



## Sterilization and disinfection system using UV-emitting electrode-less lamp with long lifespan and low power consumption

UV-emitting electrode-less lamp, which was developed by Plasma Applications Co., Ltd., emits powerful light at a wavelength of 254nm, which possesses germicidal properties. This lamp system utilizes microwave excitation, ensuring high efficiency, compactness, and long lifespan, making it suitable for various sterilization applications. With zero microwave leakage and no electromagnetic interference to peripheral devices, our system guarantees a safe and reliable operation. When combined with our 2.45GHz microwave oscillator, it enables the creation of a compact, relatively affordable, low power consuming, sterilization and disinfection system with long lifespan.

We welcome businesses interested in adopting this product to explore the possibilities it can offer.

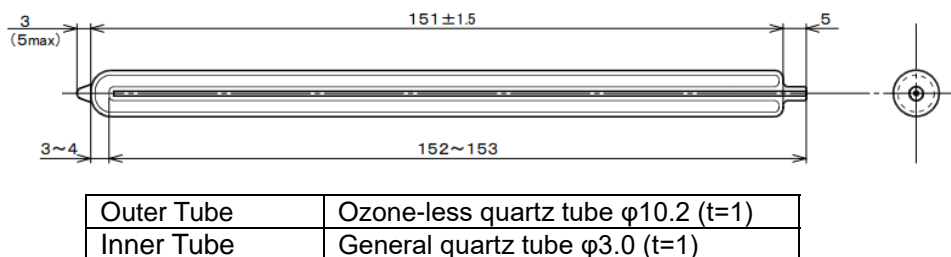
### Our Technology

We have successfully developed and tested two types of low-pressure mercury lamps in double quartz tubes. Smaller lamp usually operates at 10W of microwave power (MW). Dimensions of the smaller lamp are: diameter of 10mm and a length of 150mm (Type 1). Larger lamp operates at 40W. Dimensions for the larger lamps are: diameter of 30mm and a length of 300mm (Type 2). Both lamps exhibit an emission efficiency of approximately 30% (of MW power) and boast a long lifespan. For both double quartz tube lamps (Type 1) and a commercially available AC-powered 15W low-pressure mercury lamp (GL-15: diameter 25.5mm x length 436mm, Type 3), the required 254nm irradiation dose to achieve a 99.9% sterilization rate against *Escherichia Coli* and *Bacillus Subtilis* is almost equivalent. However, the size of Type 1 lamp is one-third of Type 3, while the input power remains nearly the same.

Figures 1 to 3 illustrate the lamp shape, the lamp lighting apparatus, and the lamp characteristics for Type 1 lamp.

Figure 1. Shape of Type 1 and 3 lamp

a) Type 1 : Double quartz tube low-pressure mercury lamp



b) Type 3 : AC discharge low-pressure mercury lamp (GL-15)





c) Comparison of dimensions of Type 1 and 3 lamps

Commercially available low-pressure mercury lamp (GL-15) 3  
(D25.5mm×L436mm)



Double quartz tube low-pressure mercury lamp 1 (D10mm×L152mm)



Figure 2. Lighting system for double quartz tube low-pressure mercury lamp 1

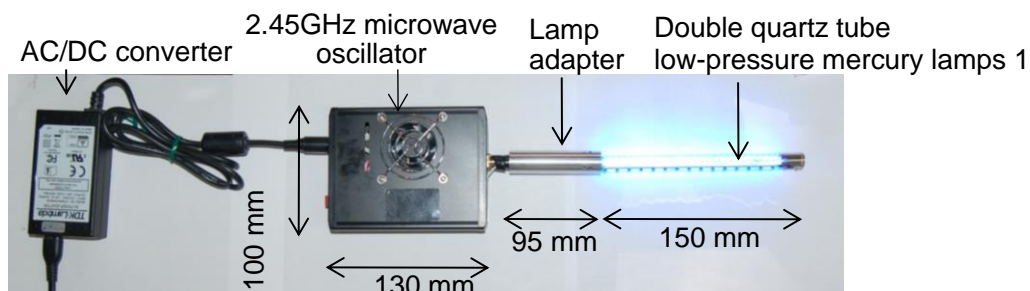


Figure 3. Lamp characteristics of double quartz tube low-pressure mercury lamp 1 and AC discharge lamp (GL-15) 3

	Type 1	Type 3
Lamp Size	D10mm×L150 mm	D25.3 mm×L43.5 mm
Input power to lamp	Microwave 10 W	AC15 W
UV-C emission intensity	3.0 W	4.9 W
Irradiation required for 99.9% sterilization of <i>Escherichia Coli</i>	5 m J/cm <sup>2</sup>	4.6 m J/cm <sup>2</sup>
Irradiation required for 99.9% sterilization of <i>Bacillus Subtillis</i>	6 mJ/cm <sup>2</sup>	6.3 m J/cm <sup>2</sup>
Lifespan	Over 50,000 hr	3,000~6,000 hr
AC power consumption	15 W	15 W

**Emission Spectra of UV-C Emitting Double Quartz Tube Low-Pressure Mercury Lamp**

When the outer tube of the double quartz tube lamp is made of vacuum ultraviolet light transparent Quartz, lamp can generate ozone due to 185 nm radiation passing through the Quartz tube.

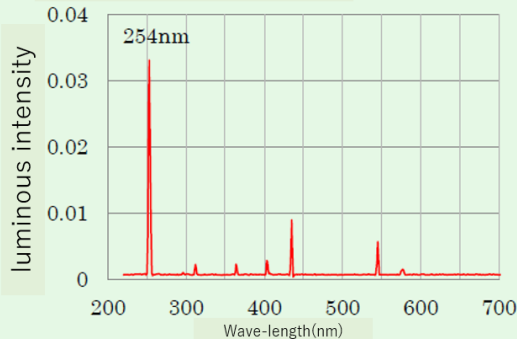
To avoid harmful ozone emission, quartz tubes that do not transmit vacuum ultraviolet light are utilized. The figure on the right below illustrates the emission spectrum with ozone generation, while the one on the left hand side shows the emission spectrum without ozone generation. Both demonstrate high sterilization effect.



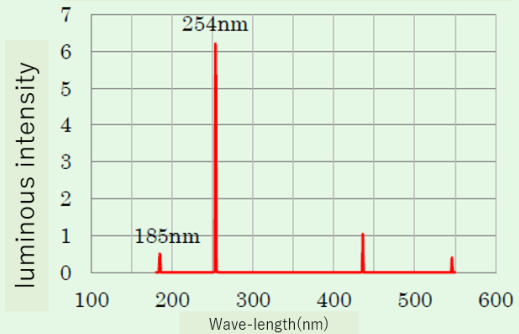
### Emission spectrum

(Lamp Shape : outer dimension 10mm,length150mm,Microwave input 10W)

1) Ozone-less UV-C lamp



2) Ozone-generate UV-C lamp

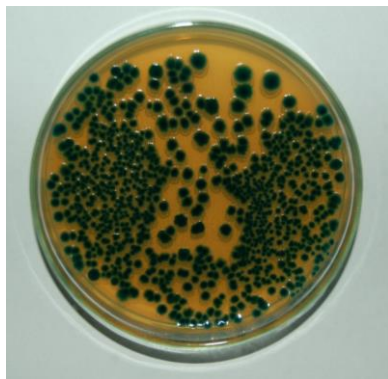


### Sterilization of water containing 0.2% *Escherichia Coli* through UV-C

To demonstrate sterilization effect, we present photographs of Petri dish with agar (X-gar medium) and 20  $\mu$ L of water with mixed bacterial culture. One plate, not irradiated by UV-C radiation, serves as control. Another plate was irradiated by UV-C radiation from double quartz tube lamp for 20 s. The plates were then placed in an incubator at 36°C for 24 hours of cultivation.

Photographs taken before and after UV-C irradiation, showing 20  $\mu$ L of water applied to agar plates (using X-gar medium).

It is evident that the UV-C irradiation has completely sterilized the *Escherichia Coli*.



The number of colonies before  
UV-C irradiation : 1074



The number of colonies after 20  
seconds of UV-C irradiation : 0

For more details, please don't hesitate to contact us. We are dedicated to providing innovative solutions that meet your business needs.