

UVVR

UV RESOURCES

RLM *Xtreme*™

Value — *Lowest Cost of Ownership*

Performance — *High Output, Low Mercury*

Sustainability — *Energy Use, Coil Cleanliness and IEQ*

COMMERCIAL

government

Institutional

Emergency



BENEFITS

- Specifically designed for Xtreme environments
- Xtreme output:
>420 $\mu\text{W}/\text{cm}^2$ at 1 Meter
- 360° distribution – highest UV-C fluence available
- Unlimited lamp configurations
- Industry's easiest to install and maintain
- Industry's lowest cost of ownership
- Highest reduction of infectious microbes
- Destroys coil/drain pan mold and bacteria
- EncapsuLamp™ technology for superior safety
- Designed for direct water wash-downs
- Worldwide lamp and ballast availability
- Minimal lamp sizes/less inventory
- Meets/exceeds U.S. mercury content standards
- UL, CUL, CE and other agency listings
- 5-year fixture warranty
- 1-year lamp warranty

UV-C, when specified into new buildings and retrofits, reduces infectious agents, occupant absenteeism, and mechanical system maintenance. UV-C qualifies for LEED points in the energy and sustainability category, and is recognized in many green building standards for being chemical free. Accordingly, UV installations are becoming more commonplace and growing rapidly.

UV-C's role in creating quality indoor environments, sustainable, and green buildings — plus its ability to preclude or correct operation and equipment issues in buildings and A/C systems — prompted ASHRAE to add a chapter on UV-C to the 2008 ASHRAE HVAC Systems Equipment Handbook, as well as to form Technical Committee 2.9, Ultraviolet Air and Surface Treatment. Efforts such as these will help to promote widespread application of UV in building systems around the world.

Fueled by growing demand, today's UV-C systems need to offer application flexibility, ease of sizing and installation, and attractive cost of ownership — and RLM Xtreme leads the way. When compared to other products in the marketplace, Xtreme's features, functions and benefits come out ahead every time.

Forget about filling air handling units with rows of costly, potentially unsafe and awkward metal and glass fixturing... Xtreme offers a simpler, better way!

Born out of two decades of experience and use, this modern UV-C system irradiates coils and kills airborne microbes to create a more energy-efficient system that doesn't have to work as hard to move air. It offers the longest warranties and installation flexibility in the industry — all at an affordable price.

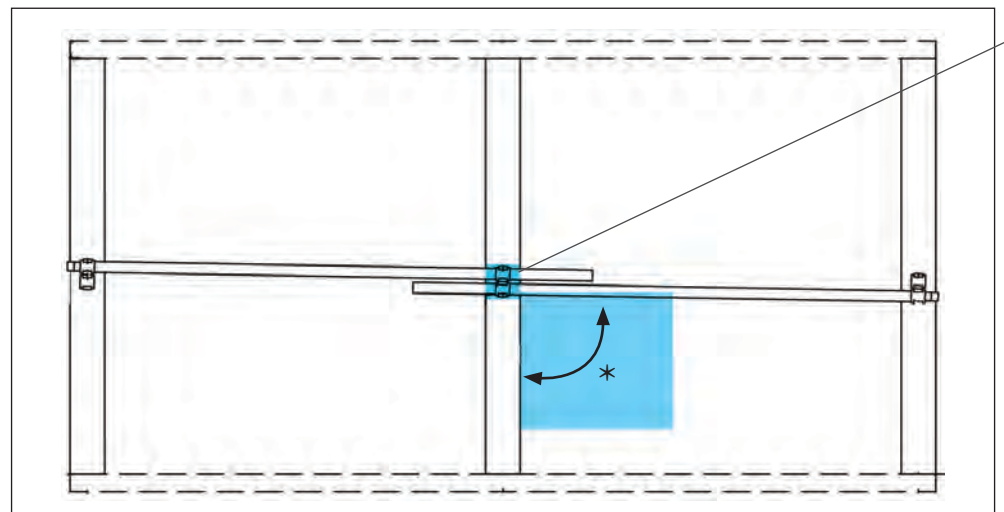
Xtreme's unique LampClamp™ allows lamps to be affixed most anywhere. It also compresses the lamp plug and socket together to fully protect the connection from moisture or direct water. This eliminates lamp pin corrosion and electrical "shorts" that routinely cause lamp and/or power supply failures in other systems. LampHolsters™ complement the LampClamp by allowing UV lamps to simply "slip-in" and click in place, so that they overlap one another. This eliminates the need for multiple lamp lengths, and provides for more "free" energy where it's needed most.

EncapsuLamp™, UVR's Teflon® lamp coating technology, protects the system, space, and installer from the residues of a broken lamp such as inert gas, mercury, and glass.

Adding to the ease and flexibility of installation is the ability to locate Xtreme's state-of-the-art power supply remotely. The installation kit includes a plenum-rated lamp loom of up to 20-feet to allow the power supply to be located in an out-of-the-way area.

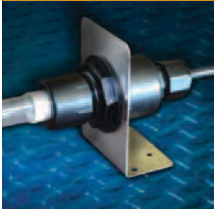
No matter what the application may be, Xtreme is the easiest UV-C system to install and service available in the marketplace.

The reasons to use Xtreme are many—but the cost is less! The choice for UV-C in any air moving system has become clear—RLM Xtreme, "the way it ought to be™."



* Lamps are not to be at right angles to coil fins. RLM's energy scatters non-directionally so lamps can be more correctly mounted to allow for a gravity drip of water off the lamp. This precludes mineral deposits, output attenuation and lamp failure. U.S. Patent #6,539,727 B1.

LAMPHOLDER/LOOM



The LampHolder features Xtreme's unique LampClamp™, along with a loom that enables power supplies to be located remotely away from lamps. The LampClamp compresses the lamp plug and socket together to form a barrier against moisture or direct water. It eliminates loose fits, lamp pin corrosion, and electrical "shorts" that routinely cause lamp and/or power supply failures. The triple-sheathed loom includes a layer of aluminized Mylar® jacketed with carbon impregnated thermoplastic. It meets UL Subject 13, 444, and 1581, and Articles 725 and 800 of the NEC as plenum rated.

POWER SUPPLY



Xtreme power supplies are CSA, CE, and UL Listed as variable input (120–277 Vac \pm 10%) types, designed to facilitate PnP wiring of both inputs and outputs. They auto-match to either one "very high output" 150W UV-C lamp, or one or two "very high output" 75W UV-C lamps to maximize their individual performance. Power supplies are warranted for 5 years.

X-BOX XTREME



X-box is NEMA 2 rated, constructed of heavy-gauge galvanized and powder-coated steel for a safe and long-lasting housing that can accommodate up to 8 Xtreme power supplies. They're easy to install, either inside or outside of a plenum, and per NEC recommendations.

LAMPHOLSTER™



LampHolsters enable lamps to provide Xtreme's unique 360° irradiance. They are designed so that the installer can quickly and safely position/suspend and overlap lamps in the UV-C cavity. Constructed of carbon-impregnated polycarbonate, LampHolsters provide unmatched durability where system air velocity is greatest.

ENCAPSULAMP™



EncapsuLamp's encapsulate uniquely contains broken lamp residues of glass, mercury, and other contaminants—and it's completely disposable! The technology isolates lamp materials from the airstream, so that UV-C energy can be used most anywhere. This near destruction-proof construction perfectly fits critical venues such as pharmaceutical and food processing plants, as well as patient care applications in hospitals and nursing homes, etc. Further, it insulates a lamp's surface against air temperature changes to maximize lamp output and performance.

CU2™



The CU2 continuously monitors current in each ballast and lamp; provides both a visual and signal method of on/off operation; and notifies building management systems whether a failure has occurred in either a lamp or ballast. Its surface LED and 5V analog signal eliminate the need to look at UV lamps directly. The CU2 is solid state and does not require power to operate. It is warranted for 5 years.



System energy use starts with overcoming the pressure required to move air through a heat exchanger (Δ delta pressure). The delta requirement is a product of air flow, coil open area and friction. Net open area does not include the area used for coil fins, refrigerant tubing, and the all-important surface build-up of contaminant and mold.

This build-up decreases the open area which will increase coil pressure drop, decrease air flow, and increase energy use (Figure A). If CFM were to remain the same, a proportional increase in velocity would occur (Figure B). This higher interstitial velocity decreases the air-to-surface contact time, which decreases heat transfer and would raise the leaving air temperature. This latent differential of temperature—which is now lower than when clean—combined with reduction in air flow, will increase space temperature and humidity (wet bulb), decreasing the comfort level of building occupants to where system alterations must be performed. Other coil changes include an increase in air friction, insulating effects, and a continual degradation of coil and drain pan surfaces.

A high UV-C energy reflection can be obtained from all grades of aluminum—a phenomena that accentuates UV-C's ability to degrade and rid a coil's surface of contamination (Figure C). There are few organic materials that can escape the destructiveness of UV-C energy.

By looking at a fluorescent lamp (Figure D), you can note the high amount of energy glowing from the lamp's surface, flooding the air and surfaces with direct and reflected rays. This pales in comparison to Xtreme's invisible waveform, which is more than 2.5 times that amount.

Xtreme outperforms all other products in airborne kill, coil cleanliness and sustained system capacity. It also excels at affordability, ease of installation, warranties and total cost of ownership. Xtreme has become number one everywhere.

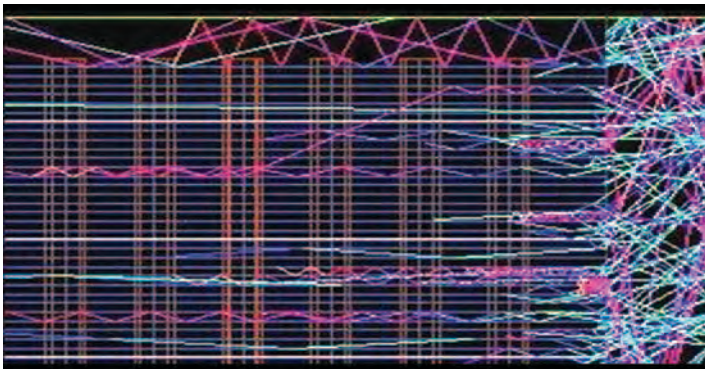


Figure C. Illustration of UV-C spectral lines reflecting off aluminum at angles associated with the entrance angle. At a minimum, aluminum provides a varied, unpredictable and dense fog of reflected radiation throughout. Coil surfaces yield "incident" angle reflection patterns from UV-C's 1/4 micron (0.25) wavelength—a key to UV-C's ability to continuously void a coil of all collected and agglomerated bio-contaminants.

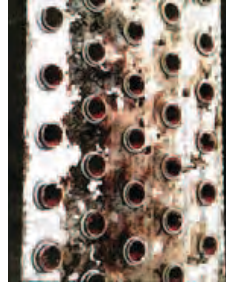


Figure A. Pre-cleaned coil shown cut in half to reveal that it's not actually clean! Instead, the material compacts deeper into it, further reducing air flow and heat transfer. The penetrating power of UV will actually clean all surfaces to restore heat transfer to as new as possible.

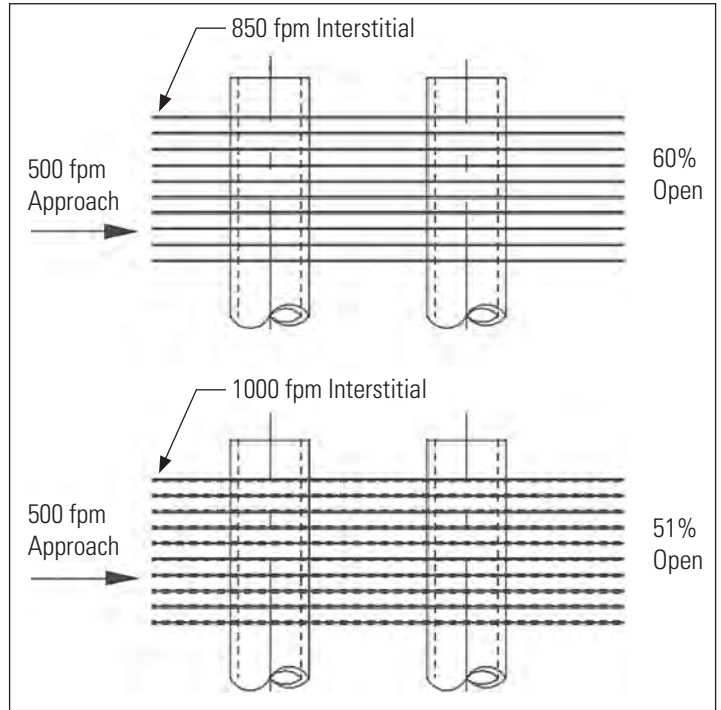


Figure B. A traditional approach velocity of 500 fpm is maintained to show the change in interstitial velocity when open area is decreased by 9% from surface contaminants like mold. With the increase in velocity and thermal insulation, sensible and latent heat transfer is dramatically reduced and space conditions are compromised.

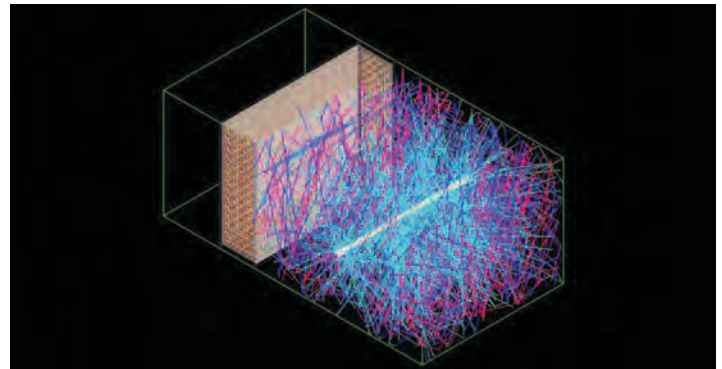


Figure D. Illustrates only a fraction of UV-C flux density and shows the benefit of 360° irradiation (RLM Xtreme). Filling the cavity plus bathing the coil proves the potential of significantly improved airborne kill ratios. The benefits are obvious when compared to the absorption of photons by fixtures and reflectors, which decreases the potential for the death of airborne infectious agents. 360° irradiation is the obvious choice.

ABOUT UV

GOVERNMENT

UVC Emitters/Lamps — “UVC Emitters/Lamps: Ultraviolet light (C band) emitters/lamps shall be incorporated downstream of all cooling coils and above all drain pans to control airborne and surface microbial growth and transfer.”

U.S. General Services Administration (GSA); Facilities Standards for the Public Buildings Service

Engineer’s Guide to the ENERGY STAR® Label for Buildings — The building should be free of visible signs of microbiological sources such as mold and mildew. *EPA, June 2003*

Energy Savings — A Pacific Gas & Electric (PG&E) study showed that a dirty condenser coil can increase compressor energy consumption by 30 percent. *Federal Energy Management Program Fact Sheet, U.S. Department of Energy, Energy Efficiency and Renewable Energy, by the Pacific Northwest National Laboratory, May 2005*

Bio-terror — Ultraviolet germicidal irradiation (UVGI) should be considered as a component of emergency preparedness plans for existing public buildings and a wide range of congregate settings. *The Application of Ultraviolet Germicidal Irradiation to Control Transmission of Airborne Disease: Bioterrorism Countermeasure, Philip W. Brickner, MD, Public Health Report, Volume 118, March/April 2003*

INSTITUTIONAL

UVGI in HVAC Systems Reduces Bacterial and Fungal Contamination of Tracheal Aspirate in a Neonatal ICU — Microbials isolated (pseudomonas, klebsiella, bacillus, and serratia) from the HVAC system were identical to those in the NICU and TA. Total microbial load markedly decreased in the HVAC system and in tracheal aspirate after installing UVGI. *Rita M. Ryan, MD, Pediatric Academic Society, 2003*

Efficacy of Ultraviolet Irradiation in Controlling TB — UVGI was able to inactivate airborne bacteria spores and mycobacteria and significantly decrease their culturable cell concentrations. *University of Colorado, Boulder, CO, for the CDC, October 14, 2002*

Ability of Fan-Powered UVGI Disinfection to Inactivate Selected Airborne Bacteria — More than 99% of the bacteria irradiated (escherichia coli, pseudomonas fluorescens, serratia marcescens, and micrococcus luteus) were inactivated. *Conference of the Society for Occupational and Environmental Health, NIOSH, 1994*

UVGI — UVGI has been recommended as a supplement or adjunct to other TB infection-control and ventilation measures in settings in which the need to kill or inactivate M. tuberculosis is essential. UVGI can be used to increase the number of equivalent air changes per hour (ACH).

Guidelines for Preventing the Transmission of Mycobacterium Tuberculosis in Health-Care Settings, 2005

UV in Schools — UVC technology is effective in reducing microbial growth on air conditioning cooling coils. *Improving indoor environment quality and energy performance of California K-12 schools, Project 3, Effectiveness of UVC light for improving school performance, California Energy Commission, 2006*

COMMERCIAL

Effect of Ultraviolet Germicidal Lights — Operation of UVGI resulted in 99% reduction of microbial and endotoxin concentrations within the ventilation systems resulting in significantly fewer work-related respiratory and mucosal symptoms. *The LANCET, Volume 362, November 29, 2003*

Defining the Effectiveness of UV Lamps — UVGI was found to inactivate vegetative bacteria, bacterial, and fungal spores (i.e., staphylococcus epidermidis, bacillus subtilis, and aspergillus versicolor), with single-pass efficiencies to >99%. *RTI International for ARTI, November 2002*

ASHRAE Standard 62-1999 — Describes conditions and equipment that should be evaluated to ensure proper control of microbial sources. *A. Persily, The Revision of Standard 62: What a Difference a Decade Makes, National Institute of Standards and Technology, Gaithersburg, MD*

Effectiveness of UV Light in Controlling Fungal Contamination — Germicidal UV light can be an effective approach for reducing fungal contamination within AHUs. *Effectiveness of Germicidal UV Irradiation for Reducing Fungal Contamination within Air-Handling Units, E. Levetin, Journal of Allergy and Clinical Immunology, Volume 103, No. 1, January 1999*

■ **CARBON BLACK** used in many of the RLM Xtreme accessories, has a high strength-to-weight ratio and has the highest melting/sublimation point of all elements. We use carbon black as a filler/pigment in our plastic compounds and products as this inorganic material is impervious to the effects of UV-C.

■ **TEFLON**, or polytetrafluoroethylene (PTFE), is a synthetic fluoropolymer used in covering UV Resources’ lamps (EncapsuLamp™). It is one of the toughest materials known. In fact PTFE is used to coat certain types of hardened, armor-piercing bullets, so as to reduce the amount of wear on the firearm’s rifling but also giving the ability to ease a bullet’s passage through armor.

About UV Resources

UV Resources (UVR) is built around brand names, long warranties, and affordable pricing. The company specializes in simplifying the correct sizing and application of UV-C equipment in HVACR systems so that everyone can benefit from UV-C's intrinsic worth. UVR team members pride themselves on the company's highly rated service, which leads the industry in customer satisfaction.

In addition to developing new and unique UV-C products for specific applications, UVR team members were among the first to develop modern sizing and efficacy software for air conveyance systems and have assisted various OEMs in developing their own. The team has participated in all aspects of ASHRAE's efforts to educate its members worldwide about UV-C energy by giving oral presentations and developing written materials. UVR team members sit on related Committees and also lecture* for ASHRAE on UV-C. They consult with, and are involved in, government or government-sponsored UV-related entities as well.

It is UVR's intent to show engineers and users alike just how simple and affordable the many benefits of UV-C energy can be. The team's significant experience in UV-C development, education, and application in a wide variety of settings provides value that engineers, building owners, plant managers, and others can all count on for many years to come.

*ASHRAE's Distinguished Lecturer program



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