APPENDIX A

Provision of UV-C, Sanuvox Coil Clean system to cooling coils in air handling equipment

A.1 Introduction

A.1.1 The efficiency and hygiene of air handling equipment are crucial components in maintaining optimal indoor air quality and operational performance in various settings, including commercial buildings, healthcare facilities, and industrial environments. One of the significant challenges faced in the maintenance of these systems is the buildup of biofilms, mould, and other contaminants on cooling coils. This buildup can lead to compromised air quality, increased energy consumption and reduced heat transfer efficiency. Traditional cleaning methods often prove to be labour-intensive, costly, and sometimes ineffective in addressing these issues comprehensively (Brais, 2020).

A.2 Sanuvox UV-C Technology

A.2.1 The introduction of ultraviolet-C (UV-C) light technology, such as those produced by Sanuvox Technologies Inc., offers a much more compelling solution to this problem. By keeping cooling coils continuously and effectively clean, UV-C light maintains the coils in an “as new” condition (Brais, 2015).

A.2.2 The mechanism behind UV-C light is quite effective; it sterilizes mould, fungus, bacteria and the like, and prevents it from reproducing by targeting their deoxyribonucleic acid (DNA) and ribonucleic acid (RNA). Unlike traditional cleaning methods, which often only address surface-level contamination, UV-C light penetrates the coil's surface and into the fins of coil, reaching deep into multi-row coils to ensure thorough cleanliness (Brais, 2015). This continuous exposure to UV-C light keeps the coils suitably clean and working more efficiently.

A.2.3 A biofilm buildup on cooling coils increases air pressure drop and reduces the heat transfer efficiency. Research suggests that even a thin biofilm layer can decrease the cooling coil's heat transfer coefficient by up to 21%, necessitating the HVAC system to work harder and therefore increasing energy consumption and costs (Brais, 2015).

A.2.4 By incorporating UV-C technology into a buildings HVAC system, we are providing an efficient and cost-effective strategy to maintain cooling coil performance, reducing operational costs and most importantly improving indoor air quality by reducing the risk of adverse airborne particulates spreading throughout the building. This technology provides a continuous, automatic solution, offering a significant improvement over intermittent and labour-intensive traditional cleaning methods.

A.3 Comparison Between T5 and T6 Lamps

A.3.1 Considerations must be made to the properties and associated characteristics of the lamps installed within a UV-C system. Sanuvox Technologies Inc. utilise a T6 lamp (approximate diameter of 1.91 cm), whereas other UV-C manufacturers typically utilise T5 lamps (approximate diameter of 1.59 cm) (Osborne, 2022).

A.3.2 The key factors influencing the characteristics of a lamp is a concept known as, ‘wall loading’, which is a parameter that impacts both the efficiency and life span of a UV-C

lamp. Wall loading is defined as the power per unit area on the interior surface of the lamp and as demonstrated in the section above, the large diameter of the T6 lamp results in a significant difference in wall loading compared to a T5 lamp.

A.3.3 The increase in surface area, therefore, leads to a reduced wall loading, which has several positive attributes:

- Fewer photons per unit area: The larger surface area of the T6 lamps causes for there to be fewer photons hitting each unit of surface area, thereby reducing the overall stress on the lamp.
- Increased energy efficiency: Due to the lower number of photons being absorbed by the lamp material, there is an increase in energy efficiency.
- Reduced ageing: Lower wall loading decelerates the aging process of the lamp, therefore providing additional longevity contributing to a longer lifespan.

A.3.4 Further to the above, the 20 % increase in surface area between the T5 and T6 lamps yields better lamp output and the 44 % increase in cross-section of the T6 lamp reduces the electrical current density, which further increases the expected lifespan of the lamp (Osborne, 2022).

A.3.5 In conclusion, the T6 UV-C lamps provide a more robust solution, better output, and a longer lifespan compared to T5 lamps due to their larger size, which leads to reduced wall loading and increased output and energy efficiency.

A.4 Additional Features of the Sanuvox System

A.4.1 Research and studies suggest that if UV-C is not applied in a suitable manner, organic materials have the tendency to discolour and ultimately degrade over time (ASHRAE, 2020). Componentry within air handling units such as, filters, powder coatings, non-UV-C resistant cables and conduits have been found to deteriorate if considerations are not made to adequately protect these components. This is supported by building and facilities managers located throughout the east coast of Australia, who have experienced degradation of the aforementioned ancillary elements within air handling units within a relatively short period of time.

A.4.2 Sanuvox Technology Inc. has carefully considered the potential of damaging the ancillary components within air handling units and have provided as standard an anodized aluminium parabolic reflector. It should be noted that other manufacturers of UV-C technology do not typically provide this feature. The parabolic shape of the reflector is designed to focus the emitted UV light into a concentrated beam directly onto the coil. As a result, this allows the maximum amount of UV radiation to be directed towards the coil thereby increasing the effectiveness of neutralising adverse particulate matter.

A.4.3 Furthermore, the utilisation of the parabolic reflector increases overall efficiency of the UV-C lamp by reflecting and focusing the emitted light instead of being dispersed

throughout the air handling unit. It is also important to note that the parabolic reflector distributes UV light more evenly across the air stream, thereby ensuring that the air passing through the coil has an increased level of exposure for effective purification.

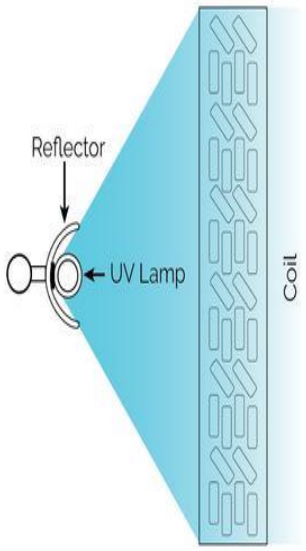

Figure 1: UV beam angle of Sanuvox UV IL Coil Clean system emitting onto cooling/heating coil

A.4.4 Sanuvox Technologies Inc.'s IL Coil Clean system also includes two pairs of dry contacts for seamless communication with building automation systems and an LED status display for easy monitoring of unit operation, lamp replacement, and failures. These user-friendly features allow for an intuitive user experience throughout the lifespan of the Sanuvox IL Coil Clean systems and are standard .

References

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