



UltraLED Air 2000/1 System for air sanitization

Virus and bacteria disruptor

An innovative air sanitization solution with UV-C technology

This proposal illustrates a technological innovation aimed at solving a massive problem with a direct impact on public health and economic efficiency related to air quality.

The **UltraLED Air 2000/1** system, currently in the "patent pending" and "CE pending" phase, is a "disruptive" solution for air sanitization in medium and large-flow plants that utilizes ultraviolet radiation emitted by UV-C LEDs arranged in a high-density matrix (**High-Density led array**) (p. 1). It replaces the current systematic use of HEPA filters

1. System Introduction

The **UltraLED Air 2000/1** system is based on solid-state technology for air sanitization with **99% transmittance** over 1 cm and a flow rate of **100 L/s (360 m³/h) to 400 L/s (1,440 m³/h)**. The system guarantees a complete microbiological barrier against bacteria and viruses.

2. "High-Density led array" Technological Architecture

The system is based on an industrial-class UV-C LED matrix.

- 2.1 Spectral Target:** the system's UV-C LEDs operate with a peak emission at 265 nm, which is the wavelength with maximum germicidal efficacy (DNA/RNA absorption); this has allowed it, at equal irradiance, to be 40% more effective than systems operating at 254 nm.
- 2.2 Optimized Geometry:** the arrangement of the irradiation sources and the characteristics of the materials used minimize spherical dispersion, concentrating energy where it is most needed.
- 2.3 Modular Configuration:** the system is composed of an independent base module designed to operate individually; it is scalable for Dose and Flow Rate, and if the application requires it, it can form series or parallels of "n" units. The System is functional to air channeling to obtain the required UV-C doses and/or flow rates; the base module creates an air path of 4,012 mm in length, the maximum width dimensions of the system are 350 mm, the height is 1600 mm, and it has an internal diameter of 187 mm. The system can be integrated with the existing air conditioning duct or be autonomous, equipped with its own axial suction / compression module.

2.4 Performance and Biological Safety: The UltraLed Air system is absolutely safe because there are no UV-C emissions outside the system, which allows the presence of personnel in the rooms while the system is active. At the system outlet, the air is forced inside special activated carbon filters. There is no Italian or European regulation for air that imposes a minimum dose; the priority of the European legislator is that UV-C radiation (dangerous for eyes and skin) does not hit people.

- **D.Lgs. 81/2008 (Italy) / Directive 2006/25/EC (Europe):** Regulates the exposure of workers to Artificial Optical Radiation (AOR). The maximum exposure limit for a worker in an 8-hour shift is **30 J/m²** (meaning only **3 mJ/cm²** effective at 254 nm).
- **EN 62471 / CEI EN 62471:** Standard on the photobiological safety of lamps and lamp systems. It classifies devices into risk groups (from exempt to high risk). If the device is a closed airflow or upper-room irradiation (Upper-Room GI) type, it must guarantee the absence of dangerous leaks into the occupied environment.

Each base module of the system, named **UltraLED Air 2000/1**, is sized to guarantee, with an **air transmittance of 99% over 1 cm** and a flow rate of **25 L/s (90 m³/h)**, an **average planar irradiance of 83.6 mW/cm²**, an **average Dose of 92 mJ/cm²** in every part of the treated air, and a **volumetric mean Dose (Fluence) of 110 mJ/cm²** with **672 W** input power.

2.5 Irradiance Uniformity: irradiance uniformity is equal to **85%**, without any "shadow zone".

2.6 Volumetric Mean Dose (Fluence): ultraviolet radiation hits pathogens (bacteria, viruses) from multiple directions; this characteristic makes the system exceptionally effective in the sanitization action.

2.7 Thermal Management: The stand-alone UV-C LED modules exploit the principle of integrated active thermodynamics by drawing available chilled water (typically 7-12°C) from the central air conditioning system to maintain the LEDs at optimal operating temperatures. If no such system is available, an additional chiller is used.



3. System Excellence

- 3.1 Eco-sustainability and Safety:** total absence of the mercury present in UV-C lamps. No risk of accidental contamination in case of breakage, making it a safe technology for users and the environment (Eco-Friendly). During operation, as there is no UV-C irradiation outside the system, it is compatible with the presence of service personnel.
- 3.2 Dimming:** self-regulation of power in the 0-100% range; the system is configured to support increases up to +50% should external factors require it.
- 3.3 IP68-20 Robustness:** UV-C LED modules are designed to operate up to 2 bar of pressure.
- 3.4 Integrated passive thermodynamics:** keeps LEDs at optimal operating temperatures, ensuring a useful life exceeding 50,000 hours, and guaranteeing an efficiency of the emitted ultraviolet radiation always higher than 80% of the nominal value.
- 3.5 Total Independence of Modules:** each module is electrically and thermally self-sufficient.
- 3.6 Integration with the existing plant:** immediate and with minimal need for structural modifications depending on the plant.
- 3.7 Elimination of routine maintenance:** meticulous design, the type and superior quality of the components and materials used, and an operating temperature of the UV-C LEDs that is consistently within an exceptionally low range, with a maximum T_j of 25/35°C, allow for zero routine maintenance for five years from the system's entry into service.
- 3.8 Remote Control:** the system is equipped with a remote control unit (TLC) for real-time monitoring of values related to the applied UV-C radiation and air speed in the conduit; based on variations in these two measurements, the TLC automatically dims the power supplies to always provide the exact necessary power, optimizing energy absorption up to turning off the system in case of no air supply.

4. Technical Summary Specifications of the UltraLED Air 2000/1 system equipped with 4 UV-C irradiation heads

Parameter	Technical Specification System 2000/1 (Base Module)
Nominal flow rate	100 l/s (360 m ³ /h)
Dimensions	1600 x 1060 x 350 mm
Ultraviolet source	LED UV-C (265 nm)
Ultraviolet Power	47 W UV-C
Dose (Average)	92 mJ/cm ²
Volumetric mean dose (Fluence)	110 mJ/cm ²
Air transmittance	99%/cm
Electrical Power	672 W
Cooling	Integrated passive thermodynamics

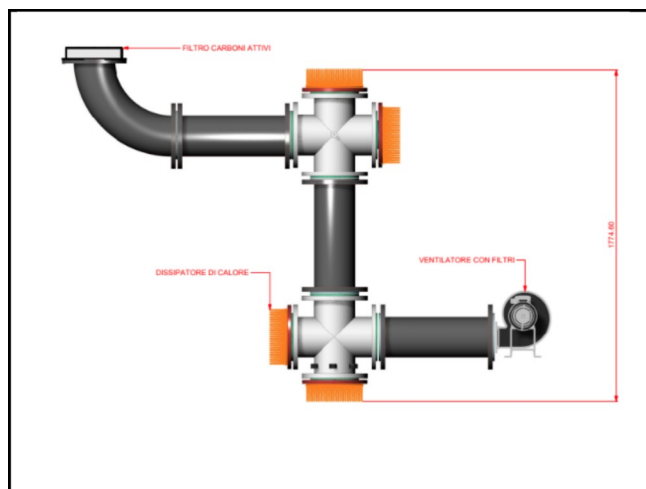


Fig. 1 - UltraLED Air 2000/1 System (Base Module) equipped with 4 UV-C irradiation heads

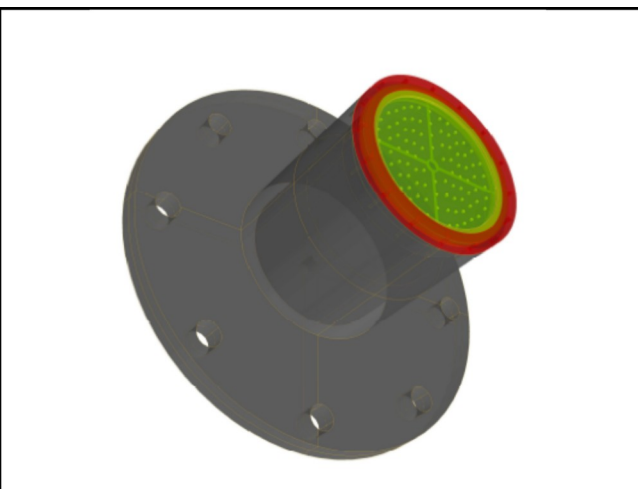
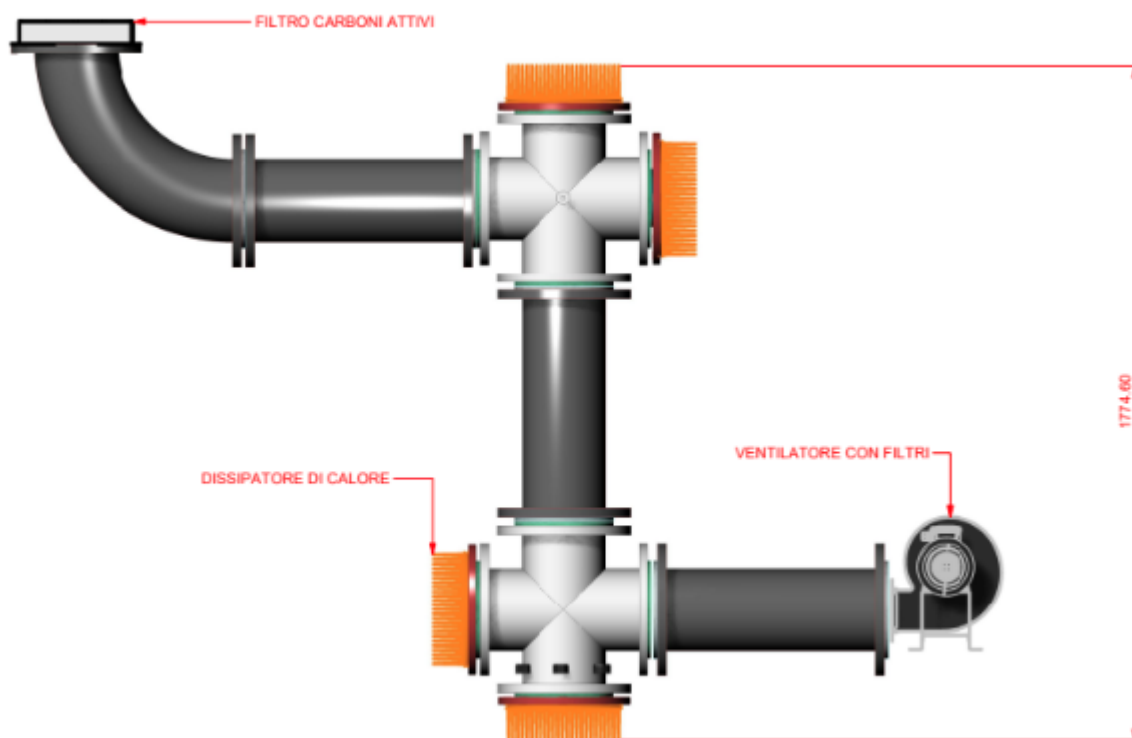
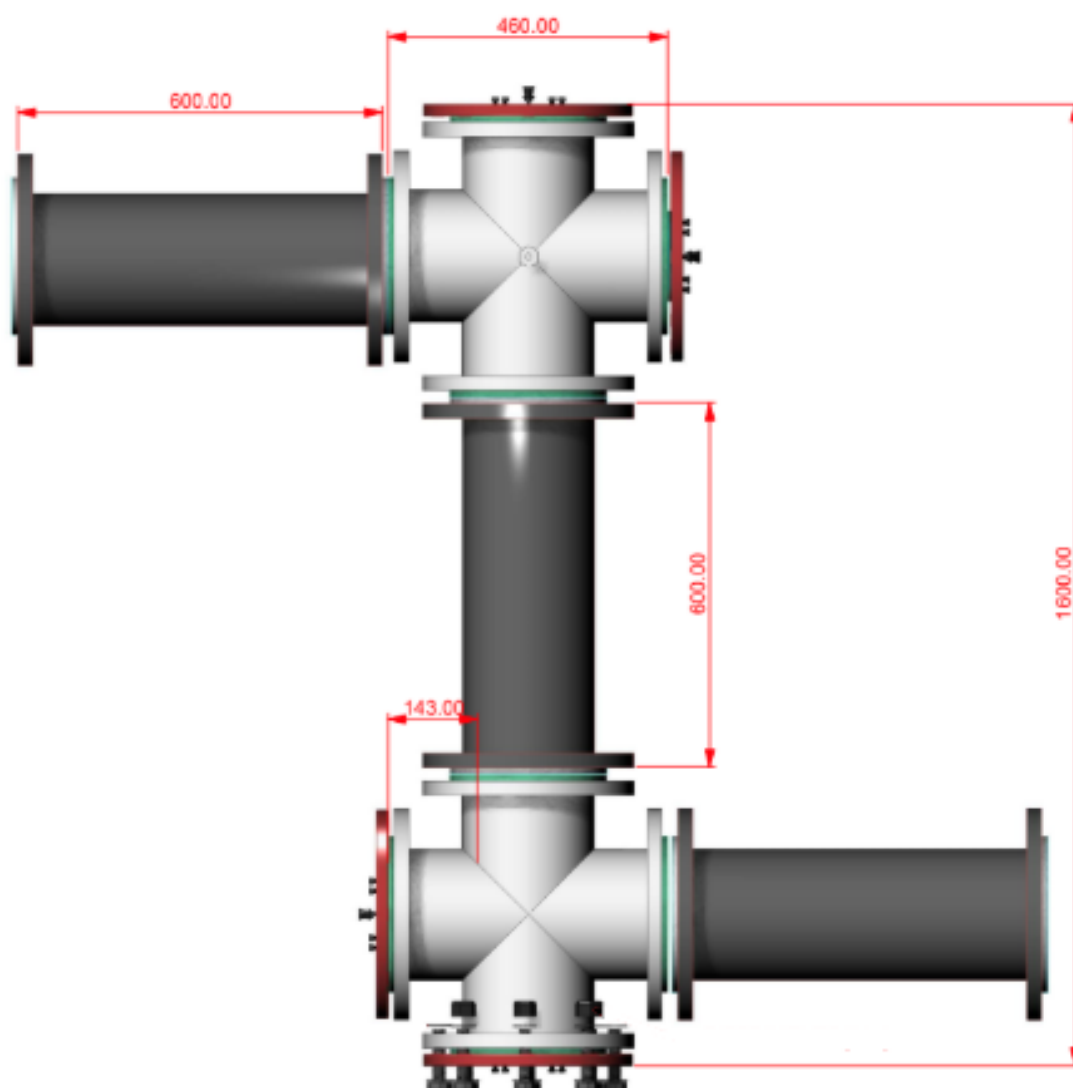


Fig.2 - UV-C irradiation head



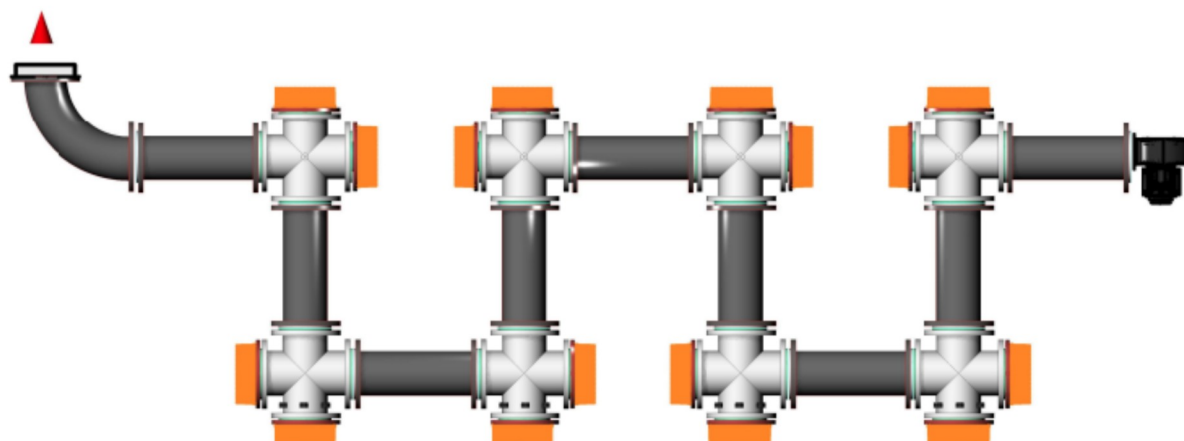
**Fig. 3 - UltraLED Air 2000/1 System equipped with 4 UV-C irradiation heads
for a flow rate of 100 l/s stand alone**



**Fig. 4 - Dimensions of UltraLED Air 2000/1 System (Base Module)
equipped with 4 UV-C irradiation heads**

5. Technical Summary Specifications of the UltraLED Air 2000/4 system in series equipped with 16 UV-C irradiation heads

Parameter	Technical Specification System 2000/4 in series
Nominal flow rate	100 l/s (360 m ³ /h)
Dimensions	1600 x 4950 x 350 mm
Ultraviolet source	LED UV-C (265 nm)
Ultraviolet Power	188 W UV-C
Dose (Average)	368 mJ/cm ²
Volumetric mean dose (Fluence)	440 mJ/cm ²
Air transmittance	99%/cm
Electrical Power	2688 W
Cooling	Integrated passive thermodynamics



**Fig. 5 - UltraLED Air 2000/4 System in series
equipped with 16 UV-C irradiation heads**

6. Technical Summary Specifications of the UltraLED Air 2000/4 system in parallel equipped with 16 UV-C irradiation heads

Parameter	Technical Specification System 2000/4 in parallel
Nominal flow rate	400 l/s (1440 m ³ /h)
Dimensions	1600 x 2700 x 3000 mm
Ultraviolet source	LED UV-C (265 nm)
Ultraviolet Power	188 W UV-C
Dose (Average)	92 mJ/cm ²
Volumetric mean dose (Fluence)	110 mJ/cm ²
Air transmittance	99%/cm
Electrical Power	2688 W
Cooling	Integrated passive thermodynamics

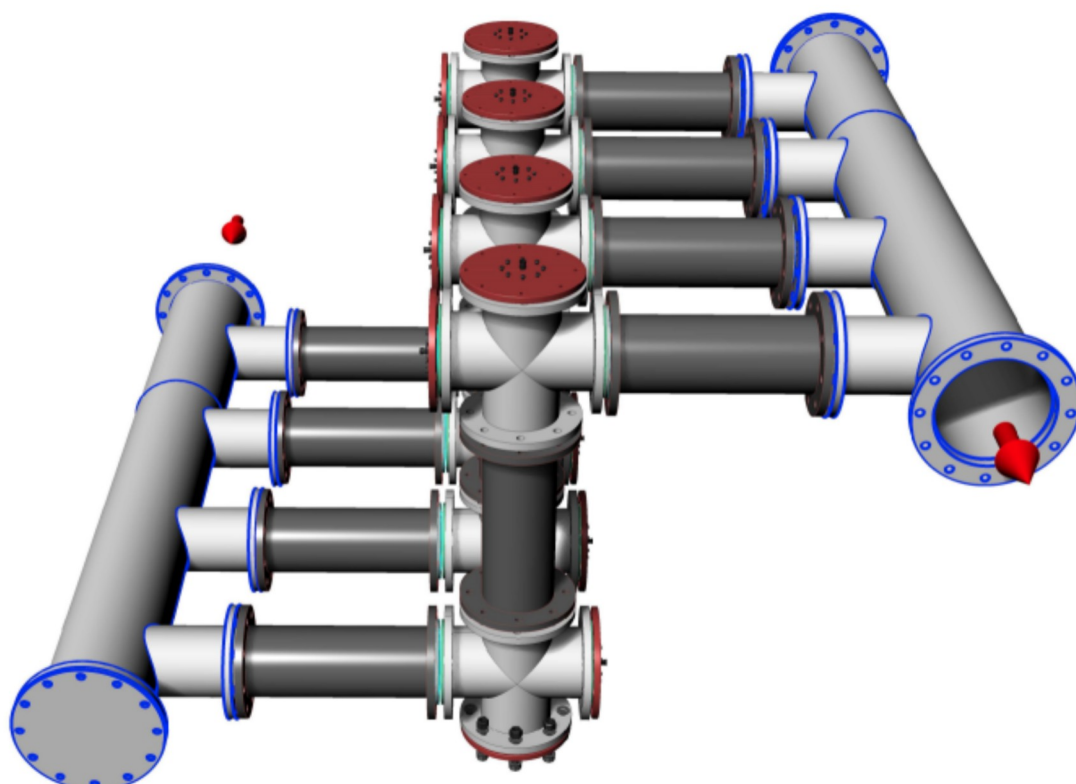


Fig. 6 - Installation for UltraLED 2000/4 System in Parallel

7. Example of Installation of UltraLED Air 2000/1 System equipped with 4 UV-C irradiation heads

