

ULTRA PURE

Germicidal Ultra Violet Water Disinfection Units

Important Information for the Correct Design of Germicidal Ultra Violet Units,
Primarily for the Disinfection of Water, but also Air, and Surfaces

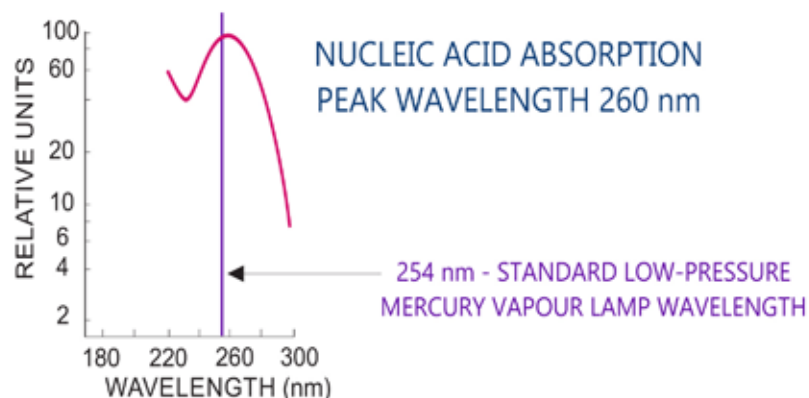
Germicidal ultra violet lamps provide Percentage Disinfection, e.g. >99.999%, and **DO NOT provide Sterilisation**. The Percentage Disinfection Rate is achieved purely as a function of the Total UV Dosage value, (TUV) as determined by the design parameters of the system, i.e. Irradiance, ($\mu\text{W}/\text{cm}^2$) x Time (In seconds) = Total UV Dosage ($\mu\text{Wsec}/\text{cm}^2$)

How UV Disinfection Works!

The mechanism of disinfection by Germicidal Ultra Violet (UV) Light differs considerably from the mechanisms of chemical disinfectants such as alcohol, chlorine and ozone. Chemical disinfectants inactivate micro-organisms by destroying or damaging cellular structures, interfering with metabolism, and hindering biosynthesis and growth. Germicidal Ultra Violet (UV) Light inactivates organisms by absorption of the 254 nm wavelength of light, which causes a photochemical reaction that alters molecular components essential to cell function. As UV light penetrates the cell wall of the micro-organism, the energy reacts with nucleic acids and other vital cell components, resulting in injury or death of the exposed cells therefore making it impossible for them to replicate. A micro-organism that cannot replicate, cannot infect a host.

ENERGY REQUIRED FROM AN ULTRA VIOLET LAMP TO BE ABLE TO DESTROY MICRO-ORGANISMS

Germicidal Range from 200 to 280 nm with the Peak at 260 nm



With Sterilisation, every micro-organism is killed, regardless of what it is. With Disinfection, different micro-organisms require different Total UV Dosages, (TUV) e.g. the dosage necessary to achieve a 99.99% kill rate against E-coli is $6,600 \mu\text{Wsec}/\text{cm}^2$, where to provide the same 99.99% kill rate against Bacillus subtilis spores, $60,000 \mu\text{Wsec}/\text{cm}^2$ is required. This is the Fundamental Law of UV Disinfection, you **must** know the Micro-organism(s) that are required to be controlled, and then the Total UV Dosage value necessary to provide the required Percentage Disinfection Kill Rate, i.e. 99%, 99.9%, 99.99%, >99.999%, etc. (A 99% kill rate is also known as a 2-log reduction, 99.9% a 3-log, and so on) Without this information you have absolutely no idea of the number of ultra violet lamp(s) required to provide your disinfection requirements.



UV Disinfection Calculations!

There is No Fixed Flow Rate for a UV Water Disinfection Unit, as it is solely based on the following: -

To be able to provide Disinfection to a Client's Specifications, requires more information than just the Flow Rate. Because a wavelength of LIGHT is providing the ability to achieve the required disinfection, there are a number of questions that must be answered to enable the calculation to determine the type of unit, and the number and type of UV lamps. The information necessary to provide the successful Germicidal Ultra Violet Disinfection is shown below:

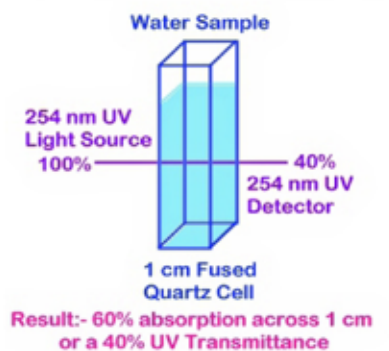


- A) Percentage UV Transmittance at 254 nm using 1 cm Fused Quartz Cells
- B) Flow Rate in L/sec, L/Hr, or m³/sec, (or per hour)
- C) The Micro-organism(s) that the Client requires to be Controlled
- D) The Percentage Kill Rate Required for the Particular Application
- E) The Total UV Dosage in $\mu\text{Wsec}/\text{cm}^2$ or mJ/cm^2

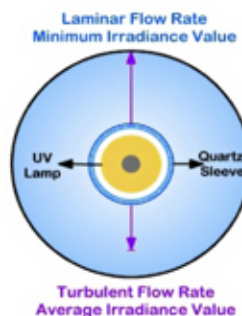
The **ONLY WAY** to be able to determine the correct sized UV water disinfection unit for any application is to provide the answers from A) to E).

UV Transmittance at 254 nm

A) Percentage UV Transmittance (PUVT) at 254 nm using 1 cm Fused Quartz Cells. Germicidal ultra violet light will lose intensity as a function of distance. This is particularly the case with water as it has a higher density than air. The PUVT of Melbourne's drinking water is around nine-two (92) percent. This means that over the distance of only 1 cm, eight (8) percent of the energy is absorbed. In the case of Secondary Sewage applications the average PUVT is forty (40) percent. Of course this means that sixty (60) percent of the UV energy is absorbed having only travelled the distance of 1 cm. PUVT is a log-arithmetic value and any reductions in the PUVT will require a far greater number of UV lamps to maintain the same TUVD value.



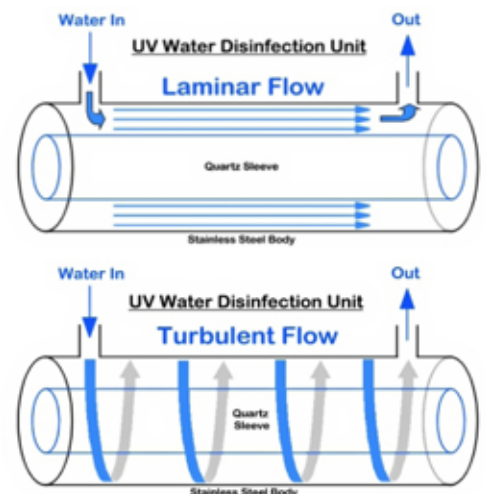
B) The flow rate in litres per second, (L/sec) or per hour, (L/Hr) must be supplied by the client and consideration given to any possible expansion in the future.



C) The micro-organism(s) that are required to be controlled must be known to allow the determination of the TUVD this is going to be required to kill them.

D) The percentage kill rate, 99.9%, 99.99%, 99.999%, etc, will be determined by the Client's application.

E) Once you have the answers to C) and D) the TUVD value can be determined. This is the value that the UV system must have at end of lamp life, i.e. after twelve (12) to sixteen (16) months continuous operation of the lamps. The lamp(s) must be replaced while they are still working as it would be a pointless exercise to experience a product failure due to microbiological contamination.

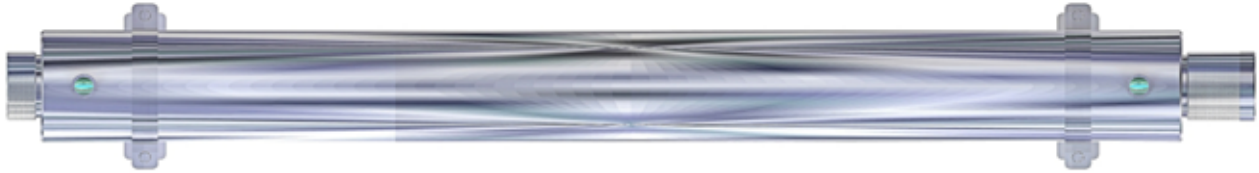


As an example, if a minimum 99.99% kill rate, (4-log reduction) was required against the micro-organism *Bacillus subtilis* spores, then a TUVD value of 60,000 $\mu\text{Wsec}/\text{cm}^2$ would be required at end of Lamp Life to allow for the 'Solarisation' effects of the fused quartz tubing. Therefore this would require a TUVD at beginning of lamp life of ~95,000 $\mu\text{Wsec}/\text{cm}^2$ to guarantee that the specified percentage kill rate was constantly achieved until the UV lamp(s) were replaced at the end of their effective UV life. (After twelve (12) to sixteen (16) months continuous operation, depending on the type of ultra violet lamp used)

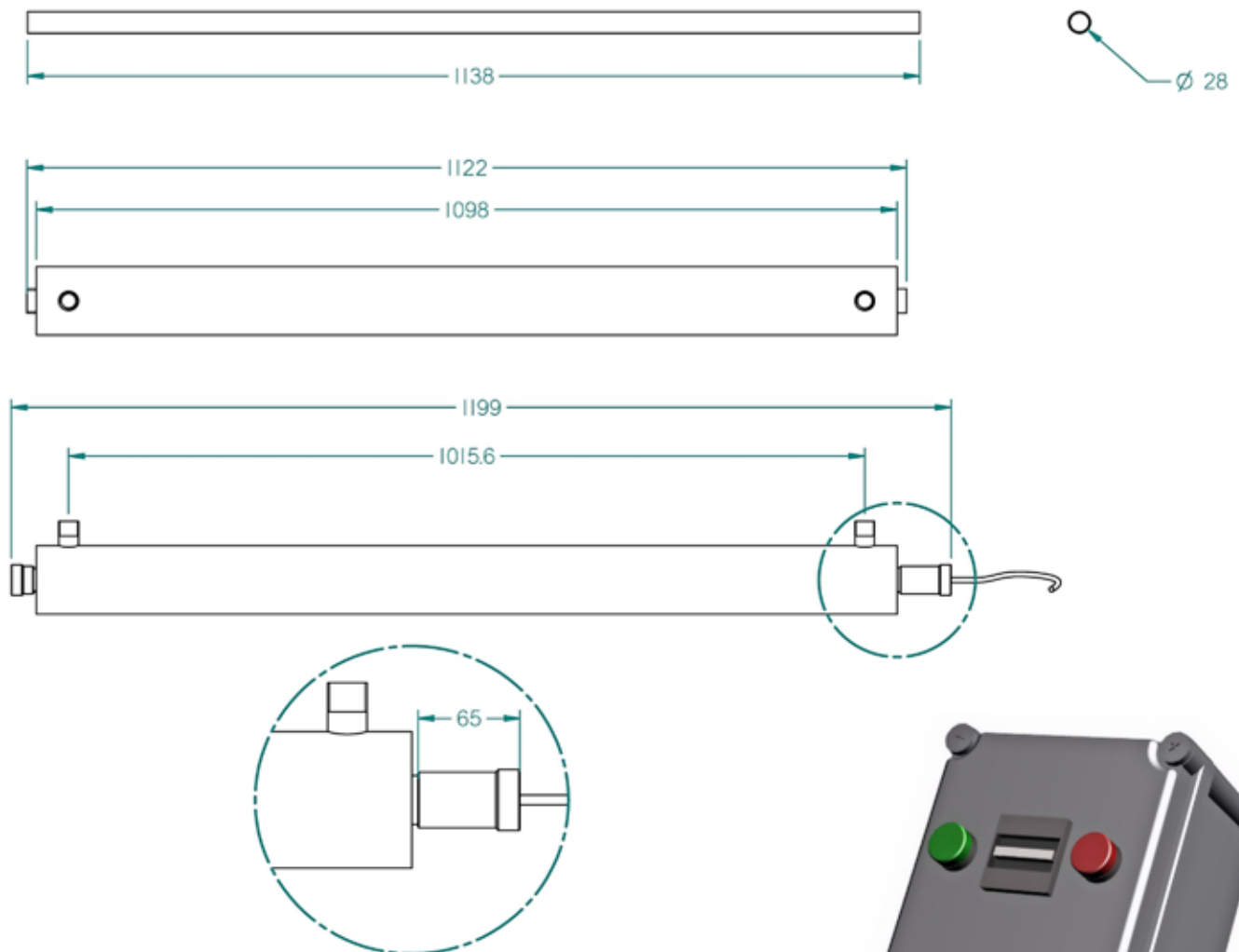
Ultra Pure-8k/85/40/G48/A90/2.1/19/14

To give an Indication of a Flow Rate, it is based on providing Safe Disinfecting Drinking Water at 85% UV Transmittance at the wavelength of 254 nm, and having a Total UV Dosage of 40 mJ/cm² at End of Lamp Life. (To comply with the Austrian, German and the USA NSF 55 Class A UV Water Disinfection Standards)

Flow Rate 8,000 L/Hr



FUSED QUARTZ SLEEVE



The Electrical Control Box is fitted with an On/Off Switch, a Green Light to indicate Power to the Unit, a Red Light and Audible Alarm to indicate either Lamp or Ballast Failure, and a Hour Run Meter. A 254 nm UV Monitor is available as an option.

Power - ~240V 50 Hz

Dimensions: - L 400 mm x W 350 mm x W 250 mm



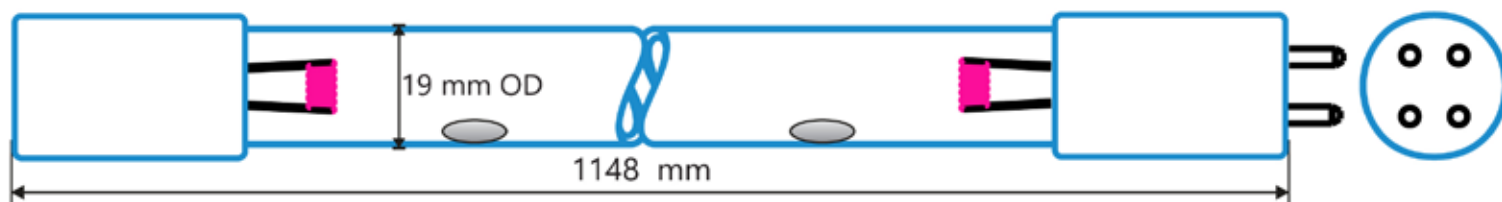
Long Life Series of Low Pressure Germicidal Ultra Violet Lamps

G48T19N A90 SE4P AMALGAM

With over sixty-seven years experience in designing and manufacturing, and the expenditure of over 16.03 million dollars, (to-date) on Research and Development, UVP is able to offer the new G48T19N A90 SE4P Amalgam lamps that have a guaranteed effective life of 12,000 hours, (compared to the previous 9,000 hours) when used with the appropriate power supplies. As with all filament lamps, excessive switchings, (>2,000) must be avoided otherwise premature failure of the filaments could occur. To try and minimise this, UVP uses heavy duty filaments in all its Slimline and Hot Cathode germicidal ultra violet lamps.

General UV Information:

Germicidal ultra violet lamps provide Percentage Disinfection, e.g. >99.999%, and DO NOT provide Sterilisation. The Percentage Disinfection Rate is achieved purely as a function of the Total UV Dosage value, as determined by the design of the system, i.e.

$$\text{Irradiance, } (\mu\text{W}/\text{cm}^2) \times \text{Time (In seconds)} = \text{Total UV Dosage } (\mu\text{Wsec}/\text{cm}^2)$$


The UVP G48T19N A90 SE4P Amalgam LAMP SPECIFICATIONS using a UVP Electronic Ballast:

- BASE FACE LENGTH 1148 mm
- ARC LENGTH 1068 mm
- LAMP WATTS 257.5 W
- LAMP CURRENT 2.136 A
- LAMP VOLTAGE 122.38 V
- FREQUENCY 28.77 KHz
- OUTPUT @ 0.3 m 2,835 $\mu\text{W}/\text{cm}^2$