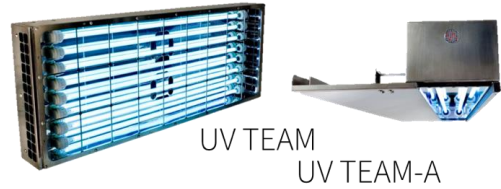


Direct Irradiation

Air Purifiers



Team of Lamps



WATER TREATMENT



HVAC



Mobile



Boxes and Cabinets



UV Disinfection:

International bodies and organizations recommend the use of UV-C radiation for air treatment.

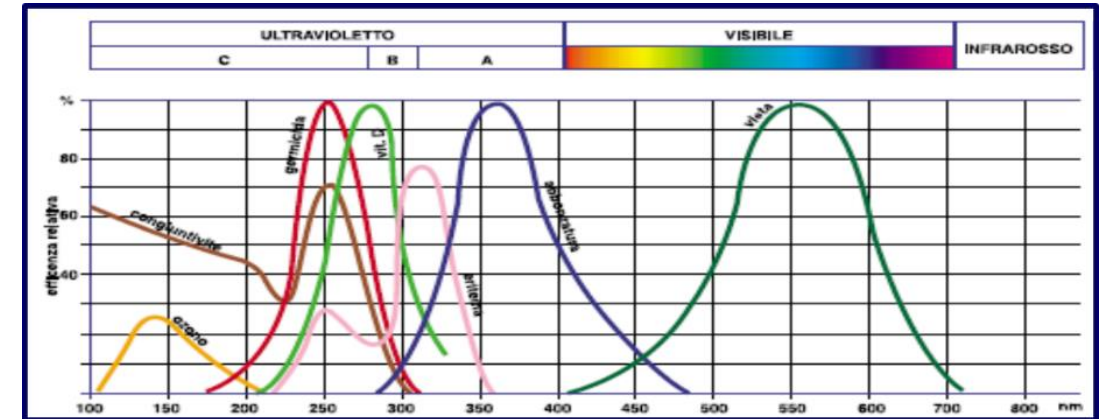
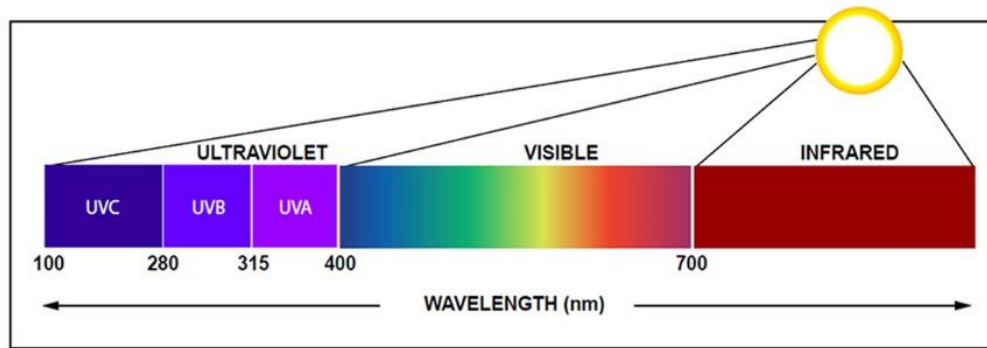
For decades, many world-class institutions and organizations such as WHO, EPA, CDC, ASHRAE have been recommending the use of UV-C radiation for disinfection of water, rooms and HVAC systems.

The use of UV-C radiation is also indicated for the prevention of Coronavirus Sars-Cov-2 and, following the recent COVID-19 pandemic, the concept of using UV sections within the HVAC system as a solution to contain the spread of the virus has been successfully introduced.

***October 5th 2020, CDC Guidance – “The principal mode by which people are infected with SARS-CoV-2 (the virus that causes COVID-19) is through exposure to respiratory droplets carrying infectious virus.”**



UV Disinfection:



Light in a broad sense can be divided in visible, infra-red and ultraviolet rays.

Ultra-violet rays (invisible) can be classified in:

- UV - A** (with tanning properties)
- UV - B** (with therapeutic properties)
- UV - C** (with germicidal properties)

UV Disinfection:

What does **UVGI** mean?

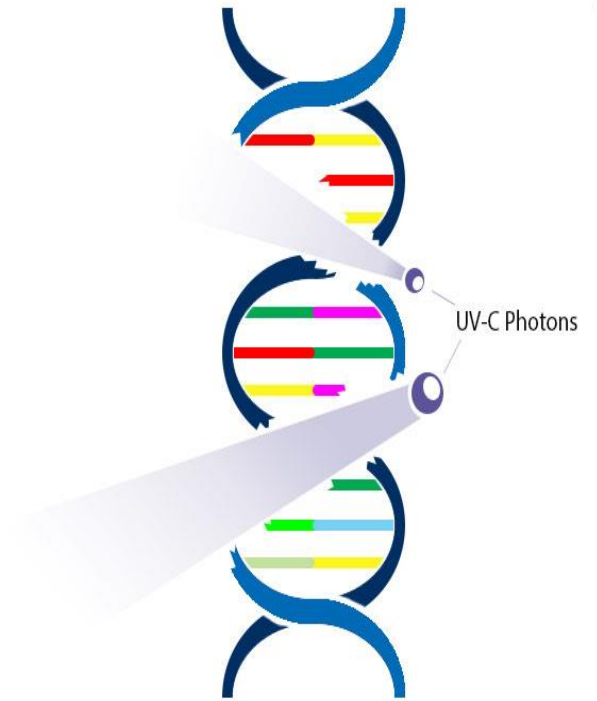
The absorption of a UV photon by the DNA of microorganisms causes a destruction of a link in the DNA chain, and consequently the inhibition of DNA replication.

The germicidal effects of the UV-C radiation destroy DNA of Bacteria, Viruses, Spores, Fungi, Molds and Mites avoiding their growth and proliferation.

UVGI technology is a physic disinfection method with a great costs/benefits ratio, it's ecological, and, unlike chemicals, it works against every microorganisms without creating any resistance.



Micro-organism DNA
(before UV-C exposure)



Micro-organism DNA
(broken by UV-C exposure)

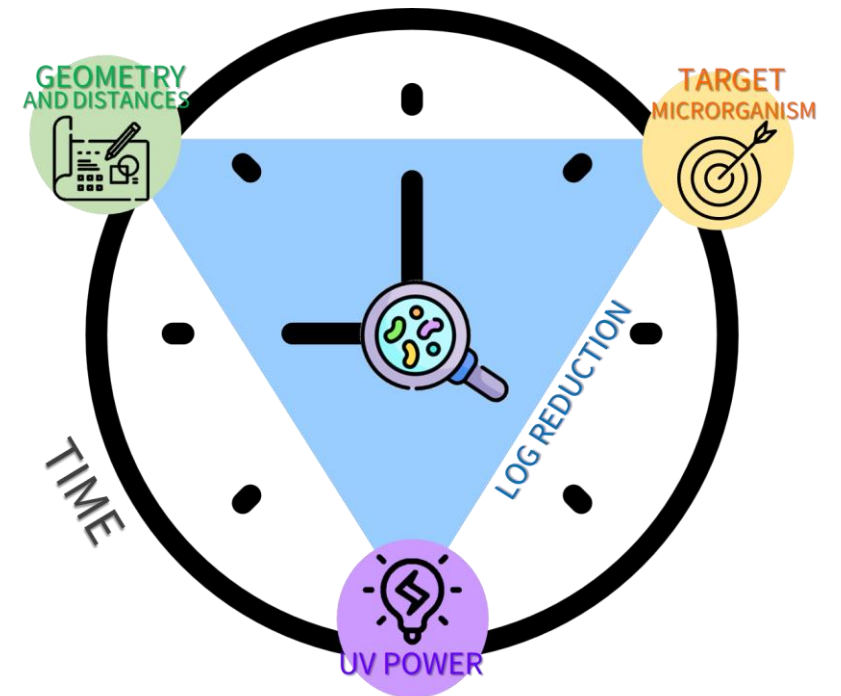
UV Disinfection:

Each microorganism has a specific UV-resistance threshold, called DOSE. The specific dose need to be delivered to get a proper disinfection level, which is expressed in LOG REDUCTION (1 Log=90%, 2 Logs=99%, 3 Logs=99,9%, etc).

Therefore, for some microorganisms a low level of UV POWER is sufficient to be eliminated, while for others it takes more power to get same elimination level...or alternatively a longer exposure TIME.

These factors are essential to understand UV technology:

- Disinfection level that needs to be achieved (Log Reduction);
- Target pathogen (and its dose);
- UV power in play;
- Exposure time / geometry and distance balance;



UV Disinfection:

UV DOSE needed to eliminate 99% (2 Logs) value in ($\mu\text{W}/\text{cm}^2$ SEC)

BACTERIA		Virus (genieric, DNA e RNA)	
Mycobacterium tuberculosisn (TBC)	4300	Virus dell' influenza A	4558
Escherichia coli ATCC 11229	4800	Hepatitis A HM175	8000
Legionella pneumophila ATCC 33152	3200	Corona Virus (SARS-CoV1 – MERS-Cov)	1200-1500
Pseudomonas aeruginosa ATCC 9027	6500	Rotavirus	15000
Salmonella ATCC 6539	4500	Molds	
Staphylococcus aureus	3200	Aspergillus Amstelodami	66700
Streptococcus hemolyticus	4400	Aspergillus Brasiliensis (Niger)	226000
Vibrio cholerae	4100	Yeasts	
MRSA	6550	Comuni lieviti dolciari	12000
Clostridium Difficile	10000	Lievito di birra	20000

Scientific Evidence: Solution & Product Support



“Evidence suggests that SARS-CoV-2, as well as other coronaviruses, can be dispersed and potentially transmitted by aerosols directly or via ventilation systems.... Detection of SARS-CoV-2 in central ventilation systems, distant from patient areas, indicate that virus can be transported long distances and that droplet transmission alone cannot reasonably explain this, especially considering the relatively low air change rates in these wards. Airborne transmission of SARS-CoV-2 must be taken into consideration for preventive measures.”

Nissen, K., Krambrich, J., Akaberi, D. *et al.* **Long-distance airborne dispersal of SARS-CoV-2 in COVID-19 wards.** *Sci Rep* **10**, 19589 (2020).
<https://doi.org/10.1038/s41598-020-76442-2>

Scientific Evidence: Solution & Product Support



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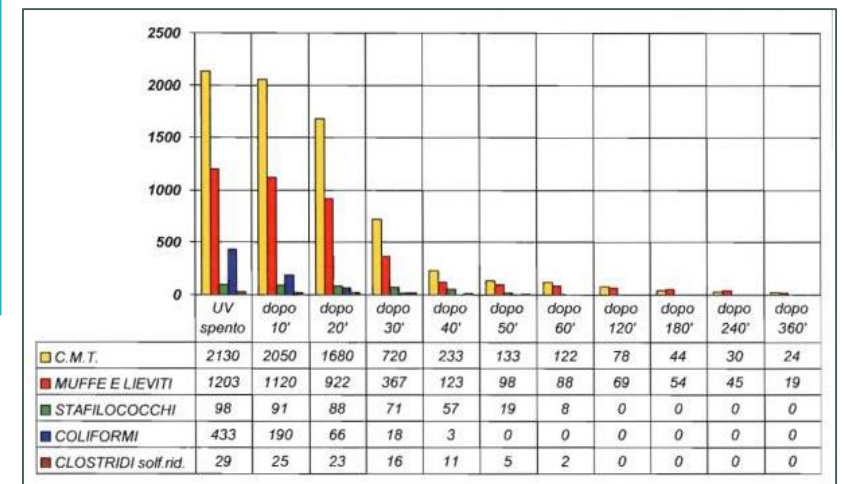
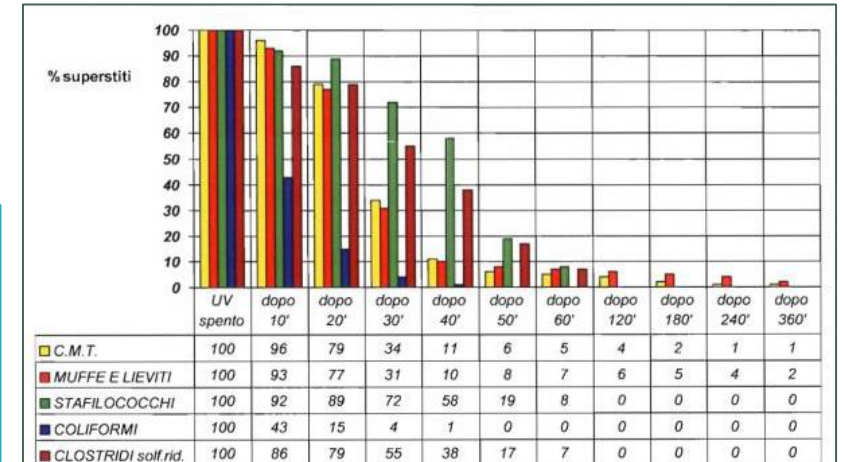
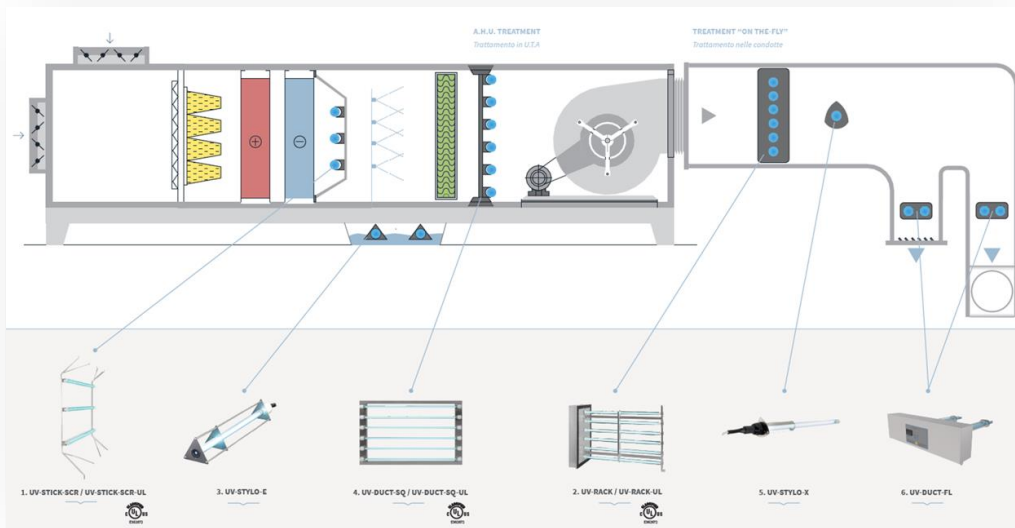
Nissen, K., Krambrich, J., Akaberi, D. *et al.* **Long-distance airborne dispersal of SARS-CoV-2 in COVID-19 wards.** *Sci Rep* **10**, 19589 (2020).

<https://doi.org/10.1038/s41598-020-76442-2>

Scientific Evidence: Solution & Product Support

Our products are designed to fit precisely into various sections of the Air Handling Units, as well as inside the ducts. All our HVAC products are dimensioned to the air conditioning system in order to guarantee safe results.

As you can see from the graphs, which can be found on "Study on UV-FAN M1 25 efficacy by Siena Univ", the percentages of microbial reduction of Light Progress systems are between 99.99% for bacteria and 99% for viruses, at every air passage.



Internal Software: Integration Calculations



Thanks to our long experience in the field, the available scientific studies and based on the valuable indications of the major manufacturers of air conditioning systems, we calculate the exact amount of UV power needed to obtain the required results in each individual HVAC system by customizing each application.

Calculation of the UV-C Power & Products Required in Air Conditioning Systems

The calculation brings back the number of lamps necessary to reach the needed results. After, You can choose the device that fits to the dimensions of the DUCT/AHU, referring to the compatible devices listed alongside the lamp results.

Airflow	Cubic Feet / Minute	3,200
Shortest Measurement (length or width) of the DUCT or AHU (D) in mm	Inches	36
Longest Measurement (length or width) of the DUCT or AHU in mm	Inches	36
DUCT or AHU material (Two-Letter Material Code)	Material (e.g. "AA", "AB", etc.)	AA
Microorganism to eliminate (Letter Code)	Micro-organism ("A", "B", etc.)	m
Number of Logs of Reduction (1 Log = 90%, 2 Log = 99%, 3 Log = 99.9%, 4 Log = 99.99%)	Required Log (1,2,3, ecc.)	1
Relative Humidity Value (0% to 100%)	Humidity=%	60
Temperature (Degrees)C	Temp="F	69

Outputs

Inputs

Light Progress* Lamp Model	Lamp Length (inches)*	Required # of Lamps (Round Up)	Compatible Products
N° LAMPS GH2-11W	10.0	10.3	UV-STYLO-X
N° LAMPS GH3-16W	12.5	6.7	UV-FCU
N° LAMPS GH5-25W	21.6	3.2	UV-STYLO-X
N° LAMPS GH4-40WH (High Output)	17.8	1.7	UV-RACK
N° LAMPS GH6-60WH (High Output)	23.6	1.1	UV-FCU
N° LAMPS GH9-90WH (High Output)	35.8	0.8	UV-STYLO-X
N° LAMPS GH11-120WH (High Output)	46.9	0.5	UV-FCU
N° LAMPS GH15-75W	61.2	0.9	UV-FCU
N° LAMPS GH15-150WH (High Output)	61.2	0.4	UV-FCU
N° LAMPS CHS 40 WH (High Output)	17.2	1.6	UV-STICK-AL
N° LAMPS CHS 60 WH (High Output)	23.6	1.1	UV-STICK- NX
N° LAMPS CHS 90 WH (High Output)	35.2	0.8	UV-STICK-AX
N° LAMPS CHS 120 WH (High Output)	46.3	0.5	UV-DUCT-SQ
N° LAMPS CHS 75 W	61.2	0.9	UV-STICK-AL
N° LAMPS CHS 150 WH (High Output)	61.2	0.4	UV-STICK- NX
			UV-STICK-AX
N° LAMPS GHP 35WH (High Output)	7.7	2.1	UV-DUCT-FL
N° LAMPS GHP 60WH (High Output)	15.4	1.3	
N° LAMPS GHP 95WH (High Output)	19.9	0.7	

* minimum size inside the DUCT/AHU

Necessary dose for 1 Log (90%) reduction of various microorganisms		
Bacteria		
A	Mycobacterium Tuberculosis (TBC)	2150
B	Escherichia Coli ATCC 11229	2400
C	Legionella Pneumophila ATCC 33152	1600
D	Pseudomonas Aeruginosa ATCC 9027	3250
E	Salmonella Enteridis ATCC 6539	2750
F	Staphylococcus Aureus	1600
G	Streptococco Hemolyticus	2200
H	Vibrio Cholerae	2050
I	MRSA	3250
L	Clostridium Difficile	5000
Virus (Generic DNA & RNA)		
M	Virus Influenza "A" / Flu "A" Virus	2750
N	Hepatitis A HM175	4000
O	Corona Virus (Sars COV1 - MERS COV	750
P	Rotavirus	7500
Molds		
Q	Aspergillus Amstelodami	33350
R	Aspergillus Brasiliensis (Niger)	113000
Yeasts		
S	Common Yeasts / Comuni lieviti dolciari	6000
T	Brewer's Yeast	10000

Material - UVC reflectivity		
Type	Material	Correction Factor
AA	Galvanised steel sheet/plate	1.1
AB	Inox (Stainless steel) 2B	1.15
AC	Inox (Stainless steel) BA mirrored	1.22
AD	Aluminium SPECULAR BRILL	2.15

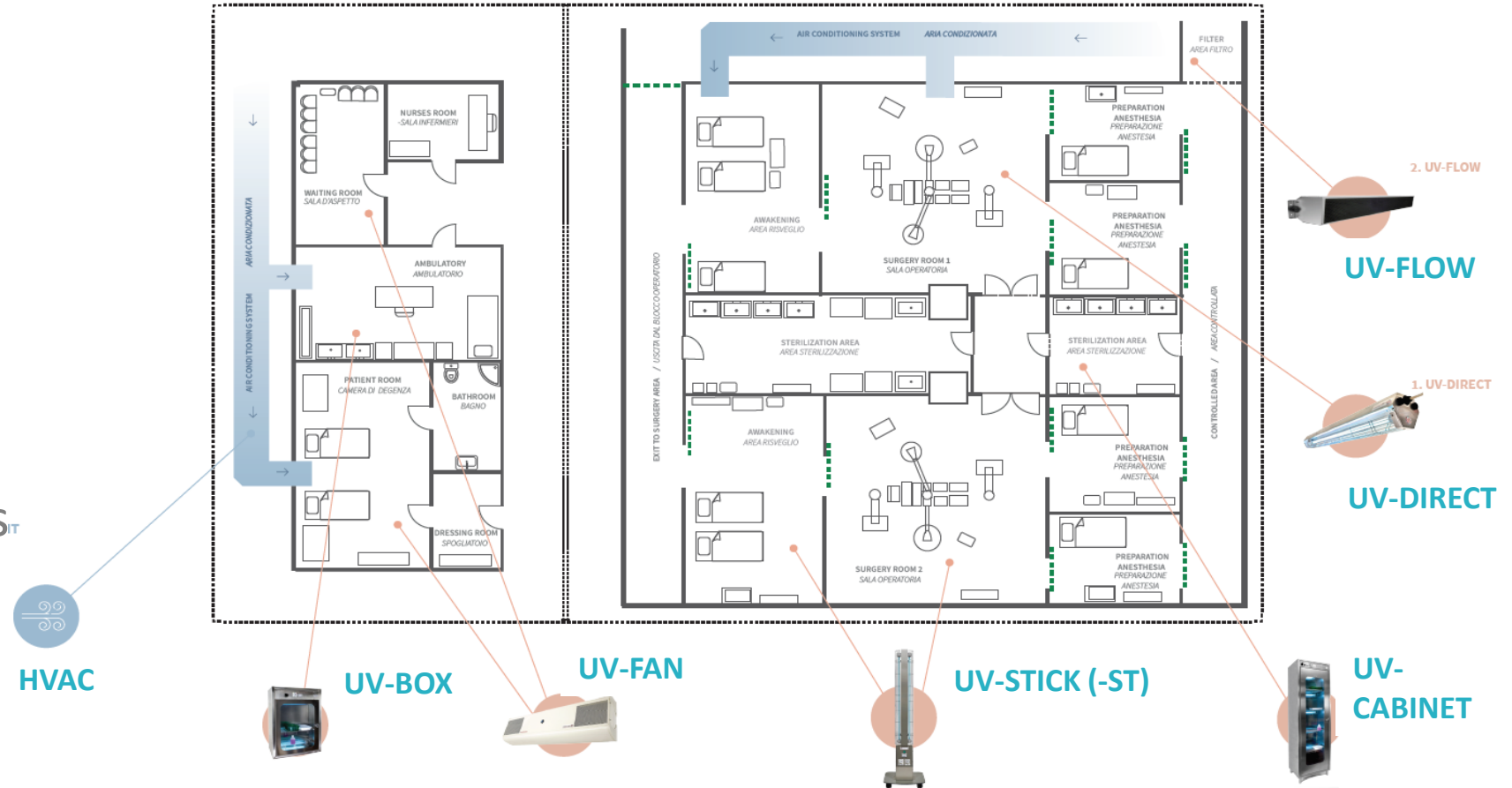
AD is a special aluminium that have high reflectivity about UVC light. It can be used to coat the inner walls of the DUCT /AHU. It can be supplied by Light Progress on request

The proprietary PROTECTX software produces a reliable and consistent approach for developing effective customized UV-C solutions.

General Application Schematic

Diversify your
Environmental
Disinfection:

- HVAC
- In-Room
- Surface
- PPE, Tools & Devices_T





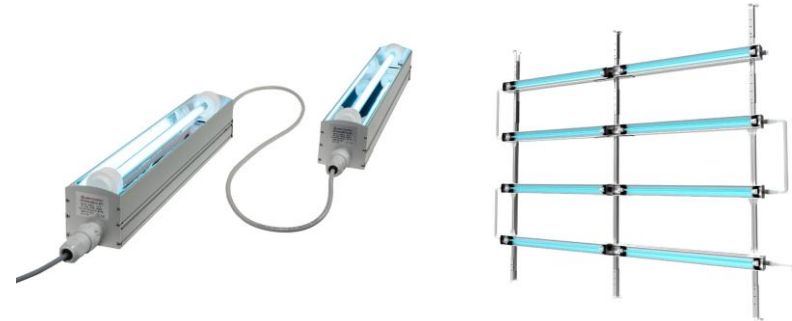
Solution: Suggested Products

HVAC

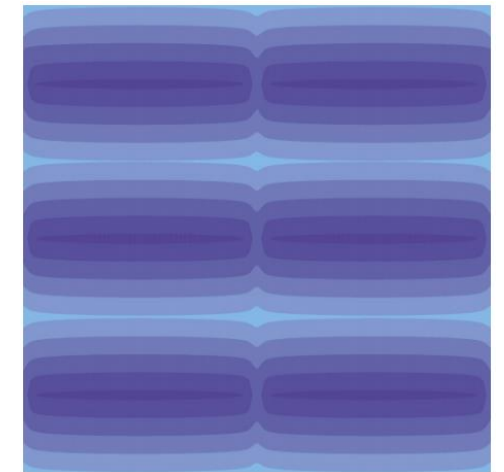
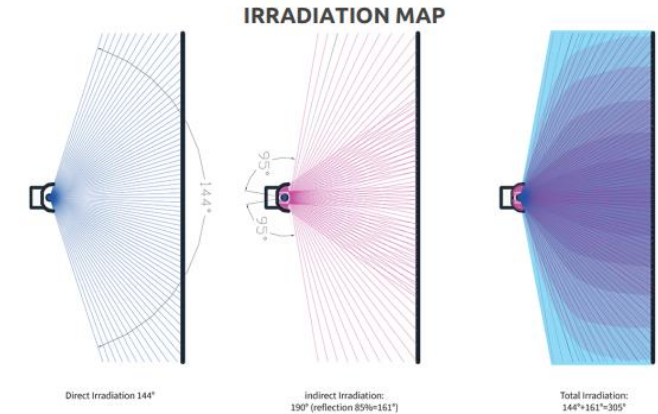
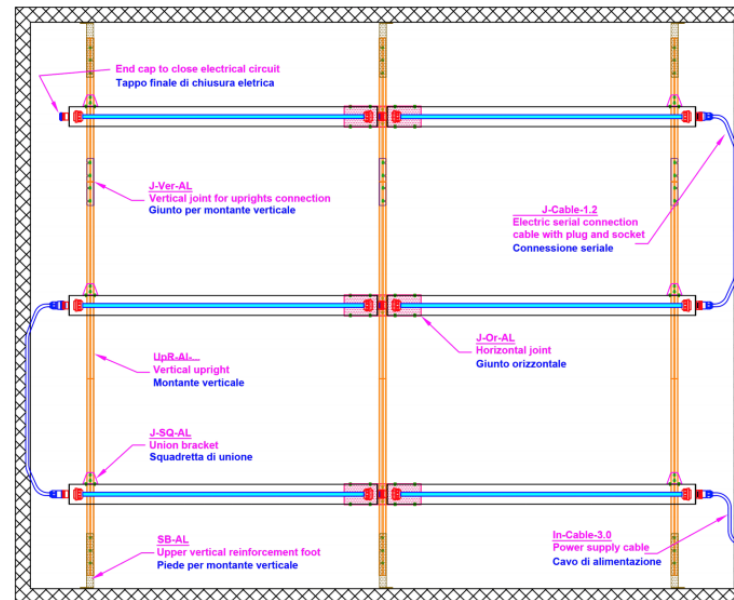
Specific for coil treatment, the UV-STICK and UV-FCU avoids settling and proliferation of Biofilm on surfaces.

The UV-DUCT-FL-NX is designed to be compact with on-board commands which allow easy application even in existing air conditioning systems (retrofit). It creates an UVGI barrier that inhibits the proliferation of dangerous viruses, bacteria, molds and spores.

HVAC ON-Coil Treatment

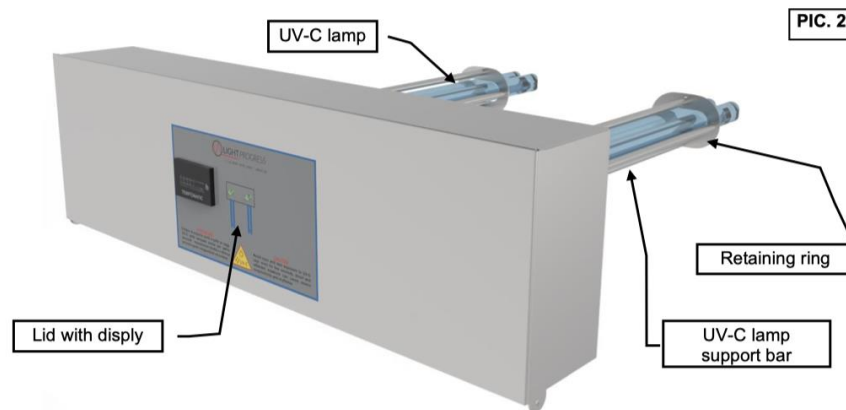


OPTIMIZED LAYOUT BASED ON GIVEN DATA (C2)

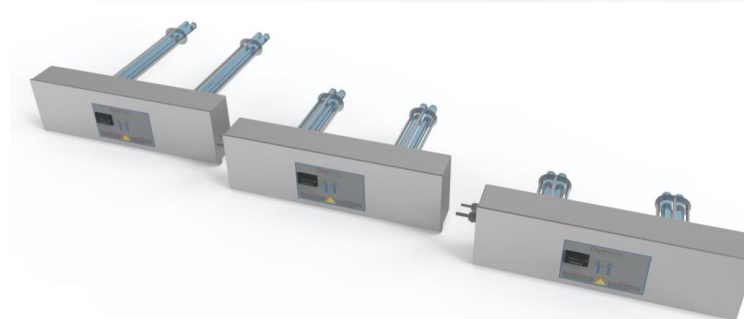


HVAC UV-DUCT-FL

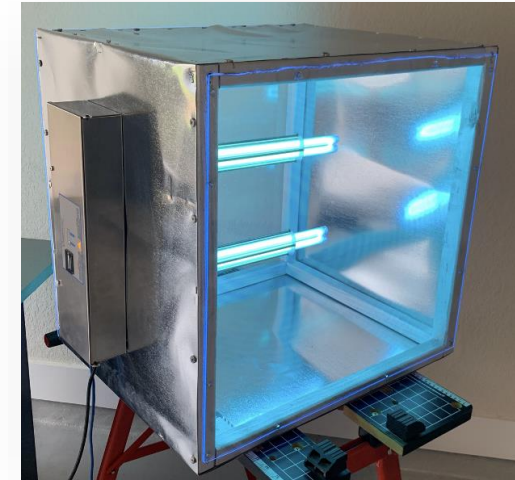
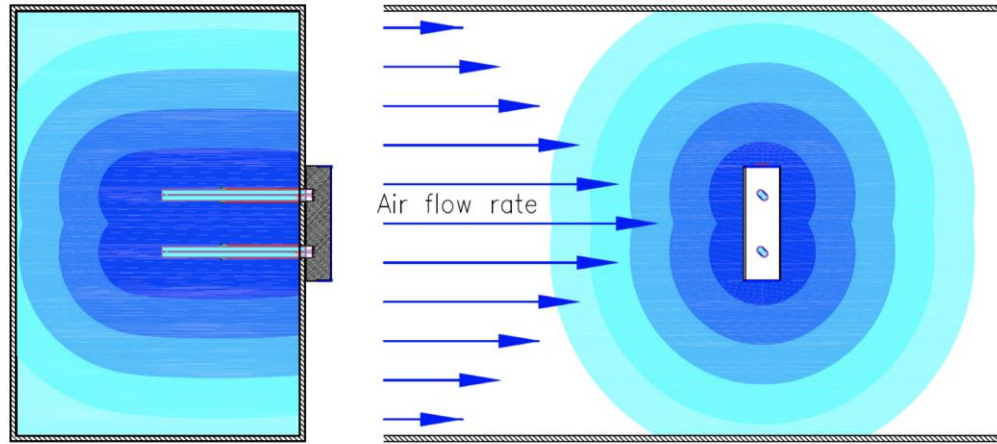
- The series UV-DUCT-FL includes modules for disinfecting air in air conditioning systems(HVAC) with a reduction of microbial load of 99.9%.
- These modules consist of a box structure (flange) from which two UV lamps emerge, in the form of "U", protected by a stainless-steel grid. They are generally applied along the ducts of air conditioning.
- This device's modularity allows a straightforward application in all types of conduct, also in the final sectors of the UTA (Air Handling Unit), with the ability to adapt to different needs and different sizes of ducts.
- The main characteristics of UV-DUCT-FL, as the compact dimensions and device controls, allow a quick and easy installation, directly inside the air conditioning ducts.



PIC. 2



HVAC UV-DUCT-FL

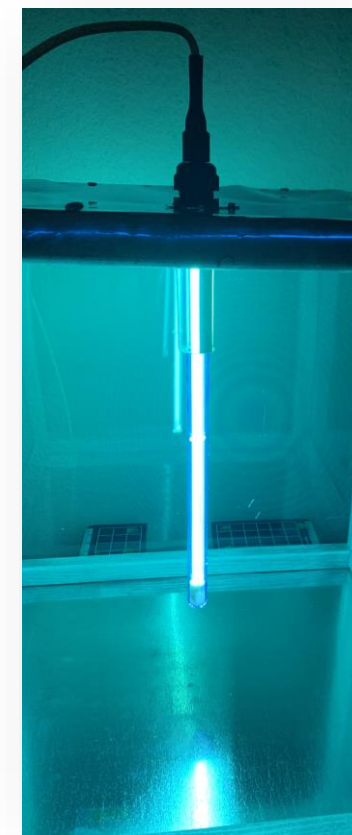
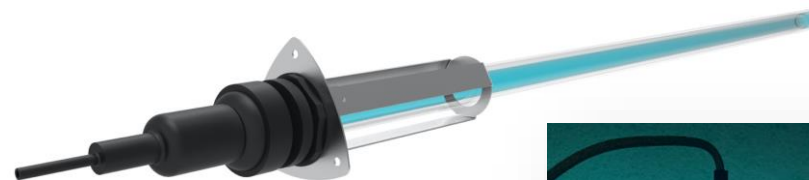


UV-DUCT-FL	2/35HP	2/60HP	2/95HP
AVERAGE LIFETIME LAMP (hours)*	≤ 18.000	≤ 18.000	≤ 18.000
CONSUMPTION (W)	70	120	190
LAMP LENGTH (in.)	7.2	15	20
WEIGHT (lbs.)	5.3	5.7	6
SPARE PARTS. UV LAMP Code	GHP-35WH	GHP-60WH	GHP-95WH

UV-STYLO-X-

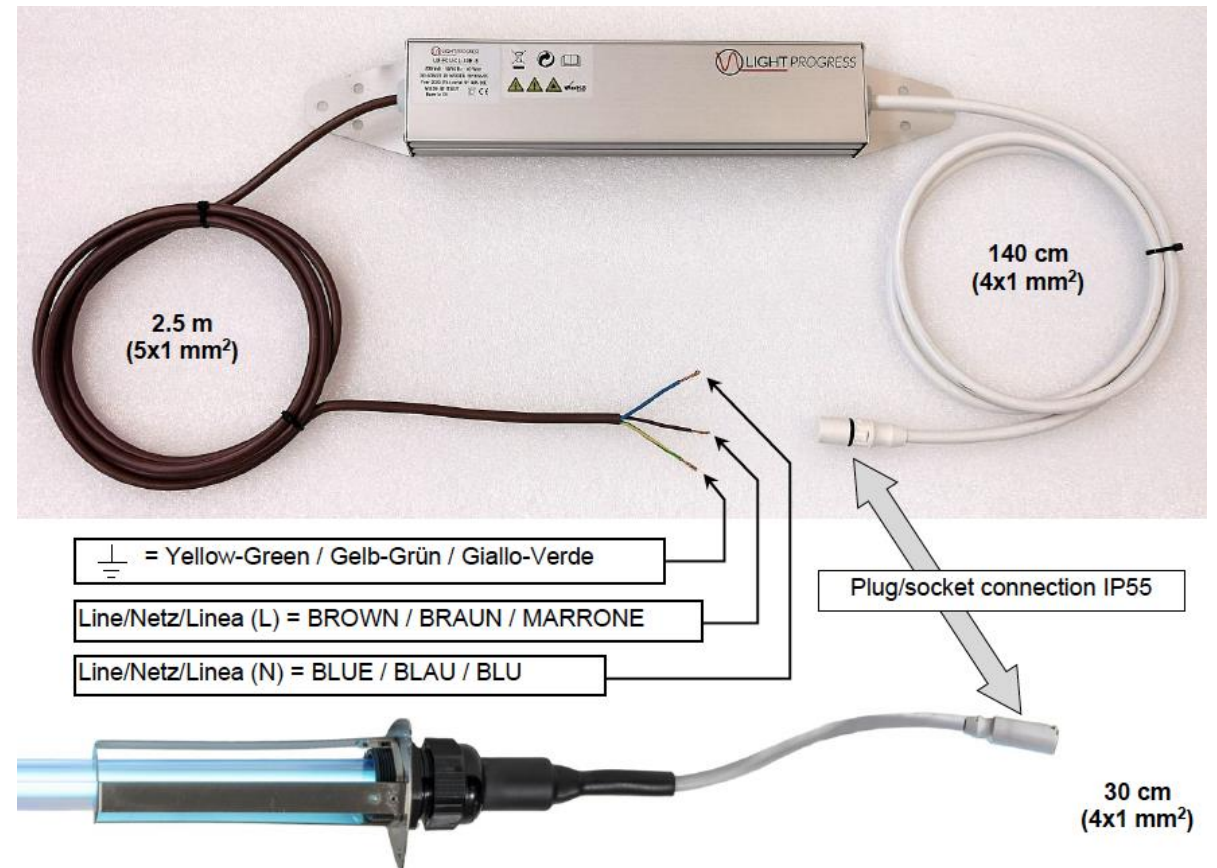
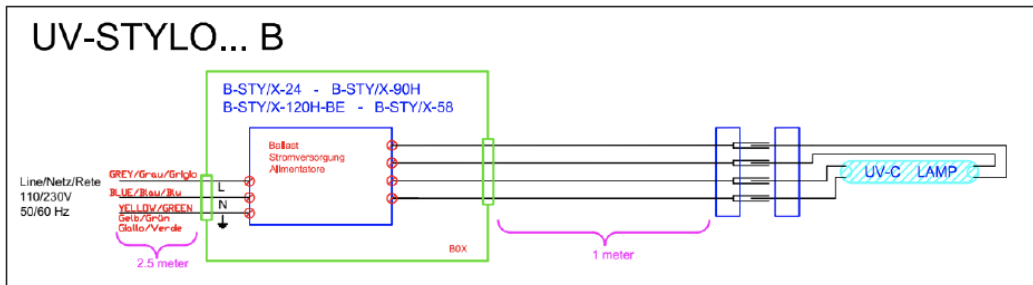
PROTECT X
UV

- The device is **IP40** protection class
- Selective UV-C lamp (at 253.7 nm.) with high efficiency
- Flange in AISI 304 Stainless Steel easy to install.
- You can apply this device on already existing systems (retrofit).
- All used materials are tested for resistance to intense UV-C rays
- Powered by electronic ballasts specific for UV-C rays lamps.
- Quartz to protect the UV-C lamp, for constant efficiency even at low temperatures.
- UVLON PIPE protection sheath against projections of glass fragments (optional)
- CE mark (LVD - EMC - MD - RoHS)
- Complies with the noise standards of Directive 2006/42/EC
- Values measured according to UNI EN ISO 3746
- Non-detectable and non-transmissible vibration values
- Suitable for class 1 installations - protected areas



Power Source -B

3) **..B** → Version with power supply in waterproof box (IP44) without any indication of lamp on. (serie UV-STYLO...-B).





Solution: Suggested Products

Persistent In-Room Air Treatment

UV-FAN and UV-FLOW allow for deep air disinfection in any type of environment. The big advantage of these machines is the ability to deal with the air while people are present, 24 hours a day. Only a continuous disinfectant action can ensure the security to maintain the microbial load is always under control. People can see the products and have comfort in the safety of air quality.

UV Fan: Air Treatment



UV-FAN

Professional High-Performance UV-C Air Purifier
w/ TiOX Filter Catalyzer



UV-FAN-M2/95PH



UV-FAN-M2/95PH-ST



UV-FAN-M2/95PH-BD-ST-Rc

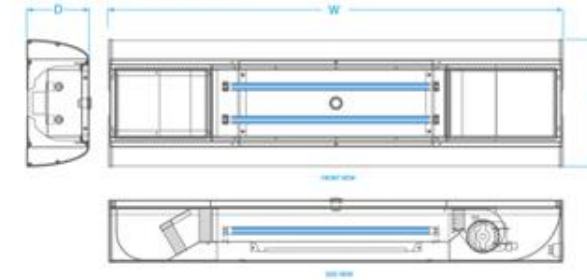


UV-FAN-M2/95PH-BD

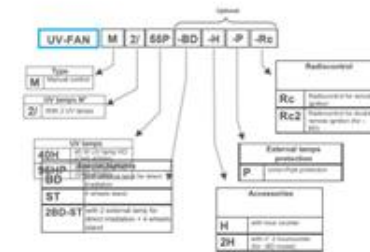
Wall-Mounted or Mobile Versions | 18,000 Hour Ozone-Free Pure Quartz 254NM UV-C Lamps
Safe to Use 24/7 in the Presence of People | Whisper Quiet (44Db) | 450 sq.ft. Coverage Area
Nano-Structured TiOX Filter | Proven 99.9% Reduction in Contaminant Load
2 x 95W Internal Lamps at 120V | IP20 Rating | Suitable for Class 1 Installations

UV FAN MODEL	DIMENSIONS WxHxD (in.)	AIR FLOW (CFM)	Consumption Watts	IRRAD. AREA Sq Ft (DFL HE)	IRRAD. VOLUME (ft ³ /hr)	Surface Area Irradiated (sq ft)
UV-FAN-M2/95PH	48 x 12 x 5	88	220 W	450	3530	N/A
UV-FAN-M2/95PH-ST	48 x 12 x 5	88	220 W	450	3530	N/A
UV-FAN-M2/95PH-BD	41 x 8 x 5	88	220 W + 55 W	450	3530	160
UV-FAN-M2/95PH-BD-ST-Rc	48 x 16 x 5	88	220 W + 110 W	550	4415	320

TECHNICAL DRAWINGS -



CODES -



TiOX Filter Catalyzer -

A titanium dioxide (TiO₂) nano-structured photocatalyst (TiOx*) which oxidizes then degrades contaminants when activated by high emission UV-C lamps placed inside the UV-FAN device.



INSTALLATION -

These devices (except for the models with support) should be installed on the wall, at the center of the room, about 6 feet above ground level (avoid positioning at corners; the air captured and treated by the device must be allowed to circulate through the room unhindered). The final result of the disinfection is however related to a higher or lower value of the outside contribution of germs in the air during UV disinfection. To install the device on the wall use the two triangular brackets enclosed in the packaging. Screw the brackets to the threaded holes on the back side of the device by use of bolts (M6x10) enclosed in the packaging. Make 2 holes on the wall by checking the center distance between the brackets. Secure the device to the wall by means of two expanding wall plugs (Ø 8 - Ø10 mm.) (not provided).

UV Fan: Air Treatment



UV-FAN-XS

Compact High-Performance UV-C Air Purifier w/ TiOx Filter Catalyzer

Key Features:

- 60W high output lamp rated for 18,000 hrs of life at Light Progress selective emission peak of 253.7nm
- Elimination of viruses, bacteria, and any other pathogen as certified by third-party tests
- High-quality stainless steel external body
- Germicide chamber of mirrored bright Aluminum to enhance UV power
- Honeycomb TiOx filter with titanium dioxide nanoparticles and silver salts photoactivated to avoid NOCs / VOCs and increase indoor air quality
- Continuous operation in the presence of people
- 1,765-2,100 ft3/h of disinfecting airflow at a near silent 32db
- Horizontal or vertical application on walls or ceilings
- Compact size to fit everywhere



Specifications:

UV-FAN	XS
Lamp Life (hours)	≤ 18,000
Total Consumption (W)	60W
External Dimensions HxLxW (inches)	27 x 6 x 6
Weight (lbs)	8.8
Protection Rating	IP20

Technical Drawings



TiOx Filter Catalyzer

A titanium dioxide (TiO₂) nanostructured photocatalyst (TiOx[®]) which oxidizes then degrades contaminants when activated by high emission UV-C lamps placed inside the UV-FAN device.



Installation

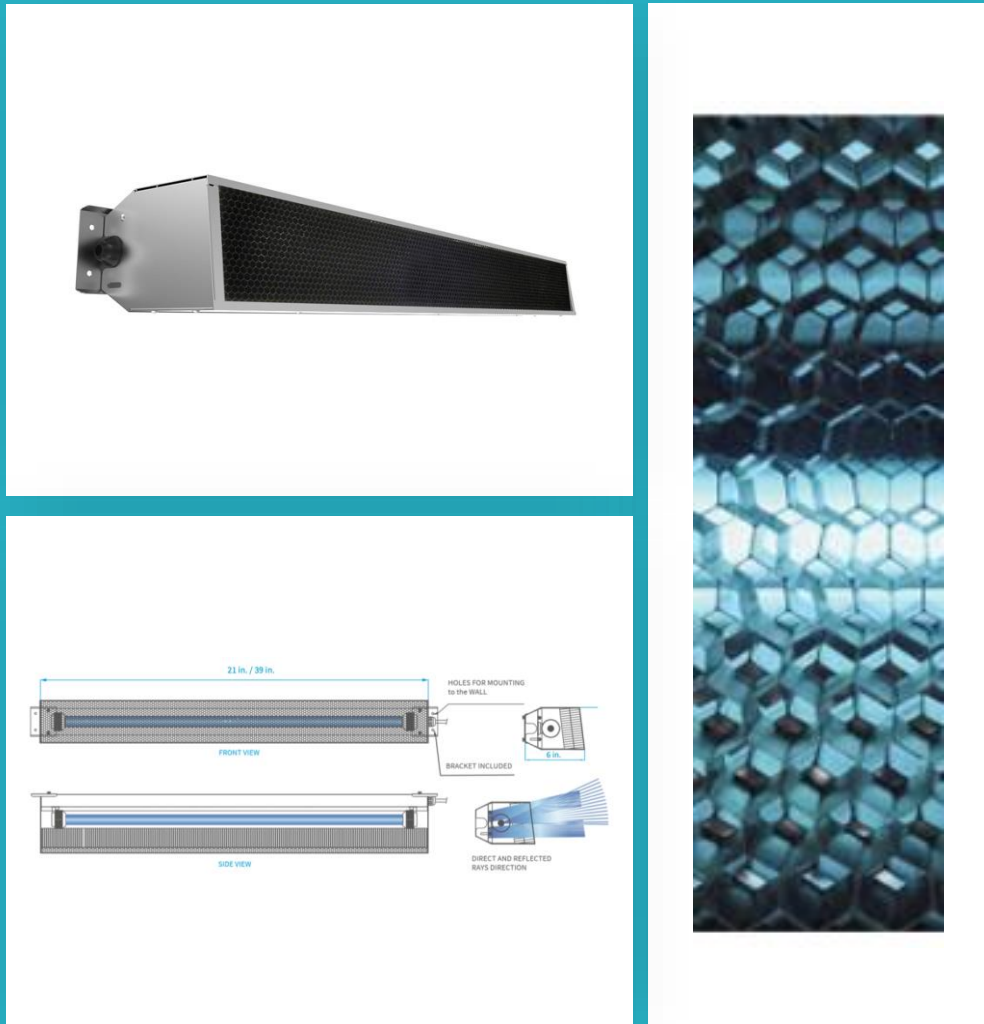
Install these devices on the wall (about 6 feet above ground level) or ceiling near the center of the desired treatment area. The air captured and treated by the device should be able to circulate through the area unhindered. To install the device on the wall, make two holes on the wall by checking the center distance between the mounting holes on the back of the device. Secure the device to the wall (wall fasteners not provided).

Solution: Suggested Products

Upper Air Disinfection

UV-FLOW has a stainless-steel structure and is equipped with directional black honeycomb filter providing a safe disinfection for the room occupants as well as a helpful way to keep the lamps less dusty.

Pointing it towards the ceiling achieves a permanent disinfection of the environmental air, which circulates naturally inside the spaces, following normal convective motions.



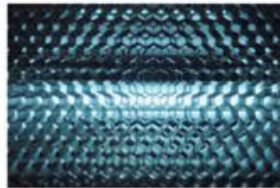
UV Flow: Air Treatment

UV-FLOW

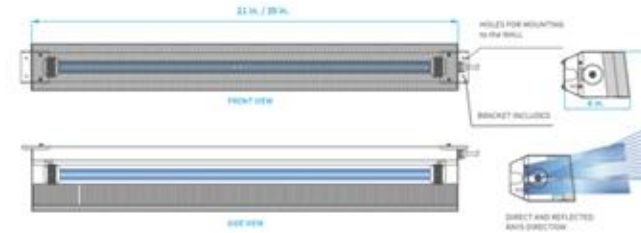
Upper-Air UV Disinfection



UV-FLOW has a stainless steel structure and is equipped with directional black honeycomb filter providing a safe disinfection for the room occupants as well as a helpful way to keep the lamps less dusty. Pointing it towards the ceiling achieves a permanent disinfection of the environmental air, which circulates naturally inside the spaces, following normal convective motions.



TECHNICAL DRAWINGS -



INSTALLATION -

Decide the type of orientation to be given to the air flow: horizontal flow or vertical downward flow

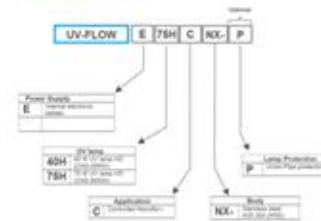
HORIZONTAL FLOW:

The installation must be made by placing the brackets at 7'3" above the floor. In this way the flow will be slightly upwards, which makes possible the continuous disinfection of the air circulating within the room, because of the natural convective motions.

VERTICAL FLOW:

The device must be placed above the doors of the controlled contamination room (clean room), with air flow directed downwards. Use the two supplied stainless steel brackets, anchoring them to the wall with expansion bolts (8 - 10 mm.) or with self-tapping screws. This arrangement generates a vertical air flow which produces barrier against germs. For proper use you should create a decontamination area between two rooms, to be kept under microbiological and hygienic control.

CODES -



SPECIFICATIONS -

UV-FLOW	E40H-C-NX	E75H-C-NX
LAMP LIFETIME (hours)*	± 18.000	± 18.000
CONSUMPTION (Watts)	40	75
EXTERNAL DIMENSIONS LxWxH (in)	21 x 6 x 4.3	39 x 6 x 4.3
WEIGHT (lbs)	4.5	8.8
TREATED AIR (Volume) (ft3)	700 - 1400	1400 - 2300
PROTECTION RATING	IP 55	IP 55



Solution: Suggested Products

Surface Disinfection

The International Ultraviolet Association (IUVA) believes that UV disinfection technologies can play a role in a multiple barrier approach to reducing the transmission of the virus causing COVID-19, SARS-CoV-2, based on current disinfection data and empirical evidence.

UV is a known disinfectant for air, water and surfaces that can help to mitigate the risk of acquiring an infection in contact with the COVID-19 virus when applied correctly.

Solution: Suggested Products

Boxes and Cabinets

Preserve the hygiene of tools, containers and any type of equipment. Commonly used objects in the health sector have the need to be disinfected to maintain high hygiene and quality standards. With the UV-BOX and UV-CABINET products, it is possible to perform the disinfection of equipment and tools in a simple, immediate and safe way, without developing heat, without using liquids and without any contraindications.



Experience: Our Certifications



PROTECT X
 UV

Thank You!

PROTECTX 
INTERNATIONAL

CONTACT US

731 Bielenberg Dr.
Woodbury, MN 55125 USA

+1 (678) 331 5548
info@protectxpro.com

PROTECT X
 UV

Appendix

Competition: Competing Technologies

- **Bipolar Ionization**
- Pulse Xenon
- Dry Hydrogen Peroxide (DHP)

Competition: Bipolar Ionization

- Point Bipolar Ionization (BPI)
 - Used with incomplete combustion in Chimneys & Power Plants for 50-60 year. It has been used to remove odors and treat free radicals to make less harmful radicals.
 - Needlepoint Bipolar Ionization began patented in the late 90s. The theory is to charge the air with positive radicals and negative radicals (ions) that are unstable molecules that desire to be neutral. The ions associate themselves with small particles and other compounds to change the molecular makeup of those particles and compounds by forming new compounds.
 - In fact ASHRAE warns that incomplete reactions can produce unintended harmful compounds.
 - The effectiveness and applicability to human safety is not validated by third party science, only manufacturer's claims.
- Ozon Creation : The needle brings high charge into a small surface and electrostatic fields are produced and ionization happens.
 - Once the discharge happens there is no control over what compound the ionization is producing. If oxygen is in the air ozone will be produced. Ozone is a lung irritant and whenever it is produced, warnings are present for the young, old, and people susceptible to respiratory illness.
 - The EPA has identified ozone as a lung irritant. The acceptable ozone recommendation from the EPA is 0.05 ppm for medical devices.

Competition: Bipolar Ionization

ASHRAE Epidemic Task Force
Filtration & Disinfection
Updated 10-20-2020

https://www.ashrae.org/filte%20library/technical%20resources/covid-19/ashrae-filtration_disinfection-c19-guidance.pdf

Bipolar Ionization/Corona Discharge/ Needlepoint Ionization and Other Ion or Reactive Oxygen Air Cleaners



- Air cleaners using reactive ions and/or reactive oxygen species (ROS) have become prevalent during the COVID-19 pandemic. New devices that are not mentioned elsewhere in this guidance likely fall into this category.
- High voltage electrodes create reactive ions in air that react with airborne contaminants, including viruses. The design of the systems can be modified to create mixtures of reactive oxygen species (ROS), ozone, hydroxyl radicals and superoxide anions.
- Systems are reported to range from ineffective to very effective in reducing airborne particulates and acute health symptoms.
- Convincing scientifically-rigorous, peer-reviewed studies do not currently exist on this emerging technology; manufacturer data should be carefully considered.
- Systems may emit ozone, some at high levels. Manufacturers are likely to have ozone generation test data.

For more information, see the [ASHRAE Position Document on Filtration and Air Cleaning](#) and [CDC Response to ASHRAE ETF on Bipolar Ionization](#).



Competition: Bipolar Ionization



CDC Position on Bipolar Ionization



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ASHRAE does not currently have a Society position on bipolar ionization. However, the ASHRAE ETF did reach out to CDC for their position on the technology. The following is the response from CDC in its entirety:

Thank you for your question. Although this was pointed out in the earlier CDC responses, it is important for me to re-emphasize that CDC does not provide recommendations for, or against, any manufacturer or manufacturer's product. While bi-polar ionization has been around for decades, the technology has matured and many of the earlier potential safety concerns are reportedly now resolved. If you are considering the acquisition of bi-polar ionization equipment, you will want to be sure that the equipment meets UL 2998 standard certification (Environmental Claim Validation Procedure (ECVP) for Zero Ozone Emissions from Air Cleaners) which is intended to validate that no harmful levels of ozone are produced. Relative to many other air cleaning or disinfection technologies, needlepoint bi-polar ionization has a less-documented track record in regards to cleaning/disinfecting large and fast volumes of moving air within heating, ventilation, and air conditioning (HVAC) systems. This is not to imply that the technology doesn't work as advertised, only that in the absence of an established body of evidence reflecting proven efficacy under as-used conditions, the technology is still considered by many to be an "emerging technology". As with all emerging technologies, consumers are encouraged to exercise caution and to do their homework. Consumers should research the technology, attempting to match any specific claims against the consumer's intended use. Consumers should request efficacy performance data that quantitatively demonstrates a clear protective benefit under conditions consistent with those for which the consumer is intending to apply the technology. Preferably, the documented performance data under as-used conditions should be available from multiple sources, some of which should be independent, third party sources.



Competition: Bipolar Ionization



“Convincing scientifically-rigorous, peer-reviewed studies do not currently exist on this emerging technology; manufacturer data should be carefully considered.” - ASHRAE

“...needlepoint bi-polar ionization has a less-documented track record in regards to cleaning/disinfecting large and fast volumes of moving air within heating, ventilation, and air conditioning (HVAC) systems.” – CDC Response

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Competition: Competing Technologies

- Bipolar Ionization
- **Pulse Xenon**
- Dry Hydrogen Peroxide (DHP)

Competition: Pulsed Xenon

History:

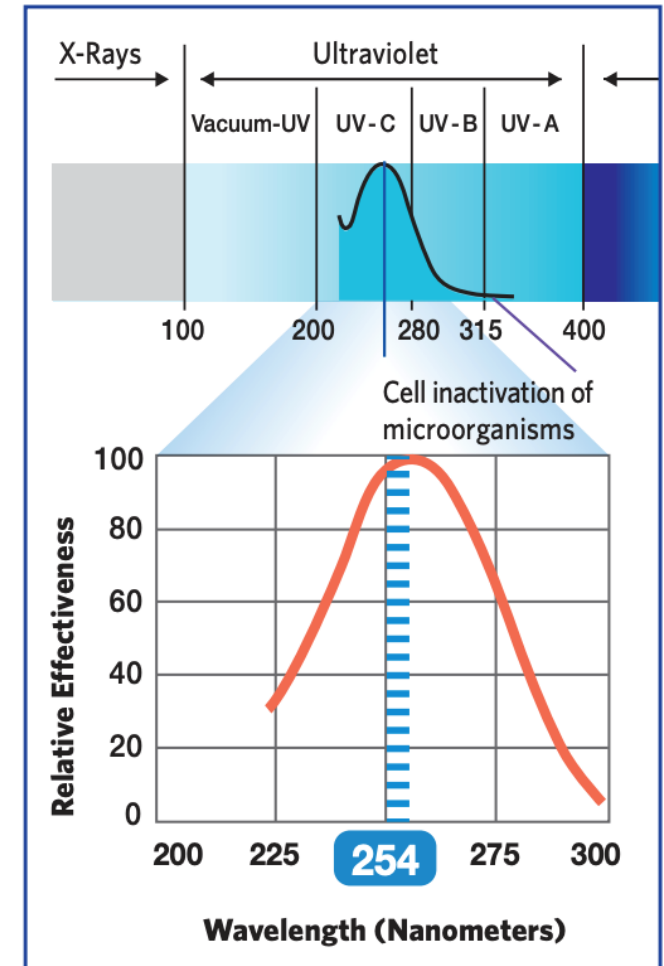
- Patented in Japan in 1980 and extended to US in 1984.
 - *“A method of sterilization effected by using flash discharge ultraviolet lamp which provides a very large instantaneous luminescence output, destroying at an increase sterilization rate and in a reduced irradiation time micro-organisms, particularly Aspergillus niger and those organisms in the lower layers which have been difficult to destroy by the lamp method of the prior art.”*
- Studied in the mid 80’s to gather data on various biological agents
- In 1996 proposed and adopted by the US Food and Drug administration for food processing
- Commercialized since 2000

Competition: Pulsed Xenon



Studies demonstrate that the effective UV wavelength for killing microorganisms is near 260nm. At this wavelength, pyrimidine dimerization, the primary mechanism for microorganism inactivation by UV-C light, occurs. The EPA reports that, “Pyrimidine dimers are the most common form of nucleic acid damage, being 1000 times more likely to occur than [other mechanisms of action].” Thus, pulsed-xenon UV devices that emit broad-spectrum UV actually generate non-useful UV energy, which is a detriment to pathogen reduction. Additionally, other possible mechanisms of cellular damage, as described by pulsed-xenon manufacturers, are only marginally relevant for pathogen reduction. Furthermore, studies have shown that low-pressure mercury UV lamps operate at a significantly higher efficiency than pulsed-xenon UV lamps.

Schaefer, Raymond et al. Pulsed UV lamp performance and comparison with UV mercury lamps. J. Environ. Eng. Sci. Vol. 6, 2007: 303-310



Competition: Pulsed Xenon

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Pulsed Xenon (Pulsed UV)

- High-powered UV lamps (generally containing xenon gas) used in rapid pulses of intense energy.
- Emits a broad band of visible and ultraviolet wavelengths, with a significant fraction in the UV-C band.
 - Uses significantly higher power outputs than usual UV-C techniques
 - Inactivates viruses, bacteria and fungi using the same mechanisms as standard UV-C systems
- Typically used for healthcare surface disinfection but can be used in HVAC systems for air and surface disinfection.

For more information, see the [FAQs on Germicidal Ultraviolet \(GUV\)](#) published by the Illuminating Engineering Society (IES) Photobiology Committee.



Competition: Pulsed Xenon



A 2015 Study: **Evaluation of a Pulsed Xenon Ultraviolet Disinfection System for Reduction of Healthcare-Associated Pathogens in Hospital Rooms**

“Continuous UV-C achieved significantly greater log₁₀CFU reductions than PX-UV irradiation on glass carriers.”

Citation: Michelle M. Nerandzic, Priyaleela Thota, Thriveen Sankar C., Annette Jencson, Jennifer L. Cadnum, Amy J. Ray, Robert A. Salata, Richard R. Watkins and Curtis J. Donskey (2015). Evaluation of a Pulsed Xenon Ultraviolet Disinfection System for Reduction of Healthcare-Associated Pathogens in Hospital Rooms. *Infection Control & Hospital Epidemiology*, 36, pp 192-197 doi:10.1017/ice.2014.36

Competition: Pulsed Xenon



Competitive Advantages:

- Using Pulsed Xenon is “like hunting for ducks with a bazooka”
- It is not validated by third party science for air disinfection
- The lamps can not be replaced, the entire fixture must be discarded
- More on Pulsed Xenon safety and applicability IES Committee Report: Germicidal Ultraviolet (GUV) – Frequently Asked Questions (referenced by ASHRAE):
<https://media.ies.org/docs/standards/IES-CR-2-20-V1-6d.pdf>

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Competition: Hydrogen Peroxide

Vaporized Hydrogen Peroxide

- Can not be used in the presence of people.
- Air must be scrubbed before people can be present.

Dry Hydrogen Peroxide (DHP)

- Hydrogen peroxide gas is not vapor.
- Is used in the presence of people.
- Claims to be effective at 1/25th the OSHA recommended limit for human exposure.
- Microbes attach to H₂O₂ because it is similar to the structure of water. Without the water the microbes die sooner.
- Typically results are tested over hours, days, and weeks.
- Not a great deal of third-party evidence developed yet.

