



Customer Manual



MADE IN USA
Effective 10-01-11

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THE APPLICATION OF ULTRAVIOLET LIGHT TECHNOLOGY

Ultraviolet light (UV) provides a non-chemical, environmentally friendly treatment option for a wide range of processes. Most microorganisms, even *cryptosporidium*, are inactivated in less than a second by high doses of UV light, leaving no undesirable chemical residues. Due to their compact size, low ownership costs and simple maintenance requirements, UV-disinfection units have been installed by many of the world's multi-national soft drink companies, breweries, pharmaceutical giants, municipal waterworks, and wastewater treatment plants.

Applications for UV light treatment continue to grow. In addition to inactivation of microorganisms, UV will break down inorganic and organic pollutants in water. This is particularly true in the **swimming pool industry**, where, in addition to the disinfection benefits, a significant reduction in **combined chlorine levels** can be achieved.

ECF



ECP



DEFINING ULTRAVIOLET LIGHT

For the past 100 years, science has recognized the bactericidal effects of UV. UV is the section of the electromagnetic spectrum with wavelengths shorter than that of visible light, in the range of **200 nm – 400 nm**. It is customarily divided into three categories known as UVA, UVB and UVC. **nm = nanometer- defined as one-billionth of a meter.**

UV breaks down the nucleic acids of DNA (RNA in the case of viruses). Although cells have the ability to repair some of the damage, sufficient high UV doses overwhelm the repair mechanisms, and the organisms cannot replicate.

All cells when subjected to sufficient doses of UV, process in a similar manner:

- UV light penetrates the cell wall.
- Cellular DNA absorbs the UV light.
- DNA is altered, which ceases cell reproduction capability.
- Organisms are destroyed and are unable to cause disease.

The effectiveness of the **UV wavelengths** depends on the **DNA** absorption curve. The absorption peaks between 260 nm and 265 nm, which makes this range the most efficient for inactivation / disinfection. **DNA, however, absorbs UV** in the whole wavelength range between 200 nm and 315 nm, so any light emitted in that part of the spectrum will have some germicidal effect. Wavelengths that operate within the 200 nm and 315 nm range are known as the UV-C spectrum.

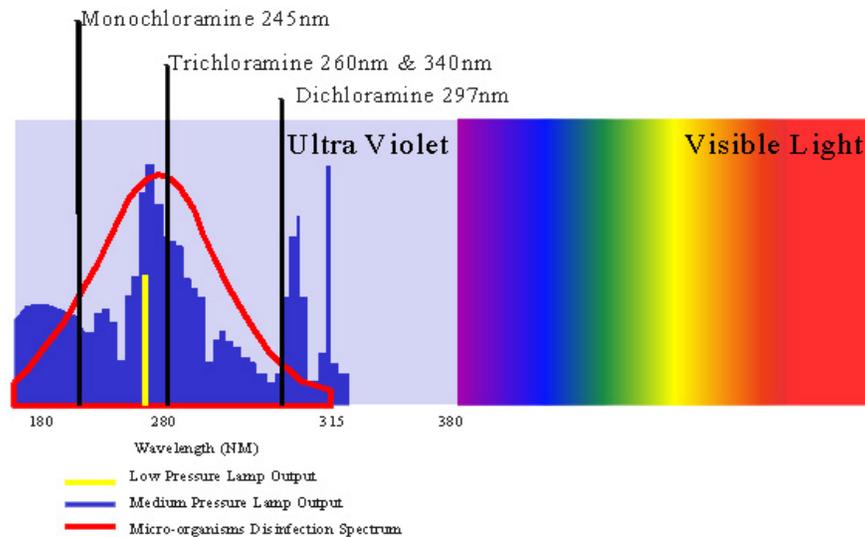
Generating UV Light

The UV lamp is similar to a standard fluorescent bulb. The bulb contains electrodes at each end, is filled with a pressurized gas (**low or medium pressure**) and a small amount of mercury. Energy applied across the electrodes excites the liquid mercury into gas within the bulb; resulting in the generation of UVC energy. UV light is generated within two types of discharge lamps: low pressure and medium pressure.

Low-pressure lamps emit almost all of their UV energy at 254 nm with operating temperatures of 110°F at the lamp surface. Low-pressure lamps have a lower power output (30 watts-200 watts), and are sensitive to water temperature variations. They lose their effectiveness above 68 Degrees F. The low power per lamp results in a large number of low-pressure lamps required for all but the smallest flows.

Medium pressure lamps produce an energy band in the bactericidal region of 200 nm to 315 nm, and remain unaffected by water temperature variance. Only medium pressure lamps emit multiple wavelengths suitable for chloramine destruction. The development of medium pressure lamp systems with high power outputs (1.3kW - 7.3kW) has resulted in compact / high flow UV units.

“It’s All in the Wavelength”



UV Dose & Inactivation

The disinfection efficiency of UV is based on the applied energy over a given surface. The conventional terminology refers to it as dose (a more modern and scientific term is “fluence”). This is expressed as: **Dose = Intensity x Time**. The intensity is determined by the UV lamp power and time is determined by the period in which the process fluid is exposed to the UV light. **Flow rate** is a critical factor affecting time of exposure to UV. ETS has performed extensive research to ensure adequate flow is maintained to achieve the desired results.

The effect of the applied dose is dependent on the species itself. Some simple bacteria, such as *E. coli*, require relatively small doses, while other microorganisms (*Hepatitis A*, *Cryptosporidium parvum*) need substantially higher levels. Examples of doses for 90% destruction (one-log) of some common microorganisms are shown within the table on the following page.

Raising the dose for a specific organism has a logarithmic effect, such that doubling the dose for 90% inactivation will result in 99.9% (three-log) inactivation. The number of surviving microorganisms is therefore a function of their initial number and the applied dose.

Many industrial applications are designed for a dose of 30 mj/cm². Doses vary depending on the specific goals to be achieved. For swimming pools and spas, ETS recommends and designs their systems for a dose of 60 mj/cm² for combined chlorine reduction. For disinfection ETS recommends 40mj and USEPA (3 log reduction) for re-circulated pools, splash pads and spas.

Dose Requirement For Some Common Microorganisms

DISEASE	ORGANISM	UV DOSE	UV DOSE
		90% KILL mj/cm ²	99.9% KILL mj/cm ²
TYPHOID FEVER	SALMONELLA TYPHI	2.2	6.5
GASTRO-ENTERITIS	SALMONELLA ENTERITIS	4.0	12.0
DYSENTERY	SHIGELLA DISENTTARIAE	2.2	6.6
CHOLERA	VIBRO CHOLERATE	3.4	10.1
TUBERCULOSIS	MYCOBACTERIUM	6.2	18.6
LEGIONNAIRE'S DISEASE	LEGIONELLA PNEUMOPHILIA	2.5	7.5
CRYPTOSPORIDIOSIS	CRYPTOSPORIDIUM	2.5	12.0

Water Clarity

The efficiency of UV treatment is dependent on the transmission of UV light through the fluid (air or water) to be treated. UV transmission through water decreases as the level of contamination increases. The most important factors to consider in determining water quality and UV transmission are color, metals (iron & manganese), organic matter, turbidity, and suspended / dissolved solids.

Lower transmissions require more applied UV power to achieve the required dose.

Typical Transmission Rates for Water

SUBSTANCE	TRANSMISSION
Sewage Effluent	45%
Water High in Humic Acid	90%
Lake/River Surface Water	92%
Potable Water	94%
Typical Pool Water	94%
Demineralized Water	100%

COMMON QUESTIONS ABOUT VALIDATION

What is validation?

Validation is a method of testing UV equipment to determine how effective and efficient it is in killing various organisms at a range of flows and with different water qualities

Can this be done by calculation, computer, or other theoretical information?

NO. Validation can only be performed by testing the equipment actually on microorganisms. Validation is ALWAYS based on actual inactivation of microorganisms

Does this involve testing the equipment on, for example, cryptosporidium?

No. Validation testing is always done on safe to handle surrogates. The surrogates used must be appropriate for the application and the performance differences to the target organism (eg cryptosporidium) must be known.

What surrogates are used for the testing?

Validations would typically use either MS-2 or Bacillus subtilis as the surrogate. The scientific community is more comfortable with these organisms as their sensitivity to UV is more reproducible amongst testing laboratories.

I have been told that bacillus subtilis is a superior surrogate and tests using this should be considered as superior and equipment using this surrogate can be rated higher than it has been validated for?

NOT TRUE. The main requirements for a surrogate are linear performance and sensitivity to treatment as close to the target organism as practical. MS-2 is slightly superior on both counts. However these variations are taken into account by the USEPA and NO EQUIPMENT can be considered to be validated above its performance test curve no matter what surrogate is used.

A manufacturer has presented a test carried out internally with the bacterial results undertaken by the 'results you want testing laboratory'. Is this third party testing?

NO. The testing, bacterial analysis and reports must be completed and compiled by a third party test house NOT the manufacturer.

Can any organization carry out third party tests?

In theory yes if they have the right qualifications and experience to carry out this testing. However; if there are errors in the report, the validation may not be accepted by regulators. There are a number of reliable companies/agencies in the USA and overseas, reports from Hydroqual, Carrollo, DVGW, Onorm and the NSF ETV program are acceptable. Any alternatives presented should be carefully checked and seek independent advice.

Is NSF-50 Annex H testing crypto validation under the USEPA?

NO. The NSF-50 Annex H is not the same as the NSF-ETV program and does not qualify as third party validation under the USEPA. This is stated on the NSF-50 site under the manufacturer's listings. Additional testing is required under Section 13 for crypto validation.

I have been told that DVGW validation is superior to USEPA because they test with doped quartz and therefore I can rate the equipment higher than its validated performance.

NOT TRUE. DVGW does test with doped quartz but if the USEPA test is carried out with, for example Lignane Sulfonate or SuperHume, as a transmittance modifier the performance will be no different during testing with or without doped quartz. As stated previously, NO EQUIPMENT is validated to a higher performance level than its validation test.

What is UV transmittance?

This is the percentage of UV light travelling through the water from the UV source (lamp).

Why is it important?

The overall performance of the UV equipment, as well as, its validated performance is reduced when the transmittance is lower. If the transmittance is lower than expected the equipment will not be validated to the same flow rate.

What is the transmittance for a typical pool?

This will vary depending on the bather loading and the pool type. Typically pools will have a transmittance of 93 – 94% and Spa's and other splash pads 90 – 93%

I have a requirement for 500gpm and the manufacturer has a validation certificate stating a performance of 525gpm at 98%. My pool has been measured with a transmittance of 94%. Is the equipment suitable because the actual flow is only 500gpm, which is more than a 4% reduction?

NO. The reduction in validated performance between 98% and 94% is not linear and would be approximately 30% or more for typical systems. The manufacturer must show the validated performance at 94% NOT apply any calculation to the 98% rating. The third party test report should clearly show this.

What is validated range?

Testing will be carried out at more than one flow, more than one transmittance and often more than one dose or power level. These tests are usually at the limits of the normal operating range of the equipment.

Is this important?

Yes. The performance of the UV equipment is recorded on a performance curve (similar to the way a pump performance is recorded as a curve). UV performance determined by extending the curve beyond the limits of the test points is not acceptable as evidence of validation.

What does this mean for flow?

As the flow increases the performance of the UV equipment reduces. In addition, the hydraulic performance may be non-linear at higher flows. For this reason if the highest tested flow point during validation is 500gpm the maximum validated flow is 500gpm no matter what other factors may indicate. This is because the performance curve cannot be safely extrapolated with confidence from the highest test point. This is not a problem for lower flows as the performance is always better as the flow is reduced.

What does this mean for transmittance?

As the UV transmittance is reduced the validated performance is reduced. For this reason if the lowest tested transmittance was 90% the equipment is NOT validated for any transmittance of less than 90%. Equipment tested at only one transmittance is not rated for any transmittance LESS than this value.

I have been told that DVGW testing is at a fixed dose which will give 99.99% reduction and therefore for a 99.9% reduction I can rate it much higher than its validated performance?

NO. Validation is designed to remove the element of calculation from the UV selection. Because the USEPA test can be carried out at doses above and below the requirement for 99.9% reduction it can be used to confirm validated performance between the upper and lower test point. Because the DVGW tests only at one performance level it is validated for performances up to that level only and only its validated test curve can be used. As stated before, EQUIPMENT IS NEVER validated for any performance outside the boundaries of its test curve.

I have a manufacturer's validated performance curve. At my tested 94% transmittance the curve indicates 180gpm. My flow rate is 500gpm but the salesman has explained that due to several factors of performance requirement, additional difficult test conditions, subsequent improvements to the equipment, the equipment can be shown to be equivalent to a 500gpm unit. Is this validated?

NO. As stated before, if it isn't clearly shown in the third party validation curve that this equipment meets your requirements, IT ISN'T VALIDATED. PERIOD

One manufacturer has included a validation factor, but another has said that this isn't relevant and therefore has not been included. Is this true?

NO. A validation factor reduces the equipment performance to compensate for any potential inaccuracies and deviations within the test data. This must apply to all validated systems. For DVGW systems this is a simple 30%, under the USEPA this can vary from 15% to 35% depending on the quality of the test data and consistency of the results. The reason the USEPA can have lower validation factor's is because more tests and data are collected, which gives a higher confidence in the reliability of the results.

What is RED Bias?

This is a correction that accounts for the difference between the UV dose measured with a surrogate microorganism and the UV dose that would be delivered to a target pathogen due to differences in the microorganisms' inactivation kinetics.

The RED bias is especially important when specifying a log reduction. For example according to the USEPA charts a 12 dose will provide a 3 log reduction, but the RED bias of 1.38 gives a 17 dose as a minimum for VALIDATED 3 log reduction.

A manufacturer has informed me that he has a US EPA certificate for the product so that this meets all validation requirements?

The US EPA does NOT issue validation certificates. It simply provides the test basis for other organizations to follow. There are **NO US EPA UV** Validation certificates or approvals by the US EPA

A manufacturer has offered me a letter confirming the equipment has been validated but not any validation data or performance curves. Should I accept this?

No, a UV system can be validated but it is essential that you are allowed to see confirmation that the validation conforms to your requirements. Don't forget a validated system is only validated within certain parameters.

VALIDATION DATA

More and more state health departments are developing codes to deal with disinfection of pool water. The disinfection dose required is different than the dose required to reduce or eliminate combined chlorine in the pool water. ETS has a range of units validated via third party testing to meet the requirements of health department codes.

In the new performance charts shown you will find which units including those validated that should be recommended for use depending on the flow required. Several factors are involved in this selection process. New York State and Ontario Province require a validated 40RED inactivation of crypto. All other state and provincial codes to date require a validated 99.9% (3-log) inactivation of crypto.

ECF Units Sizing Chart

				COMBINED CHLORINE	DISINFECTION	
Pipe	Model	Lamps	Total KW	Calculated UV Dose of 60mj/cm2	US EPA 3 Log Reduction and calculated 40mj/cm2	US EPA Validated 40 RED and calculated 40mj/cm2 (New York & Ontario)
4"	ECF -210-4	2*1.0kW	2	300	360	200
6"	ECF-215-6	2*1.5kW	3	580	665 (V)	375(V)
	ECF-220-6	2*2.0KW	4	800	1100	
8"	ECF-220-8	2*2.0kW	4	930	1100 (V)	528(V)
	ECF-225-8	2*2.5kW	5	1370	1310	
10"	ECF-225-10	2*2.5kW	5	1230	1310 (V)	675(V)
	ECF-230-10	2*3.0kW	6	1680	2046	
	ECF-425-10	4*2.5kW	10	2525	2620	
12"	ECF-230-12	2*3.0kW	6	1680	2046 (V)	880(V)
	ECF-233-12	2*3.3kW	6.6	2300	2250	
	ECF-430-12	4*3.0kW	12	3350	3705 (V)	1980(V)
14"	ECF-233-14	2*3.3kW	6.6	2150	2250	
	ECF-433-14	4*3.3kW	13.2	3590	4800	
16"	SX-635-16	6*3.5kW	21	4800	6400	

VALIDATION DATA

SP Units Sizing Chart

				COMBINED CHLORINE	DISINFECTION	
Pipe	Model	Lamps	Total KW	Calculated UV Dose of 60mj/cm2	US EPA 3 Log Reduction and calculated 40mj/cm2	US EPA Validated 40 RED and calculated 40mj/cm2 (New York)
3"	SP-25-4S	1*2.5kW	2.5	210	210 (V)	195(V)
4"	SP-25-6	1*2.5kW	2.5	365	365 (V)	281(V)
6"	SP-25-8	1*2.5kW	2.5	500	550	
	SP-50-8	1*5.0kW	5.0	800	990	
8"	SP-50-10	1*5.0kW	5.0	1145	1600	

ECP Units Sizing Chart

				COMBINED CHLORINE	DISINFECTION	
Pipe	Model	Lamps	Total KW	Calculated UV Dose of 60mj/cm2	US EPA 3 Log Reduction and calculated 40mj/cm2	US EPA Validated 40 RED and calculated 40mj/cm2(New York)
2.5"	ECP-110-4	1*1.0kW	1.0	114	170	
3"	ECP-113-5SP	1*1.3kW	1.3	176	260(V)	150(V)

Notes:

- 1) All flows based on a 95% UV transmission
- 2) All flows are based on end of lamp life expected performance
Hydraulic limits of 10feet/sec applied to
- 3) flows
- 4) Figures in black in bold with a (V) are VALIDATED in accordance with EPA guidelines
- 5) Figures in Blue are estimated from validated data

Operational Considerations

- **Bulb Life:** Average life expectancy of a medium pressure Ultraviolet lamp under normal conditions is equal to 8,000 – 12,000 hours. Life can be extended by “turning down” bulb intensity during low operational demand. Lower bulb intensity can be maintained at owner’s discretion as long as air and water quality remain sound. An external signal supplied from a flow switch/meter should be tied into the control cabinet to assure water flow through the chamber when the lamp is illuminated. Allowing the lamp to operate in non-flow conditions can affect lamp life.
- **Regular Maintenance Considerations:** We recommend that the owner / operator enter into a **service contract** with the equipment supplier/supplier representative upon purchase of a ultraviolet disinfection system. The contract should include that the equipment supplier/supplier representative will visit the pool site two (2) times per year to review and perform the following related items:
 - Lamp Performance – Service and change as required
 - Wiper Performance – Monitor operation and perform service work as required
 - Temperature Probe – Monitor performance and perform service as required
 - Ultraviolet Monitor – Monitor performance and perform service as required
 - Replace Seals as required
 - Examine quartz sleeve and clean / replace as needed.

Industry Trends: Aquatic Designers around the country are incorporating ultraviolet disinfection units into projects as a risk management/supplemental disinfection component and as a primary chloramines destruction device.

Better by Design

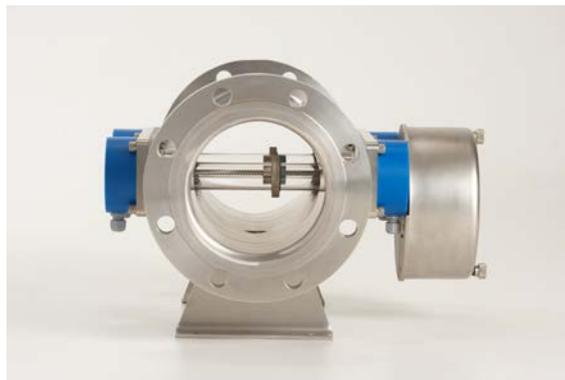
The proper design of a swimming pool UV system for both inactivation/disinfection and chloramines destruction, involves applying the **correct UV dose** while taking into consideration the transmission (water clarity) of the fluid. ETS understands that the chamber design is a significant part of the sizing formula and has employed extensive computer fluid dynamic modeling (CFD) to optimize the flow pattern through treatment chambers.

Low-pressure multi-lamp designs, utilizing large numbers of lamps housed in one chamber, can present hydraulic, mechanical, and monitoring challenges. The flow patterns are random, and the chambers often require baffle systems in an attempt to improve hydraulics.

ETS designs utilize **medium pressure** single or multiple lamp chambers. For extremely high flows, up to four medium pressure lamps may be used (as opposed to thirty-six low pressure lamps). The UV chamber is manufactured of **316L stainless steel** to the exacting standards determined by the CFD modeling. Chambers include temperature sensors and UV output monitors. The ultra-compact design allows simple installation directly into the process-piping configuration.



Our medium pressure UV systems are managed by **SPECTRA** microprocessor control units. They feature simple touchpad control buttons for ease of operation, but incorporate many user-configurable features for system integration. The **SPECTRA** microprocessor can even be set up to monitor your UV system from a remote computer.



Why Use Ultraviolet Light for Swimming Pools?

Ultraviolet light provides a supplemental, non-chemical, environmentally friendly treatment option for swimming pools.

Most microorganisms, including *Cryptosporidium*, are inactivated in less than a second by high doses of UV light, leaving no undesirable chemical residues.

The photochemical benefits of UV treatment have proven to significantly increase pool water and thus air quality, with very low combined chlorine levels and excellent clarity.

Due to their compact size, low ownership costs and simple maintenance requirements, UV disinfection units have been installed worldwide in many swimming pools.

Properly maintained systems provide continuous and reliable performance; year after year.

Advantages of Ultraviolet in Pool Water Treatment

- UV treatment provides its benefits at economical operating costs.
- UV destroys chloramines (combined chlorine), providing a more pleasant environment by eliminating eye irritation, itching and odors.
- UV reduces degradation of building, deck equipment, and ventilation components due to corrosive condensation.
- UV allows operating at lower free chlorine levels (with state approval) and eliminates the need for breakpoint chlorination.
- UV destroys the cause of red eye irritation, provides a cleaner safer environment and increases customer confidence.
- Provides high level disinfection for “chlorine resistant” pathogens in the filtered water.
- Self-cleaning, self-monitoring systems require minimal staff input and annual maintenance.



**Low Pressure Technology
And Side Stream Use**

Low Pressure Disadvantages:

- Not NSF 50 Certified for Commercial Swimming Pools for Validated Crypto Inactivation
- Use Multiple Lamps (as many as 6, 8, 12, 18 versus 1 or 2)
- Longer Chambers required to provide treatment time
- Lamps are sensitive to water temperature variations
- No wiper system to keep quartz clean
- No Calibrated UV Monitor to measure Intensity in order to provide accurate data on the effective disinfection dose being provided
- No capability to control intensity of lamp output with varying chloramines levels, bather load, external flow controls, or off hour pool use. (lamps run continuously)
- Lamps effective only at 254nm, tri-chloramines and di-chloramines not destroyed at that level of intensity provided by medium pressure wavelengths.
- Found to allow pathogens like crypto to be able to re-generate themselves in the pool water while the water is being treated and filtered.
- Higher operating cost, replace many more lamps, cost of lamps, many more quartz sleeves and more labor involved
- Utilize expendable ballasts to power the lamps, adding to service costs and affecting reliability.
- No built in safety controls, alarm system, etc.
- Large numbers of lamps do not allow for accurate measurement of output by the UV monitor.

Side Stream Use:

- Treats only a % of the water returning to the pool/spa
- Cannot keep up with Chloramines destruction and Disinfection in a typical public pool or heavy use spa
- Not acceptable by Health Department Codes

Why Choose ETS

Our equipment is superior because:

We use medium pressure technology

- Polychromatic light for improved chloramines destruction
- One or two lamps – not large numbers of low power lamps
- Smaller compact systems reduces installation and service space requirements
- Designed to improve performance by treating 100% of the filtration flow.

We supply quality equipment

- NSF/ANSI 50 Certified
- Manufactured in the USA
- MET/UL/CSA Approved
- ISO9001 Quality System
- Validated Systems for health code requirements.

We incorporate the most advanced wiper technology

- DC electrically powered - a safer alternative – no need for compressors or pneumatic supply
- The wiper 'parks' away from the lamp – reduced wiper ring degradation and no light shielding
- The location is determined by state-of-the-art optical readout, no proximity switches, magnets and timers with their associated reliability issues
- We use a multiple seal arrangement for high reliability and long life

We utilize the latest computer designed systems

- Lower pressure drop
- Maximizes efficient use of the UV energy
- Provides the industry standard 60mj/cm² UV dose at the end of lamp life for indoor applications and 40 mj/cm² UV Dose for outdoor applications.
- Simpler installation, smaller footprint
- Twin lamps for greater security – redundancy built in
- Can be installed vertically or horizontally, ideal for tight retrofits. Lamps must remain parallel to the floor.

We have designed our control system with pool operators in mind

- Self-cleaning, self-monitoring systems require minimal staff input and annual maintenance.
- Simple start, stop and reset controls with 'running' and 'fault' LEDs
- Text display of all parameters – temperature, flow, UV output, lamp hours
- Helpful display for all faults and spare parts

Why Choose ETS, cont'd

We have included many new pool interface options into the control system

- Process interlock for local pressure switch or pump interface
- Low power overnight operation using a full 24/7 timer
- Low power override for DE filter 'bump' operation
- Automatic restart on power supply interruption
- Modbus and Profibus Interface capabilities.

We use superior lamp technology

- Chokes not ballasts, ballasts replaced every couple years with most other manufacturers.

We have a fully trained distributor network in the USA and Canada

- Intensive spares, service, telephone support provided

EQUIPMENT WARRANTY

[Product Warranty – Terms and Conditions](#)

1. Product

Duration

The product (excluding consumables) is guaranteed for a period of five (5) years after commencement of operation provided that the customer/distributor has returned the warranty form after receipt of the unit in the required timeframe and has entered into a service agreement, with a factory trained representative, to annually service the unit as outlined in the Operations Manual.

Replacement of components under warranty

The manufacturer will supply replacement components to the same specification of the original component, delivered by carrier free of charge to the equipment site. The manufacturer reserves the right to request that items claimed as faulty under warranty are returned freight paid to the factory for inspection. Should the user unreasonably fail to return the defective item then the manufacturer reserves the right to charge for any items claimed under warranty.

Manufacturer repair under warranty

The manufacturer will carry out repairs under warranty under the following provisions:

The manufacturer will carry out a full repair and re-test of the equipment if required in the factory. In such circumstances all components and factory labor would be free of charge, as would any return freight. The user would be expected to return the unit for repair to the factory in the same condition as it is at the time of the claim.

The manufacturer can carry out repairs to the unit on site. Under such circumstances all site labor will be free of charge but the manufacturer reserves the right to charge for all travel time and travel expenses.

2. Consumables

Definition

Consumables are normally defined as all components having a limited life e.g. UV Lamps, Quartz sleeves, Seals, Wiper blades, Wiper bushings.

Replacement of components under warranty

The warranty period for consumables is dependent on the use and type; and users should consult on the consumables warranty for each installed system. The General Warranty is: UV Lamps 4000 hours use (assuming no more than 1 switch cycle per 24 hour operation Quartz sleeve 2 years use, excluding accidental damage

Seals replaced after use on each occasion:

Wiper seals 12 months operation (on normal operation)

Wiper blades 6 months operation (on normal operation)

Wiper bushings 12 months operation (on normal operation)

Replacement of consumables under warranty

The manufacturer will supply replacement consumables to the same specification of the original component. The manufacturer reserves the right to request that items claimed as faulty under warranty are returned to the factory for inspection. Should the user unreasonably fail to return the defective item then the manufacturer reserves the right to charge for any items claimed under warranty. Where consumables have run to more than 50% of their rated life then a pro-rata credit is normally issued.

Manufacturer repair under warranty

The user normally carries out consumable replacement. Should the manufacturer be requested to replace on site then all charges will be to the users account.

- 3. Limitation on Warranty.** The manufacturer fabricates UV systems from 316L stainless steel. This material is selected for resistance to corrosion. However, under certain conditions corrosion will occur. Notwithstanding any other provision in this warranty, all claims based on or caused by corrosion of 316L stainless steel are specifically excluded from this warranty, unless a specific corrosion warranty is provided.

- 4. Force Majeure**

ETS UV shall not be liable for any warranty claims resulting in whole or in part from Acts of God, including severe conditions.

Effective 9-13-10

SPECTRA CONTROL PANEL

The SPECTRA CONTROL PANEL incorporates the latest state-of-the-art microprocessor control system, with multiple levels of operation from basic controls to full plant and system integration. The SPECTRA CONTROL PANEL is available on all ETS medium pressure UV units.

Basic Controls and Display

- STOP, START and RESET soft touch push buttons suitable for gloved operation.
- UV lamp running and fault LED Two-line text display unit indicating:

- UV dose (derived from flow and intensity inputs)
- Lamp current
- UV intensity
- Flow (accepts a 4-20 mA signal from an optional flowmeter)
- Temperature
- Operational hours
- System spares listing
- Lamp fault, low UV & temperature alarm
- Temperature and bleed (pre-temperature) alarm
- Power supply unit over-temperature alarm
- Ground fault trip
- Wiper fault

All alarm functions have a simple text message display to assist the fault finding.



Interface Controls

- Local/remote operation
- Process interrupt (from valves, flowmeters, pressure switches)
- Valve control with limit switch feedback
- Low UV shutdown, or alarm only
- Bleed temperature
- Flowmeter input
- Auto-restart
- Half to full power or variable control (with daily and weekly timer)
- Duty/Standby
- System trip levels user selectable
- Modbus and Profibus interface capability

Quality Records

The SPECTRA has built in data-logging facility (retrievable by users on a standard PC or laptop)

The parameters logged are:

- UV intensity required (set point)
- UV intensity measured
- Lamp current
- Temperature
- Flow (if a flowmeter signal is supplied)
- Time and date
- All alarms generated
- Restrike timer, low intensity, low dose, high temperature, PSU temperature, lamp fault, ground leakage current

NOVA CONTROL PANEL

The NOVA CONTROL PANEL incorporates the latest state-of-the-art microprocessor control system, with simple to operate controls to effectively operate and monitor your standard ECP units.



Basic Controls and Display

- Simple STOP, START and RESET soft touch buttons
- UV Output, Lamp Current and Temperature display
- Lamp Running, Interlock and Lamp Change LEDS
- Fault Display for Lamp, Ground Fault, Over Temperature Warning, Wiper Fault
- 208/220V Single Phase Power

Interface Controls

- Process interrupt (from valves, flowmeters, pressure switches)
- Valve and Pump interface contacts
- Low UV shutdown, or alarm only
- Auto-restart on power failure
- Half to full power or variable control (with daily and weekly timer)
- Duty/Standby
- System trip levels user selectable

NEMA 4X SPECTRA CONTROL PANEL W/ COOLING UNIT

The NEMA 4X SPECTRA CONTROL PANEL is available for outdoor applications or severe indoor applications where the panel is susceptible to the environment. It is a completely enclosed 316SS enclosure with its own 316SS enclosed cooling unit to protect the internal components of the control panel.

The enclosure and the cooling unit are connected and individually isolated so that the panel can be turned off for repair with the cooling unit also separately controlled. It is available for all Models.

The cooling unit operates off its own **115V, 10Amp power supply** although it is interfaced with the control panel to insure that the panel does not operate without the cooling unit operating.



** Note: Photo does not show sloped top (ECF-ST)

TYPE	SUPPLY	WEIGHT	DIMENSIONS		
			Width	Height	Depth
NEMA4X -SP	480V 60 HZ 3PH	145lbs	36"	24"	12"
NEMA4X-ECF-A	480V 60 HZ 3PH	305lbs	44"	39"	12"
NEMA4X-ECF-C	480V 60 HZ 3PH	475 lbs	48"	48"	14"
NEMA4X-ECF-ST	480V 60 HZ 3PH	570 lbs	52"	54"	16"

ECP UNITS

Utilizing our proven medium pressure lamp technology, the ECP-type UV systems offer a high quality product at a very competitive price. Ideal for smaller pools and whirlpools with flows from 114 – 176 gpm and flange sizes from 2 1/2"-3". The ECP models offer the flexibility of a horizontal or vertical installation application

Treatment Chamber

UV treatment chambers are designed for installation into the pipe work after the filter, but before any chemical injection. Please refer to the ECP Units Technical Specifications document for chamber dimensions and clearance requirements.

The UV chamber is manufactured from polished 316L stainless steel and is flanged with ANSI 150 RF flanges for easy installation. Temperature probes, UV monitor probes, power control, and an automatic wiper are all included. ECP systems operate on 208V or 220V, single-phase power.



The treatment chamber has been designed for the simplest installation into any pipe work system. The compact design allows existing facilities to be easily upgraded with minimum site work.

Control System

The control system is located in a NEMA 12 (IP54) rated panel.

As a standard, it is supplied with a 15' cable for connection to the treatment chamber.

The power supply (PSU) and control cabinet is powered with the latest NOVA microprocessor control unit. Simple control and configuration allow for easy, uncomplicated, use by the operator. Includes a strainer as standard.

Auto power restart, pump and valve interfaces, process interrupt and low power overnight operation are all features specifically designed for use on smaller swimming pools, spas, and therapy pools.

ECP Units – designed to be the best.



ECP UNITS ARE ALSO AVAILABLE UPON REQUEST WITH A SPECTRA PANEL FOR FULL SYSTEM CONTROL. (Required for Validated Units)

ECP CONTROL UNIT TECHNICAL SPECIFICATIONS

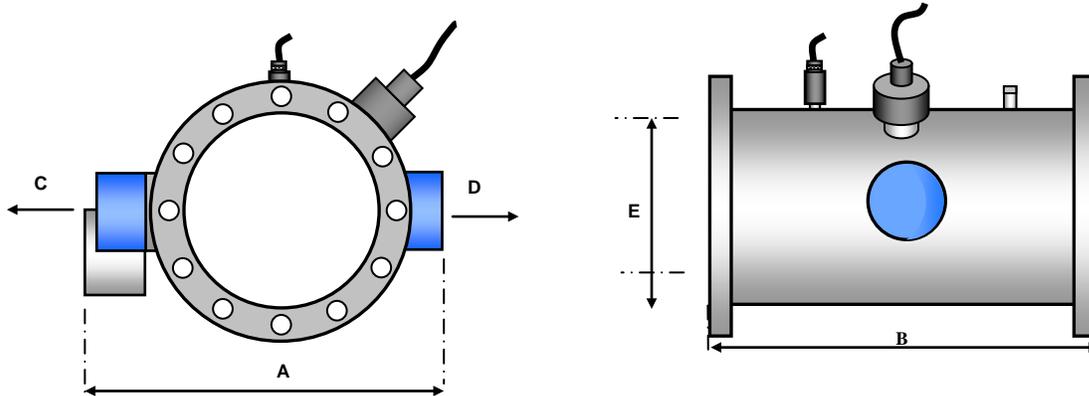


TYPE	SUPPLY	WEIGHT	DIMENSIONS		
			Width	Height	Depth
NOVA-A	208/220v 60hz 1ph	70lbs	20"	20"	8¼"
NOVA-B	220v 60hz 1ph	70lbs	20"	20"	8¼"
MATERIAL		Carbon Steel	IP Rating		IP54
COMPLETE WITH					
RCD protection			Over temperature Protection		
UV Monitoring			Automatic wiper		
NOVA Electronic control					
Simple START STOP and RESET buttons			UV Output, Lamp Current and Temperature display		
Lamp Running, Interlock and lamp change LEDS			Fault display for Lamp, Ground Fault, Over temperature and Wiper		
Auto restart on power failure			Valve and Pump interface contacts		
Half power operation for low pool use periods			Separate password protected engineer functions		

****ALSO SUPPLIED WITH SP-A-220 PANEL FOR FULL SYSTEM CONTROLS and ON VALIDATED UNITS.

**** ALSO SUPPLIED WITH NEMA4X CABINET FOR OUTDOOR USE

ECP TECHNICAL SPECIFICATIONS



TYPE	LAMPS & POWER	PANEL & CHAMBER WEIGHT (Dry/Wet)	DIMENSIONS & ACCESS					CONTROL PANEL TYPE
			A	B	C	D	E	
ECP-110-4	1.0kW	105/115lbs	17"	12"	16"	6"	2 1/2"	NOVA-A
ECP-113-5	1.3kW	112/126lbs	17"	12"	16"	6"	3"	NOVA-B
MATERIAL		316 Stainless steel	FLANGE TYPE				ANSI 150 RF	
PRESSURE DROP		Less than 0.6 PSI	AUTO-WIPER				Included	
PRESSURE RATING		150PSI	STRAINER				Supplied loose	

OPTIONAL- REQUIRED FOR VALIDATED UNITS

TYPE	LAMPS & POWER	WEIGHT (Dry/Wet)	DIMENSIONS & ACCESS					CONTROL PANEL TYPE
			A	B	C	D	E	
ECP-110-4SP	1.0kW	145/165lbs	17"	12"	16"	6"	2 1/2"	SP-A-220
ECP-113-5SP	1.3kW	160/180lbs	17"	12"	16"	6"	3"	SP-A-220
MATERIAL		316 Stainless steel	FLANGE TYPE				ANSI 150 RF	
PRESSURE DROP		Less than 0.6 PSI	AUTO-WIPER				Included	
PRESSURE RATING		150PSI	STRAINER				Supplied loose	

ECOFLO II UNITS

The ECOFLO II is the most advanced UV treatment system available. Our objective for the product was simple – to be the best on the market, no compromise. The ECOFLO II offers the flexibility of a horizontal or vertical installation application. The ECOFLO product line treats the largest pools with a very compact footprint.

Utilizing our proven medium pressure lamp technology, the ECOFLO II type UV systems offer a high quality 'high specifications' product at a very competitive price. The powerful two lamp units are designed to provide protection and extended life from that of single lamp systems. Suitable for all pools and whirlpools with flows from 560 – 7000

Treatment Chamber

The new ECOFLO II UV treatment chambers are designed for installation into the piping after the filters before chemical injection. Please refer to the ECOFLO II Units Technical Specifications document for dimensions and clearance requirements.

The UV chamber is manufactured from polished 316L stainless steel, with ANSI 150 RF flanges for easy installation. Temperature probes, UV monitor probes, and automatic quartz wipers are included.

A pressure rating for the unit is 150 psi, and pressure drop through the chamber is minimal.



The treatment chamber has been designed for the simplest installation into any pipe work system. They can be mounted vertically or horizontally. The

Control System

The control system is located in a NEMA 12 (IP54) rated cabinet.

As a standard, it is supplied with a 15' cables for connection to the treatment chamber.

The power supply (PSU) and control cabinet is powered with the latest SPECTRA microprocessor control unit. Three levels of operation (simple control, full parameter display, and operator configuration) allow easy, uncomplicated operation of the unit by an operator. Included is a sophisticated password protected engineering section for integrating the unit with other system devices.

Auto power restart, pump and valve interfaces, process interrupt and low power overnight operation are all features specifically designed for use on swimming pools and waterparks.



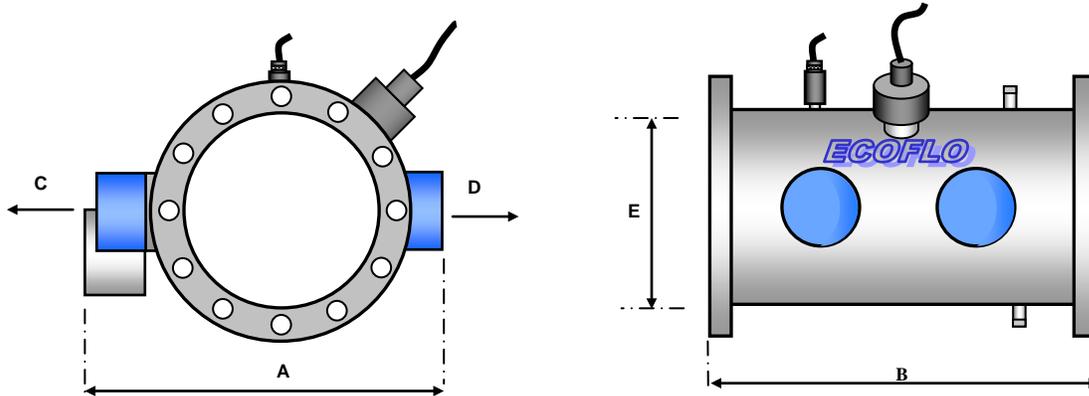
ECOFLO II CONTROL UNIT TECHNICAL SPECIFICATIONS



TYPE	SUPPLY	WEIGHT	DIMENSIONS		
			Width	Height	Depth
ECF – A-480	480/460v 60hz	250lbs	24"	40"	12"
ECF- A-220	220v 1 ph 60hz	250lbs	24"	40"	12"
ECF – C-480	480/460v 60hz	350lbs	32"	48"	12"
MATERIAL	Carbon Steel		IP Rating	NEMA12/IP54	
COMPLETE WITH					
RCD protection			Over temperature Protection		
UV Monitoring			Automatic Wiper		
SPECTRA Microprocessor Control					
Simple START STOP and RESET buttons			Full fault screen display and help screens		
Dose, Flow, Current and Temperature display			Remote operation and control function		
Auto restart on power failure			Valve and Pump interface contacts		
Half power operation for low pool use periods			Separate password protected engineer functions		

******* ECF-A-220 Panel available for ECF215-6 unit only**

ECOFLO II TECHNICAL SPECIFICATIONS



TYPE	LAMPS & POWER	WEIGHT (Dry/Wet)	DIMENSIONS & ACCESS					CONTROL PANEL TYPE
			A	B	C	D	E	
ECF-210-4	2 * 1.0kW	110/125lbs	19"	16"	14"	6"	4"	ECF - A-10
ECF-215-6	2 * 1.5kW	125/145lbs	19"	20"	16"	6"	6"	ECF - A-15
ECF-220-6	2 * 2.0kW	140/185lbs	21"	24"	16"	6"	6"	ECF - A-20
ECF-220-8	2 * 2.0kW	140/180lbs	21"	20"	16"	6"	8"	ECF - A-20
ECF-225-8	2 * 2.5kW	150/225lbs	23"	26"	16"	6"	8"	ECF - A-25
ECF-225-10	2 * 2.5kW	150/210lbs	23"	20"	18"	6"	10"	ECF - A-25
ECF-230-10	2 * 3.0kW	160/275lbs	24"	28"	18"	6"	10"	ECF - A-30
ECF-425-10	4 * 2.5kW	190/270lbs	23"	28"	18"	6"	10"	ECF - C-25
ECF-230-12	2 * 3.0kW	160/245lbs	24"	20"	20"	6"	12"	ECF - A-30
ECF-233-12	2 * 3.0kW	170/320lbs	26"	28"	22"	6"	12"	ECF - A-33
ECF-430-12	4 * 3.0kW	200/315lbs	24"	28"	20"	6"	12"	ECF - C-30
ECF-233-14	2 * 3.0kW	170/320lbs	26"	24"	22"	6"	14"	ECF - A-33
ECF-433-14	4 * 3.0kW	220/375lbs	26"	28"	22"	6"	14"	ECF - C-33
MATERIAL	316 Stainless steel		FLANGE TYPE			ANSI 150 RF		
PRESSURE DROP	Less than 0.6 PSI		DRAIN & VENT			¾" NPT & ¼" NPT		
PRESSURE RATING	150PSI		STRAINER			Supplied loose		

NSF LISTING

AS OF 10-01-11

Engineered Treatment Systems

PO Box 392
W9654 Beaverland Pkwy
Beaver Dam, WI 53916
USA
Ph 920-885-4628 Fax 920-885-4386

Ultraviolet Light Process Equipment

UV Generators[1] [3]

ECF-215-6[2]	ECF-220-6[2]	ECF-220-8[2]
ECF-225-10[2]	ECF-225-8[2]	ECF-230-10[2]
ECF-230-12[2]	ECF-230-14[2]	ECF-233-12[2]
ECF-233-14[2]	ECF-320-8[2]	ECF-325-10[2]
ECF-330-12[2]	ECF-330-14[2]	ECF-425-10[2]
ECF-430-12[2]	ECF-430-14[2]	ECF-433-14[2]
ECF-530-14[2]	ECP-110-4[2]	ECP-113-5[4]
		ECF-210-4[2]
SP-13-4[2]	SP-25-4[2]	SP-25-4S[2]
SP-25-6[2]	SP-25-8[2]	SP-273-14[2]
SP-273-14S[2]	SP-50-10[2]	SP-50-10S[2]
SP-50-12[2]	SP-50-8[2]	SP-73-12[2]
SP-73-12S[2]		

[1] Certified for pool and spa/hot tub end use.

[2] Product has met the requirements of NSF/ANSI 50, Annex H.1: Disinfection Efficacy for the ≥ 3 log reduction of *Enterococcus faecium* [ATCC #6569] and *Pseudomonas aeruginosa* [ATCC #27313]. This product is intended for supplemental disinfection and should be used with registered or approved disinfection chemicals to impart residual concentrations in accordance with state and local regulations. This product has not been evaluated to the cryptosporidium inactivation requirements of NSF/ANSI 50.

[3] This product has not been Certified by NSF to the requirements of the National Electrical Code or electrical product safety standards.

[4] Certified for 3 log inactivation of *cryptosporidium parvum* based on challenge organism MS2 at 260 gpm at a sensor reading of 192 mW/cm² with a minimum RED of 31.06 mJ/cm². Also Certified for inactivation of *cryptosporidium parvum* based on a challenge organism MS2 at 150 gpm at a sensor reading of 196 mW/cm² with a minimum RED of 40.74 mJ/cm². Product has also met the requirements of NSF/ANSI 50, Annex H.1: Disinfection Efficacy for the ≥ 3 log inactivation of *Enterococcus faecium* [ATCC #6569] and *Pseudomonas aeruginosa* [ATCC #27313]. This product is intended for supplemental disinfection and should be used with registered or approved disinfection chemicals to impart residual concentrations in accordance with state and local regulations.

