The HVAC Factor: The ABCs Of UVC

This technology works to keep HVAC systems clean from the inside out.

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The economic downturn has placed greater pressure than ever on facility managers (fms) to reduce operating costs and defer costly capital expenditures—without compromising green initiatives and building quality or performance. Ultraviolet C (UVC) devices installed in HVAC systems can provide an effective, yet often overlooked, tool for helping meet these challenges.

UVC devices designed specifically for installation in HVAC systems were introduced in the mid 1990s. Since that time, the use of UVC technology in HVAC systems has progressed from virtually unknown status to a growing acceptance by fms, engineers, and government agencies such as the U.S. General Services Administration (GSA). UVC can offer rapid return on investment in all types and sizes of HVAC systems found in commercial, healthcare, school, and industrial environments.

How does UVC work? The C wavelength of the UV spectrum targets the DNA of microorganisms, destroying their cells or making replication impossible. Directed at a cooling coil or drain pan, UVC energy destroys surface biofilm, a gluey matrix of microorganisms (bacteria, fungi, debris, et al.) that grows in the presence of moisture. Biofilm is prevalent in HVAC systems and leads to a host of indoor air quality (IAQ) and operational problems that are sometimes mistakenly attributed solely to mold. UVC also destroys airborne viruses and bacteria that circulate through an HVAC system.

Benefits

By controlling surface and airborne microbes, UVC can be beneficial to a facility at many levels. These include IAQ control, energy savings, maintenance savings, equipment efficiency and service life, water conservation, and LEED contribution.

IAQ control. UVC improves air quality by preventing the spread of infectious diseases and reducing the allergy and asthma symptoms triggered by biofilm/mold. It creates safer and more comfortable indoor environments, resulting in improved productivity, reduced absenteeism, and less likelihood of occupant complaints or litigation.

UVC is effective by itself for preventing and controlling mold growth that occurs in HVAC systems; but, if mold infestation has spread to other areas of a building, UVC should be used in tandem with other remedial techniques.

Energy savings. Studies show that even a very thin (.024") layer of biofilm buildup on a coil increases energy consumption by 21.5%. UVC provides continuous cleaning of coils to eliminate biofilm more effectively than conventional cleaning methods. Field data from UVC commercial and healthcare installations has shown resulting HVAC energy savings ranging from 10% to 28%.

Maintenance savings. Manual coil cleaning is an HVAC maintenance expense that can total thousands of dollars per year. UVC greatly reduces or can even eliminate the need for chemical cleaning or pressure washing of coils. It also eliminates the associated equipment downtime, inconvenience, and potential discomfort of occupants as well as worker exposure to cleaning chemicals.

Equipment efficiency and service life. The surface cleaning effects of UVC help restore HVAC systems to efficient operation, allowing fms to prolong the life of aging air handlers or maintain new systems at factory design efficiency. Mechanical systems have a limited life span—usually 25 to 40 years, depending on how well they are maintained. UVC users report the technology can add many years to the life expectancy of such systems by keeping coils in a perpetually clean state.

Water conservation. The condensate water from coils treated by UVC is so clean that some users collect and pump it into the cooling tower as make-up water or use it for irrigation.

LEED contribution. Because of its multiple benefits, the use of UVC may contribute to earning LEED points in one or more areas.

Questions To Ask

Despite growing acceptance, UVC devices for HVAC systems are not yet governed by an official standard. Until a UVC standard is published, there is useful independent information available to fms from a series of test reports commissioned by the U.S. Environmental Protection Agency (EPA) in conjunction with the National Homeland Security Research Center (NHSRC) through its Technology Testing and Evaluation Program (TTEP).

The reports compare nine leading UVC devices tested by research group RTI International. The testing provides a benchmark for comparing performance of various UVC devices. (Research highlights can be accessed at www.epa.gov/NHSRC/news/news100406a.html.)

When considering UVC, fms should be prepared to ask educated questions of potential suppliers.

What is the output of the device? Devices marketed for commercial HVAC applications fall into two basic categories—those with new generation, high output lamps introduced in the 1990s and those using conventional, older style UVC lamps not engineered for HVAC use. The germicidal output of these devices will vary widely, especially when exposed to HVAC operating conditions.

For optimum performance, the device should be manufactured to deliver output of nine microwatts per linear inch of glass measured from a distance of one meter, tested at an air velocity of 400 fpm (feet per minute), and situated in a temperature of 50°F. This information is critical because UVC output declines over time, reaching a half-life after 9,000 operating hours or slightly over one year when running on a 24/7 basis. It is necessary to start at a high enough output, based on microwatts per linear inch of glass, to ensure adequate output will be maintained throughout the service life of the device. Otherwise, the device may not be able to maintain effective microbial control.

Has the device been independently tested under HVAC conditions? Some devices are tested in warm, still air instead of cold, moving air conditions. Some are tested at closer distances than one meter (or with insulating sleeves), and such conditions can yield higher output results that are deceiving.

Where will the device be installed? For the most effective microbial control, UVC devices should be installed on the supply side of the system downstream from the cooling coil and above the drain pan. This location provides more effective control than in-duct UVC installations, because it attacks contaminants at the source to deliver simultaneous cleaning of surface and airborne microbes.

What is the dose (defined as output x exposure time to UVC) per watt? This is a measure of the energy needed for microbial control. It is a useful measure of performance, because it not only considers output but it also weighs the energy used by the device to deliver that output.

Once installed, UVC devices can serve fms as an effective way to keep the interiors of HVAC equipment free from biofilm, mold, and other types of build up.

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Do you use UVC devices in your facilities? What has been your experience? Send your thoughts to avazquez@groupc.com.