

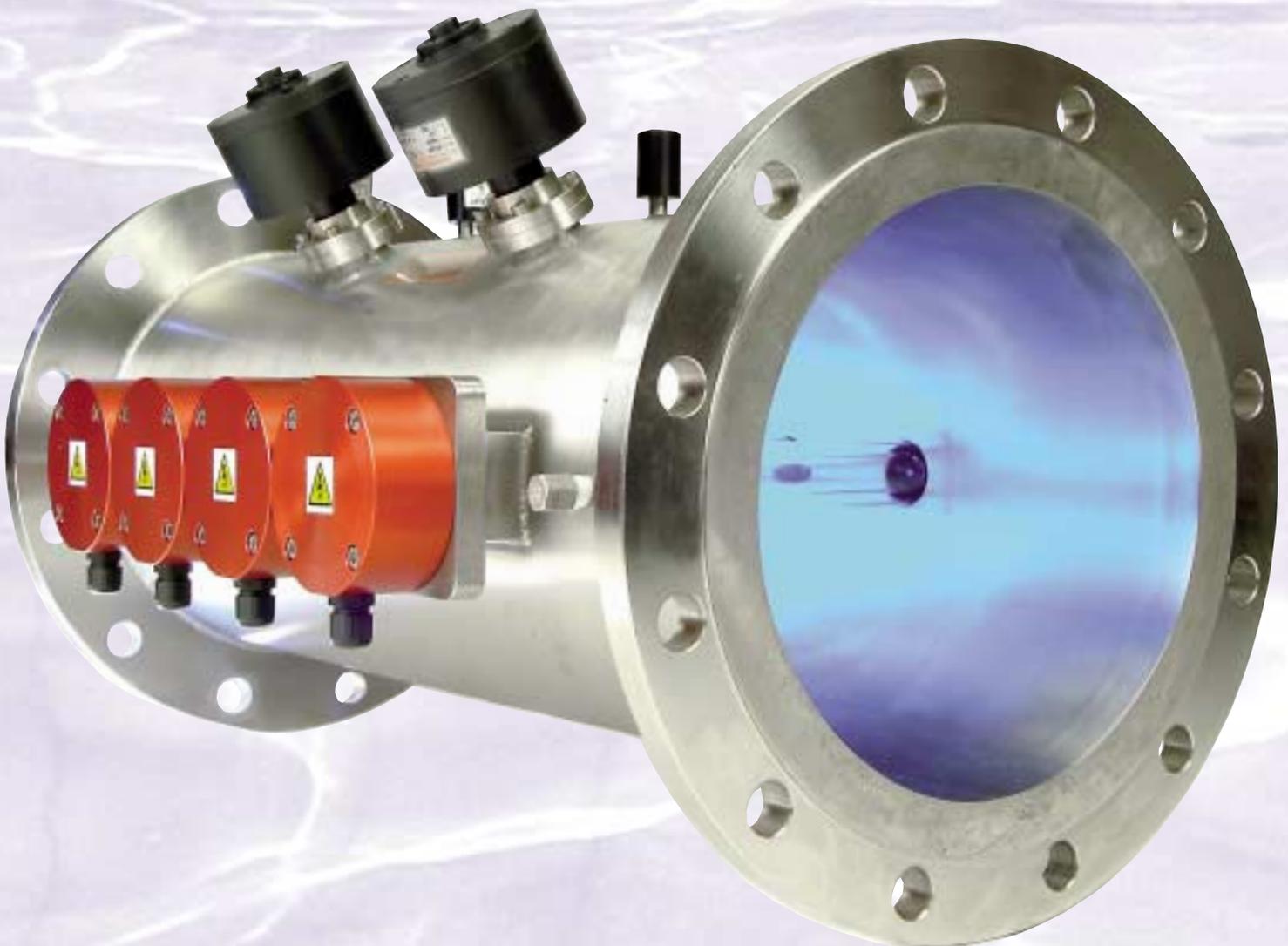
The Rodin Group

the water friendly company



Ultrodin Ultraviolet Disinfection Systems

an environmentally friendly, chemical-free
water disinfection system



Ultrodin – using green ultraviolet technology
to treat water contaminated
by bacteria, viruses and pathogens

Ultradin UV - features and benefits

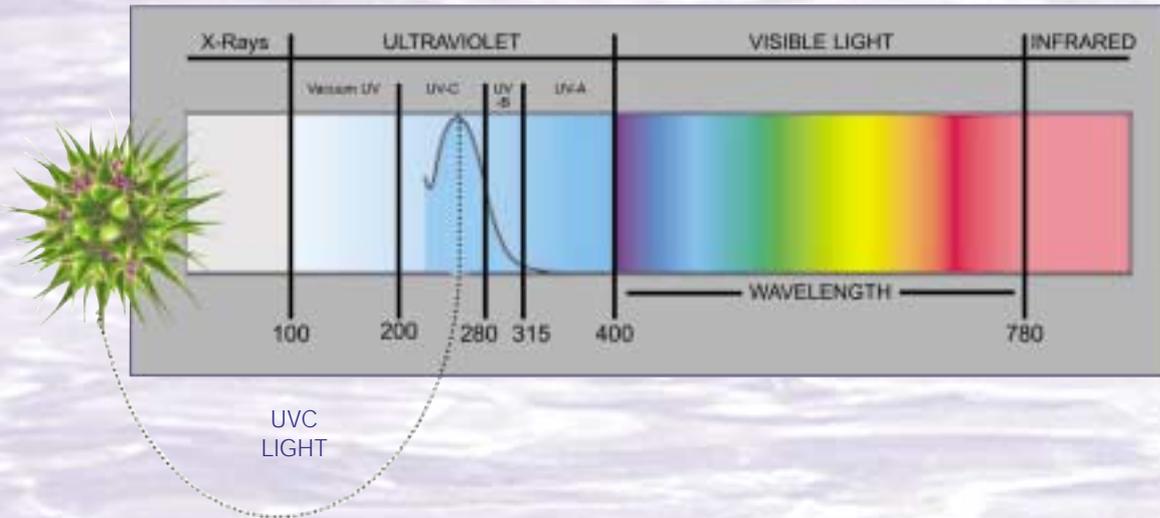
Ultraviolet (UV) treatment is a green technology that is effective against all micro-organisms including Chlorine resistant organisms such as Cryptosporidium and Giardia. It is fully automatic, cannot be over dosed and is effective with either a single pass or re-circulating flow. It is environmentally friendly as no by-products are created during use while also eliminating the need for chemical disinfection in many circumstances.



- Environmentally friendly as no by-products are produced
- Approved for drinking water and does not alter its taste, colour or odour
- Cost effective - expensive chemicals are not required
- Eliminates risk of over dosing with chemicals and subsequent corrosion to pipework and valves
- 316L stainless steel construction ensures corrosion resistance
- UV intensity is monitored to ensure effective dose levels of UV are maintained
- Wiper systems are available to ensure optimum operating performance
- Control panels integrate with building management systems
- Compact design allows installation where space is a constraint
- Simple, low cost maintenance procedures
- Low energy consumption
- Systems available for a wide range of flow rates
- High quality manufacture and design with full technical after sales support and maintenance if required
- Proven track record – installed worldwide
- WRAS Approved



Ultroдин UV - the operating principles



Over 100 years ago German scientists discovered that the top surface of lake water was sterile when exposed to sunlight. Investigation led to the discovery of Ultraviolet light. Situated in the electro-magnetic spectrum between X-rays and visible light, Ultraviolet (UV) light has many beneficial properties. UV light is split into four main categories, UV-A, UV-B, UV-C and Vacuum UV. The area between 240 and 280 nanometres (nm) is UV-C, commonly known as the germicidal region.

UVC light has the ability to cause permanent damage to a wide variety of organisms in water, air and other fluids. UV light is a physical, non intrusive method of ensuring that organisms are unable to replicate, and hence remain inert. In addition to disinfection, a correctly sized UV system can also be used for de-chlorination and to de-ozonate process water, and to assist in the removal of TOC (Total Organic Carbon) and Urea from ultra pure water.

UV does not effect the taste, colour, or ph of the fluid being disinfected, and as such the technique is often used where conventional disinfection with chlorine cannot be applied, such as within a brewery, soft drinks plant, pharmaceutical facility, fish farm or environmentally sensitive application. The range of applications for UV systems are shown on pages 5 and 6.

UV DOSE

UV light output at 254 nanometres is known as UVC light (germicidal region), and has the ability to inactivate all known micro-organisms, bacteria, pathogens, virus and moulds, including chemically resistant organisms such as Cryptosporidium and Giardia. UV dose is commonly measured in mJ/cm².

Systems are typically sized in two ways: -

- 1 To provide a minimum level of UV intensity. This sizing ensures that the UV intensity at the furthest location from the UV lamp (UVC light source) is the minimum dose the system will provide. This UV dose is known as a wall dose.
- 2 An average dose takes into account the wall dose (furthest distance from the UV lamp) and the area immediately in front of the UV lamp where the UV output is greatest. The average dose for the system is then calculated using these values which means that the UV dose at the wall will be lower than the average dose for the system as a whole.

For more information on sizing and dosing of Ultroдин UV systems please refer to page 10.



Ultrocin UV – effectiveness against micro-organisms

UV IS EFFECTIVE AGAINST ALL MICRO-ORGANISMS

Some micro-organisms are resistant to chlorine, but all are susceptible to ultraviolet light. Therefore disinfection by UV is very effective against bacteria, algae, moulds and yeasts. Bacteria and viruses are the major cause of water borne pathogenic diseases. Enteric viruses, hepatitis viruses and legionella pneumophilia are known to survive for considerable periods in the presence of chlorine, but are effectively eliminated with UV treatment.

UV DISINFECTION HAS NO ADVERSE BY-PRODUCTS

Chlorine in contact with organic contamination found in some waters forms halogenated by-products such as trihalomethanes (THMs) which have been proven to be carcinogenic. Ozone possesses properties which require considerable care in its choice and application. In contrast UV light has no adverse effect on water quality.

TYPICAL UV DOSES FOR INACTIVATION OF MICRO-ORGANISMS

The table below shows the approximate dose values for the inactivation of 90% (log 1 reduction) and 99.9% (log 3 reduction) of waterborne organisms pathogenic to humans.

The results were achieved using laboratory cultured organisms and some studies have shown that bacteria populations in the environment will require a higher UV dose to ensure inactivation occurs. This highlights the need to size the unit correctly to achieve the appropriate wall dose. For more information on sizing and dosing of Ultrocin UV systems please refer to page 10.

Bacteria/Viruses/Protozoa				
Disease	Organism	Bacteria/ Virus/ Protozoa	UV DOSE mJ/cm ² @ 90% (log 1 reduction)	UV DOSE mJ/cm ² @ 99.9% (log 3 reduction)
Typhoid Fever	<i>Salmonella typhi</i>	Bacteria	6	17
Dysentery	<i>Shigella dysenteriae</i>	Bacteria	3	8
Cholera	<i>Vibrio cholerae</i>	Bacteria	2	7
Gastroenteritis	<i>Escherichia coli</i>	Bacteria	5	14
Legionnaire's disease	<i>Pneumophila</i>	Bacteria	8	23
Infectious Hepatitis	<i>Hepatitis A virus</i>	Virus	6	17
Poliomyelitis	<i>Poliovirus type 1</i>	Virus	7	22
Gastroenteritis	<i>Rotavirus SA-11</i>	Virus	10	29
Cryptosporidiosis	<i>Cryptosporidium</i>	Protozoa	3	12
Giardiasis	<i>Giardia</i>	Protozoa	2	11

Data references

Bacteria and viruses - Hijnen WAM, EF Beerendonk and GJ Medema 2006. Inactivation credit of UV radiation for viruses, bacteria and protozoan (oo) cysts in water: a review. Water Res 40:3.22
 Protozoa – US Environmental Protection Agency

COMPARISON OF UV TO SIMPLE CHLORINATION

As well as being effective against all known micro-organisms, Ultrocin systems have a low operating cost and are designed specifically for ease of installation and maintenance. This is shown below compared with the most common alternative primary disinfectant, which is simple chlorination.

	Ultraviolet	Simple Chlorination
Initial capital cost	Low	Lowest
Ease of installation	Excellent	Good
Overall operating cost	Very low	Low
Ongoing maintenance cost	Low	Low
Ease of maintenance	Excellent	Good
Maintenance frequency	Annually	Frequent
Virucidal performance	Good	Poor
Hazards to personnel	None	High
Requires toxic chemicals	None	Yes
Trihalomethanes formation	No	Yes
Operational problems	Low	Medium
Water residence time	0.1 - 5 seconds	30 - 60 seconds
Performance with variable flows	Excellent	Poor



Ultradin UV – applications

A wide range of Ultradin UV systems exist with a choice of control panels that allow integration into a variety of applications. Market leading designs allow for the systems to be optimized to suit any operational requirements for a vast range of industry applications and processes, some of which are set out below.

DRINKING WATER

From small well water supplies to large water treatment works UV disinfection is a proven barrier to pathogenic micro-organisms including Cryptosporidium and Giardia.



WASTE WATER

From municipal treatment to water recovery for irrigation and re-use, UV treatment can provide the final disinfection stage required to meet increasingly strict regulations.

SWIMMING POOLS

Sparkling clear water and clean fresh air. UV destroys the chemicals responsible for poor water quality and reduces the risk of illness from chlorine resistant micro-organisms. UV can provide dual functionality within a swimming pool application with combined chlorine reduction as well as bacteria disinfection.



PHARMACEUTICALS

Our range of high specification systems are specifically designed for installation into high purity water loops for the world's leading pharmaceutical companies.



AQUACULTURE

Market pressures demand chemical and antibiotic free produce; to stay competitive, intensive farming requires UV disinfection to prevent infection and disease.

ELECTRONICS

High quality systems specially designed for the production of low TOC (Total Organic Carbon) ultra pure water for use within a range of electronic production applications including semi conductors.



FOOD & BEVERAGE

The importance of bacteria free products combined with the need to vastly reduce chemical additives has established Ultraviolet disinfection as a core technology.



Ultradin UV – applications

HORTICULTURE

UV treatment will not affect the chemistry of water fed to the Rhizosphere. Unlike Hydrogen Peroxide it does not affect the organic additives, germination or seedling development.

PROCESS WATER

Chemical free UV disinfection has become a key technology for process water applications, including condensate cooling water, fountains, cooling towers, storage tanks and mains supplies.

AIR CONDITIONING

UV systems treat condensate cooling water, a prime source of bacteriological growth in air conditioning applications. Ideally suited for this application, UV is an effective barrier against viruses, bacteria and parasitic micro-organisms.

COOLING & HEATING

Micro-organisms such as *legionella* can thrive in cooling/heating systems. Evaporated water and spray can carry harmful micro-organisms to populated areas, posing a significant threat to public health. UV provides an effective non-chemical solution.

WATER FEATURES

UV systems effectively protect against harmful micro-organisms such as *legionella*, which present a significant danger in water feature applications e.g. fountains, where wind can carry infected atomised water great distances.

ICE MAKERS & VENDING

All ice makers and post mix vendors in commercial establishments are connected to a water supply. Utilising a low pressure UV unit will ensure that the water is free of harmful micro-organisms and bacteria.

NORMAL UV DOSE REQUIRED FOR TYPICAL UV APPLICATIONS

Typical Application	Typical UVT* %	Required Dose
Drinking water	90% - 95%	30 mJ/cm ² Wall Dose
Waste water	50% - 80 %	30 mJ/cm ² Wall Dose
Swimming pools	94%	60 mJ/cm ² Average
Aquaculture	85% - 90%	320 mJ/cm ² Average
Rain water harvesting-irrigation	80% - 85%	150 mJ/cm ² Average
Rain water harvesting-process	80% - 85%	30 mJ/cm ² Wall Dose
Process water-towns mains	90%	30 mJ/cm ²
Make-up water-towns mains	90%	30 mJ/cm ²
Cooling loops	70% - 90%	30 mJ/cm ²

*UVT – Ultraviolet Transmittance



Ultrocin UV – certification and warranty

WRAS

All the Ultrocin range comes with full WRAS approval and are manufactured in an ISO 9001 manufacturing facility so you can be assured our systems are consistently engineered to the highest standards.

Our UV systems have been designed to meet exacting standards by engineers who are highly experienced within the Ultraviolet industry.

WARRANTY

The Ultrocin product range is covered by a one year warranty as standard. The warranty will be extended by a further year up to a maximum of five years provided a full service contract is taken out through The Rodin Group and only genuine manufacturers approved consumable parts are used. The warranty is a sure sign of quality, demonstrating that Rodin not only works hard to provide world class system designs but continues to provide customers with a world class after sales support service. The warranty covers chambers, mechanical parts and electrical components but excludes consumable spares & labour. (UK supplied product only).

VALIDATION

For critical systems where dose delivery must be assured, we can supply 3rd party validated Ultraviolet systems for a range of applications at varying Ultraviolet transmittance (UVT%). These systems are validated to

the US EPA UVDGM (Ultraviolet Disinfection Guidance Manual) Standard. This gives us the flexibility to offer systems for both RED dose and 1 - 5 LOG reductions.

All modern systems for drinking water and make-up water applications are now expected to be validated by a 3rd party test house. Our systems have 3rd party validation using the US EPA UVDGM, a standard seen as the 'worlds strictest performance criteria'. This ensures our systems will perform and guarantees the system provided will be future proof against new specification standards and legislation.



DWI FEBRUARY 2010 GUIDELINES

3rd Party validation is now a major part of the UK Drinking Water Inspectorate (DWI) Guidelines on UV Disinfection February 2010. These guidelines directly reference the use of the US EPA UVDGM Standard as the preferred validation standard for drinking water companies throughout the UK. All our validated systems fully conform to US EPA UVDGM standards and with the DWI Guidelines February 2010.



Ultrocin UV – monitoring and control systems

The Ultrocin UV system is controlled through the use of either the Synergy 1 or Synergy 2 control panel. The Synergy 1 is a cost effective multi-feature control system while the Synergy 2 provides a higher specification whilst retaining an easy to operate control interface.



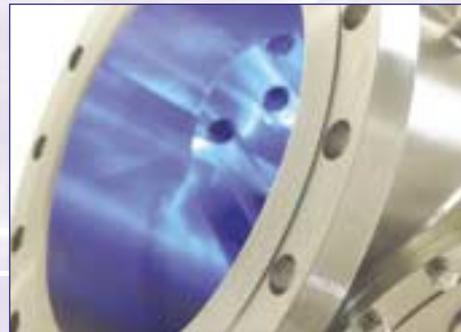
	Synergy 1	Synergy 2		Synergy 1	Synergy 2
Maximum working ambient temperature	35° C	35° C	Panel over-temperature fault		Yes
Electrical single phase	230V/50Hz	230V/50Hz	Chamber over-temperature fault		Option
Power on/off switch	Yes		Bleed temperature		Option
Start – soft touch		Yes*	LED display – UV intensity		Yes
Stop – soft touch		Yes*	LED display – chamber temperature		Option
Reset – soft touch		Yes*	Input – remote start/stop		Selectable
Power on indication	Yes		Input – pump un/stop process interlock		Selectable
Hours run	Yes		Output – system healthy contact		Yes
Lamp on indication	Yes		Output – water shut off solenoid contact		Yes
Lamp fail (volt free contact)	Yes		Output – UV intensity healthy contact		Yes
Fused solenoid valve output	Yes		Output – high temperature bleed solenoid contact		Option
Electronic ballast	Yes				
Audible alarm	Yes				
System running		Yes			
Process interlock (pump interface)		Yes			
Change lamp		Yes			
Lamp fault		Yes			

*Suitable for gloved operation

CONTROL CABINETS

The cabinets are hinged and made of epoxy coated mild steel. The dimensions of the control cabinets are set out below

	Synergy 1	Synergy 2
Height	250 mm	275 mm
Width	360 mm	385 mm
Depth	160 mm	160 mm



Ultradin UV - questions and answers



Which is better, UV or Ozone?

Both are highly effective for disinfection, however, ozone requires considerably more knowledge and maintenance to operate and maintain it. It also takes up considerably more space than a UV system. With UV systems, you just turn on the lamp and let it run.

What is typical low pressure lamp life?

Typically the average life of a lamp is approximately 12,000 hours. The warranty period of the low pressure lamp is 9,000 hours. However, lamp life will diminish if it is turned off and on frequently.

Does the world 'UV filter' mean the UV removes the microbes from the water?

No, UV systems do not remove the microbes from the water; they however do deactivate the bacteria by breaking down their DNA using UV-C rendering them unable to reproduce.

Is UV effective against all types of bacteria?

There are currently no known microbes that are resistant to UV treatment.

Does UV treatment affect the end products taste, colour or ph value?

UV does not affect the taste, colour, or ph value of the fluid being disinfected, and as such the technique is often used where conventional disinfection with chlorine cannot be applied.

How long has the technology been used for disinfecting water?

The first systems were installed in Eastern Europe in the 1980's with now many units installed all over the world including Sweden, Germany, France, Poland, China, Australia, the Middle East, America and more recently in the UK.

How do you size a UV system to ensure they are providing the correct level of treatment?

UV dose is measured in mJ/cm^2 . and systems are typically sized in two ways: -

- 1) A Wall Dose (Minimum Dose), provides a minimum level of UV intensity. This sizing ensures that the UV intensity at the furthest location from the UV lamp (UVC light source) is the minimum dose the system will provide. This UV dose is known as a wall dose.
- 2) An average dose takes into account the wall dose (furthest distance from the UV lamp) and the area immediately in front of the UV lamp where the UV output is greatest. The sizing method calculates an average dose for the system.

What are the possible locations and applications where Ultradin UV systems could be utilised?

Air conditioning, cooling and heating, water features, ice makers and vending, drinking water, water supplies and swimming pools are all possible applications.



Ultrodin UV - model range and sizing

Ultrodin UV provides a comprehensive model range for a wide range of water treatment applications

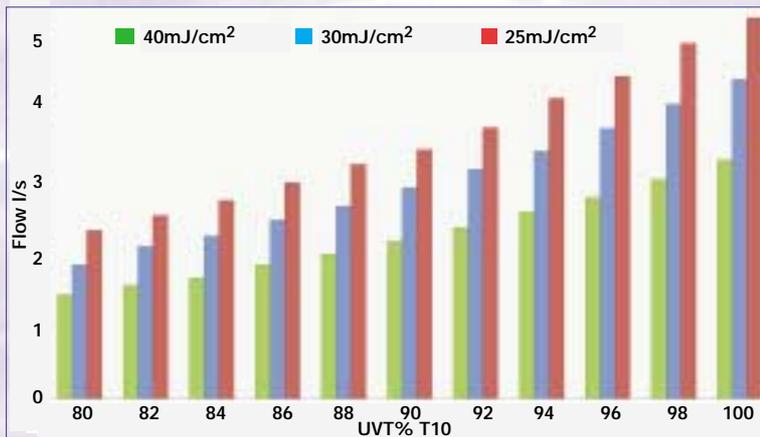
ULTRODIN UV SYSTEMS - SIZING CHART

Model number	Wall Dose 30mJ/cm ² Single pass Flows in l/s at T10		Model number	Wall Dose 30mJ/cm ² Single pass Flows in l/s at T10	
	95%	90%		95%	90%
ULTRODIN 1-15-2	0.12	0.11	ULTRODIN 3-200-4 (v)	3.56	2.89
ULTRODIN 1-30-2	0.24	0.22	ULTRODIN 2-325-3	4.11	3.60
ULTRODIN 1-55-2	0.44	0.40	ULTRODIN 3-325-4	6.12	4.75
ULTRODIN 1-75-2	0.60	0.56	ULTRODIN 3-2200-6	8.63	5.50
ULTRODIN 1-75-3	0.93	0.81	ULTRODIN 3-2325-6	13.28	8.17
ULTRODIN 1-75-4	1.18	0.96	ULTRODIN 3-3200-8	16.69	10.08
ULTRODIN 3-120-4	1.92	1.55	ULTRODIN 3-4200-8	23.75	15.73
ULTRODIN 2-200-3	2.56	2.25	ULTRODIN 3-3325-8	26.99	16.35
ULTRODIN 2-200-4	3.56	2.89	ULTRODIN 3-4325-8	40.07	26.23

All units in the sizing chart above include a lamp monitor and volt free contact as standard. Various options are available on request. The data assumes a maximum velocity of 3 m/s and a UV transmittance percentage(UVT%) of T10 (1 cm cell)

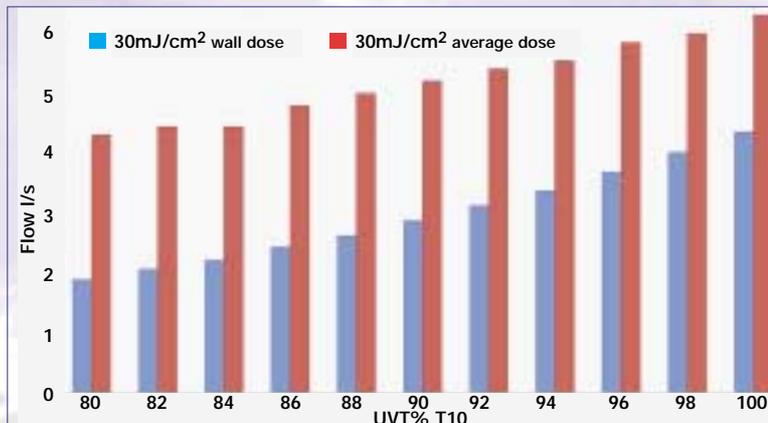
The sizing chart shows a wide range of fully WRAS approved units and comprehensive technical data sheets are available to support each model. **Alternative sizes covering additional flow rates are available on request.** Details of the Synergy control panels for the above units are set out on page 8.

EFFECT ON FLOW RATE OF USING DIFFERENT DOSE STRATEGIES AT A GIVEN LEVEL OF UV TRANSMITTANCE



This graph shows the maximum flow for a given dose and Ultra Violet Transmittance(UVT). Three different dose strategies are shown for each UVT being 40mJ/cm², 30mJ/cm² and 25mJ/cm². The graph also shows how the flow increases with an increase in UVT and allows a comparison of flow rates to be made between each dose strategy for a given level of UVT.

FLOW RATE VARIATIONS RESULTING FROM USING WALL DOSE LEVELS OF 30mJ/cm² AS OPPOSED TO AVERAGE DOSE LEVELS OF 30mJ/cm² AT A GIVEN LEVEL OF UV TRANSMITTANCE IN A TYPICAL 200 WATT ULTRODIN UV UNIT



This graph shows that a lower flow rate is required for a wall dose of 30mJ/cm² compared to an average dose of 30mJ/cm² for any given level of UVT. For a detailed description of the difference between wall dose and average dose please refer to page 3.



Specifying Ultroдин UV systems

The use of ultraviolet (UV) light has now become standard practice in a vast range of industries including municipal drinking water and waste water treatment, industrial process and manufacturing, offshore and marine and aquatics. Ultraviolet disinfection systems are used to ensure water is free from harmful organisms, and is a proven, regulated and environmentally friendly technology.

In order to provide the best Ultraviolet system to suit your needs, the following variables are required to size a UV system for a specific application. The following information is helpful but not essential to providing a quotation: -

- Flow rate
- Application
- Water Source
- UVT (Ultraviolet Transmittance) percentage
- Details of pre-treatment (if any)
- Intended use
- Known biological challenge
- Known dose standard
- Treatment cycle

ULTRODIN SPECIFICATION

- The water disinfection unit shall, subject to correct sizing and UV dose, deactivate all waterborne organisms and prevent them from being able to reproduce by the use of ultraviolet light with a wave-length of 254nm
- The disinfection process will generate a minimum wall dose of 30mJ/cm² where the UVT is at least 90%
- Photonic energy at a wave-length of 254nm will be produced by the lamps within a chamber constructed of 316L stainless steel
- The UV lamps will be secured using a twist lock system
- No additives shall be used in the process and no harmful residuals shall be formed
- The unit shall include a full control system that runs from a 230v 50Hz single phase supply
- The control of the UV system will be carried out through either a Synergy 1 or Synergy 2 control panel
- Water disinfection units shall be Ultroдин UV from The Rodin Group Ltd (www.therodingroup.co.uk) or equal and approved subject to a technical submittal demonstrating compliance with the above criteria.



The Rodin Group range

WATER TREATMENT PRODUCTS

CARTRIDGE FILTERS



CHLORINE DIOXIDE



CYCLONE FILTERS



SCALE-BUSTER



TITANIUM AOP SYSTEMS



WATER SOFTENERS



WASHROOM PRODUCTS

TOILET CUBICLES



WATER SAVING AERATORS



WATER SAVING SHOWERS



WATERLESS URINALS



WATER SAVING TAPS



ACCESSIBILITY



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