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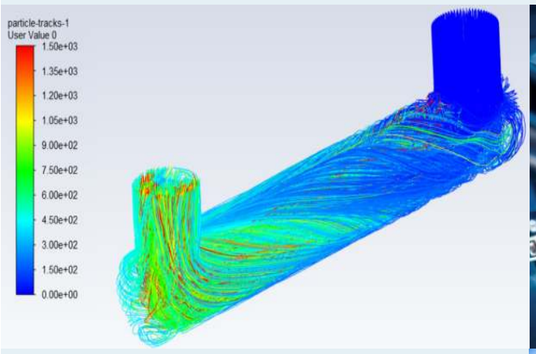
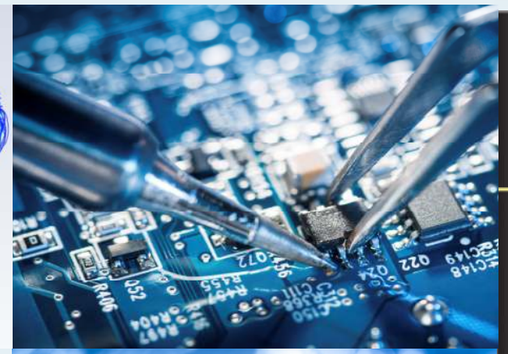
ESCO International

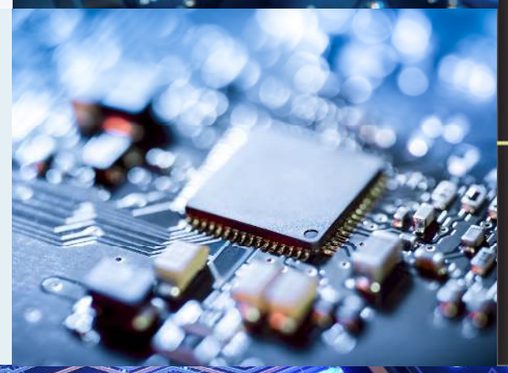
Industry Specific Applications For UV Technology

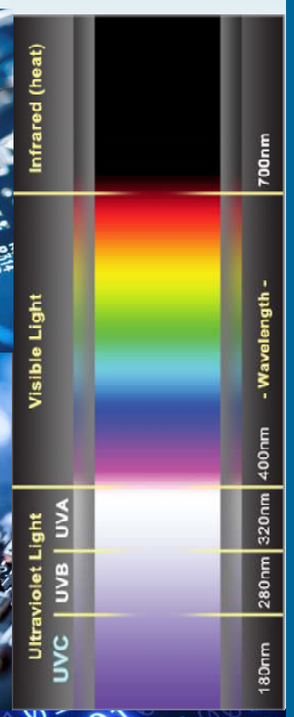
TOC reduction Ozone destruction Chlorine/Chloramines destruction Advanced oxidation Disinfection

SEMICONDUCTOR INDUSTRIES









- High performance, cost effective UV systems for stringent industrial applications
- Bespoke designs for specific processes

UV
O3
AOP

Advanced Treatment Technologies

UV technology for

High Purity Water Applications

16,000 hours lamp lifetime
Systems are designed to operate for 24 hours a day 365 days a year.

Easy maintenance
No tools required for regular maintenance. Manual or automatic cleaning process options are provided upon request.

Easy control
PID controller offering automatic system control and a convenient human machine interface, providing direct at-a-glance feedback of operational information.

Reduction of TOC in process water is critical for the microelectronic, pharmaceutical and power generation industries. TOC UV reduction at 185 nm is efficiently accomplished by integrating a UV system correctly designed and sized as well as strategically located in conjunction with other equipment.

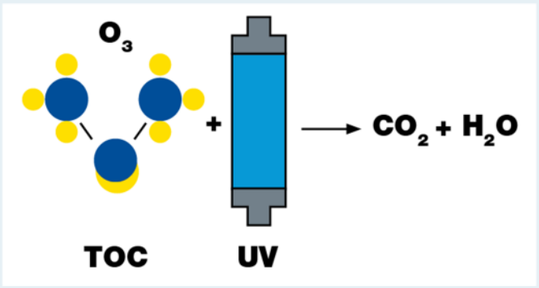
The efficiency of **ESCO TOC UV** reactors depend on specific UV irradiance and hydraulic conditions. We can use our decades of technical expertise to specifically design, size and optimise UV systems for your process conditions, through a combined chemical process, kinetic and CFD modelling approach using existing site data and results.

TOC Reduction

Ozone / Chlorine / Chloramines destruction

Advanced oxidation

Disinfection



UV Technology for Microelectronics

UV light is a versatile, dependable approach to address numerous requirements in industrial water applications.

UV light is a section within the energy band known as the electromagnetic spectrum shown in figure 1 below. UV irradiation is a known method for water disinfection. This is due to the germicidal nature of UV as it is known to effect a change in the molecular DNA of microorganisms preventing multiplication and causing cell death. In addition to its germicidal nature, UV systems can also perform multiple functions such as TOC reduction, ozone and chlorine/chloramines reduction. These functions can be essential as per system requirements in microelectronic industries, as critical dimensions for integrated circuits decrease and transistor capacities increase, maintaining electronic grade water and minimizing the various contaminants that cause defects, even in the parts per trillion range, becomes a much greater priority.

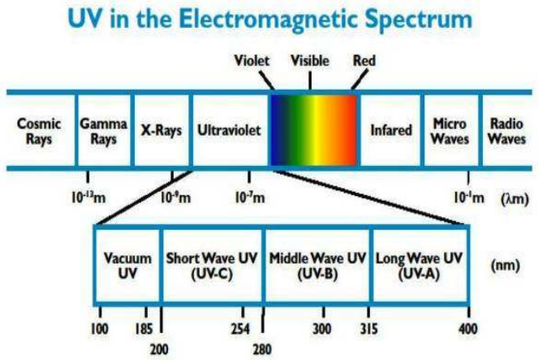


Figure 1 - Representation of the electromagnetic spectrum.

UV Technology for the Semiconductor Industry

The International Technology Roadmap for Semiconductors (ITRS) defines the following requirements to reduce the risk of yield problems in the manufacturing process:

- Reductions in organic contaminants.
- Reduction in water consumption
- Increased recovery of recycled ultrapure water.

Focusing on the quality of source water for semiconductor facilities, it is constantly subjected to seasonal changes, which can be attributed to various sources such as agricultural activities, varying industrial/domestic waste streams and other decaying organic matter. Notably, the combination of chlorine and organics in municipal water feed streams may produce trihalomethanes (THM's), such as chloroform. THM's can make up a significant fraction of Total Organic Carbons (TOC). UV irradiation at 185 nm is an essential part of the solution as it effectively destroys THM's and other constituents of TOC producing water and carbon dioxide as the sole products. This reaction may be promoted with ozone, subject to process requirements.

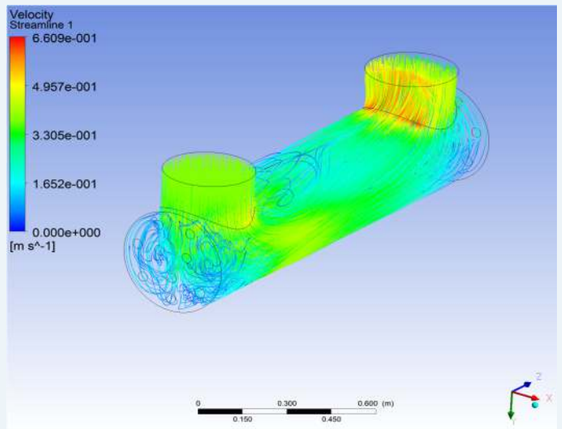
How does UV reduce TOC levels?

Trace organics are some of the most difficult contaminants to control in a pure water system. Activated carbon and Ion exchange beds are effective as a pre-treatment. However, they do not reduce TOC levels to the required PPB levels in high purity water recirculation and polishing systems for microelectronics. At ESCO International, we provide specially designed 185 nm TOC reduction UV units that induce three different reactions that destroy and remove TOC:

1. Conversion of non-ionic organic molecules to charged species enabling ion exchange removal

2. Production of hydroxyl radicals (OH•) which oxidize amenable molecular bonds causing photochemical breakdown

3. Emission of high energy photons which dissociate refractory molecular bonds



Our UV systems guarantee a return on investment with less frequent water system servicing, reduced downtime, lower manufacturing costs, greater operational control and significant efficiency gains as your product yields increase.

Other UV Applications in Microelectronics

Disinfection

TOC is also a food source for microorganisms that could support their proliferation. Therefore, specific UV chambers for disinfection alongside TOC reduction can offer a synergetic effect for your microelectronics system as shown in figure 2, typical placement of the disinfection unit is post-carbon filter or pre-reverse osmosis unit. This can reduce microbial counts by more than 99.9% in the incoming stream of water, while keeping all of the important properties of ultra-pure water constant.

Chlorine/Chloramines reduction

Chlorine and Chloramines tend to exist in source water as they are used to control bacteria levels in public water supply systems. However, this may have a negative effect on semiconductor production process as it tends to degrade membrane filters or reverse osmosis beds. Furthermore, existing solutions such as carbon beds and chemical injection suffer from troublesome effects such as, providing breeding grounds for microorganisms, altering the chemical properties of the water, or creating inefficiencies through issues such as channeling. UV technology can provide an excellent and cost effective solution to these issues as it removes chlorine and chloramines through photolysis, while maintaining process water quality. UV technology is an all-encompassing, multi-faceted solution for the microelectronics industry.

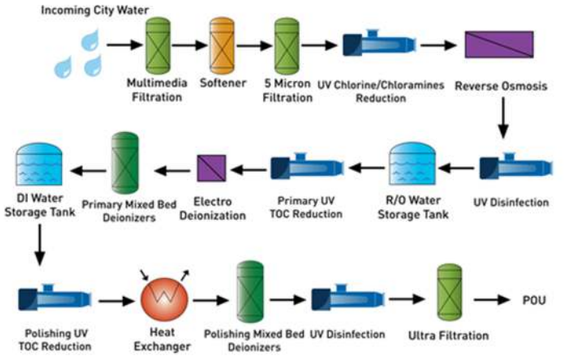
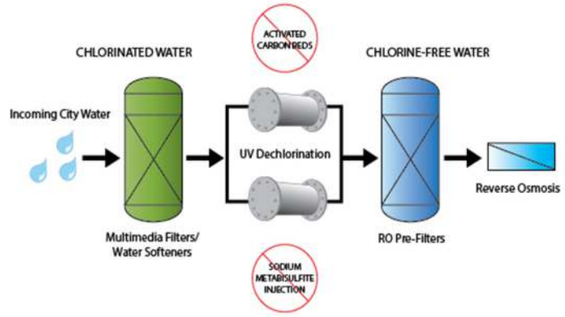


Figure 2 – Example of a microelectronics water treatment system.

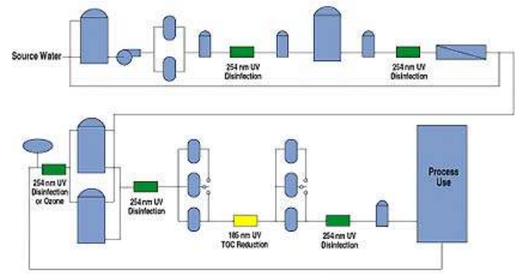
Ozone Destruction

Ozone can be used as strong disinfection agent or as a powerful oxidizing agent alongside UV for efficient oxidative destruction of TOC. It can also be used in other areas of the water system, namely in pre-treatment processes, sanitizing and recycle processes. If Ozone is used in your water treatment system, it must be removed prior to point of use, as it can compromise the process water and equipment. Residual Ozone can be removed to undetectable levels, using a properly designed and sized UV system at a wavelength of 254 nm. Typically, a UV dose of 90 mJ/cm^2 can be used to reduce dissolved ozone from 1ppm to 0.1ppm. This process forms inert oxygen, which can also be eliminated according to process requirements.



ESCO International offer effective design and sizing of UV equipment, coupled with decades of experience and bespoke solutions as per your process requirements, addressing TOC reduction, ozone and chlorine/chloramines reduction and microbial disinfection.

For exceptionally designed industrial UV systems, contact us today at info@escouk.com.



Introducing ESCO International Industrial UV Range

Providing you with flexible, dependable and robust UV systems that meet the rigorous requirements of the Microelectronics Industry.

Results Guaranteed

TOC level reduction to less than 1 ppb (parts per billion). Also effective against bacteria, viruses, and protozoan pathogens, Ozone destruction and Chlorine/Chloramines reduction. Delivering water confidence.

Exceptional Design

Design is unique in industry with no un-illuminated areas ensuring **total UV penetration** and excellent **flexibility** with parallel interconnected arrangements and multiple configuration options.

Excellent Reliability with Proven, Robust Performance

The UV systems are designed for automatic 24-hour operation, all year long. UV components have also evidentially demonstrated reliability in thousands of installations globally.

Improved Technology Optimised to Your Process Conditions

Improved low pressure high output UV amalgam lamps. Lamp output variation can be integrated into the design, maintaining a continuously optimised power consumption, and extended lamp lifetimes of up to **16,000 hours**. Industry standard intensity monitors are also provided to ensure the optimal UV dose.

User Friendly Human-Machine Interface

Provides excellent system monitoring and safety features that enable quick and easy system status checks.

Fast and Effective

UV has no requirements in terms of holding tanks and reaction times, providing fast, clean ultra-pure water with no bottlenecks in your process.

Safe

No requirements of storage or handling of potentially hazardous chemicals (as with chemical treatment systems). UV is **safe**, it does not pollute the environment and safety is an intrinsic feature of our expert design considerations in accordance with your process.

Economic

Our UV systems are lower in capital investment, relative to chemical treatment systems with low maintenance and operation costs. We unlock **significant cost-saving** potential within your process that will guarantee a return on investment.

Easy, Compact Installation

Very easy installation, with minimal plant room space requirements as optimised chamber design and multi-lamp arrays enable cost-effective, compact installation in tight spaces. Further options include a flexible modular TOC water skid, optimised for flowrate or maximum TOC reduction.

Quality

Our products are designed with materials of the **highest quality**. All products are CE approved and are designed in compliance with ISO 9001/2000 Standards.

Support

We provide a convenient one stop shop for all of your needs in terms of spare parts and services. Furthermore, we provide a performance guarantee through industry-leading warrantees.

Impeccable Engineering

Our engineering expertise will provide standard and bespoke solutions to suit your particular stringent process requirements, supported by decades of R&D work and experience working with these UV systems

Simple, Intuitive Maintenance

Automatic/Manual cleaning system optionality available. System is also designed for easy access to chambers and lamp replacement procedure is simple, with no tools required.

EC-T series / TOC

ECT MODELS	ECT-2	ECT-3	ECT-4	ECT-5
Flow range (m^3/h)	0.5 m3/h - 2 m3/h			
Number of Lamps	2	3	4	5
Lamp Lifetime (hours)	9000			
Power Consumption (W ± 2%)	160	240	320	400
UV-C dose (mJ/cm2) @ UVT 99% - 1cm	> 40			
Manifold Material	SS 316 L			
Max. Pressure (bar)	10			
In - out connections	1/2"M to DN50			
Surface finish	Standard Ra32 Optional Ra15			
Electrical Supply	230 V 50/60 Hz (others available upon request)			
Electrical Panel Dimensions (mm)	215 x 215 x 90	400 x 300 x 200		

UV dose: > 600 mJ/cm2 at end of lamp life.
Standard Inlet/outlet connections.
ANSI flanges and Tri-clamp sanitary optional.
Please consult technical datasheets and drawings for exact specifications.
Control panels in stainless steel optional.

Electrical Panel	LCD
Enclosure Material	Black PP or Painted Steel – RAL 7035
Protection degree	IP 55 / IP54
LCD Display (microprocessor control)	Yes
Total hour meter	Yes
Resettable count down hour meter	Yes
Alarm red LED	Yes
Alarm relay free contact NO/ NC	Yes
Alarm relay 230 V NO/ NC outlet - 2A max	Yes
On/ Off timer	Yes
Remote On/ Off contact	Yes
Display of Irradiation/ temperature control	LCD + model only
Shutdown for high temperature UV Chamber	LCD + model only
4/20 Ma output	Optional for LCD + model only
Audio alarm	Optional

AMT series / TOC

AMT	AMT-1	AMT-2	AMT-3	AMT-4	AMT-5	AMT-6
Flow range (m^3/h)	1.5 m3/h - 10m3/h					
Number of Lamps	1	2	3	4	5	6
Lamp Lifetime (hours)	14000					
Power Consumption (W ± 2%)	220	440	660	880	1100	1320
UV dose (mJ/cm2) UVT 99% - 1cm	> 600 (for 14000 h)					
UV chamber material	SS 316L			SS 316 L		
Max. Pressure (bar)	10					
In - out connections (PN 10)	1/2" to DN50					
Surface finish	Standard Ra32 Optional Ra15					
UV and temperature sensor	included					
Chamber operating temperature	5-40 deg C					
Electrical panel	LCD			Touch screen or ECOLINE		
Electrical Supply	230 V 50/60 Hz (others available upon request)					
Electrical Panel Dimensions (mm)	400 x 300 x 200			400 x 500 x 250	750 x 400 x 250	

UV dose: > 600 mJ/cm2 at end of lamp life.
Standard Inlet/outlet connections.
ANSI flanges and Tri-clamp sanitary optional.
Please consult technical datasheets and drawings for exact specifications.
Control panels in stainless steel optional.

Electrical Panel	LCD	Touch Screen
Enclosure Material	Painted Steel – RAL 7035	Painted Steel – RAL 7035
Protection degree	IP 54	IP54
LCD Display (microprocessor control)	Yes	No
Touch Screen (65K colors)	No	Yes
Multi-Language display	No	Yes
Hour meters (system and lamp life)	Yes	Yes
Digital Outputs	No	Yes
Red fault LED	Yes	No
Alarm relay free contact NO/ NC	Yes	Yes
Alarm relay 230 V NO/ NC outlet - 2A max	Yes	Yes
Remote On/Off	Yes	Yes
On/ Off timer	Yes	Yes
Display of Irradiation/ temperature control	Only LCD model or ECOLINE	Yes
CAN, Ethernet, USB, Serial (modbus. TCP/IP, CANopen)	No	Yes
Remote access with App or Webgate	No	Yes
4/20 mA output	Optional for LCD + model	Yes
Datalog - Events	No	Yes
UV dose calculation	No	Optional
Lamp power regulation	Optional	Optional
Audio alarm	Optional	Optional

EC400-T series / TOC

EC400-T	T-1	T-2	T-3	T-4	T-5	T-6	T-8	T-10	T-12	T-15
Flow range (m^3/h)	5 m3/h - 50 m3/h									
Lamps	1	2	3	4	5	6	8	10	12	15
Lamp Lifetime (hours)	16000									
Lamp power regulation	(50-100%) only on TS panels				Yes (50-100%)					
Power Consumption (W ± 2%)	440	880	1300	1750	2180	2600	3500	4400	5300	6600
UV dose (mJ/cm2), UVT99%-1cm	>600 (after 16000 h)									
UV chamber material	ANSI 316 L									
Max. Pressure (bar)	10									
In - out connections (PN 10)	**2" - DN80**									
Openable side	Yes									
Surface finish	Standard Ra32 Optional Ra15									
Electrical panel	TS or ECOLINE				Touch screen (TS)					
Electrical Supply	230 V 50/60 Hz (380/400V 50/60 Hz)									
Electrical Panel Dimensions (mm)	400x500x250		400x750x250		600x800x300			800x1000 x300	800x1200x300	

UV dose: > 600 mJ/cm2 at end of lamp life.
Standard Inlet/outlet connections.
ANSI flanges and Tri-clamp sanitary optional.
Please consult technical datasheets and drawings for exact specifications.
Control panels in stainless steel optional.

Electrical Panel	ECOLINE	Touch screen
Enclosure Material	Painted Steel (optional SS304 or SS316)	
Protection degree	IP 54	IP54
LCD Display (microprocessor control)	Yes	No
Touch Screen (65K colours)	No	Yes
Multi-Language display	No	Yes
Hour meters (system and lamp life)	Yes	Yes
Digital Outputs	No	Yes
Red fault LED	Yes	No
Alarm relay free contact NO/ NC	Yes	Yes
Alarm relay 230 V NO/ NC outlet - 2A max	Yes	Yes
Remote On/Off	Yes	Yes
On/ Off timer	Yes	Yes
Display of Irradiation/ temperature control	Yes	Yes
CAN, Ethernet, USB, Serial (modbus. TCP/IP, CANopen)	No	Yes
Remote access with App or Webgate	No	Yes
4/20 mA output	Optional	Yes
Datalog - Events	No	Yes
UV dose calculation	No	Optional
Lamp power regulation	Optional	Yes
Audio alarm	Optional	Optional

EC400-T series / TOC

EC400-T	T-20	T-25	T-30	T-35	T-40	T-50	T-60	T-70	T-80	T-100
Flow range (m^3/h)	50 m3/h - 300 m3/h									
Lamps	20	25	30	35	40	50	60	70	80	100
Lamp Lifetime (hours)	16000									
Lamp power regulation	Yes (50-100%)									
Power Consumption (W ± 2%)	8800	11000	13200	15400	17600	22000	26400	30800	35200	44000
UV dose (mJ/cm2), UVT99%-1cm	>600 (after 16000 h)									
UV chamber material	ANSI 316 L									
Max. Pressure (bar)	10									
In - out connections (PN 10)	**DN80 - DN200**									
Openable side	Yes									
Surface finish	Standard Ra32 Optional Ra15									
Electrical panel	Touch screen (TS)									
Electrical Supply	230 V 50/60 Hz (380/400V 50/60 Hz)									
Electrical Panel Dimensions (mm)	Please contact us for details									

UV dose: > 600 mJ/cm2 at end of lamp life.
Standard Inlet/outlet connections.
ANSI flanges and Tri-clamp sanitary optional.
Please consult technical datasheets and drawings for exact specifications.
Control panels in stainless steel optional.

Electrical Panel	Touch screen
Enclosure Material	Painted Steel (optional SS304 or SS316)
Protection degree	IP54
Audio alarm	Yes
Touch Screen (65K colours)	Yes
Multi-Language display	Yes
Hour meters (system and lamp life)	Yes
Digital Outputs	Yes
Red fault LED	No
Alarm relay free contact NO/ NC	Yes
Alarm relay 230 V NO/ NC outlet - 2A max	Yes
Remote On/Off	Yes
On/ Off timer	Yes
Display of Irradiation/ temperature control	Yes
CAN, Ethernet, USB, Seriale (modbus. TCP/IP, CANopen)	Yes
Remote access with App or Webgate	Yes
4/20 mA output	Yes
Datalog - Events	Yes
UV dose calculation	Optional
Lamp power regulation	Yes

ESCO International

UV O3 AOP

Advanced Treatment Technologies

About ESCO International

ESCO International provides cutting edge water, waste water and gas effluent treatment solutions to industries around the world.

We have successfully developed the most environmentally friendly technologies available, helping organisations meet and exceed high purification standards and local and national regulations by providing simple, safe, clean and cost effective solutions.

ESCO International is a specialist supplier of engineered Ozone systems and skid packaged ozone solutions, UV systems, and Advanced oxidation processes (AOPs) for a wide range of applications .

We work with renowned engineering and water treatment companies , striving to provide the most effective solution that meets your needs.

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