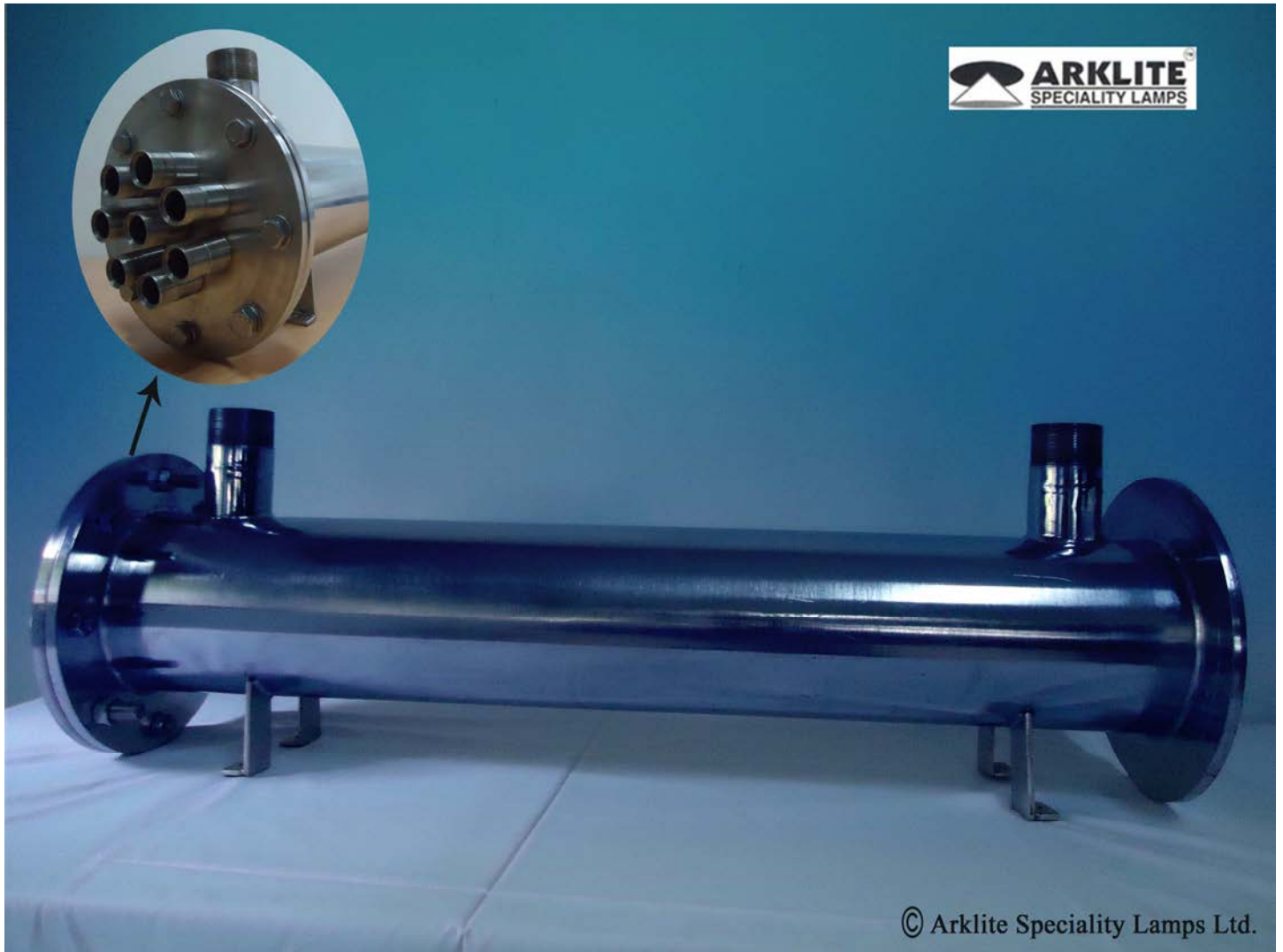


# SYSTEMS FOR UV DISINFECTION OF WATER



***EFFECTIVE, ECONOMICAL AND ENVIRONMENT FRIENDLY.***

## Basic Concepts: Water Treatment with UV

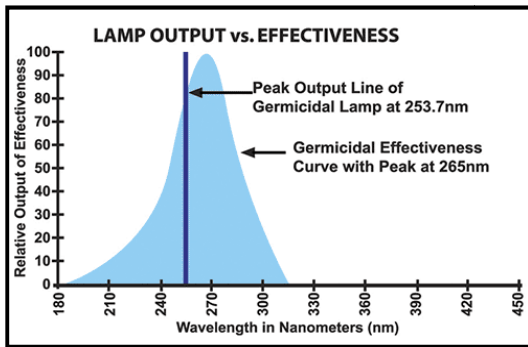


Fig.1: Germicidal Action with wavelength

The concept of water disinfection by exposing it to Ultra Violet (UV) rays have been around for over a century. A band of light in the range of 100 to 380 nm, just shorter in wavelength than the visible band of light, is known as UV light. For the purpose of disinfection, i.e. the germicidal action, the UV band between 200 and 300 nm is most effective as shown in the above figure.

This band of UV light (200 to 300 nm) has the ability to inactivate bacteria, viruses and protozoa by breaking down the bonds in their DNA as shown in the adjoining figure. With ruptured DNA microbes cannot multiply; they die.

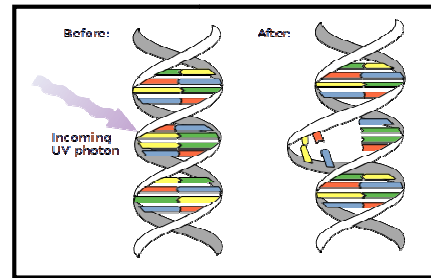


Fig2: Effect of UV on DNA

The UV dosage required for inactivation is specific for each type of organism. The UV dosage is the product of UV intensity and time. For example, to kill 99% of E coli, a UV dose of 45 Joule/m<sup>2</sup> or 4.5 mW.sec /cm<sup>2</sup> are needed. By doubling the UV dosage the kill rate will increase from 99% to 99.9%. The UV dosage needed for 90% kill rate for several microbes are available in literature.

Organisms	UV Dosage μW.s/cm <sup>2</sup>	Organisms	UV Dosage μW.s/cm <sup>2</sup>	Organisms	UV Dosage μW.s/cm <sup>2</sup>	Organisms	UV Dosage μW.s/cm <sup>2</sup>
<b>Bacteria</b>	<b>90%</b>	<b>Bacteria</b>	<b>90%</b>	<b>Bacteria</b>	<b>90%</b>	<b>Virus</b>	<b>90%</b>
Bacillus anthracis - Anthrax	4520	Micrococcus sphaeroides	1000	Serratia marcescens	2420	Bacteriophage - E. Coli	2600
Bacillus anthracis spores - Anthrax spores	24320	Mycobacterium tuberculosis	6200	Shigella dysenteriae - Dysentery	2200	Infectious Hepatitis	5800
Bacillus magaterium sp. (veg.)	1300	Neisseria catarrhalis	4400	Shigella flexneri - Dysentery	1700	Influenza	3400
Bacillus paratyphus	3200	Phytomonas tumefaciens	4400	Shigella paradysenteriae	1680	Poliovirus - Poliomyelitis	3150
Bacillus subtilis spores	11600	Proteus vulgaris	3000	Spirillum rubrum	4400	Tobacco mosaic	240000
Clostridium tetani	13000	Pseudomonas aeruginosa	5500	Staphylococcus albus	1840	Vibrio comma - Cholera	3375
Corynebacterium diphtheriae	3370	Salmonella enteritidis	4000	Staphylococcus aureus	2600	Sarcina lutea	19700
Ebertelia typhosa	2140	Salmonella paratyphi - Enteric fever	3200	Staphylococcus hemolyticus	2160	Micrococcus candidus	6050
Escherichia coli	3000	Salmonella typhosa - Typhoid fever	2150	Staphylococcus lactis	6150	Streptococcus viridans	2000

Table 1: List of UV dosage for 90% kill rate of some microorganisms

A short list of UV dosages for 90% kill rate of a few microbes is listed in the adjoining table. These dosages also depend upon the media; whether it is in water or air or on surface.

The UV dosage reaching the microbes in water depends upon the UV transmission of water. Often separate treatments are required improve water quality prior to UV disinfection. Such as, water softeners to reduce hardness, sediment filters to remove particles which shield microbes or absorb UV, etc.

## Advantages:

1. Needs no chemicals and leaves no residue.
2. No harm caused by over dosage; in fact it leads to higher kill rate.
3. No disinfection by-products.
4. No impact on aesthetic quality of water in terms of smell, colour, taste and mineral content.
5. Effective at wide range of pH and does not alter pH of water.
6. Destroys all microbes, including bacteria, viruses, fungi, and protozoa.
7. Destroys even cryptosporidium (which causes diarrhoea infection) which is resistant to chlorine treatment.
8. Totally safe to operate and environment friendly.
9. Compact, needs minimum floor space.
10. Easy to install and maintain.
11. Most energy efficient, as compared to any other process.
12. Low capital and operating costs.

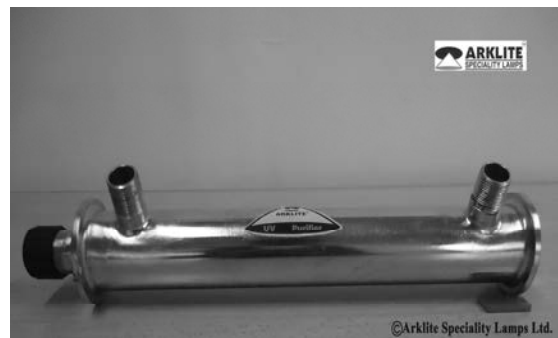
## System Design:

Equipped with excellent UV test facility, ARKLITE's expertise in UV technology begins with lamp design and manufacturing and extends into design, manufacturing and sale of a wide range of customized UV water disinfection systems for drinking, process and waste water.

## Applications:

Specifications of ARKLITE water disinfecting systems of standard design range from 0.5 to 125 cubic metres per hour (CMH) capacity are in the table 2 on the next page. A lot variation in the design is possible to meet customer requirements. ARKLITE water disinfection systems find wide usage in industry, commercial establishments, residential complexes, municipal corporations, schools, colleges, etc. Some of the applications of ARKLITE systems are given below:

- Beverage and packaged drinking water plants
- Residential drinking water
- Water treatment plants
- Drinking water facilities
- Pharmaceutical plants
- Effluent Treatment Plant
- Sewage Treatment Plant
- Poultry farm water treatment



## Special UV Devices:

1. Zapper: A quartz UV lamp sealed inside a quartz jacket, capable of being totally immersed in water, with suitable electrical connection to ballast and mains.



*Fig 3: Zapper*

2. UV Intensity meter: A sensitive UVC sensor connected to a custom designed PCB mounted inside a 3 cm diameter and 6 cm long a Teflon cylinder, with electrical leads connecting to an LCD display of UV intensity.



*Fig 4: UV Sensor for Intensity Display*

## Key Features:

- Flow rate: 0.5CMH to 125CMH
- SS304/316 cylindrical reactor, internally & externally mirror finished
- Designed for requisite number of UV lamps and quartz jackets
- Necessary Gaskets and Resting Brackets provided
- Inlet and outlet size as per flow rate
- Designed for 60mJ/cm<sup>2</sup> for waste water treatment with UV transmission in water of 75%
- Control Panel with high frequency electronic ballast.

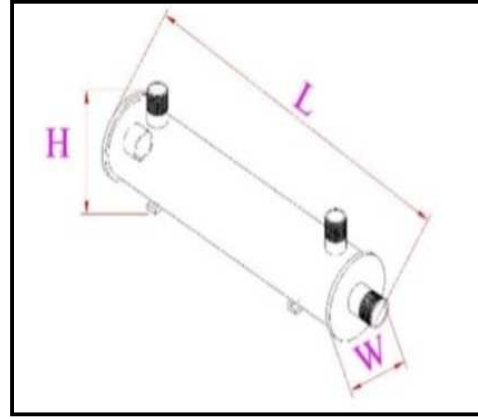


Fig5: Schematic of Water System

Table 2: ARKLITE Water Disinfection Systems from 0.5 CMH to 125 CMH

Model No	Maximum Flow rate at 75% UVC Transmission (m <sup>3</sup> / hr)	UV reactor dimensions L*W*H (mm Max)	Inlet/outlet Size	Control Panel L*W*H (mm).	Control Panel	Panel rating	Max. operating pressure	Total Lamp Wattage
AWWS 01	0.5	525 X 100 X 125	1 inch	305 X 255 X 50	MS Powder coated	NA	80 psi	21
AWWS 02	1	525 X 100 X 125	1 inch	305 X 255 X 50	MS Powder coated	NA	80 psi	48
AWWS 03	2	525 X 100 X 150	1 inch	305 X 255 X 50	MS Powder coated	NA	120 psi	96
AWWS 04	4	1025 X 100 X 150	1 inch	305 X 255 X 50	MS Powder coated	NA	120 psi	75
AWWS 05	5	1025 X 100 X 150	1 inch	305 X 255 X 50	MS Powder coated	NA	120 psi	150
AWWS 06	7	1025 X 150 X 200	1 1/4 inch	500 X 430 X 105	MS Powder coated	IP-42	120 psi	225
AWWS 07	10	1025 X 150 X 200	1 1/2 inch	500 X 430 X 105	MS Powder coated	IP-42	120 psi	300
AWWS 08	15	1050 X 300 X 325	2 inch	500 X 430 X 105	MS Powder coated	IP-42	120 psi	450
AWWS 09	25	1050 X 300 X 325	2 inch	500 X 430 X 105	MS Powder coated	IP-42	120 psi	600
AWWS 10	35	1650 X 500 X 300	DN 80	500 X 430 X 105	MS Powder coated	IP-42	120 psi	750
AWWS 11	50	1650 X 500 X 300	DN 80	500 X 430 X 105	MS Powder coated	IP-42	120 psi	1000
AWWS 12	85	1650 X 550 X 350	DN 150	500 X 430 X 105	MS Powder coated	IP-42	120 psi	1500
AWWS 13	125	1650 X 640 X 420	DN 150	500 X 430 X 105	MS Powder coated	IP-42	120 psi	2000



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