
LIGHT PROGRESS
hvac

LIGHT PROGRESS®

studies, develops, projects and produces

Ultraviolet Germicidal Irradiation

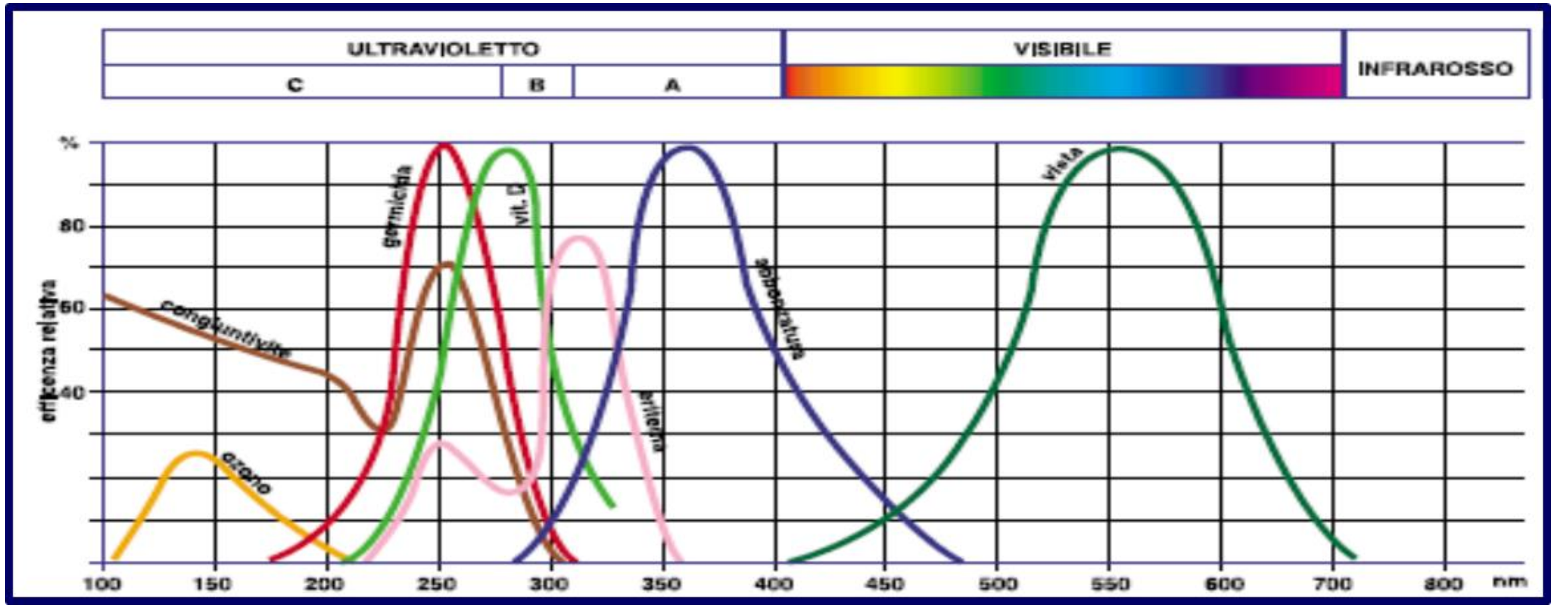
devices, since

What does UVGI mean ?

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-C (short-wave) from 100 to 280 nm

The absorption of a UV photon by the DNA of microrganisms 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**, **Moulds** 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.

LIGHT PROGRESS

operates in different fields and turns Ultraviolet Technology into real Solutions, providing a Specific Device for every application needed.

HVAC

Water

Health

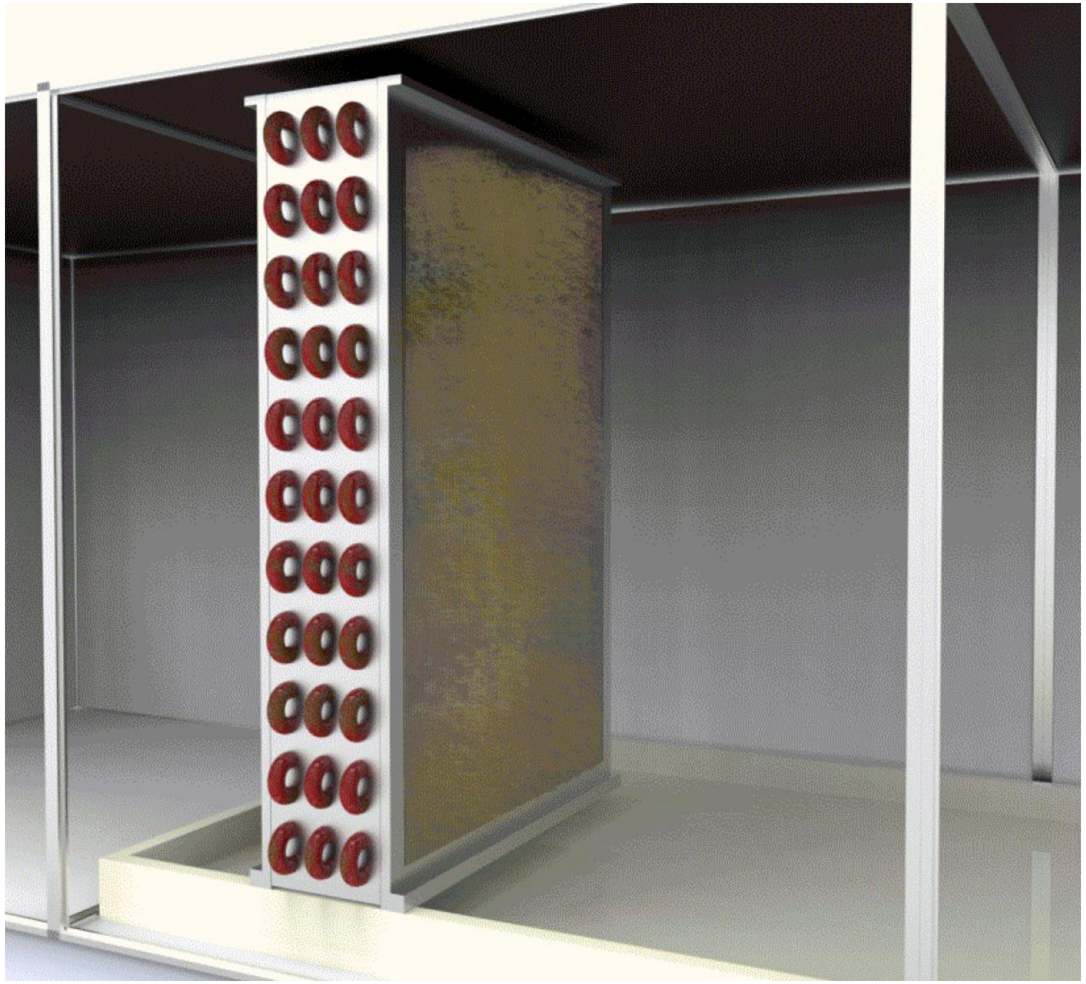
Food

Smell reduction

What are most common HVAC issues ?

Air-conditioning systems, and especially the A.H.U. (Air handling unit), are the perfect microcosm for the **growth and distribution of microbial organisms, pathogens, spores, moulds**, etc.

What happens inside HVAC Systems ?



Air recirculation, temperature fluctuations and humidity allow microorganisms to combine with each other in complex ways and settle all over surfaces inside the AC system in the form of an unpleasant **biofilm**.

This biofilm adheres particularly in between the fins of heat exchangers (coils), it settles in water collection tanks and clog the filters in the ducts.

A biofilm less than .5 mm can reduce system efficiency up to 40%.

What happens inside HVAC Systems ?

- Proliferation of **BACTERIA, VIRUSES, PATHOGENS, SPORES MOULDS,** etc.
- AC system inner surfaces are covered by an unpleasant **BIOFILM**
- Coils and filters are **CLOGGED** and loose their efficiency
- Maintenance interventions with **CHEMICAL** are frequent and necessary

Benefits of using LIGHT PROGRESS devices

HEALTH

ECOLOGY

COSTS

LIGHT PROGRESS

IT ELIMINATES COMPLETELY ALL PATHOGENS - MICROBIAL LOAD

Kills Legionella, TBC, viruses, moulds and mites that contaminate HVAC air and surfaces.

IMPROVES A.H.U. EFFICIENCY, SAVING ENERGY

UVGI maintains system clean, keeping inner components' good performances and operation level.

IT IS ECOLOGICAL, SAFE AND ENSURES HIGH AIR QUALITY LEVEL

Even without a dersistent and expensive A.H.U. cleaning intervention schedule.

NO CHEMICALS!

UVGI is a physical method that restrains the use of chemical cleaning products, useful credit for LEED CERTIFICATION Indoor Environmental quality (Green Building Council).

YOU CAN USE IT EVERYWHERE!

Healthcare, Food Industries, Commercials, Hotel and Restaurants, Public Transportation, Airports, Schools and Universities, but also Residential and Private Buildings.

EASY-TO FIT, YOU CAN TRUST ON US!

Our Team sizes and projects the most suitable layout for your needs with a specific software. Our devices are adaptable and easy to apply.

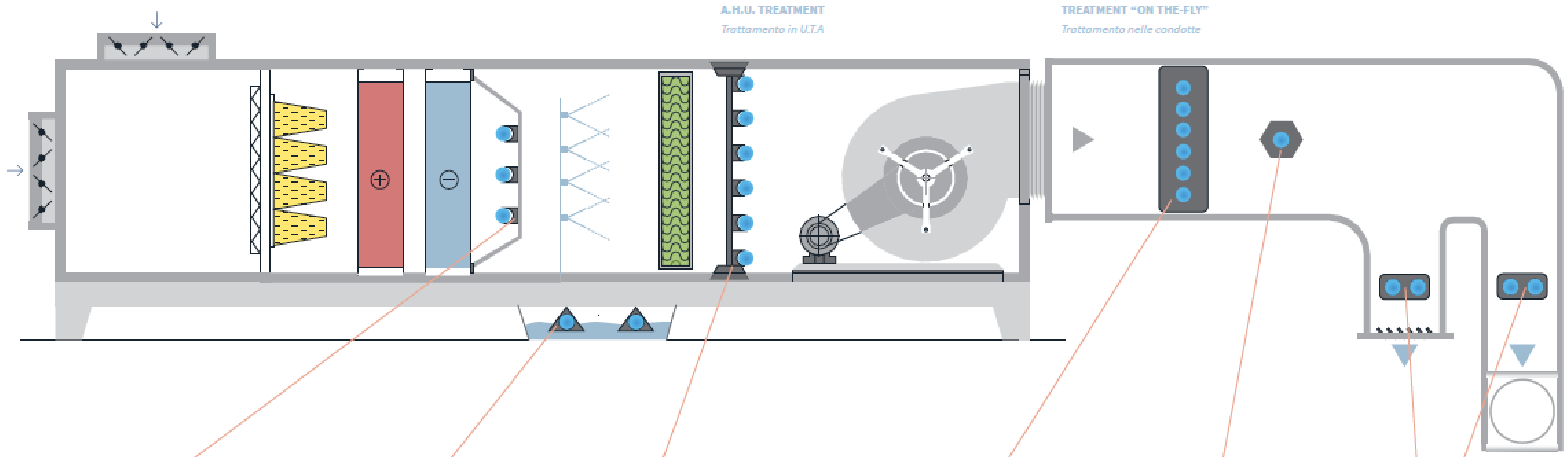
What are LIGHT PROGRESS devices

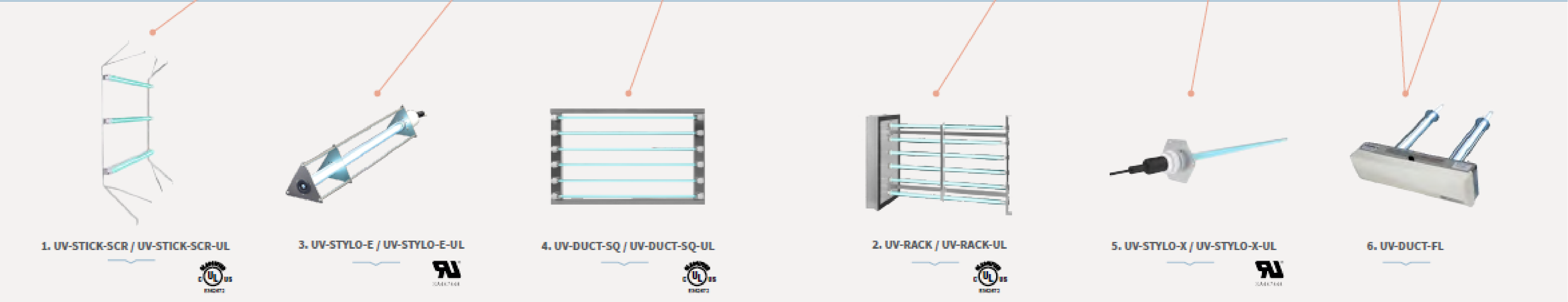
designed to improve

Indoor Air Quality

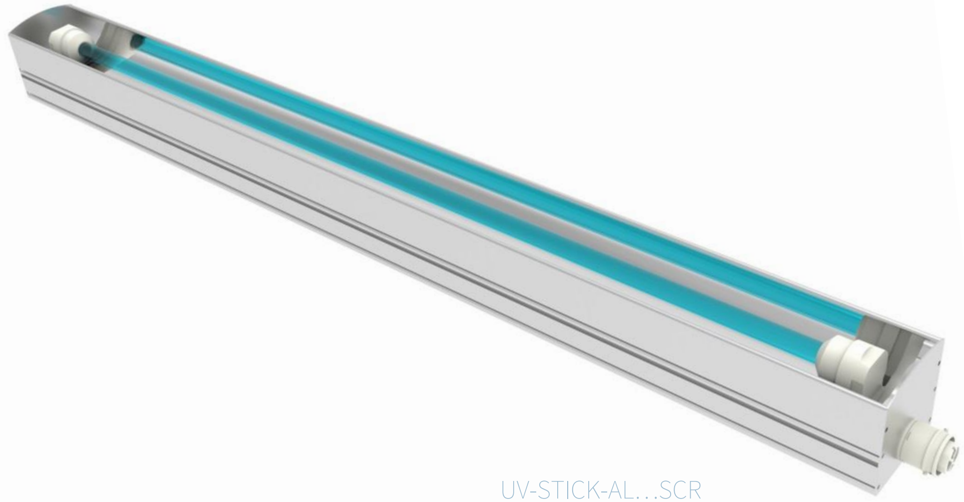
and comfort ?

Application Scheme

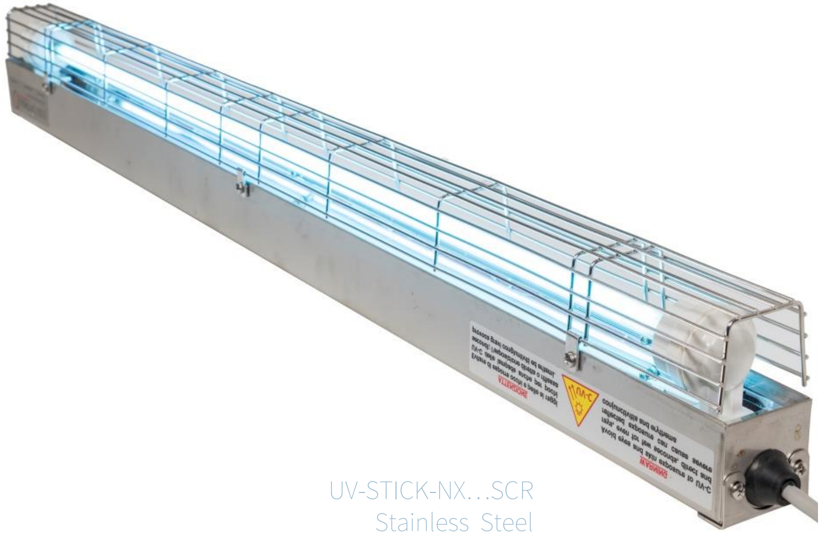




UV-STICK-SCR



UV-STICK-AL…SCR
Aluminum



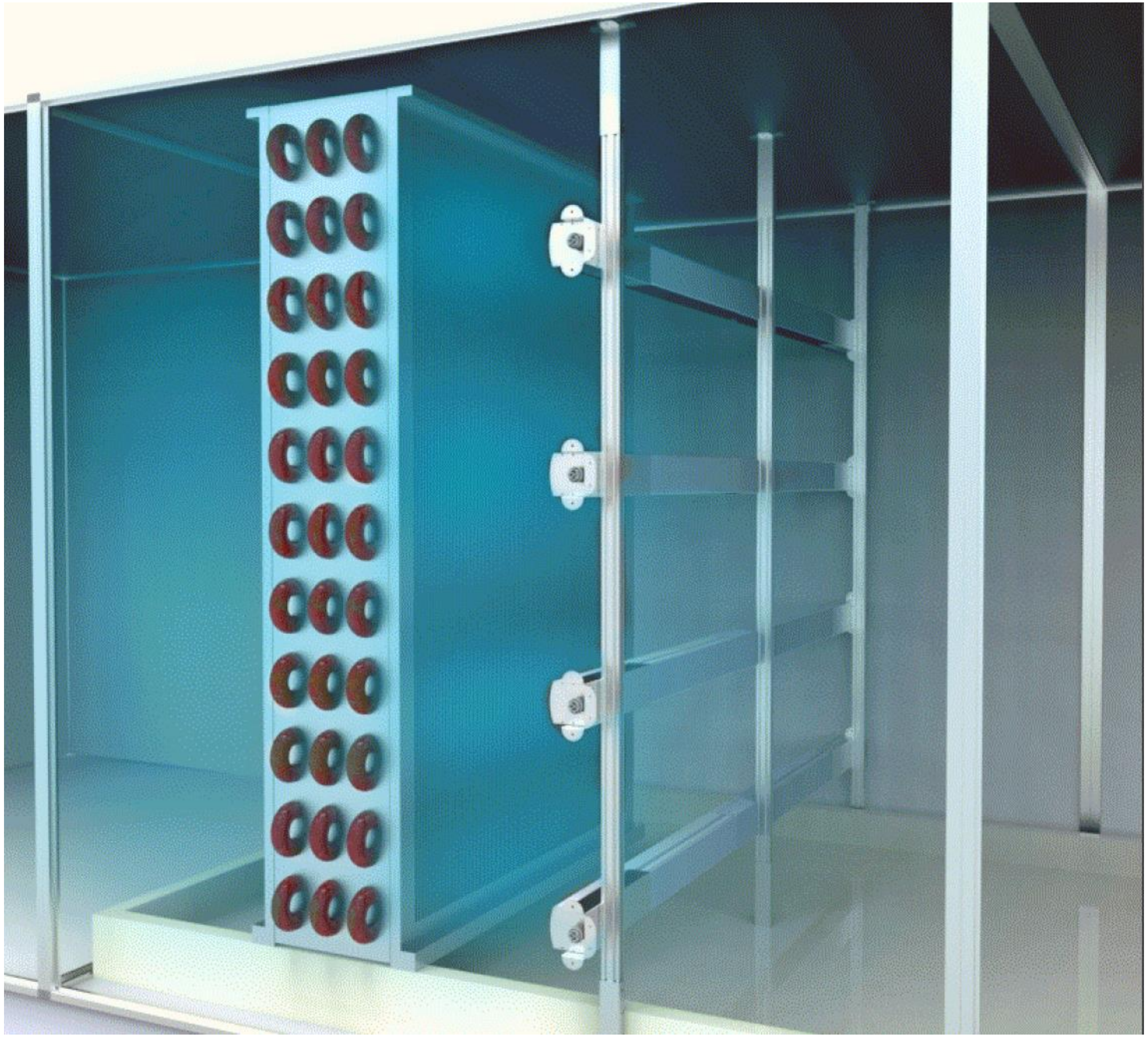
UV-STICK-NX…SCR
Stainless Steel

Specific for Coils treatment, it avoids settling and proliferation of Biofilm on the surfaces.

Special mirror bright reflector to increase UVGI power.

Available in SS or Aluminum.

Ballast on-board.



UV-STICK-SCR

Mounting kit is provided to fit every AHU, UV-STICK-SCR is very flexible and easy to apply, the serial connection of more than 10 devices allows you to switch ON all the systems, through 1 single power supply cable.

Signals and alarms can be checked on a control board.

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N° COLUNM Width (inside AHU) / ROWS Nr Height (inside AHU)	1 From 650 to 2000 mm	2 From 1500 to 3700 mm	3 From 3000 to 5300 mm
A From 400 to 1000 mm	A1		
B From 1000 to 2000 mm	B1	B2	
C From a 2000 to 3000 mm		C2	C3
D From 3000 to 4000 mm			D3

We designed 6 different **application layouts** to fit all common AHU sizes.

These solutions **include also the mounting kit** to install the devices on AHU walls;

The 6 different kits have two options to link the systems to AHU's walls:

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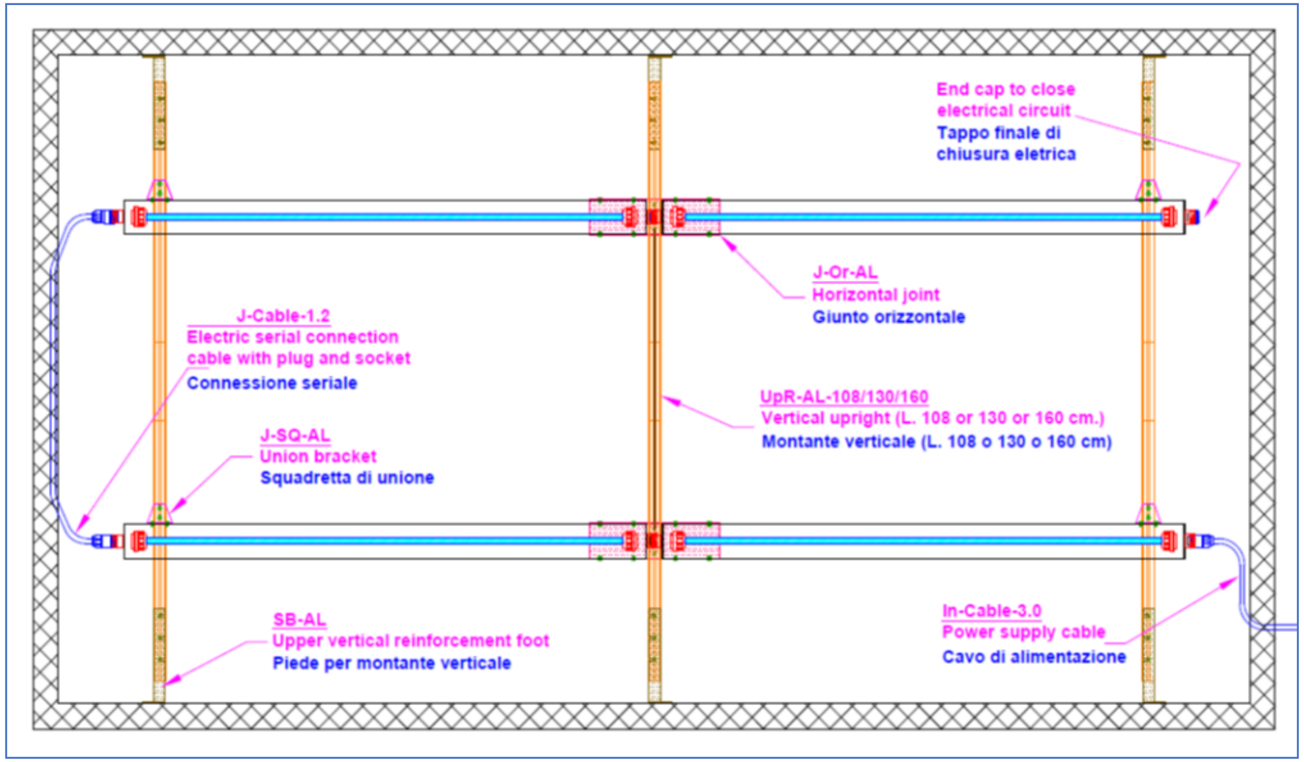
<u>-V version</u> = include only vertical frames (uprights).
It is easier to apply; devices are linked inside the AHU only on AHUs' floor and ceiling.



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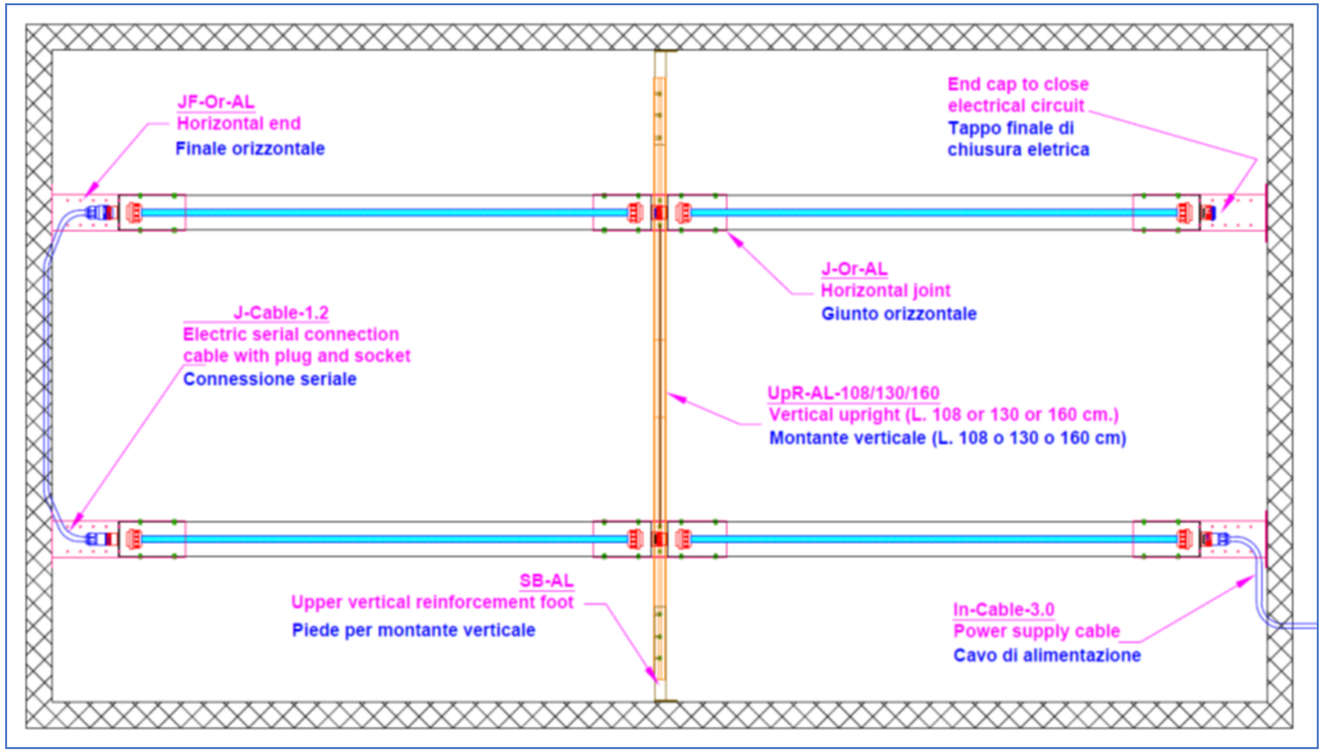
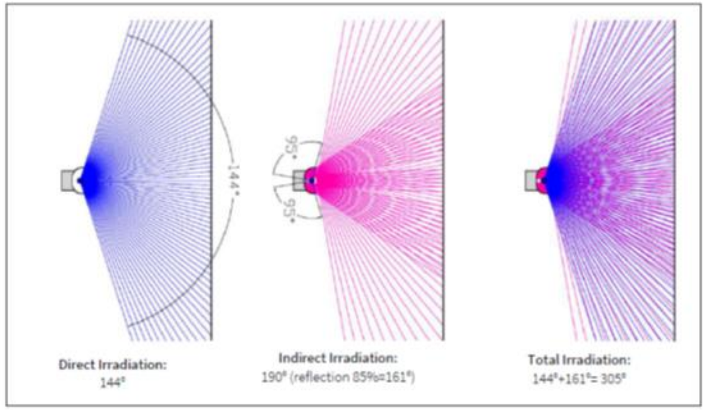
-H version = mounting kit include both horizontal and vertical links.
This solution provide less pieces, but the fixing phases could be more complicated, (especially in small AHUs);

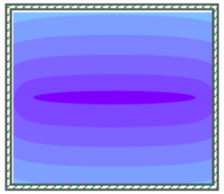


Reduction 99%		
	Aspergillus N.	Legionella Pn.
1	6 min.	12 s
2	7 min.	14 s
3	8 min.	16 s
4	9 min.	18 s
5	10 min.	20 s
6	11 min.	22 s
7	12 min.	24 s
8	13 min.	26 s

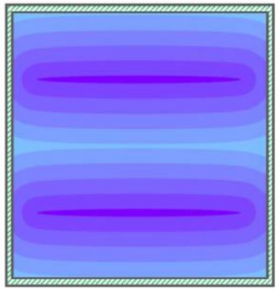


Reflection coefficient
Direct = 40%
Reflected = 53% with 85% reflection
UV-C power transmitted to the Coil = 85%

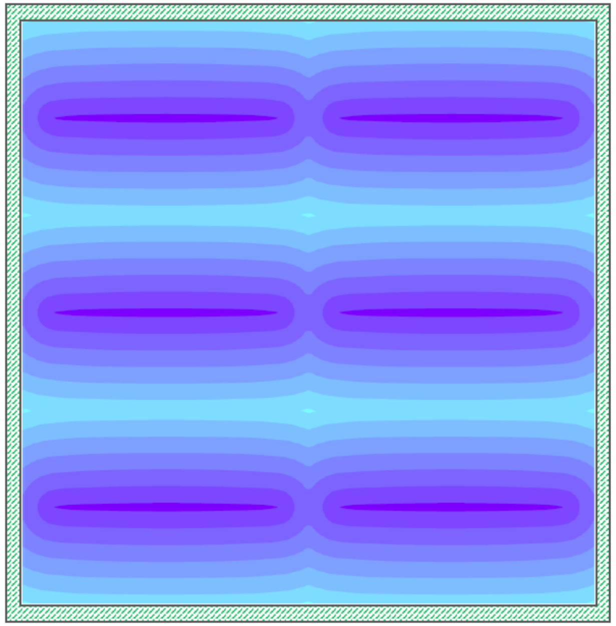
IRRADIATION MAP: this simple schema show you the distribution and intensity of UV-C rays toward the coil, even though you can reach 99% of microbial load reduction within seconds/minutes, always remember that UV light has to be always turned ON while Air Conditioning System is working!



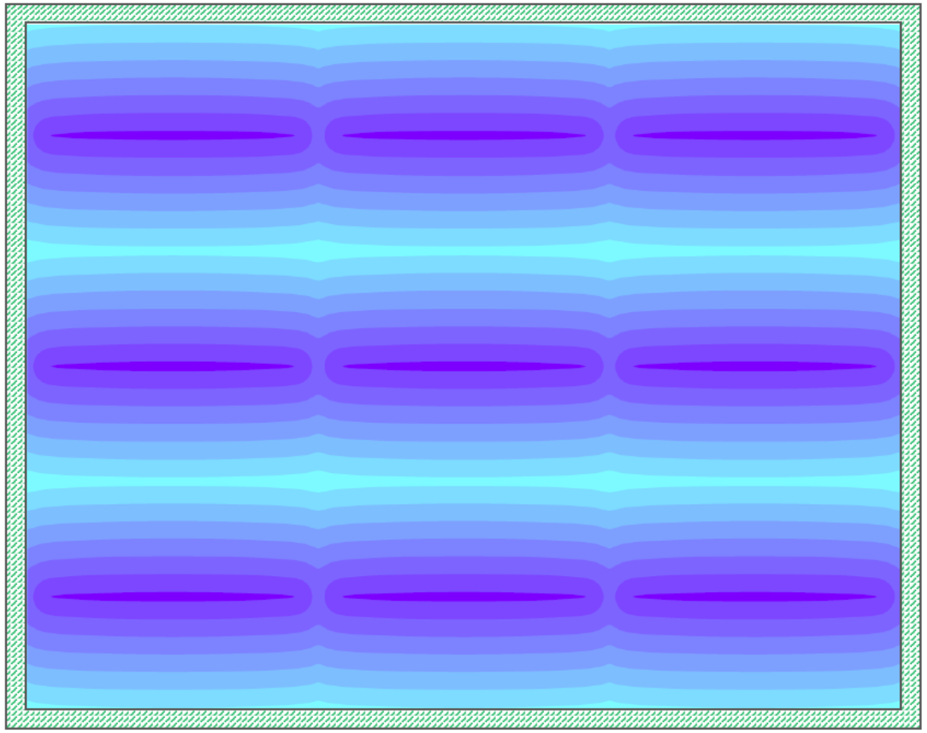
A 1



B 1



C 2



D 3

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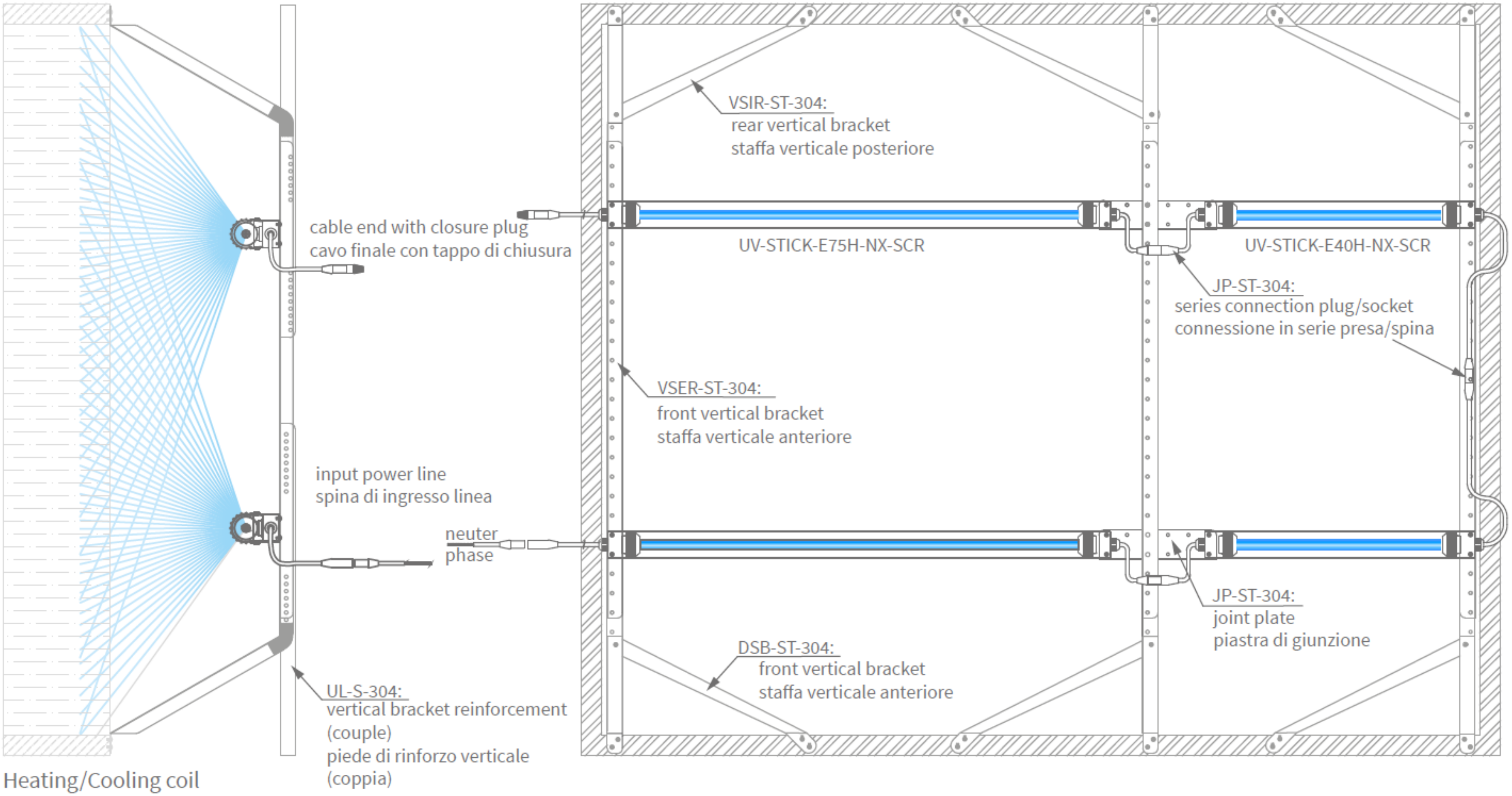
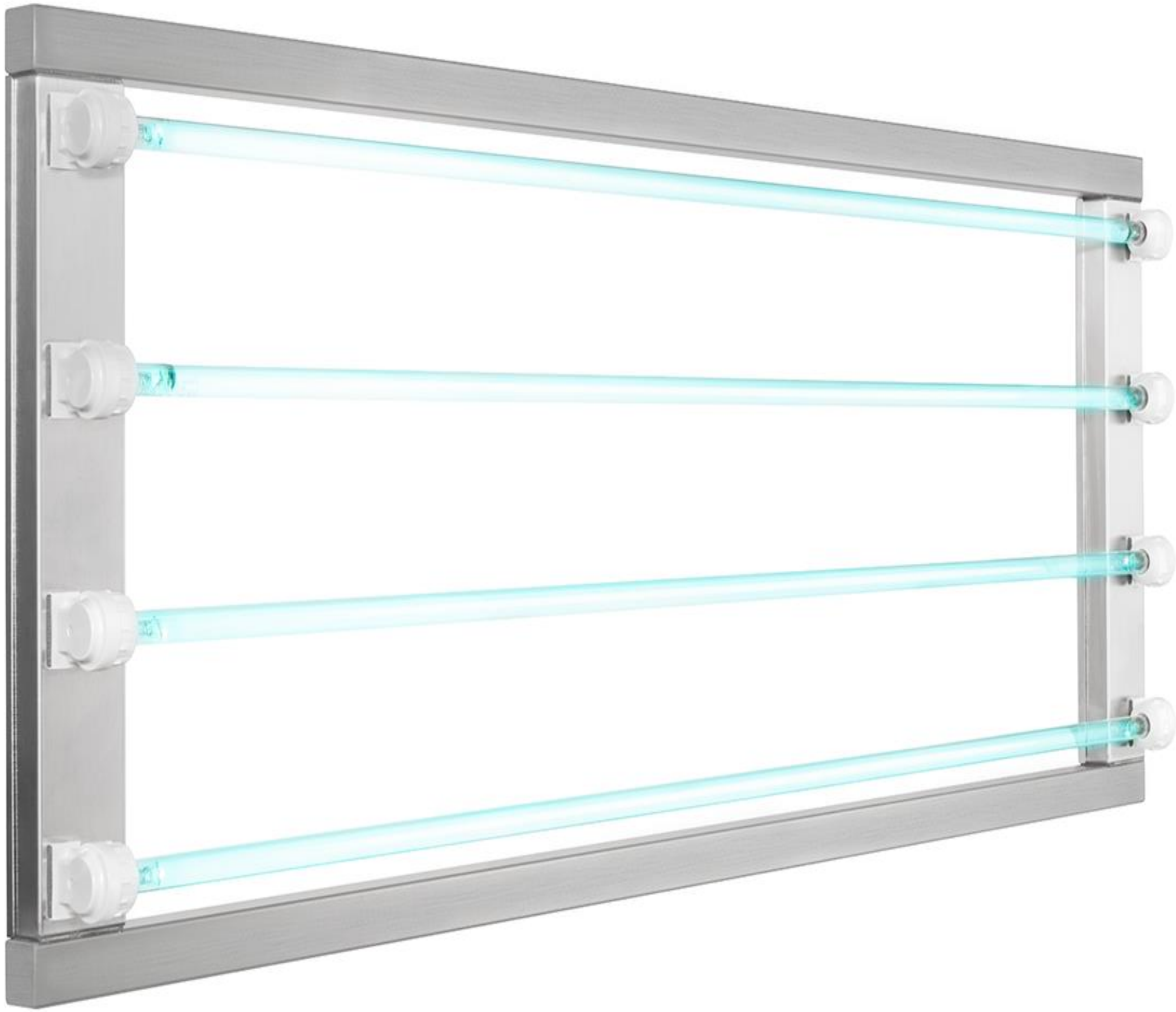
INSTALLATION LAYOUT: it is possible to apply our systems also linking them directly on the coil surface, in this way you can be sure that the distance between coil and UV-C lamp is fixed at 25 cm c.a.
(only for UV-STICK-NX-SCR)



	STERIL-AIRE	SANUVOX	LIGHT PROGRESS
EMISSION LEVEL	✓	✓	✓
BUILT-IN POWER SUPPLY	✓	✗	✓
BI-PIN lamp	✗	✗	✓
AERODYNAMIC REFLECTOR	✗	✓	✓
MIRROR BRIGHT REFLECTOR	✗	✗	✓
MAP-PATHOGEN-TIME	?	✓	✓
IP55 PROTECTION	✗	✗	✓
UL CERTIFICATE	✓	✓	✓
ready-to-plug SERIAL CONNECTORS	✗	✗	✓
A.H.U. WALLS FIXTURE	✗	✓	✓
A.H.U. COIL FIXTURE	✓	✗	✓
IN-DUCT INSTALLATION PARALLEL TO AIR FLOW	✗	✓	✓
IN-DUCT INSTALLATION PERPENDICULAR TO AIRFLOW	✓	✗	✓

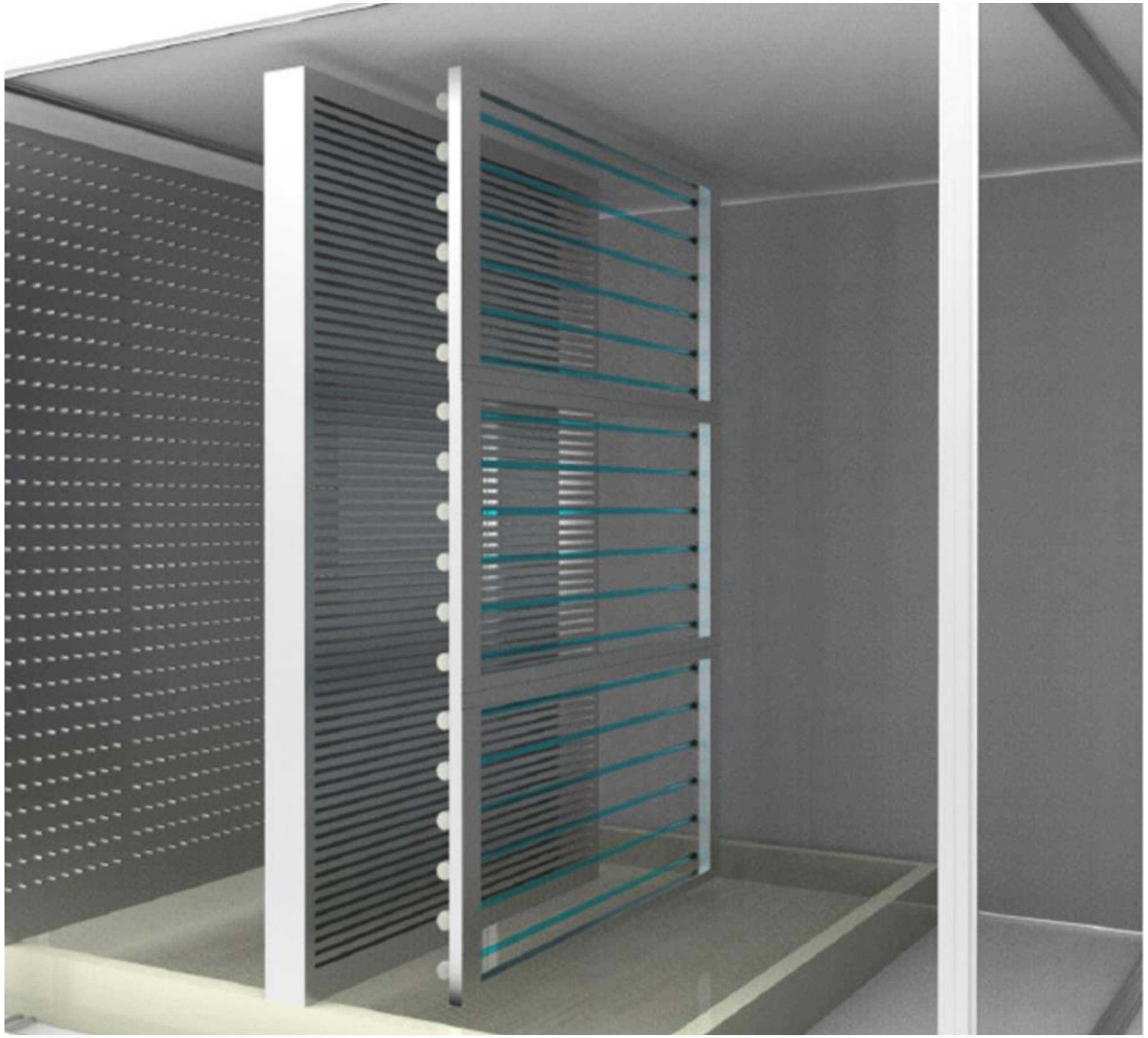
UV-DUCT-SQ



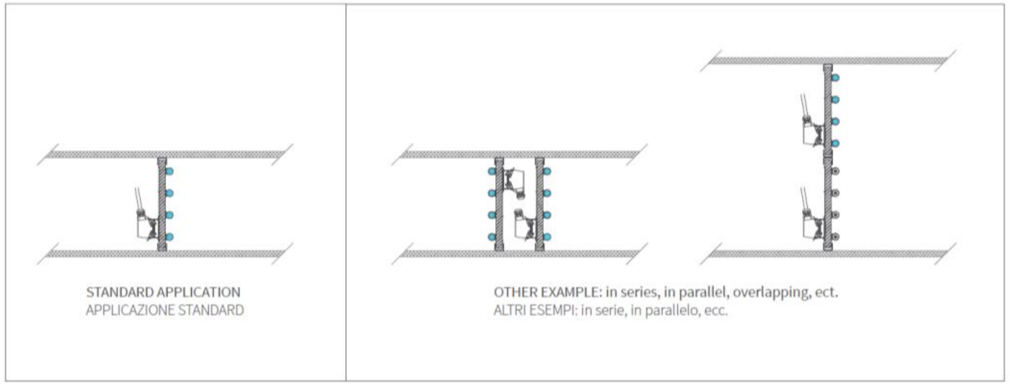
Square-grid device, it fits everywhere because its sizes are the same as common filters .

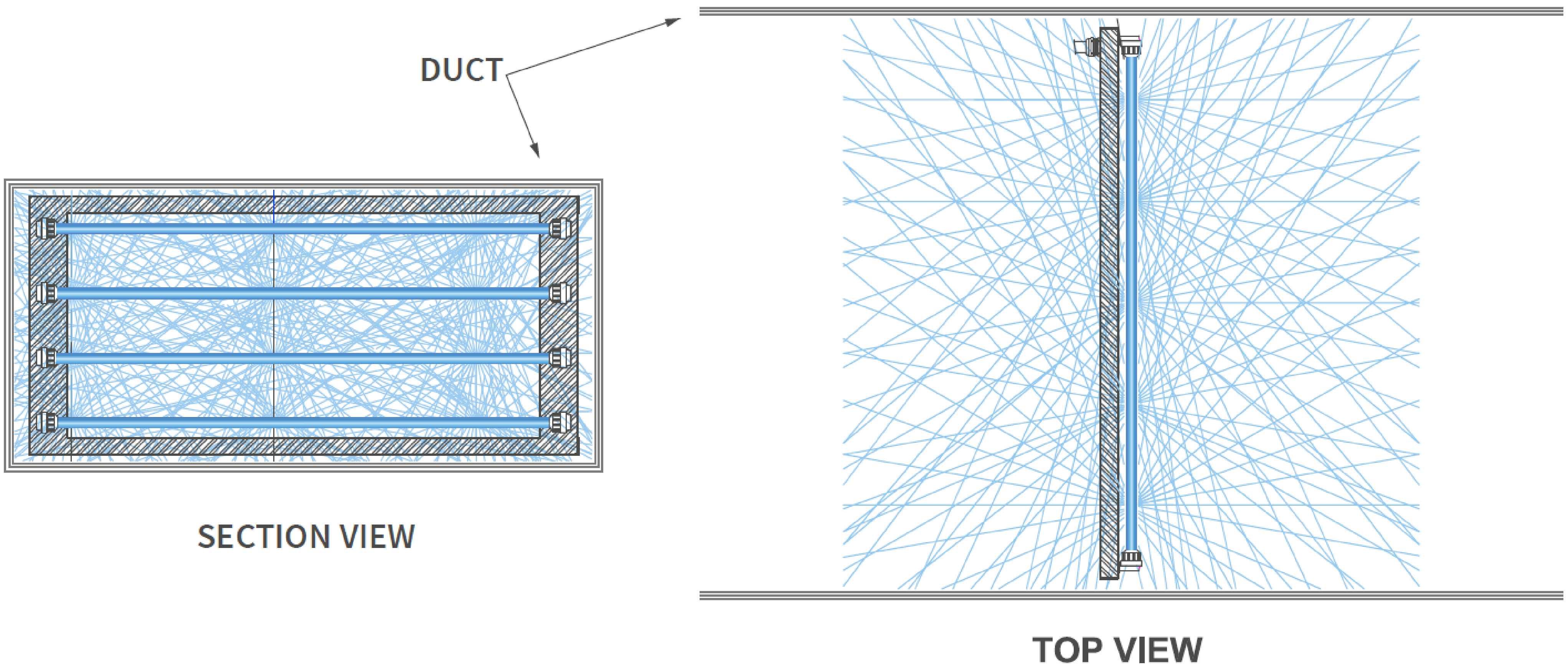
Signals and alarms can be checked on the control board, where ballast is also located.

UV-DUCT-SQ

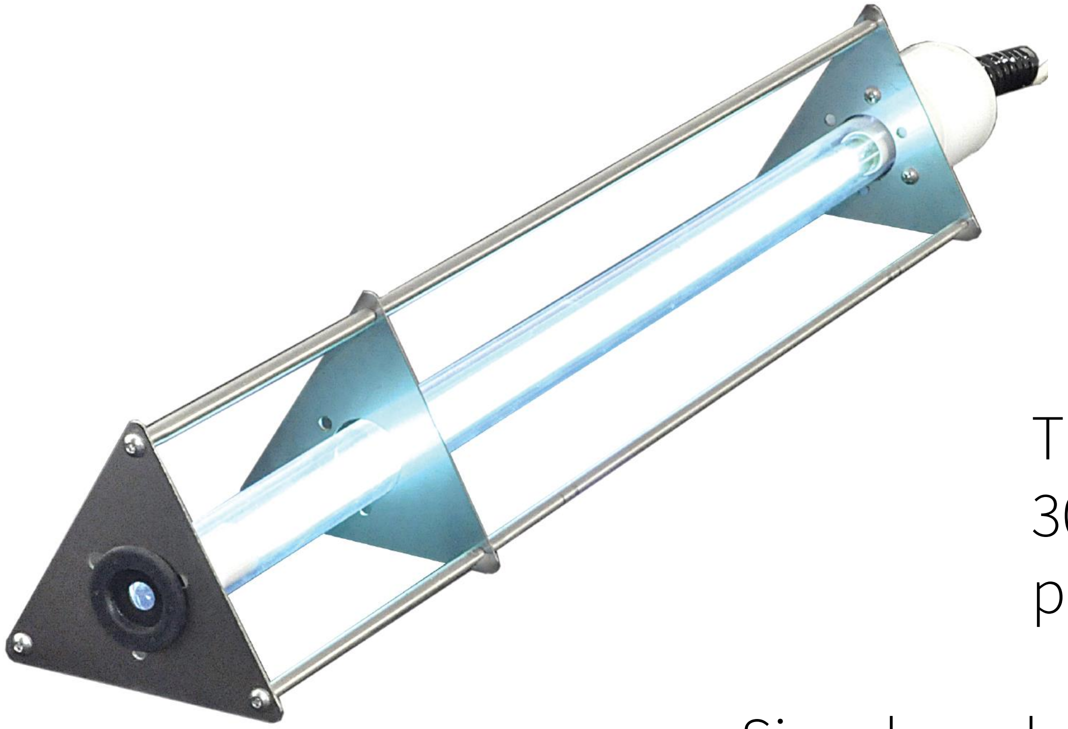


UV-DUCT-SQ has been designed to adapt to different sizes and ducts sections, placing one device to cover the surface or matching more devices together side-by-side, one on the other (overlapping), in series, etc. using scroll-in “U”profile, like filters.




DUCT
SECTION VIEW
TOP VIEW

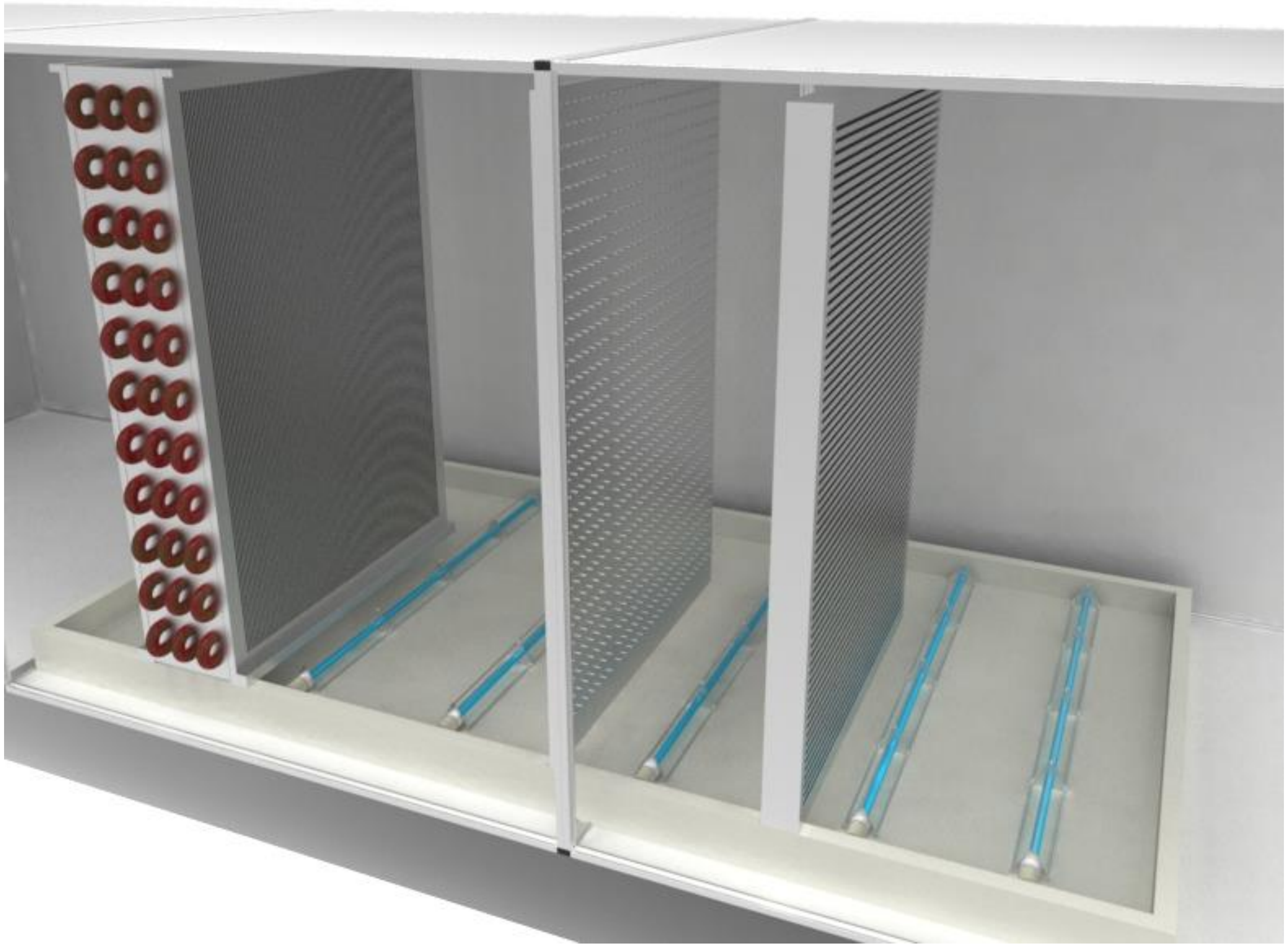
UV-STYLO-E



Installed inside the humidifier collection tanks submerging the device (up to 10 m) or under water splashes.

Triangular frame in stainless steel AISI 304 in which is housed a UV-C lamp protected by a pure quartz sleeve.

Signals and alarms can be checked on the control board, where ballast is also located.



UV-STYLO-E

Water sprayed inside AC system spreads airborne diseases inside buildings, through infectious particles breathable in air, some of them are very dangerous and lethal, such as *Legionella Pneumophila* and *TBC*.

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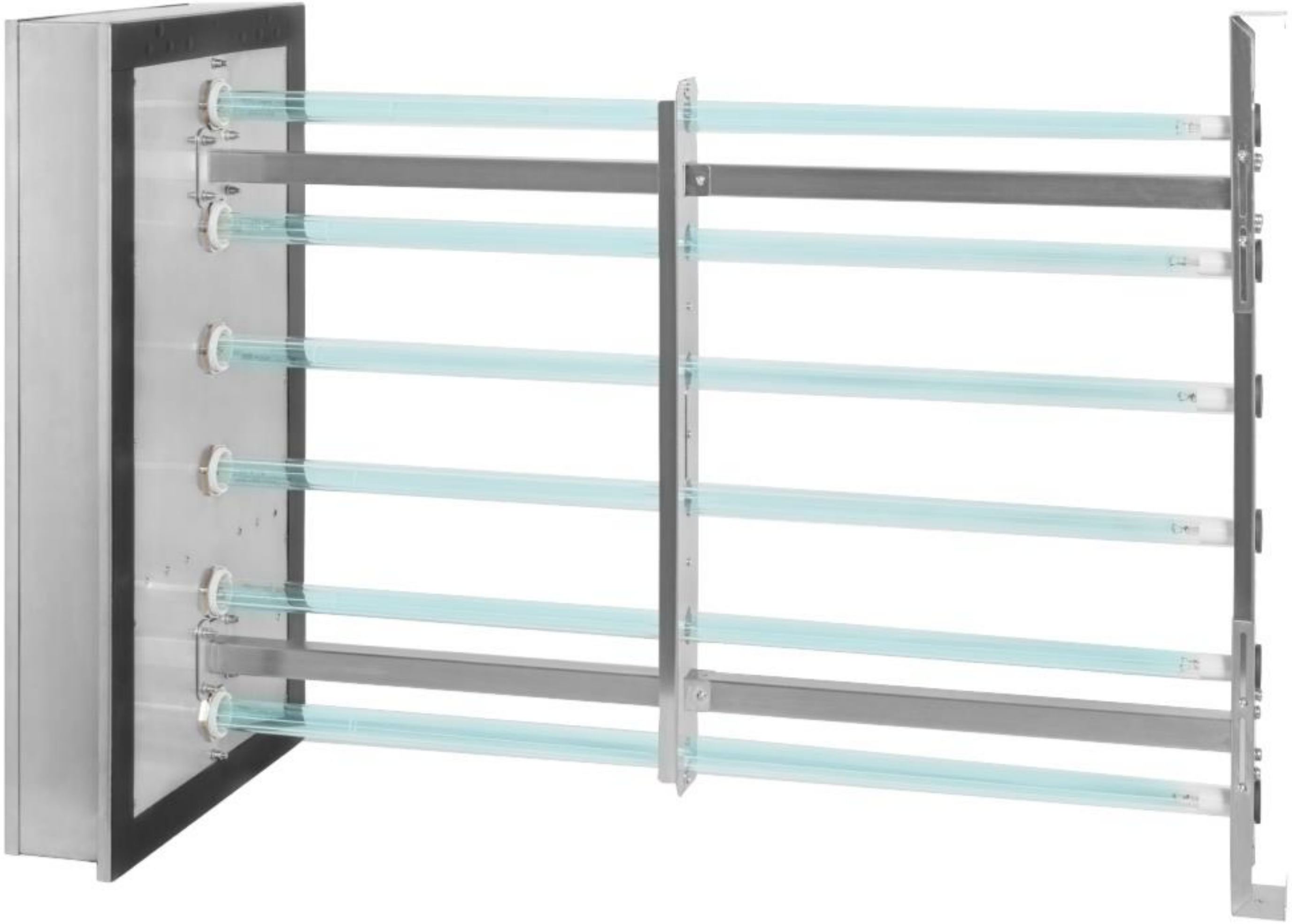
UV-RACK



Designed for in-duct air treatment, it may be applied inside final AHU portion to sanitize surfaces, too.

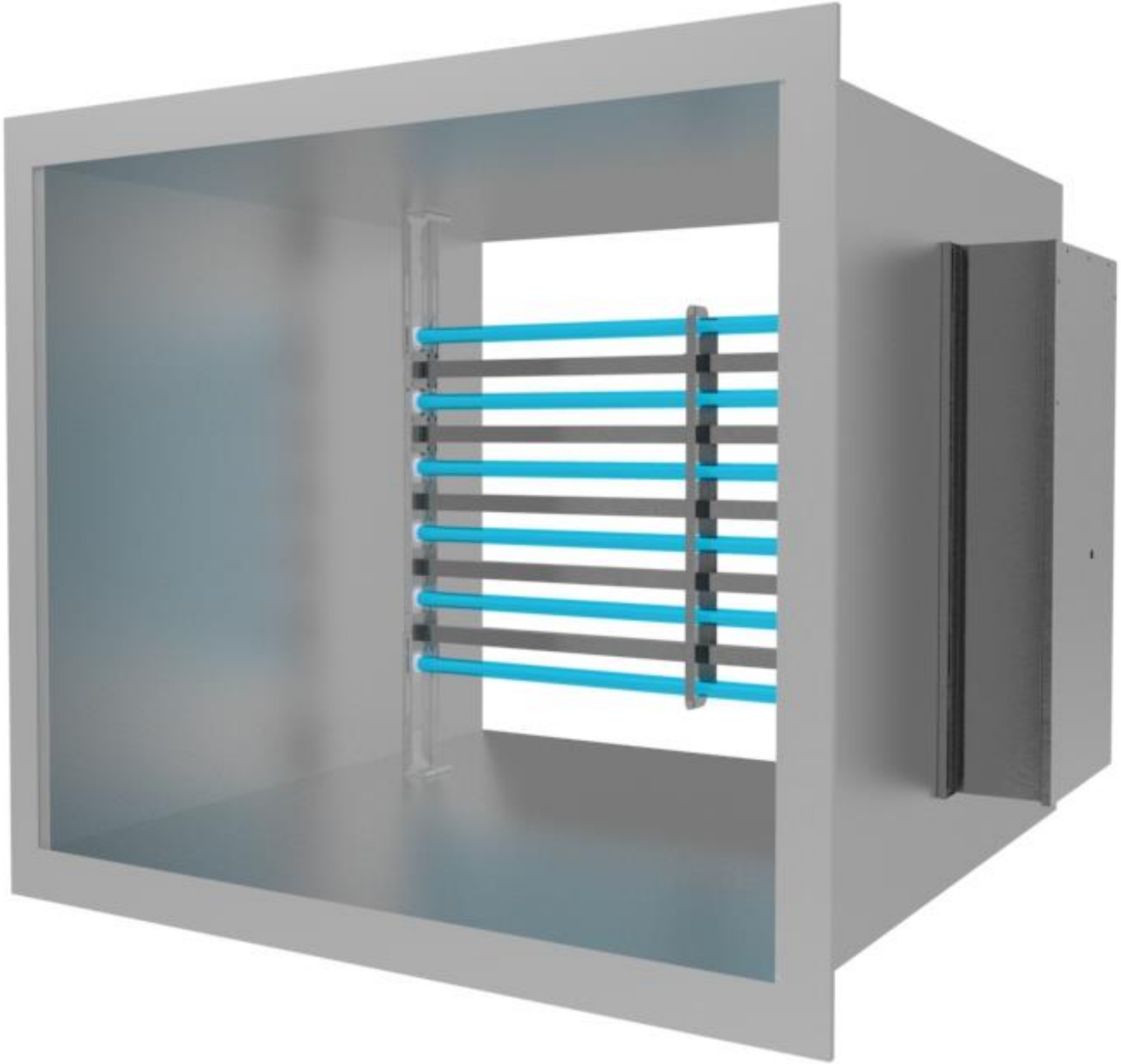
Adjustable feet to fit duct sizes

Ballast on-board.

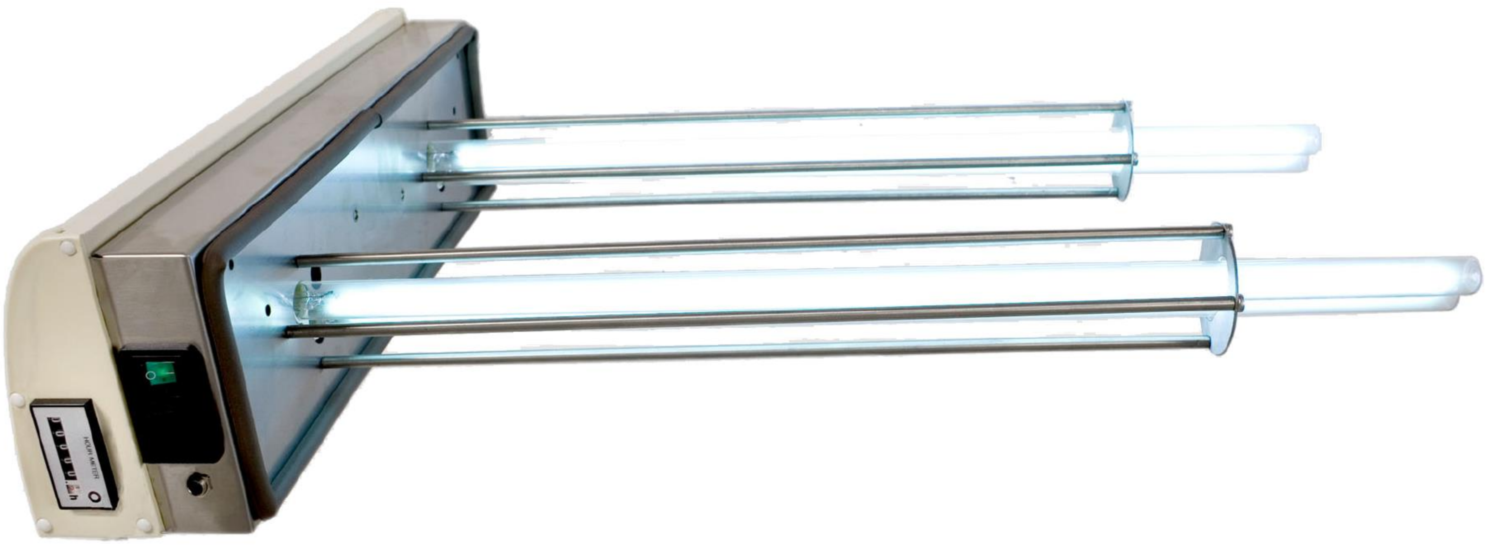
CE cULus RoHS

UV-RACK

UV-RACK has been designed to adapt to different sizes and ducts sections, it is very compact, and its installation requires just a few simple steps: insert the lamps within the air duct through a cut and screw UV-RACK case on the external channel wall, and you're done!



UV-DUCT-FL

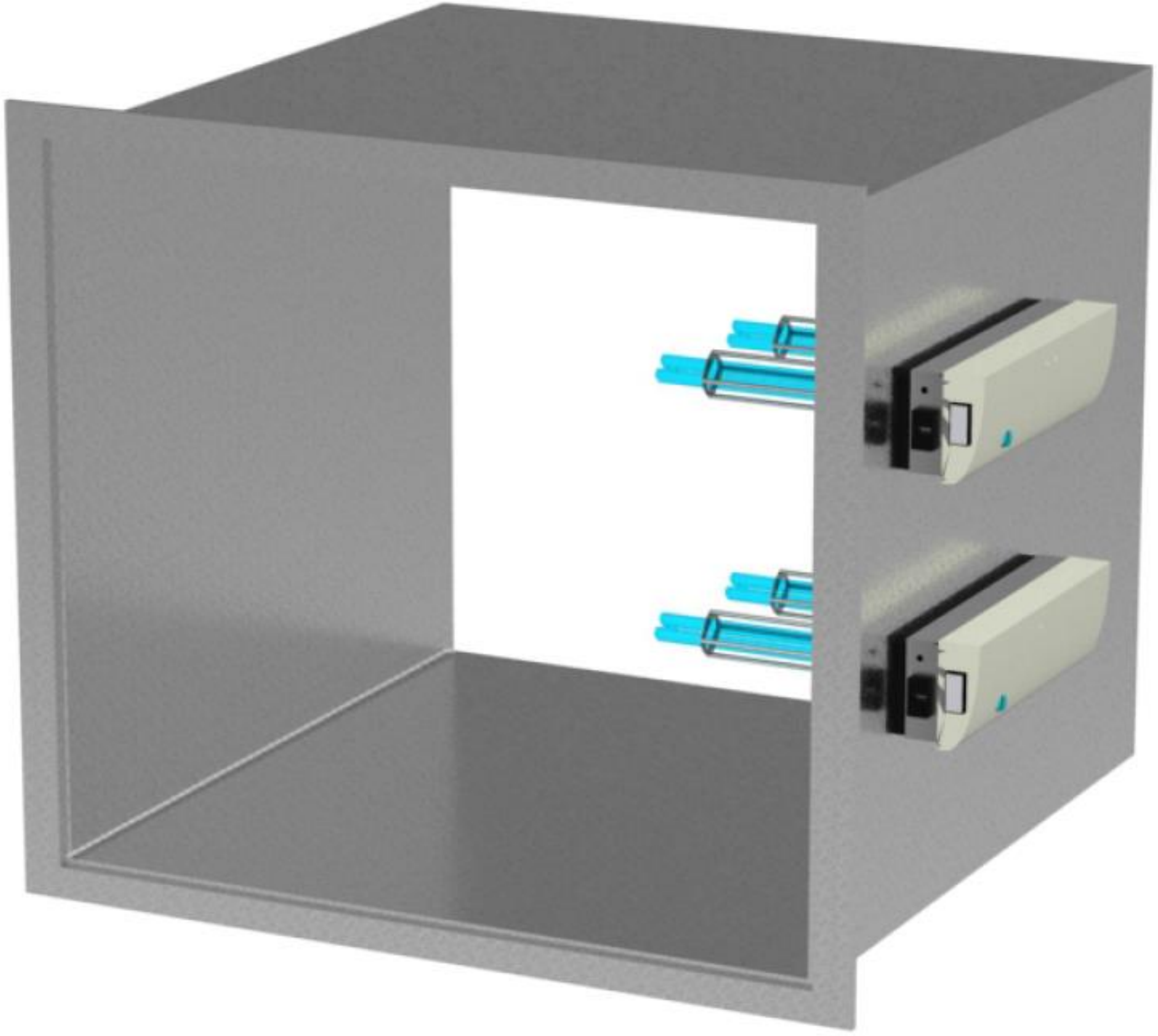


Designed for in-duct air treatment, it can be applied inside final AHU portion to sanitize surfaces, too.

Fits in small spaces, even for retrofit applications.

Ballast on-board.

CE RoHS 2002/95/EC



UV-DUCT-FL

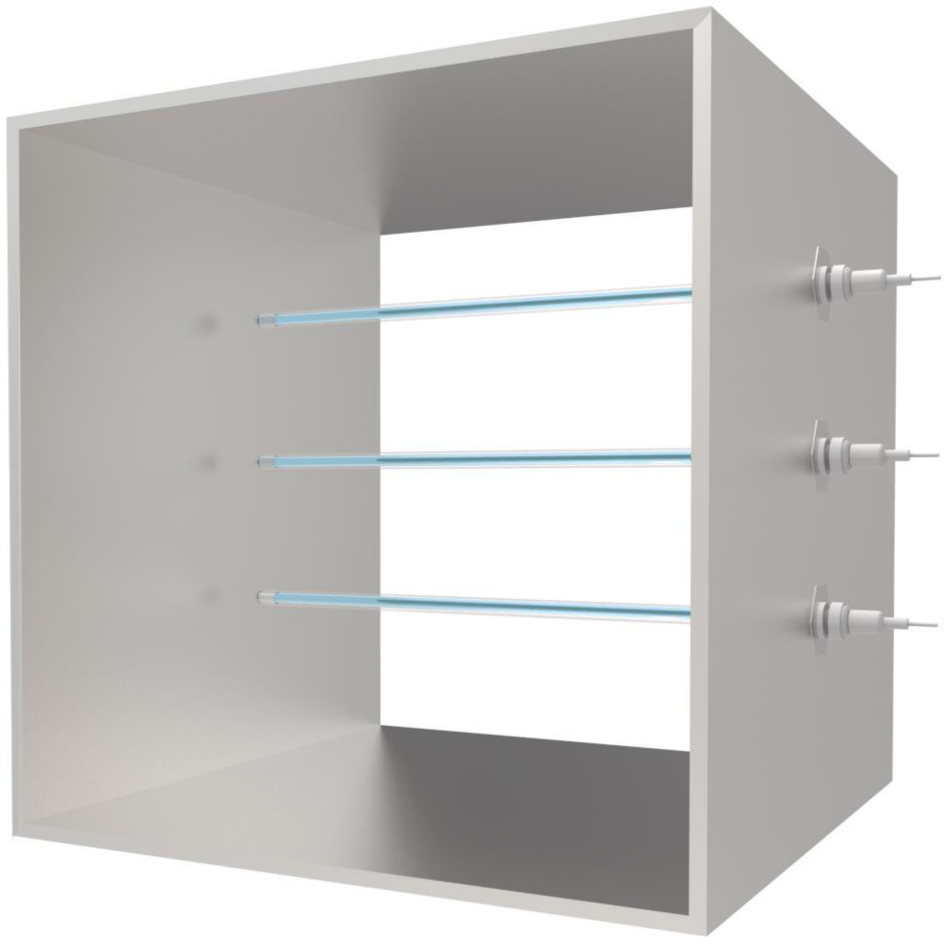
Its installation requires just a few simple steps: insert the lamps within the air duct through two holes and screw UV-DUCT-FL flange on the external channel wall, and you’re done!

UV-STYLO-X

UV-STYLO-X serie includes a choice of different models designed for the application in very narrow spaces. The device consists of an hexagolan flange in stainless steel AISI 304 in which is housed a UV-C lamp protected by a pure quartz sleeve.

UV-STYLO-X

UV-STYLO-X can be installed in tiny spaces, just making a hole directly on the wall where you want to apply the UV-C irradiation, as for example on the side of a duct . Then you need to insert the unit through the hole made and screw the AISI 304 stainless steel flange with three screws. 360° irradiation accomplished!



LIGHT PROGRESS

Certificates
Best Practice Compliance

HVAC

Water

Health

Food

Smell reduction

Certificates

CE RoHS Compliant

CERTIFIED ISO 9001:2015 COMPANY

UL

LIGHT PROGRESS

CE

DECLARATION OF COMPLIANCE

We, LIGHT PROGRESS S.r.l., hereby declare under our own responsibility that the following units of own production:

⇒are in accordance with EEC directive 2014/30/EU (Electromagnetic Compatibility)
⇒are in accordance with EEC Machinery Directive dispositions 2006/42/EU
⇒are in accordance with EEC Low Voltage Directive 2014/35/EU
⇒are in accordance with EEC (RoHS) directive 2002/95/EU and 2011/65/EU

TECHNICAL STANDARDS APPLIED

UNI EN ISO 12100:2010	Safety of Machinery - Basic Concepts, General Principles for Design - Risk assessment and risk reduction
UNI EN ISO 13857:2008	Safety of Machinery - Safety Distances to prevent danger zones being reached by the upper and lower limbs (2008)
ISO 14120:2015	Safety of Machinery - Guards - General Requirements for the Design and construction of fixed and movable guards
UNI EN ISO 13849-1:2016	Safety of Machinery - Parts of the Control System related to the Safety – Part 1: General Design Principles
UNI EN ISO 14119:2013	Safety of Machinery - Interlocking devices associated with guards - Principles for design and selection
CEI EN 60204-1/EC	Safety of Machinery - Electrical Equipment of Machines. Part 1: General Rules (2010)
EN 61439-1:2011	Low-voltage Switchgear and Control Gear Assemblies. Part 1: General rules

FURTHER TECHNICAL STANDARDS APPLIED:

IEC EN 60335-1 "Safety of household electrical appliances and similar"
Electronic Ballasts for the control of the lamps in accordance with the standard EN 60928.
Germicidal UV-C Lamps in accordance with EN 61199.
Electrical Protective Measures in accordance with IEC 70-1, EN 60229.

Anghiari, 05 January 2017

LIGHT PROGRESS

Responsible for Standards: Dr. Aldo Santi

LIGHT PROGRESS S.r.l. Via G. Marconi, 81 - 53031 ANGHIARI (AR) - ITALY - http://www.lightprogress.com

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kiwa
Partner for progress

Reg. Number	6950 - A	Valid From	2016-07-26
First issue date	2007-12-21	Last modification date	2013-07-24
Following renewal date	2019-07-29	EA Sector	EA: 19

Quality Management System Certificate
ISO 9001:2015

Certificate

We certify that the Quality Management System of the Organization:

LIGHT PROGRESS S.r.l.

Is in compliance with the standard UNI EN ISO 9001:2015 for the following products/services:

Design and production of UV-C rays disinfection systems

Chief Operating Officer
Giampiero Belcredi

Maintenance of the certification is subject to annual survey and dependent upon the observance of Kiwa Cermet Italia contractual requirements.

This certificate consists of 1 page.

LIGHT PROGRESS S.r.l.
Registered Headquarters
- Via Guglielmo Marconi, 81 52031 Anghiari (AR) Italia
Certified sites
- Località San Antonino 40 52043 Castiglion Fiorentino (AR) Italia
- Via Guglielmo Marconi, 81 52031 Anghiari (AR) Italia

Kiwa Cermet Italia S.p.A.
Società con socio unico, soggetta all'attività di direzione e coordinamento di Kiwa Italia Holding Srl
Via Cadriano, 23
40057 Granarolo dell'Emilia (BO)
Tel +39.051.459.3.111
Fax +39.051.763.382
E-mail: info@kiwacermet.it
www.kiwacermet.it

CERMET

IAF ACCREDIA L'ENTE ITALIANO DI ACCREDITAMENTO
SGQ N° 007A SSI N° 006G
SGA N° 010D FSM N° 004I
PRD N° 069B

CERTIFICATE OF COMPLIANCE

Certificate Number	20130702-E362672
Report Reference	E362672-20130628
Issue Date	2013-JULY-02
Issued to:	LIGHT PROGRESS SRL VIA G. MARCONI 81 52031 ANGHIARI AR ITALY
This is to certify that representative samples of	ACCESSORIES, AIR-DUCT MOUNTED Duct-Mounted UV Lamp Assembly, Models UV-RACK, followed by 3/, 4/ or 6/, followed by 40H, 60H or 90H. Have been investigated by UL in accordance with the Standard(s) indicated on this Certificate.
Standard(s) for Safety:	Bi-National Standard for Heating and Cooling Equipment, ANSI/UL 1995-2011 and CAN-CSA C22.2 No. 236-11
Additional Information:	See the UL Online Certifications Directory at www.ul.com/database for additional information

Only those products bearing the UL Classification Mark for the U.S. and Canada should be considered as being covered by UL's Classification and Follow-Up Service and meeting the appropriate U.S. and Canadian requirements.

The UL Classification Mark includes: the UL in a circle symbol: with the word "CLASSIFIED" (as shown); a control number (may be alphanumeric) assigned by UL; a statement to indicate the extent of UL's evaluation of the product; and the product category name (product identity) as indicated in the appropriate UL Directory. The UL Classification Mark for Canada includes: the UL Classification Mark for Canada: with the word "CLASSIFIED" (as shown); a control number (may be alphanumeric) assigned by UL; a statement to indicate the extent of UL's evaluation of the product; and the product category name (product identity) in English, French, or English/French as indicated in the appropriate UL Directory.

Look for the UL Classification Mark on the product.

William R. Carney, Director, North American Certification Programs
UL LLC

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Page 1 of 1

University Tests - Air Treatment

UNIVERSITÀ DI SIENA 1240

LIGHT PROGRESS

Dpt of Physiopathology, Experimental Medicine and Public Health **University of Siena**	**MOLECULAR EPIDEMIOLOGY** **Research Division** EpidMol
Via Aldo Moro 3, 53100 – SIENA - ITALY Tel +39 0577 234134 - Fax +39 0577 234090 e-mail: *epidmol@unisi.it*	

Valutazione dell'effetto che purificatori d'aria a raggi UV-C prodotti da ***LIGHT* PROGRESS®** hanno sulla carica microbica e fungina presente nell'aria.

University of Siena
Department of Physiopathology,
Exp Medicine and Public Health
Lab. Molecular Epidemiology
Prof. Emanuele Montomoli

Grafico 1

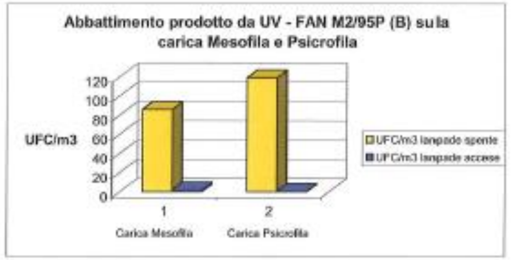
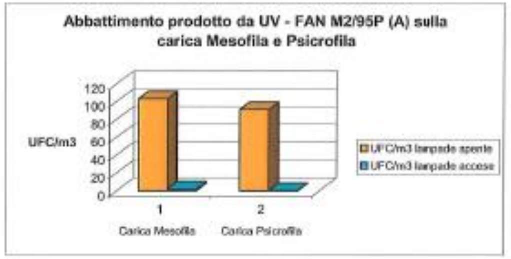


Grafico 2



University of Siena
Department of Physiopathology,
Exp Medicine and Public Health
Lab. Molecular Epidemiology
Prof. Emanuele Montomoli

University Tests - Microbial Load Reduction

UNIVERSITÀ DI SIENA 1240

LIGHT PROGRESS

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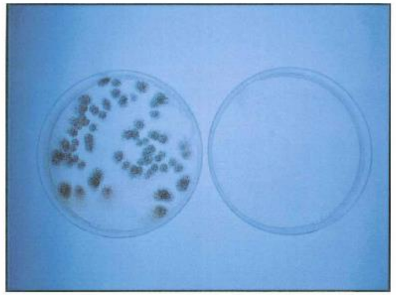
MOLECULAR EPIDEMIOLOGY
Research Division
EpidMol

Valutazione dell'effetto battericida, sporicida e fungicida dei raggi UV-C emessi da apparecchi *LIGHT* PROGRESS®

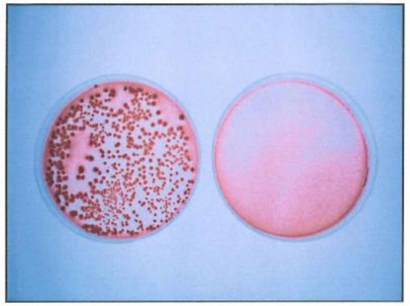
University of Siena
Department of Physiopathology,
Exp Medicine and Public Health
Lab. Molecular Epidemiology
Prof. Emanuele Montomoli

Aspergillus niger



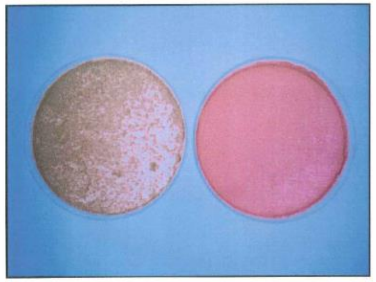
Aspergillus niger su Sabouraud dextrose Agar, a sinistra la piastra non irradiata, a destra la piastra irradiata con UVC

Escherichia coli



Escherichia coli su Macconkey Agar n.3, a sinistra la piastra non irradiata, a destra la piastra irradiata con UVC

Staphylococcus aureus



Staphylococcus aureus su Mannitol salt agar, a sinistra la piastra non irradiata, a destra la piastra irradiata con UVC

Grafico 8

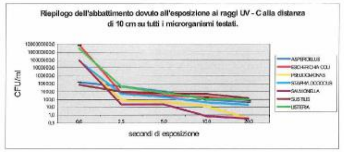
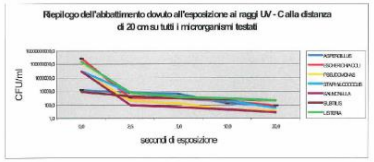
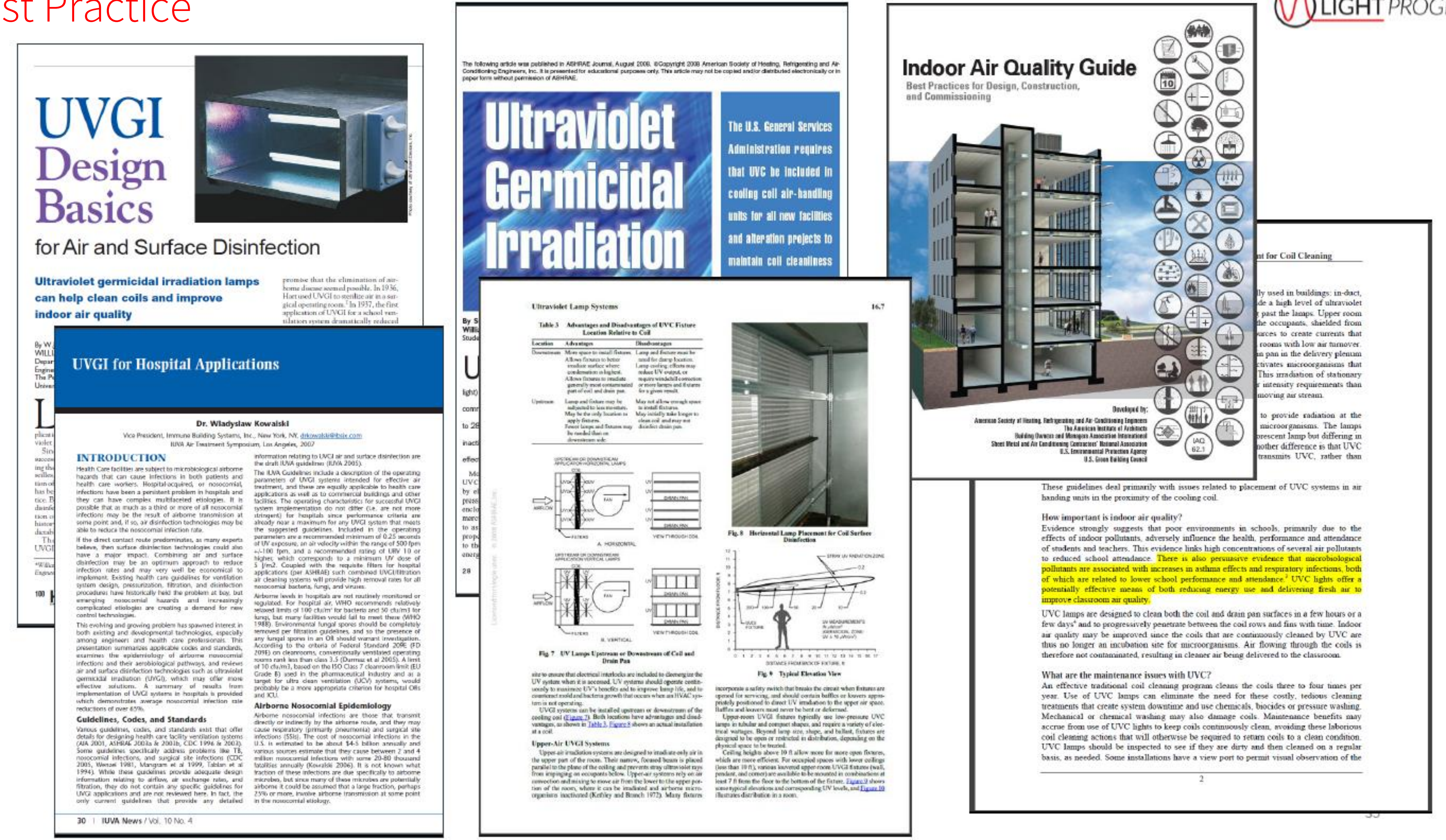


Grafico 9



Best Practice

LIGHT PROGRESS



Scientific Studies

LIGHT PROGRESS

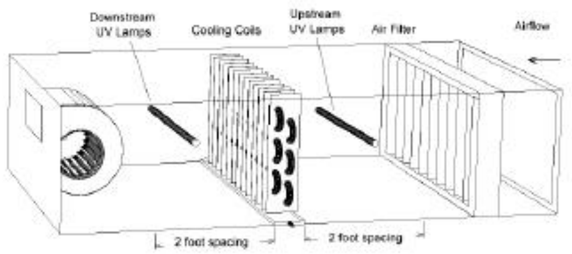


Figure 2.1: Location and spacing for UVGI system in an air handling unit.

2.2 Location of UV Lamp Ballasts

UV lamp ballasts should preferably be located external to the ventilation system although this is not currently a strict requirement due to so many systems that have integral lamp ballasts that must be located wherever the lamp is located. One of the problems with lamp ballasts being located inside air handling units is that they may be exposed to temperature and humidity extremes.

If lamp ballasts are located in an internal lamp housing, the housing should be of drip-proof construction or other approved housing method. If lamp ballasts are located external to the air handling unit or ductwork, the wiring must be run through conduit such that there is no exposed wiring inside the air handling unit. Exposed wiring may be subject to deterioration inside and air handling unit and may also be exposed to UV irradiation, which may cause photodegradation over time and thus pose a fire hazard.

2.3 Operating Conditions

Both the UV lamp and the ballast should be located such that the ambient operating conditions (i.e. temperature and relative humidity) are within the component design or operating limits. Refer to manufacturer's information for design operating conditions. In general, both UVGI and filters are designed to operate at an air velocity of 500 fpm, although some lamps may be suitable for operation at higher velocities. Variations in air velocity (i.e. +/- 100 fpm) may be acceptable depending on the manufacturer's lamp but such variations should be evaluated to include or assess the impact on UV output. See IUVA-G01A-2005, "General Guideline for UVGI Air and Surface Disinfection Systems," for

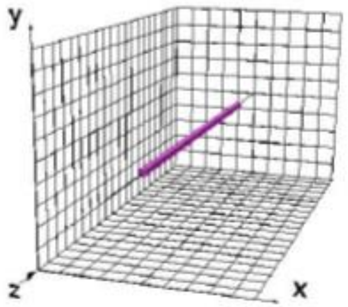


Figure 6.1: Grid for a 10x10x20 Matrix and Coordinate System, shown with a lamp in an axial configuration.

6.2 Operation of the Program

The program takes the input data from an input text file, performs the analysis and outputs results in a text file. Intermediate results can be extracted and graphed in spreadsheets.

Input data requires definition of the coordinate system. The lamp coordinates are based on the lower left front corner of the matrix being at (0, 0, 0). The indices for both the large and small matrices are also based on this (0, 0, 0) point.

Using the input the enclosure intensity field is determined by evaluating the direct intensity field of the lamp, the first reflection intensity field, and the total inter-reflected intensity field. These are summed to produce the total intensity field of the enclosure. This process is shown by the flow chart in Figure 6.2.

As mentioned previously, the inter-reflections are only computed for three iterations, after which the total bulk average intensity is determined mathematically for the remaining inter-reflections. Each of the first three inter-reflection calculations involves computing the exchange of radiative energy from each of the blocks on the other three sides, for all four walls. The summed result produces the wall intensity contours for the next set of inter-reflection calculations. This is the most calculation-intensive portion of the program and takes up the most operating time. In comparison, the direct and first reflection calculations proceed relatively rapidly.

Because two different size matrices are used for the computations, it is necessary to scale up the smaller matrix to match the size of the larger matrix prior to adding them. This is

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Effective UVGI System Design Through Improved Modeling

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ABSTRACT

This paper summarizes an improved methodology for predicting the rate of airstream disinfection for UVGI systems that will enable effective designs and lower energy costs. This approach uses radiative view factors to define the three-dimensional intensity field for lamps and reflective surfaces inside enclosures. Lamp photosensor data for a variety of lamps are shown to agree more closely with the view factor model than with models using the Inverse Square Law. The intensity field due to reflectivity from internal surfaces is determined by assuming diffuse reflectivity. An analytical method is used to determine the inter-reflection component of intensity due to multiple internal reflections. The superposition of these components yields a three-dimensional intensity field matrix that can be used to calculate disinfection rates for any given microbial rate constant. Results from laboratory bioassays using S. marcescens *in various duct configurations have corroborated model predictions within ±15% in most cases.*

INTRODUCTION

Currently available design information has not guaranteed predictable performance for UVGI air disinfection systems. Some of today's design practices can overdesign systems, leading to prohibitive costs and high energy consumption. Other design practices lead to undersized and ineffective systems. Design practices have not changed in decades, and it is worthwhile to review the history of UVGI applications to discover how this situation has come to be.

Although the first UVGI water disinfection system was implemented in 1909 (AWWA 1971), the first UVGI systems designed for airstream disinfection weren't implemented until the 1930s (Sharp 1940). Based on limited laboratory data and using newly available UVGI lamps, these systems were sized without the benefit of preexisting criteria. Tests, either air sampling or epidemiological, were used to determine their efficacy. Some of these systems were highly successful, such as those used to control measles in schools, and one used by Riley to eliminate TB bacilli from hospital ward exhaust air (Riley and O'Grady 1961).

Other designs appeared to be ineffective, with the result that the initial glowing reviews of this technology became tempered. Guidelines were issued that sanctioned the use of UVGI only in combination with HEPA filters (Luciano 1977; ASHRAE 1991). No studies were ever undertaken to determine the root cause for any UVGI system failures. Apart from improvements in lamp designs, applications technology for airstream disinfection has remained almost stagnant for decades.

The first design guidelines for UVGI airstream disinfection systems were developed in the 1940s (Luckiesh and Holladay 1942; Luckiesh 1946). Versions appeared in catalogs that continue to be reproduced and used today (Philips 1985). These guidelines offer procedures, charts, and tables to size lamps and reflective surfaces so as to obtain a desired disinfection rate. These sizing methods, though admirably detailed for the period, suffer from a number of deficiencies:

1. They fail to define the intensity field, instead merely using the lamp rating or else relying on photometric data for lamp midpoints.
2. Lamps are specified without regard to lamp location or type.
3. The correction factor for rectangular ducts ignores the intensity field variations due to surface reflectivity.

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