BRIGHTENING the Path to Cleaner Air

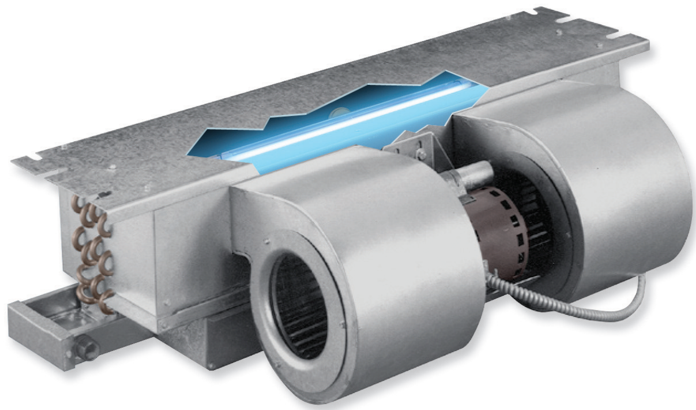
BY CHRIS WILLETTE

Low-voltage UV lights provide installation ease and flexibility

As the indoor air quality (IAQ) market matures, more HVAC contractors and IAQ professionals are embracing the benefits and use of ultraviolet (UV) light technology as a tool to control indoor air contamination. This increased interest also has boosted the market's need for more flexible and easier-to-install UV products.

Traditional line voltage UV-light systems

Traditional UV-light systems for residential applications are illuminated via a power-supply base—which the UV lamps are rigidly fixed to—and the unit is mounted on the exterior of air-handling systems. Holes are then made to allow the lamps to protrude inside the air-conditioning system for surface sterilization or airborne disinfection. Unfortunately, locating a nearby power source to use for this type of installation may be difficult, if not impossible. Installers also may find it tedious and/or undesirable to cut large holes in the systems' covers or ductwork.



By tapping the transformer of a low-voltage control circuit, installers can locate the UV-light system remotely from the air handler.

Interest in UV-light as a way to manage indoor air contamination has spurred the growth of low-voltage products.

Low-voltage alternatives

Traditional line voltage systems typically use much larger power supplies that are mounted externally to the air handlers, and the line voltage power is then tapped into the main or plugged in, which often requires the aforementioned cuts in the covers or ductwork. With a low-voltage power supply, however, the enclosure is small enough to mount in the control panel, which allows the installer to then mount the UV lamps internally inside the air handler.

A low-voltage 24-volt AC (VAC) control circuit in a typical air-handler installation exists for the thermostat and component contactors that control the system. These circuits usually contain a standard 24-VAC transformer with 40 volt-amps (VA) of power that, in most cases, has plenty of additional power available to supply other low-voltage accessories, such as overflow drain float switches, humidifiers, zone dampers and electronic air cleaners.

In this case, a readily available accessory becomes an ideal power source for a UV-light system that provides many benefits. First and foremost, it provides a convenient and safe source of power for an inexperienced first-time installer who may find connecting to the line voltage somewhat intimidating.

Second, it provides a source of power the installer can use to locate the UV-light system remotely from the air handler or, in the absence of local power, by running a low-voltage wire to the desired installation location.

This accessory also provides a means to safely tuck the UV light inside an air handler, eliminating the need to drill holes to access the air space and prevent any tampering of the UV light. Lastly, it allows for the installation of a UV light in applications that previously could not accommodate this type of lighting, such as packaged through-wall A/C (PTAC) or fan coil units.

Investigating low-voltage circuits

Prior to installation, investigate the air handler's control components to determine whether it is a simple or complex circuit. This is important because if the type of control circuit is overlooked, it can cause failure to some 24-VAC UV-light products. A simple circuit contains single-speed blowers and motor/compressor contactors. These are often referred to as straight heat or cool systems. A more complex circuit contains variable-speed blower circuits and electronic control boards, which are becoming more common with the rise of the 13 SEER standards.

Straight heat/cool systems tend to have low power draw and typically can easily accommodate additional accessories such as the UV light with little concern. Variable-speed blower circuits, however, can cause problems with UV-light products or accessories that are not designed to work on these types of circuits. Such problems are due to inherent voltage spikes, referred to as "signal noise," created by the variable-speed blowers' control board.

Signal noise occurs because the circuit typically converts the alternating sine wave of the 24-VAC circuit to pulse waves to drive the variable-speed blower motor, and the spikes are due to voltage "bounce back" from the circuit.

To be more precise, the signal noise is in the line voltage and is created by the variable-speed blowers' circuit. Signal noise is not a problem on single-speed systems, but the advent of variable-speed blowers—though great for conserving energy—can cause havoc to line voltages in terms of the AC sine wave. The "bounce back" noise is essentially small voltages and frequency signals that can be added back into the 24 VAC line. So instead of having a peak voltage of 24 volts, a noisy signal may add an additional 2-6 volts on top of that, for a total peak voltage of up to 30 volts.

For typical AC components such as contactors, relays and float switches, this usually is not of any consequence. However, on a UV-light circuit where the service technician is actually multiplying both the frequency and the voltage of the incoming power, this can prove to be a compounding problem. Therefore, the noise needs to be filtered out to avoid this.

Otherwise, the spikes can cause failure to earlier generations of 24-VAC UV-light products because the power supply's circuits cannot handle the circuit's "noise." The noise can cause the power supply to handle higher voltage than is intended and run hot. This will blow electronic components internal to the UV power supply such as thermistors, which are designed to protect against overheating; and internal fuses or resistors, which can be sensitive components to overvoltage and excess heat. Therefore, installing earlier versions of 24-VAC UV-lights on an isolated, low-voltage power source via a second 24-VAC transformer is recommended.

Newer generations of low-voltage UV lights take this phenomenon into account and are designed with several fail safes in place, such as a wider operating voltage range—extended operating range—designed to operate at 18–32 VAC instead of just at 24 VAC. Another fail safe incorporates input power filters and conditioners intended to filter out the "noise" of these circuits to prevent the failure problems.

Verifying power load availability

As with any installation that uses power, whether it is a line- or low-voltage circuit, it is important to check the availability of additional power load before installing the UV light or other accessory. To perform this test, take a full-load voltage reading—with the heat or A/C running—of the circuit by connecting the meter's probes across the transformer's output terminals. For variable-speed air handlers a true RMS meter is recommended for an accurate reading. Take a full-load current-draw reading using either an amp clamp on one of the output leads of the transformer or the probe's inline on one of the output leads.

After taking the readings, use the following formula to determine the VA load:

Full Load Volts x
Full Load Amp Draw =
VA (Volt-Amps)

For example:
Full Load Voltage = 25.61 VAC
Full Load Current Draw = 0.43 A
25.61 volts x 0.44 amps = 11.27 VA

The example in the chart leaves an additional 28.73 VA that a technician can use to install additional accessories on a 40-VA full-load transformer. Most of the low-voltage UV products currently found on the market only require 16–18 VA, making them easily installable and, in the above example, leaving 28.73 VA still available to use. However, if the load exceeds 40-VA full load (UV VA + FL VA), the technician should install a separate transformer.

Conclusion

As the interest in the use of UV-light products continues to grow in the HVAC market, the diversity of the installation opportunities and the experience of the installers also will increase. The use of low-voltage UV-light products can afford the opportunity for many new types of installations that were previously impossible. Developments with newer systems, such as evolving product designs and functions, means first-time installers can safely get involved with applying these types of products.u

Chris Willette is president of Triatomic Environmental Inc. Chris is a published author and has several patents pending. To learn more visit, www.freshaireuv.com; call 800-741-1195 or e-mail; sales@freshaireuv.com.

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