and contaminants in the air.

UVGI systems alone should not be considered a complete solution for managing microorganisms and should be used as part of a broader multimodal infection control strategy.

UV lamps are often used in air handling units. There are also in-room type units that are self-contained complete with built in fans, reflectors, diffusers, filters, controls and catalysts. The following provides an overview of typical options and what is involved with UVGI.

In general terms, where the air is moving fast and time of exposure is low, there needs to be more lamps (i.e. AHU application) or mirrors (fan assisted room unit) to amplify the intensity of the light. Where the air moves slower, fewer lamps can be used (i.e. upper room units).

Upper Room Ultraviolet Germicidal Irradiation

These units work by irradiating the unoccupied parts of a room. They rely on air drifting in front of the UV rays for enough time to destroy the microorganisms suspended in the air. The units typically have 1 or 2 lamps, a parabolic reflector and diffuser to stop the light being directed onto room occupants.



These devices mount on the wall and plug into a 230V power supply. They are normally passive and don't have fans. They rely on good mixing of the room air to ensure that all air has time in the irradiated zone. They become less effective at high air change rates due to the reduced exposure time.

In room recirculating units

In room units typically consist of a fan, filters and a UVGI section with catalysts and reflectors all housed in a protective box.



These units work by using a fan unit to draw room air into the unit. The air is passed through HEPA filters and then passed through a chamber containing intense UV lamps with reflectors and catalysts. These units can destroy most of the microorganisms that pass through them, but there is no guarantee that all room air will actually go through them. The units are typically supplied by a 230V power supply.

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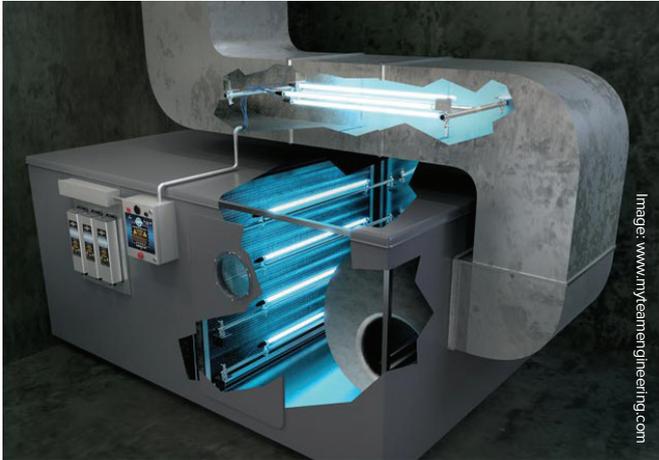
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AHU Coil and Duct Type

These types of systems involve mounting UV Lamps in air conditioning ducts or near air handling unit coils. These systems reduce biological build-up on coils and can assist with air quality.



These types of basic lamps are often used in AHUs to keep coils cleaner for longer and keep microbe levels down in the unit. To be effective, multiples of the lamps are required (depending on unit size and desired effect). The downside of the AHU type units is that any microbes suspended in the air stream are only irradiated briefly as they pass through the unit. This typically means that not all microbes suspended in the air stream are destroyed in a single pass. For AHU applications, the lamps are normally wired into the AHU lighting circuit and interlocked; signage and a view portal are fitted to the AHU.

UV lighting applications have also been effectively utilised for the disinfection of room surfaces and equipment and also to kill airborne organisms. The narrow wavelength of UVGI allows the light to breakdown the molecules. The most common applications are in the healthcare / aged-care sectors, schools and other sanitary / cleaning-based services which provides the ability to help assist with destroying many contagious viruses or bacteria. This application of high intensity exposure and duration requires to be applied where the area is unoccupied. To ensure occupants are safe, the installation of interlock safety switches or occupancy sensors allows the lights to immediately switch off.

UVC radiation can cause some materials to degrade prematurely so care needs to be taken when applying these systems to ensure that susceptible materials are adequately protected.

For more information on Ultraviolet Germicidal Irradiation for HVAC Applications, please contact:

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