



## Water Purification UVC LED Sterilizer

**Junglin Tsai**

2023.04.13

Cristal Materials Corporation



# Agenda

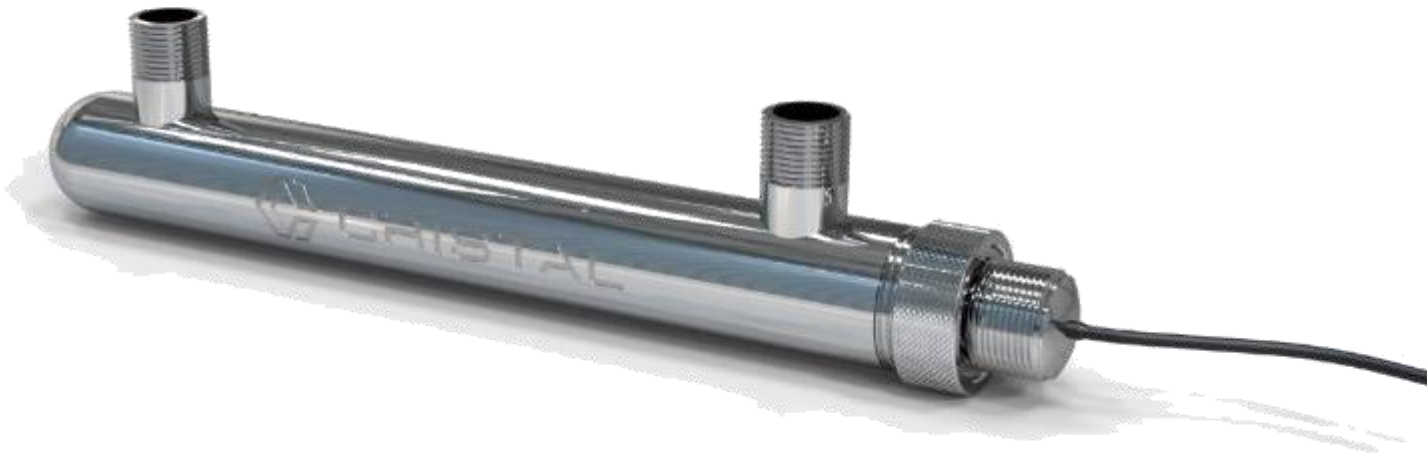
- **NOVATICS Water Sterilizer**
- NOVATICS WS spec
- NOVATICS WS functions
- NOVATICS WS features
- 3<sup>rd</sup> party sterilization report
- NOVATICS WS product series
- Applications





## UVC water purification modules

To drink a glass of purified water  
Is not unreachable any more



# NOVATICS Water Sterilizer

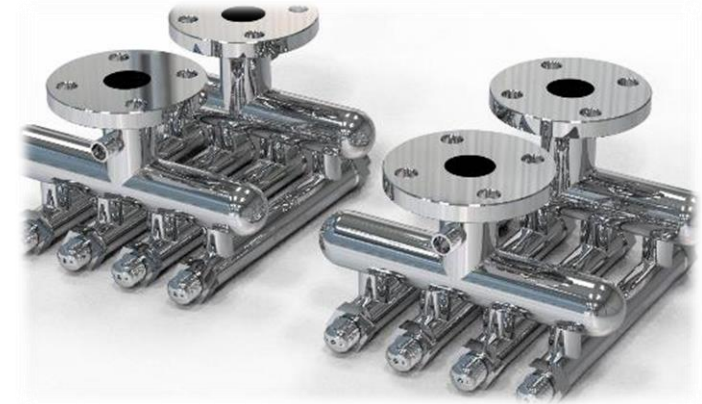


**NOVATICS WS G4**

Input & Output

Sterilization Chamber

UVC LED Module



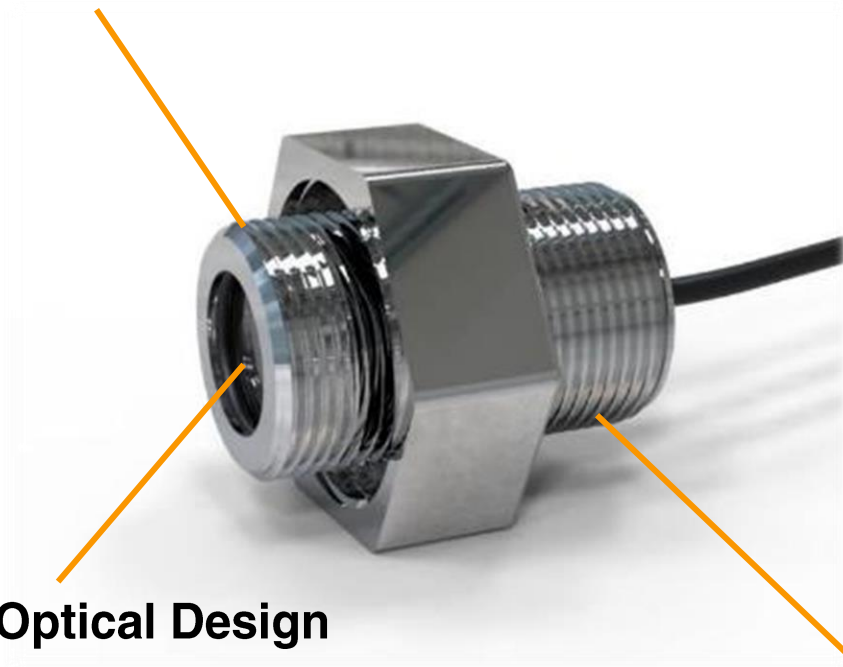
Industrial Type WS



# NOVATICS UVC LED Module



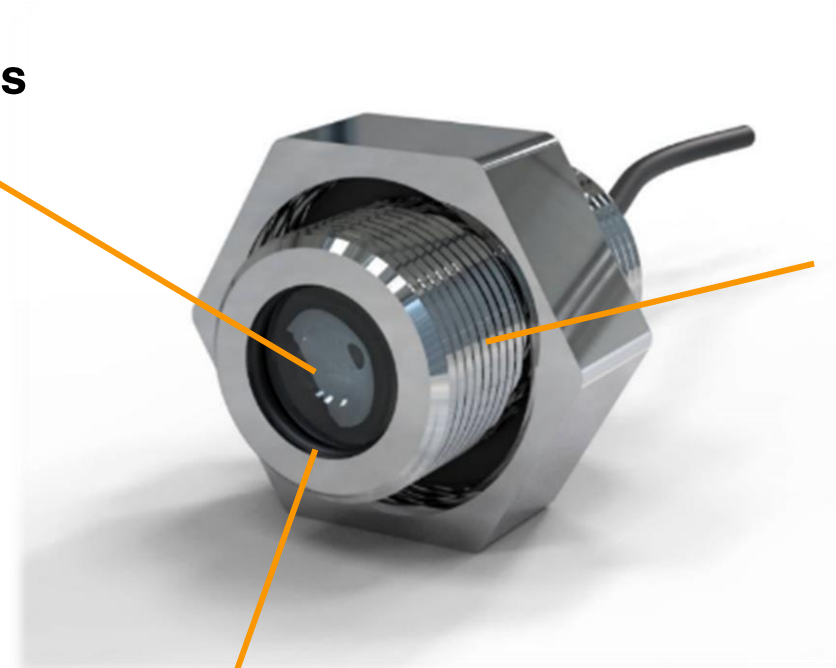
**Water Cooling System**



**Patented Optical Design**

**Food Grade SUS 316**

**Silica Optics**

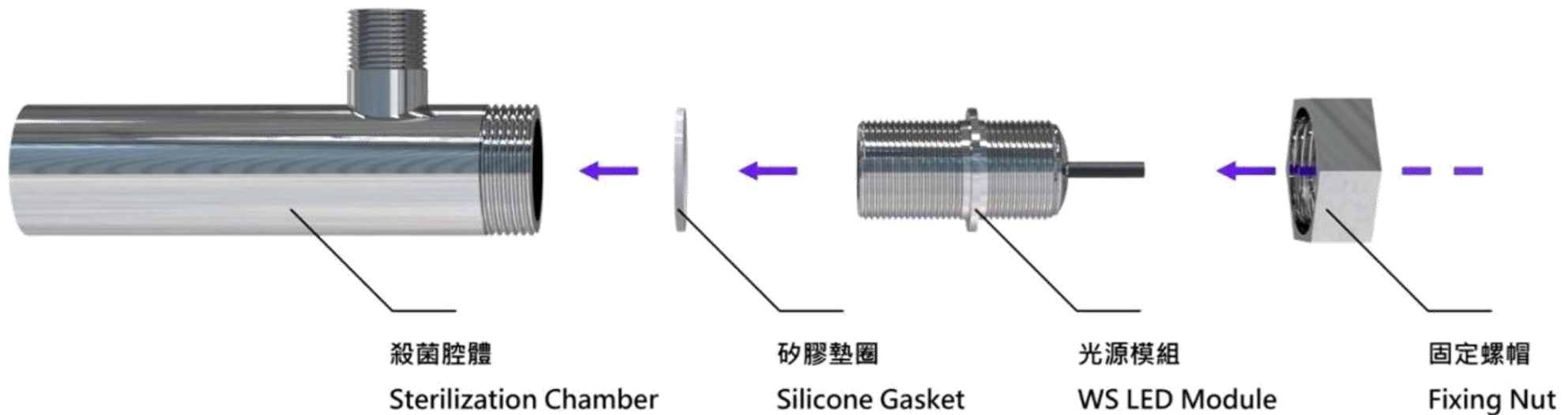


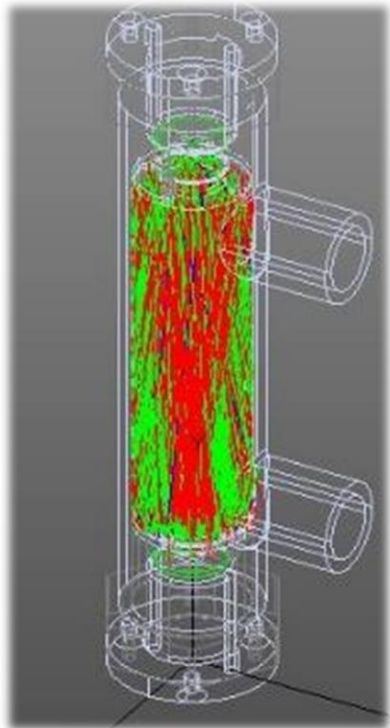
**UVC LED**

**Water Proof Module**



# NOVATICS Assembly Method







## 中華民國專利證書

發明第 I761197 號

發明名稱：紫外光陣列模組


專利權人：晶盛材料股份有限公司

發明人：蔡榮霖、蔡爾賢


專利權期間：自 2022 年 4 月 11 日至 2041 年 4 月 28 日止

上開發明業經專利權人依專利法之規定取得專利權

經濟部智慧財產局局長 **洪淑敏**

中華民國 111 年 4 月 11 日 

注意：專利權人未依法繳納年費者，其專利權自應繳費期限屆滿後消滅。



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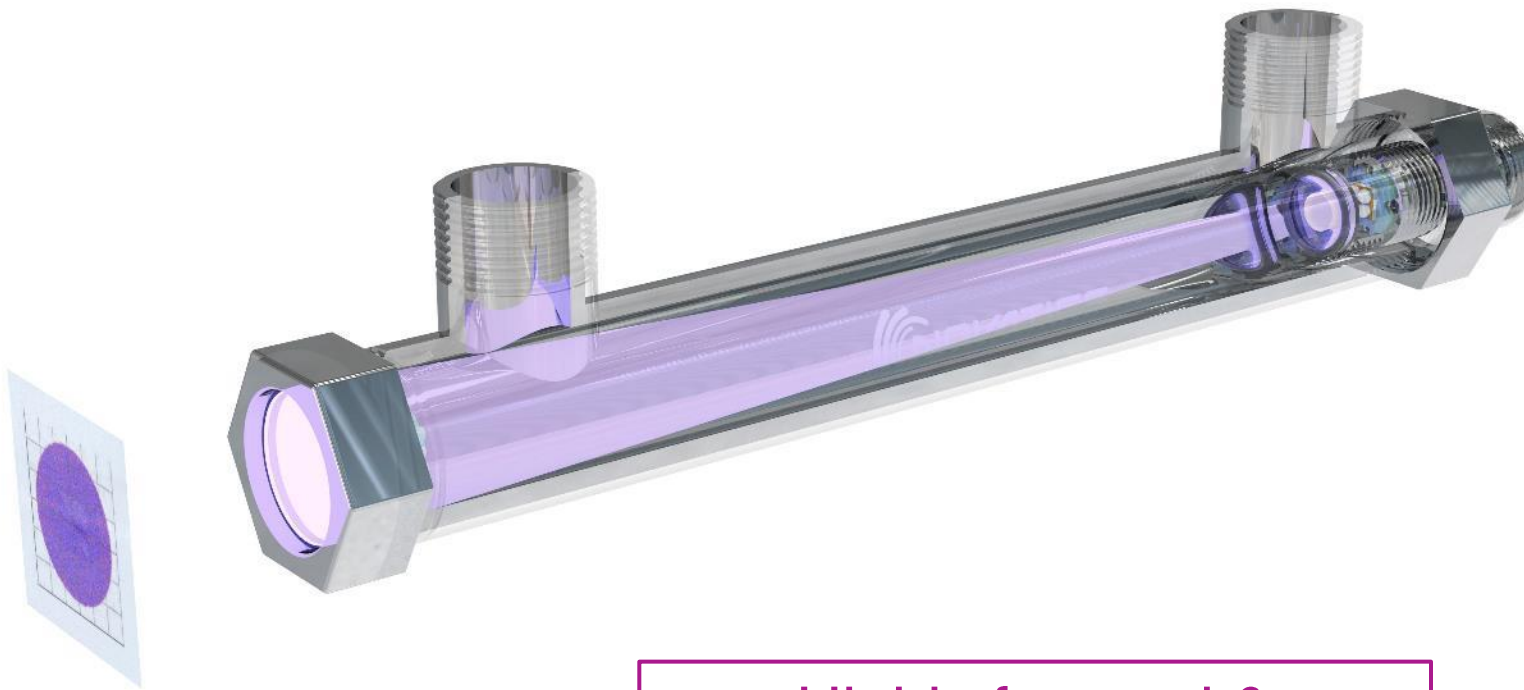
經濟部智慧財產局局長 **洪淑敏**

中華民國 111 年 4 月 11 日 

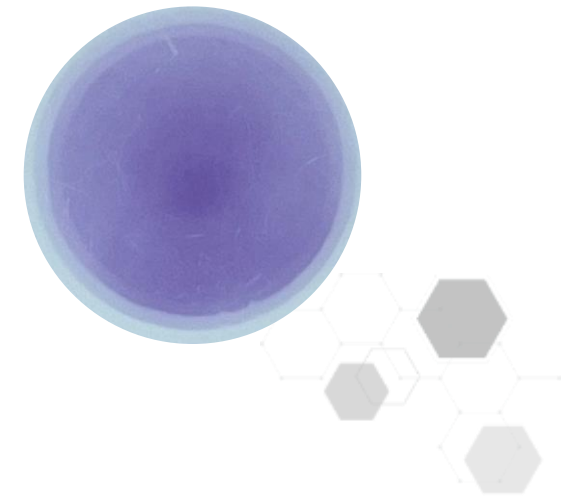
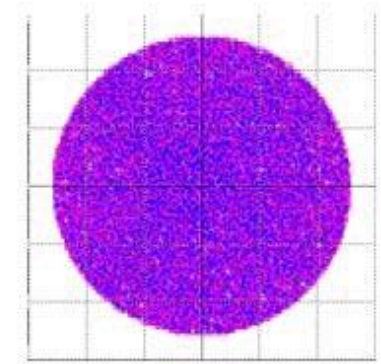
注意：專利權人未依法繳納年費者，其專利權自應繳費期限屆滿後消滅。



# Optimized optical design

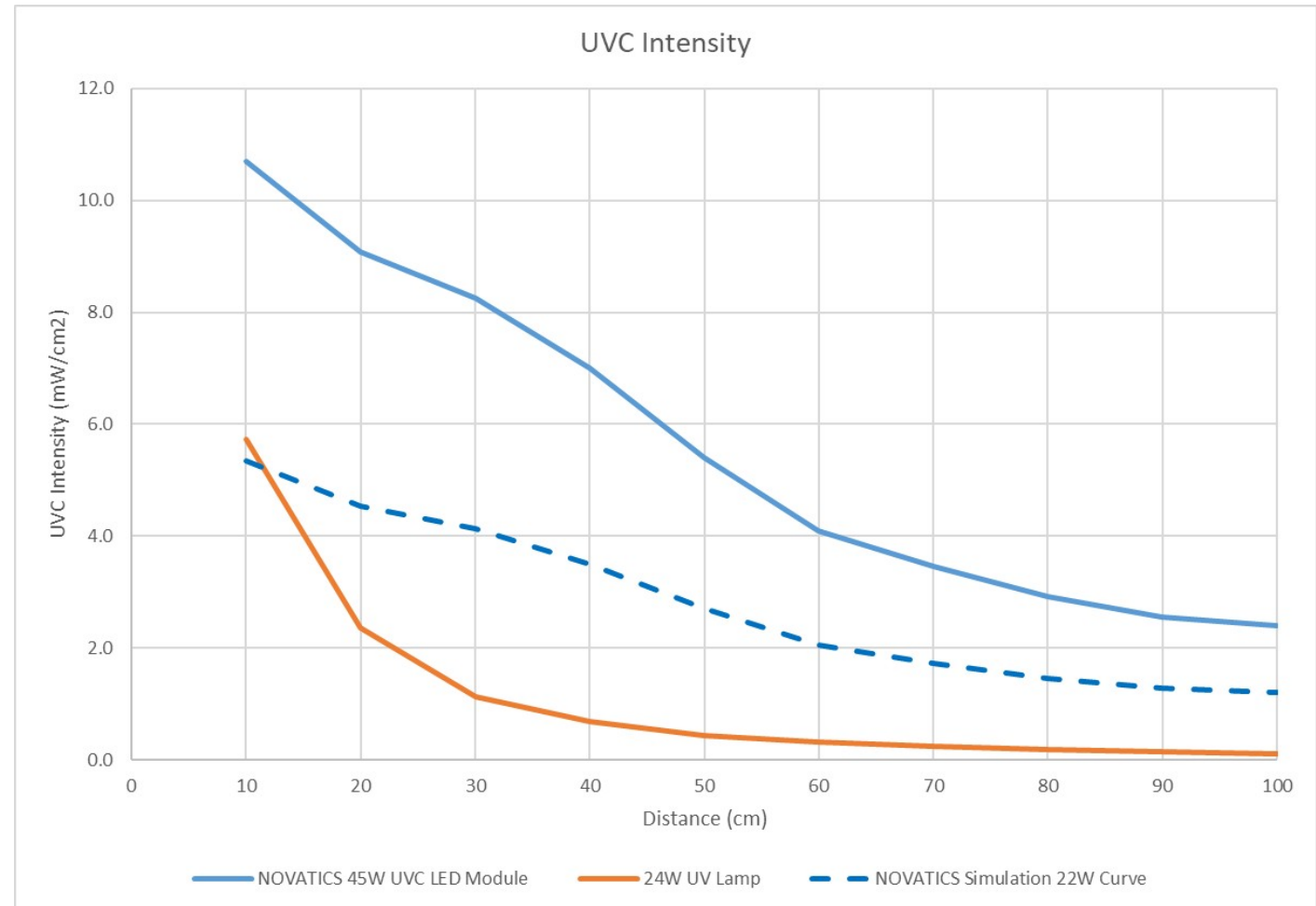


Highly focused &  
Uniform UVC beam



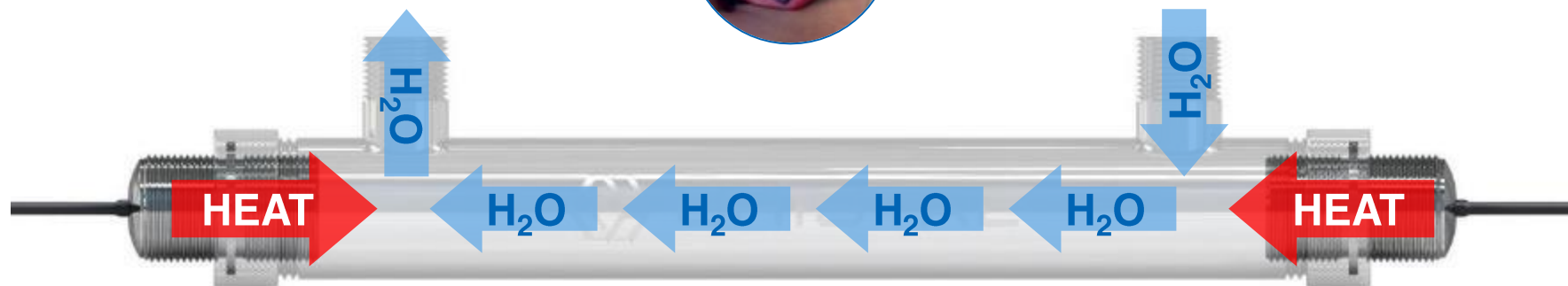


- NOVATICS WS is a special designed highly focused UV solution for long distance transportation in limited tunnel
- It is born for **fluid** system such as water purification and industrial air conditioner



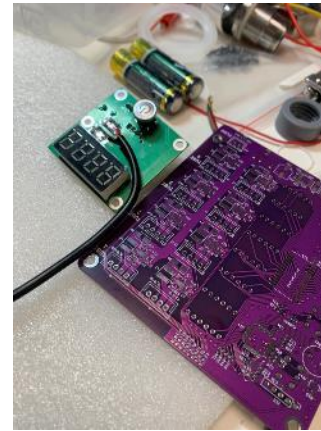
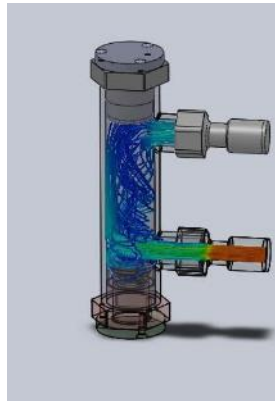
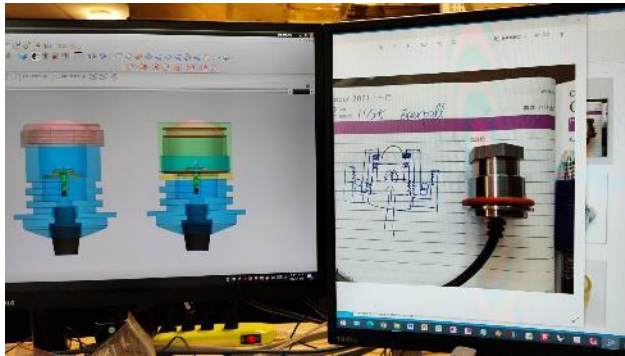


Real time temperature monitoring



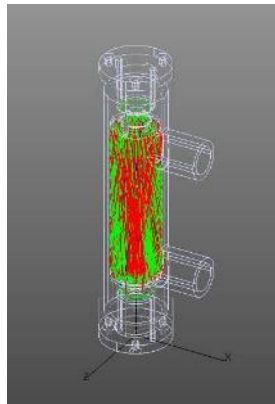
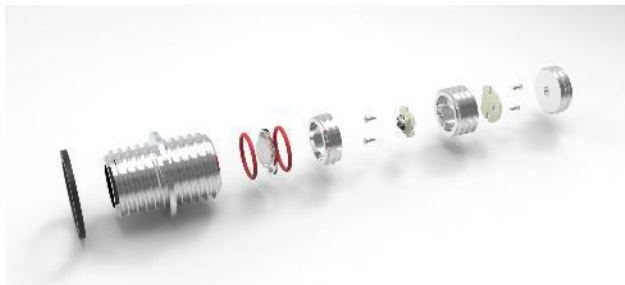
Water cooling LED module





## NOVATICS Service

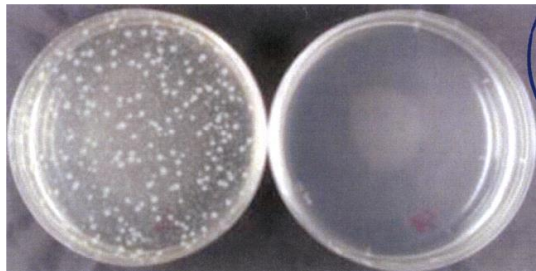
- Optical Design
- Optics Manufacturing
- Fluid Dynamics
- Mechatronics Design
- Module Design
- System Integration



# Sterilization Report



## E. Coli sterilization test



Flow Rate (LPM)	Before Sterilization (CFU/100 mL)	After Sterilization (CFU/100 mL)	Sterilization Efficiency
2.0	$4 \times 10^5$	<1	99.98%
7.5	$2 \times 10^5$	60	99.97%

財團法人食品工業發展研究所  
生物資源保存及研究中心  
afaq ISO 9001 Quality Certification

委託試驗報告  
TEST REPORT

委託者 Applicant: 晶盛材料股份有限公司  
報告號碼 Report No.: 2022CT102

取樣者 Sampler: 晶盛材料股份有限公司  
送件日期 Date Received: 2022/04/07

樣品名稱 Sample Name: NOVATICS UV LED 淨水器組裝機  
寄件日期 Date Issued: 2022/04/11

包裝型態 Package Type: 不適用  
樣品編號 Sample No.: 2022CT102

批號 Lot No.:  
樣品狀態 Sample Status: 不適用

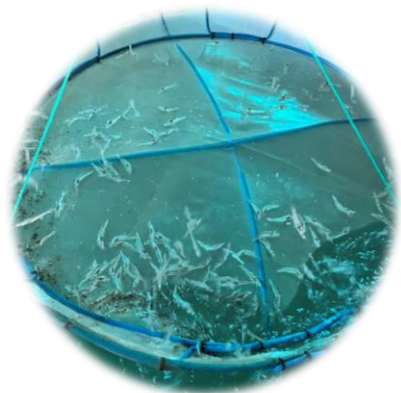
試驗項目 (Item)	結果 (Result)
常態化驗	游大腸桿菌 (Escherichia coli) BCR 11634 菌液濃度極低，耗菌率為 99.97%。 試驗內容，詳如附件。 以下空白

簽署者: [Signature]  
Authorized Representative: [Signature]

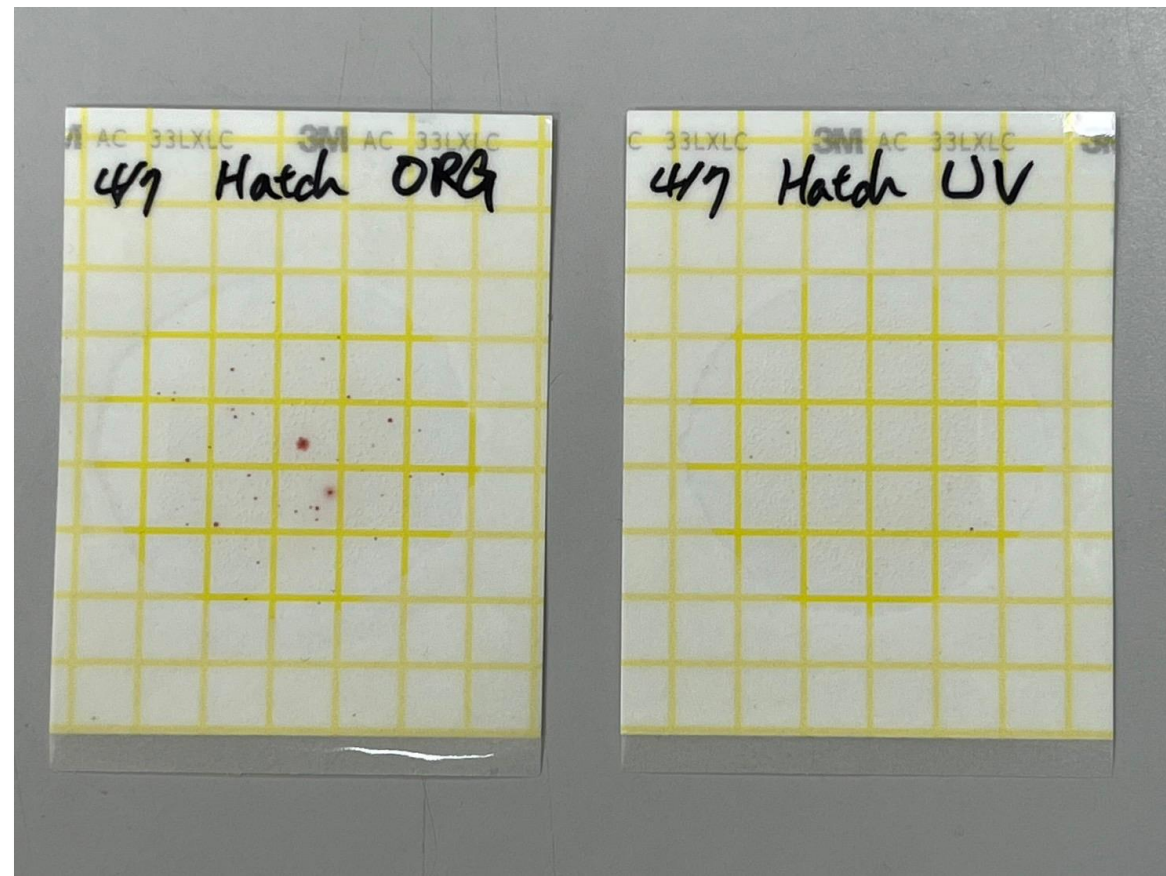
備註:  
1. 本份報告僅供參考，僅供參考資料，不具法律效。公證或與資料無關，應與本所同意。  
2. 本報告所送樣品及寄件者資料，恕不負責。  
3. 本報告內容僅供參考，僅供參考資料，不具法律效。公證或與資料無關，應與本所同意。  
This report is for reference only, if it is used for advertisement, sales promotion, or material use, please consult FIRD first.

第一頁/全一頁 T-CR-011

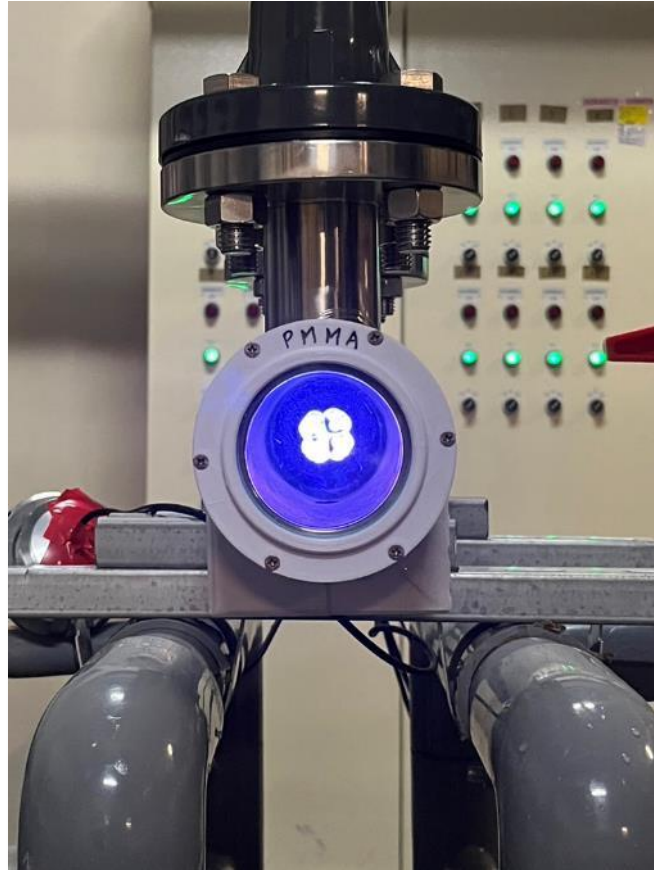
# Shrimp Farm Test



# Murry Cod Hatchery Test



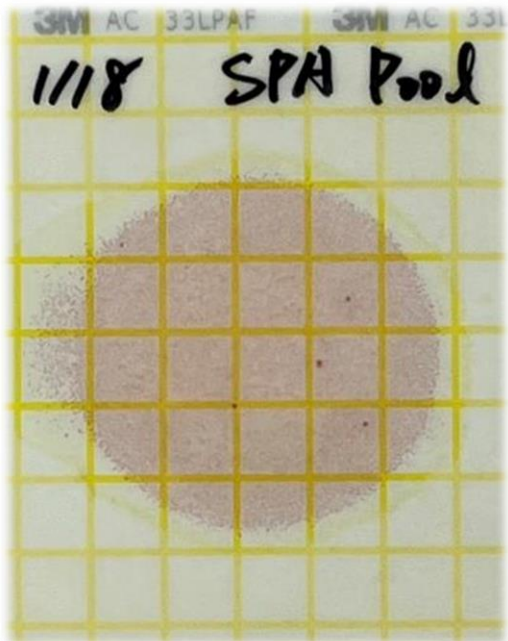
# SPA Pool Real Site Test



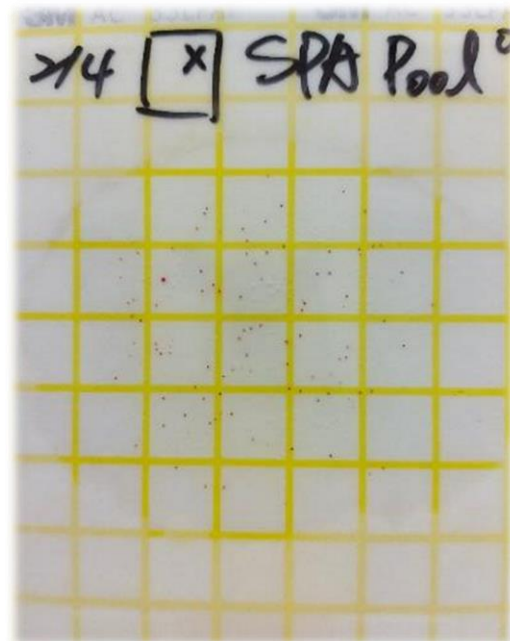
# SPA Pool Test Comparison



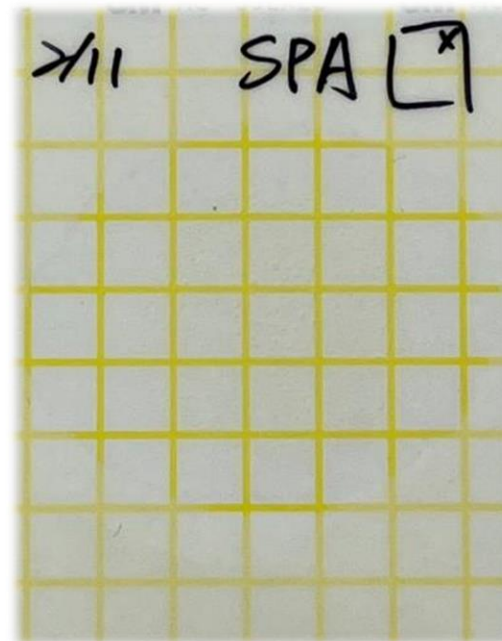
No treatment in water for 12 hrs



UV circulation only for 24 hrs

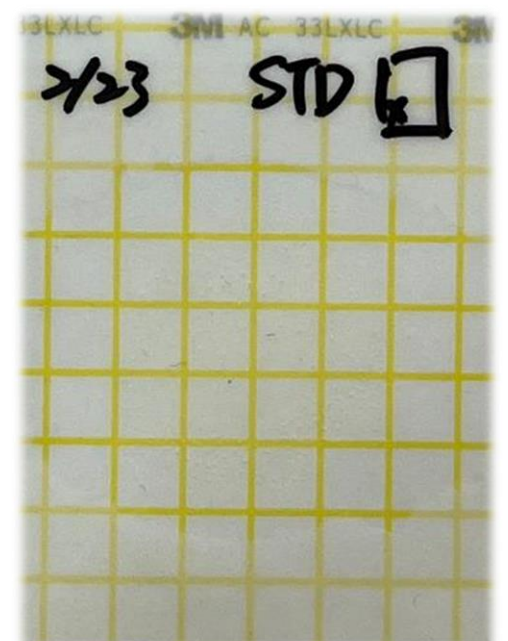


UV circulation + 0.5 ppm Cl



(Reference)

Regular Cl 1 ~ 1.5 ppm

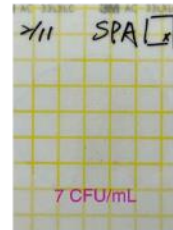
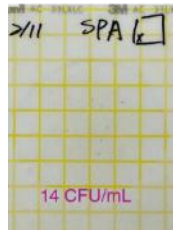
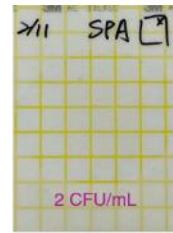
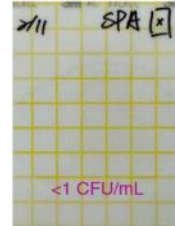
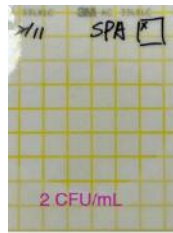


# Continuous Test Results

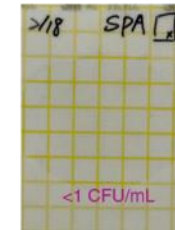
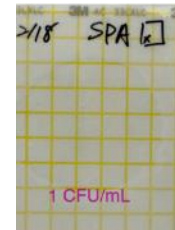
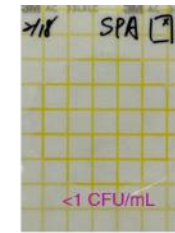
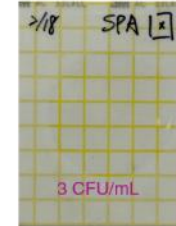
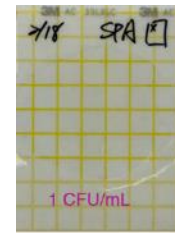


UV circulation  
with 0.5 ppm Chlorine

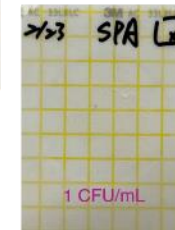
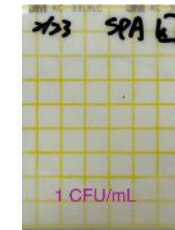
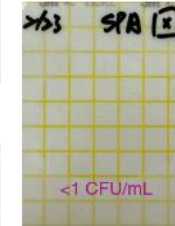
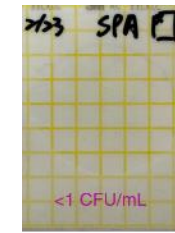
2/11



2/18



2/23



# 3 ft Aquarium (WS G2)



NOVATICS WS G2

Test Day 1



NOVATICS WS G2

Test Day 3



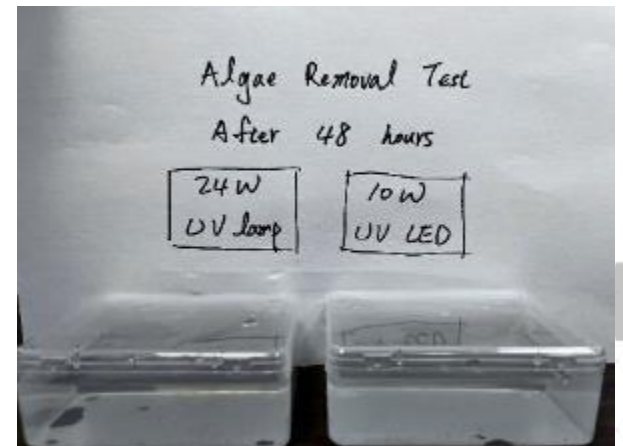
# Algae Removal Test



3 ft Aquarium Algae Removal Test



Performance: 10W UV LED equals to 24W UV lamp



# Algae Removal Test



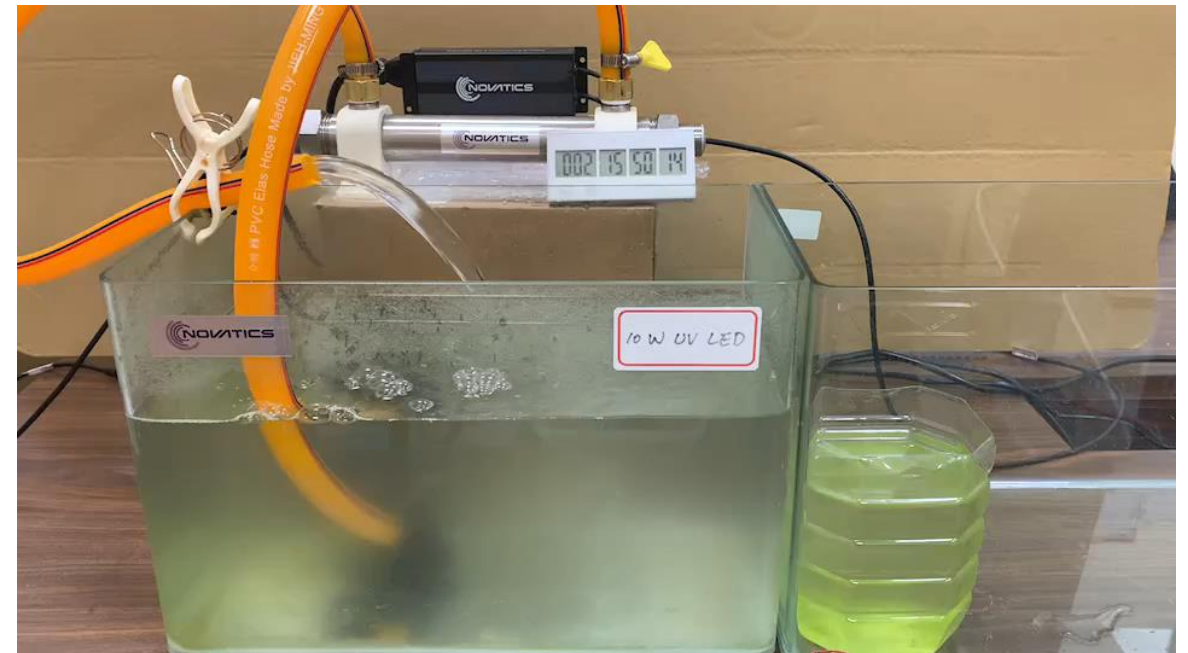
NOVATICS WS G4

Greenish Water Test for 60 hrs



NOVATICS WS G4

Crystal Clear Water



# Chlorine Removal Test



## Features

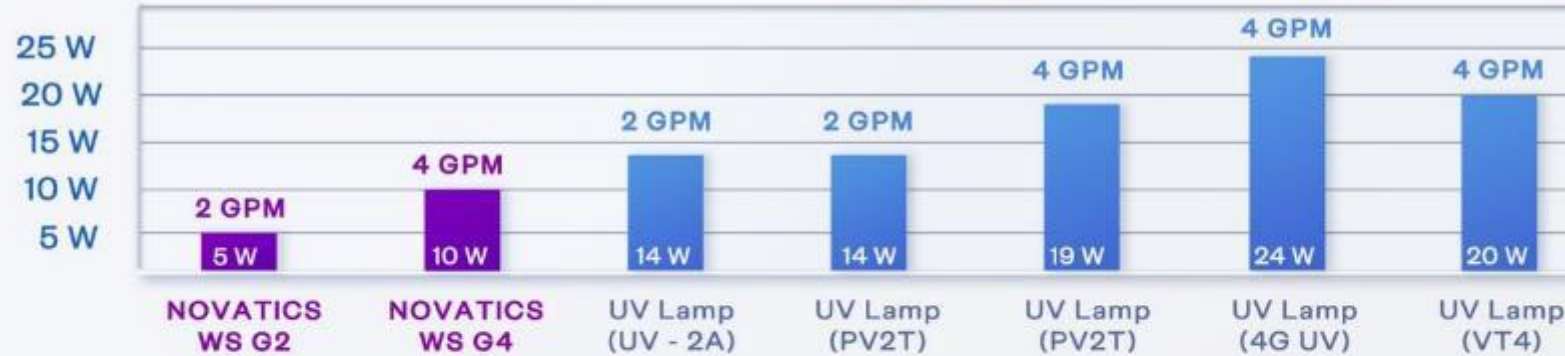
- Light Source UVC LED
- LED Lifetime 5,000+ hrs
- Input Power A/C 100 V – 240 V
- Optical System NOVAXIL™ Silica
- Cooling System Water Cooling
- Module Material SUS 316
- Max Pressure 10 Bar
- Sterilization 99.9 %

## Benefits

- Hg / O<sub>3</sub> free
- High Flow Rate (4 - 80 GPM)
- Compact Size
- Power Saving
- Eco Friendly



## POWER CONSUMPTION



## OPERATION COST PER 10 TON WATER



# NOVATICS WS Advantages



WS G2

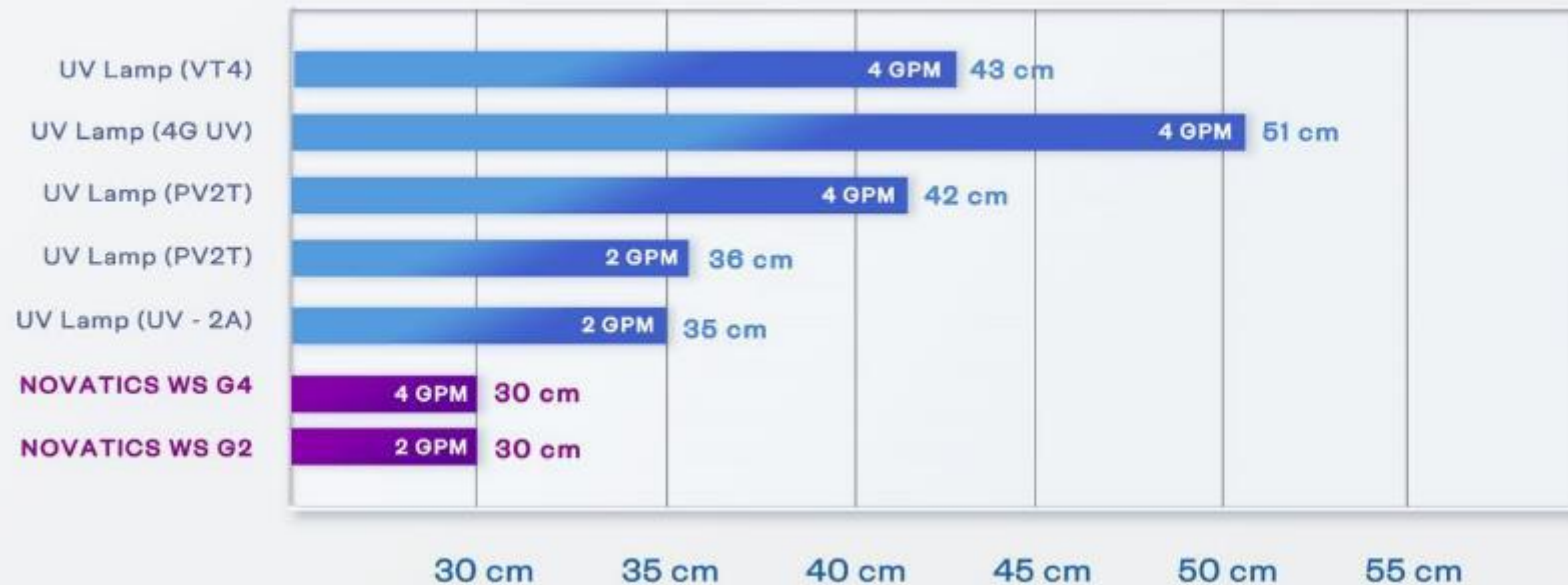


WS G4



**HG FREE**

## LENGTH



# NOVATICS WS Series



WS LED Module



WS G2



WS G4



WS T5



WS T10



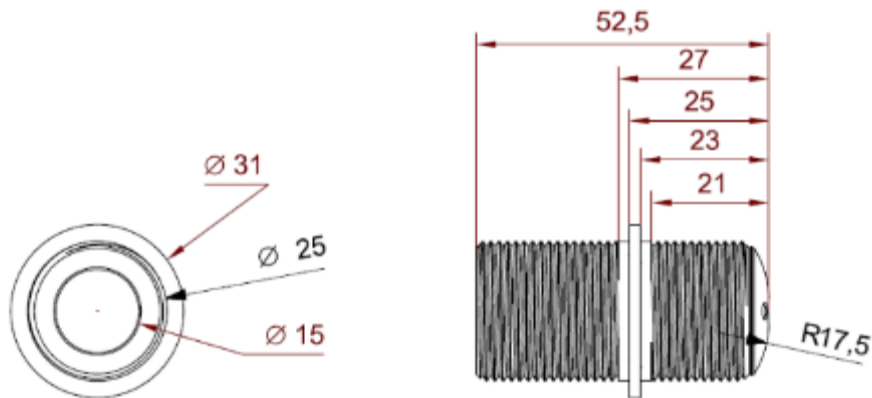
Specification	WS G2	WS G4	WS T5	WS T10 Matrix
Flow Rate	4 GPM	8 GPM	20 GPM	40 GPM
Power Consumption	5 W	10 W	40 W	80W
Product Length	273 mm	291 mm	300 mm	750 mm
Sterilization Chamber Diameter	1 in	1 in	1 in	1 in
Input Jack Diameter	½ in	½ in	1 ½ in	1 ½ in
LED Lifetime	5,000 hrs+			
Max Pressure	10 kg/cm <sup>2</sup>			
Timer/Alarm	N/A	N/A	●	●
Control Panel	N/A	N/A	●	●

UVC LED module material SUS 316

● Standard

○ Option





## NOVATICS WS CORE

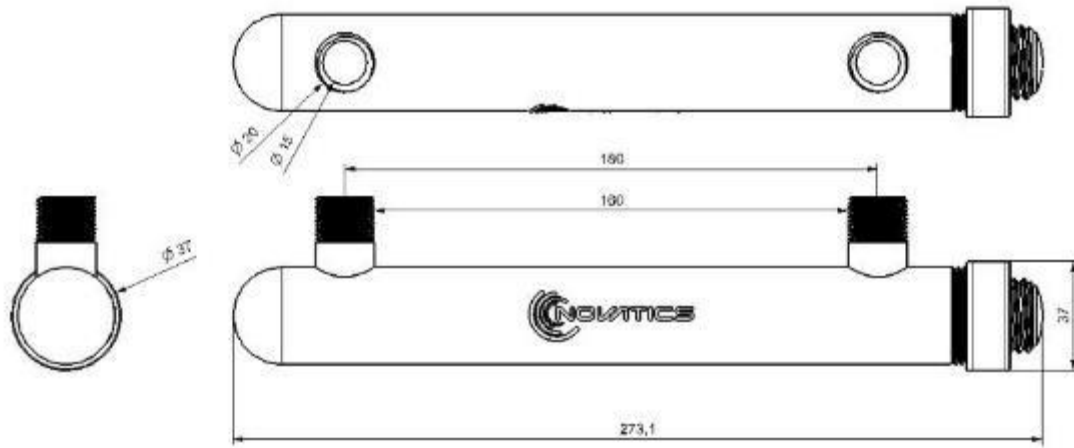
- Max Flow Rate 4 GPM
- Power Consumption 5 W
- Total Dimension 52.5 mm
- Input Voltage D/C 13 V
- Lifetime 5,000 hrs+

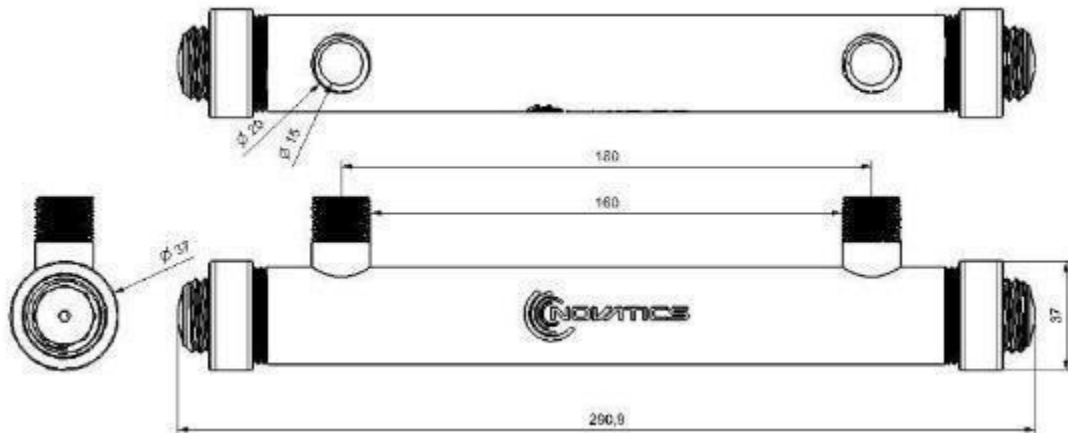




## NOVATICS WS G2

- Max Flow Rate 4 GPM
- Power Consumption 5 W
- Total Dimension 273 mm
- Input Diameter  $\frac{3}{4}$  in





## NOVATICS WS G4

- Max Flow Rate 8 GPM
- Power Consumption 10 W
- Total Dimension 291 mm
- Input Diameter 3/4 in





## NOVATICS WS T5 Matrix

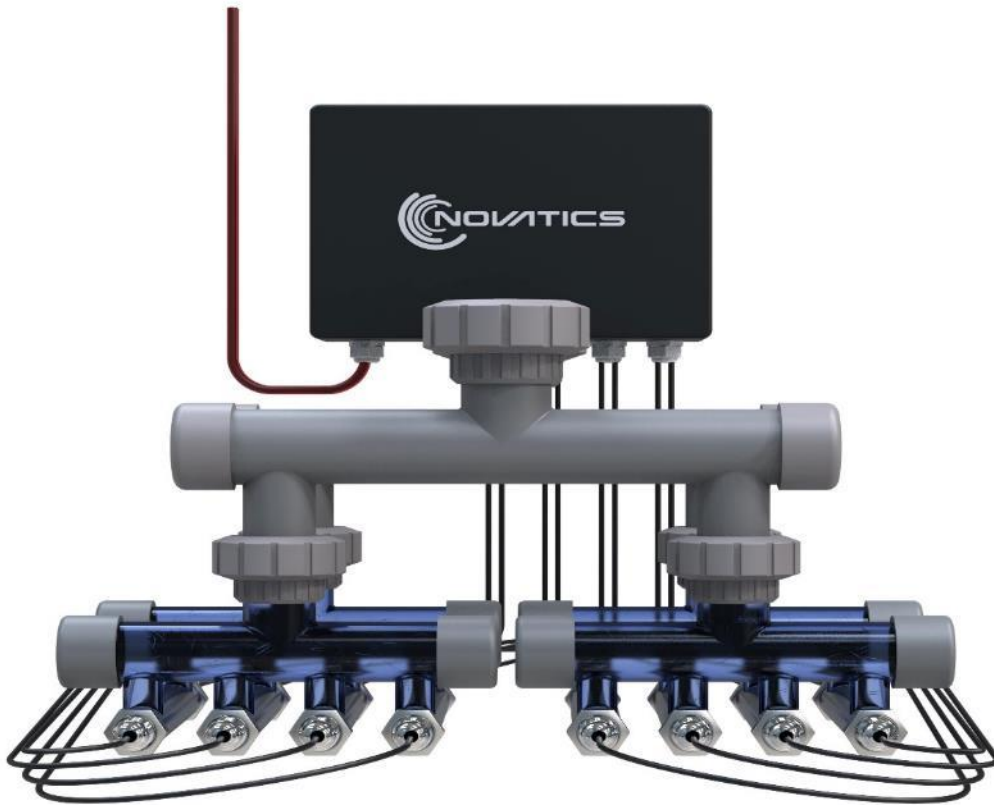
- Max Flow Rate 20 GPM
- Power Consumption 40 W
- Height 15 cm
- Width 30 cm
- Depth 30 cm
- Input Diameter 1½ in
- Control Panel Standard
- Power Supply Standard





## NOVATICS WS T10 Matrix

- Max Flow Rate 40 GPM
- Power Consumption 80 W
- Height 15 cm
- Width 75 cm
- Depth 30 cm
- Input Diameter 2 in
- Control Panel Standard
- Power Supply Standard



# Applicable applications



**WS LED Module**



**WS G2**

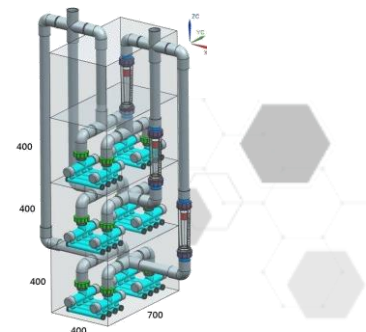


**WS G4**

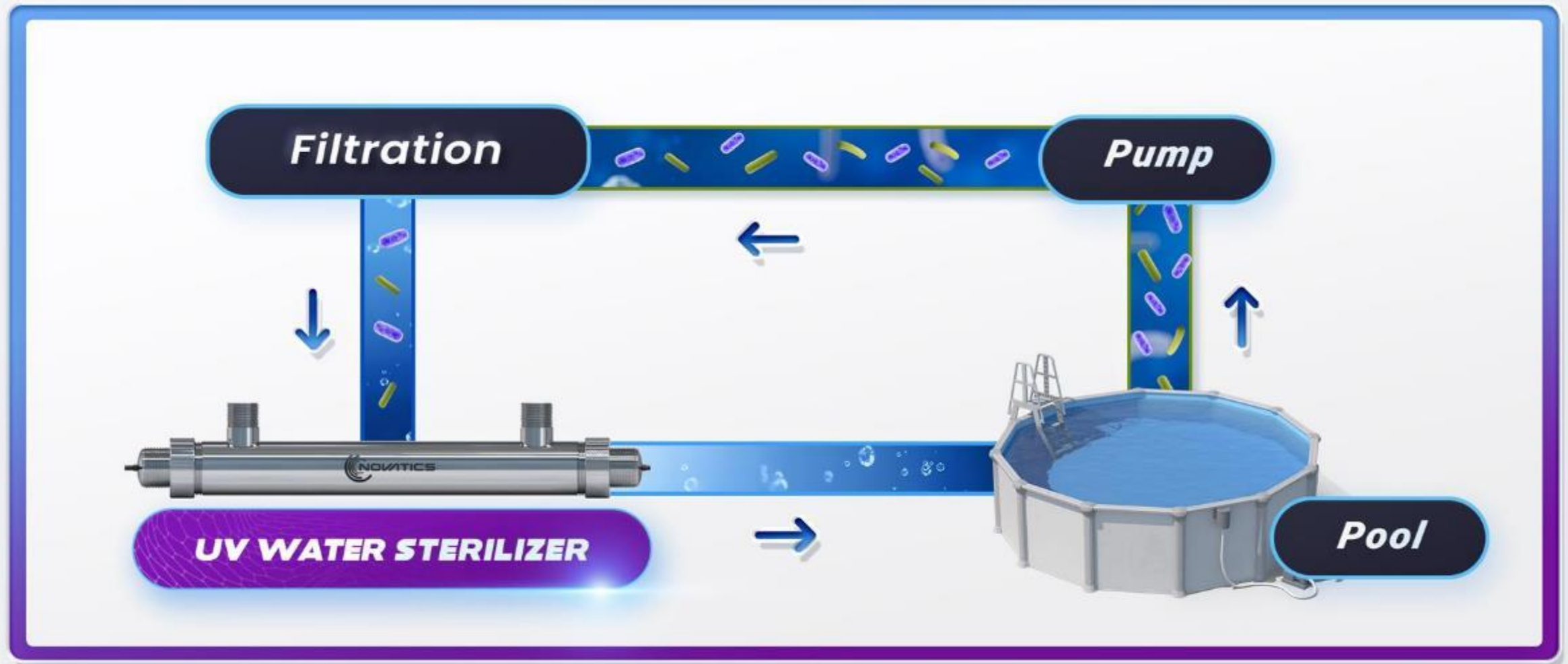
**WS T5**



**WS T10**



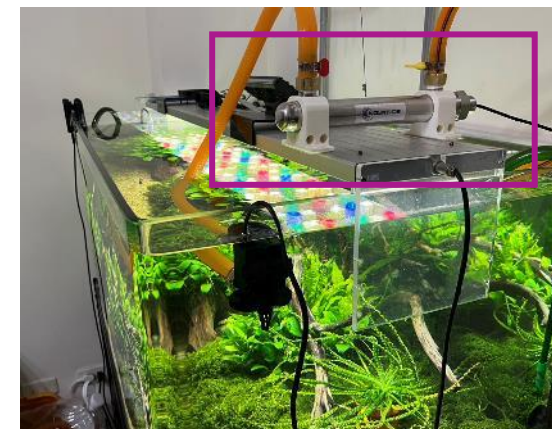
# Connection Example



# 4 ft Aquarium (WS G2)

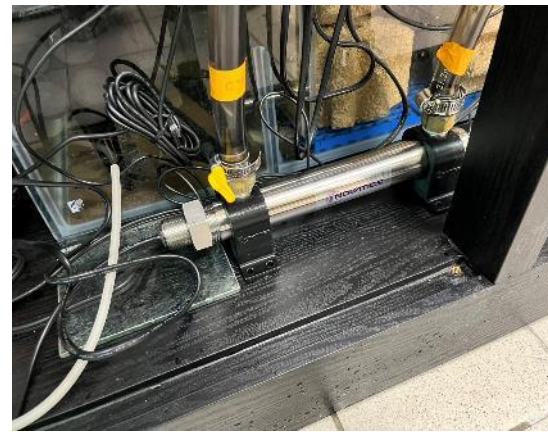


Test Start

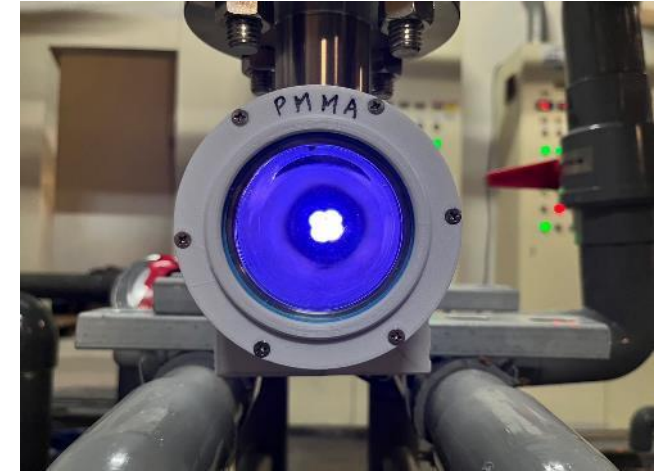


2 Weeks Later

# 6 ft Aquarium (WS G2)



# Spa Pool (WS T10)



# Spa Pool (WS T10)



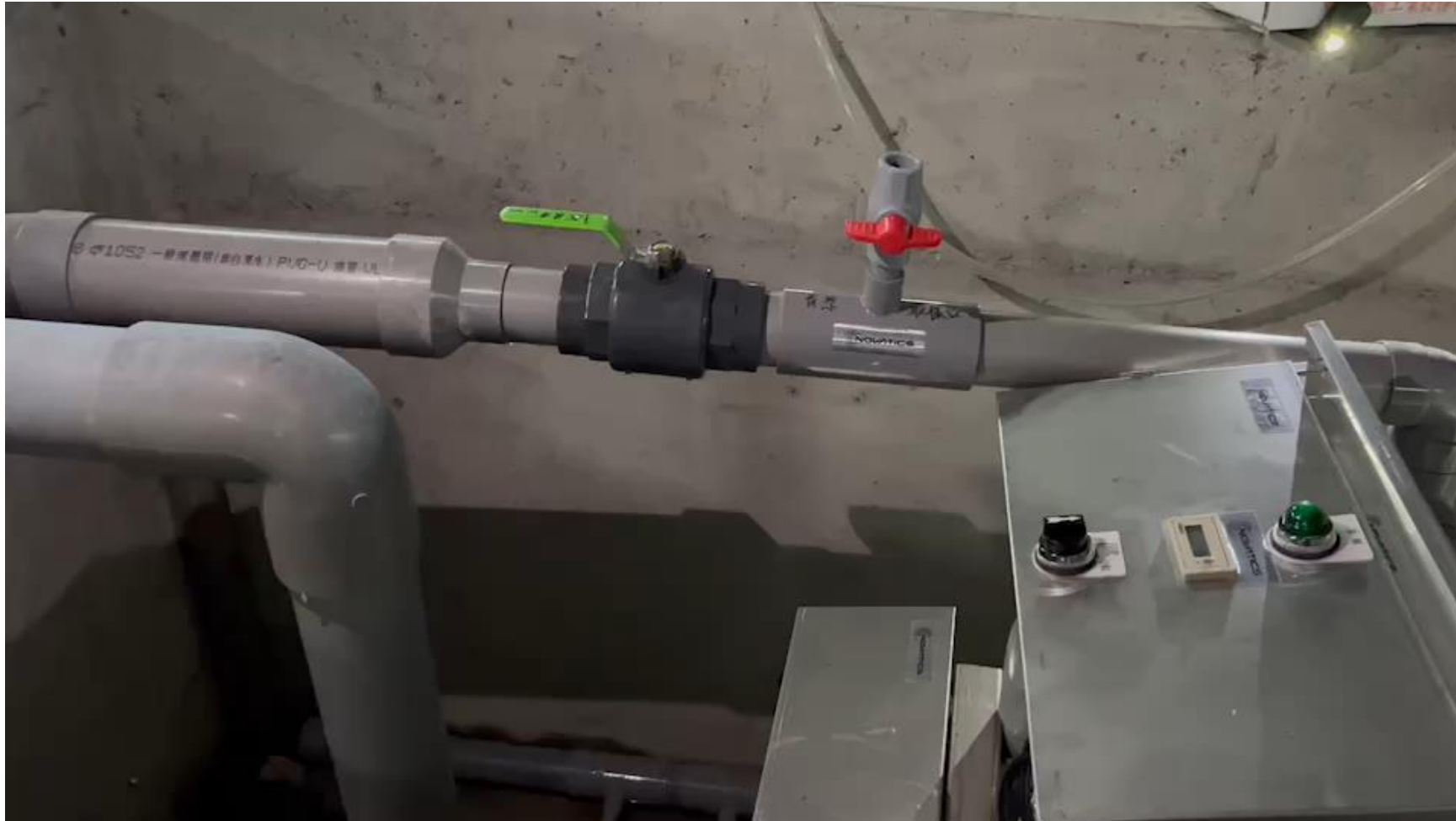
# Tilapia Farm (WS T10)



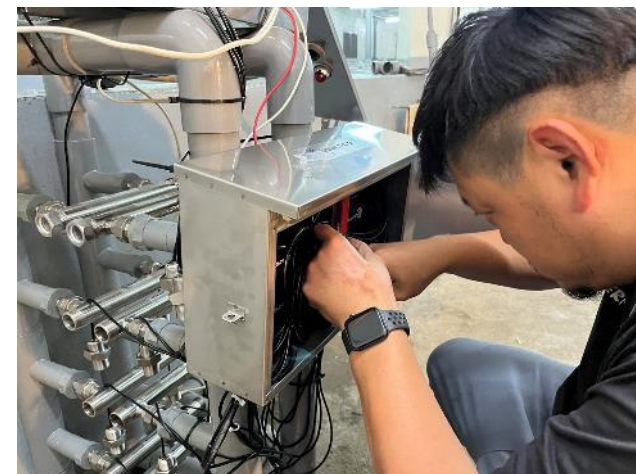
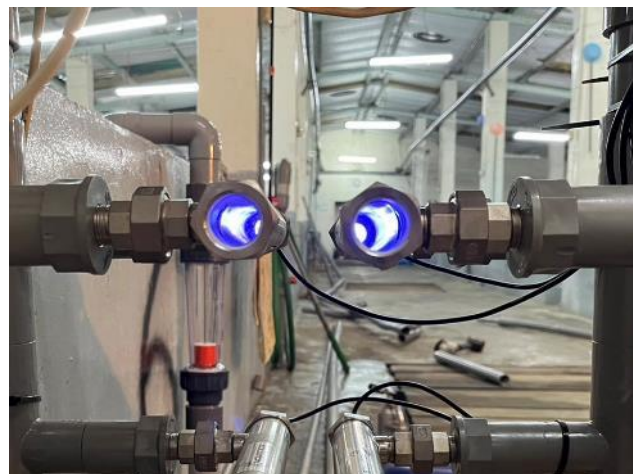
# Sturgeon Farm (WS T10)



# Sturgeon Farm (WS T10)









# Shrimp Farm (WS T10)



# Shrimp Farm (WS T10)

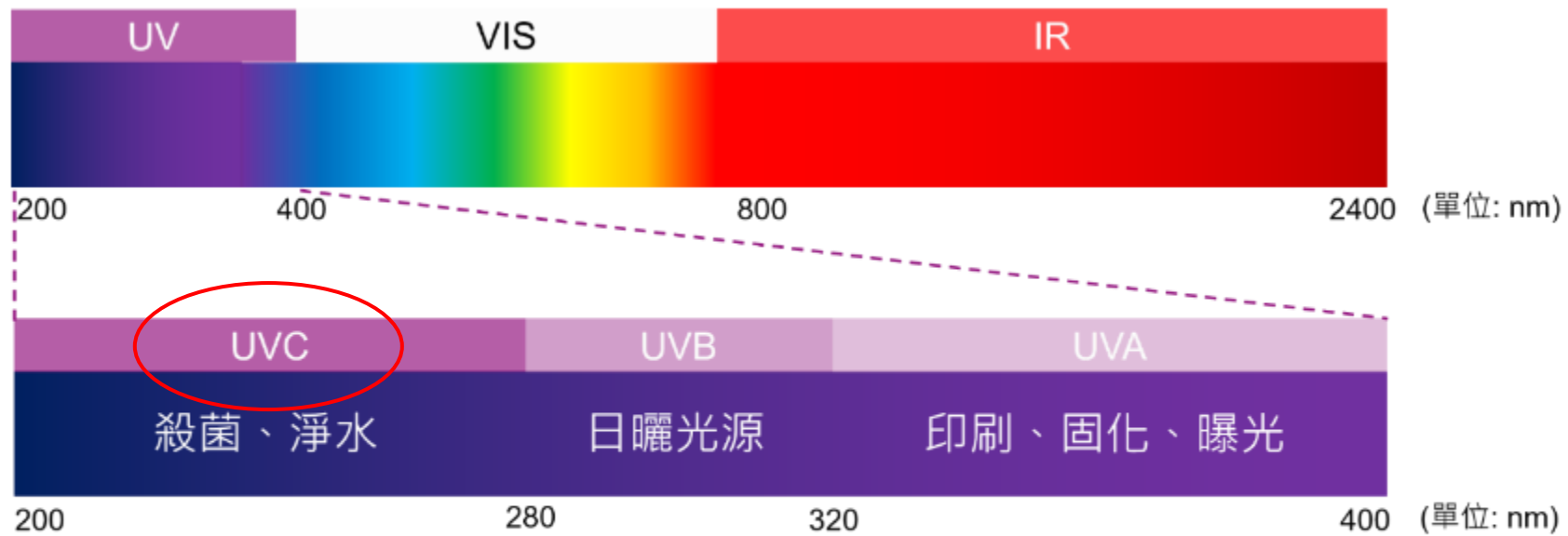


## Approaches for bacteria neutralization in drinking water

Catgory	NOVATICS	UF	RO	UV lamp	Chlorine
Mechanism	UV LED	Physical Block	Physical Block	UV lamp	Chemical
Efficiency	 High	High	High	High	High
Running Cost	 Very Low	High	Mid	Low	Low
Equipment Size	 Compact	Medium	Large	Medium	Compact
Parts Cost	 Low	High	High	Low	Low
Waster Water	 No	Low	High	No	No
Lifetime	 Long	Short	Short	Long	Short
Issues	New Brand	Expensive	Water Waste	Mercury (Hg) Ozone Induced (O <sub>3</sub> )	<b>Bio Safety</b>

# Backup Slides

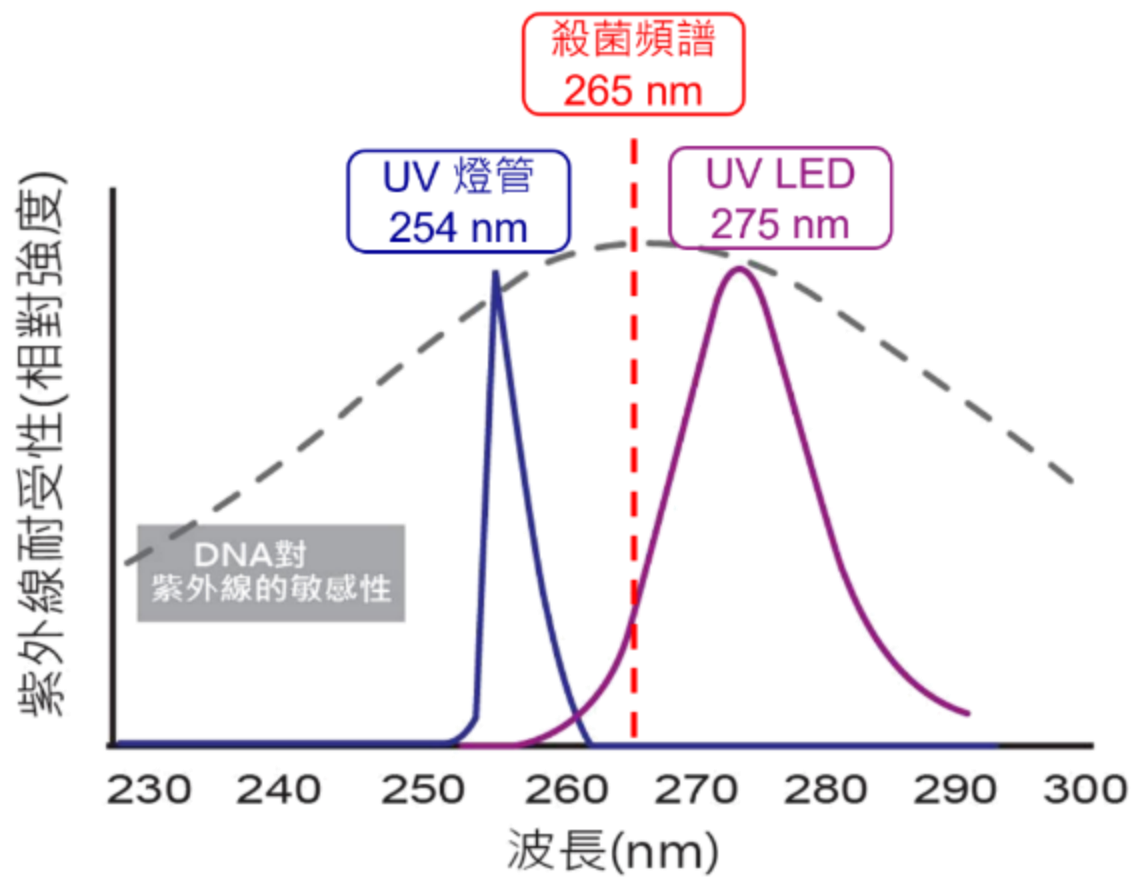
UVC spectrum & LED Sterilization



光學全波長頻譜示意圖



# UVC sterilization



UVC殺菌頻譜範圍



# SPA Pool Real Site Test



Spa Pool



Original



Original 10<sup>-3</sup>



6 TPH 10<sup>-3</sup>



4 TPH 10<sup>-3</sup>



SPA Pool 24hr



24hr Original

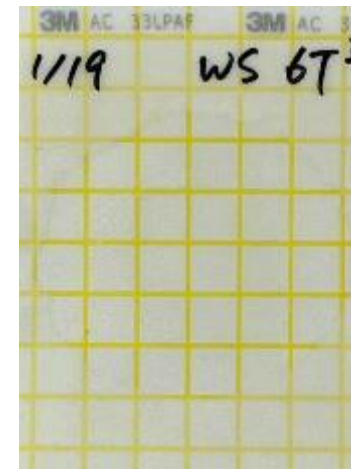


24hr Origin. 10<sup>-3</sup>

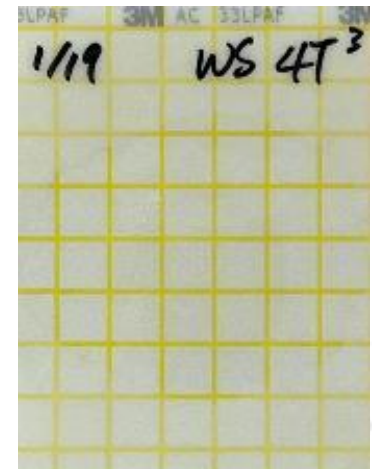


BEFORE (Original Background) AFTER (UV Activated Treatment Result)

24hr 6 TPH 10<sup>-3</sup>



24hr 4 TPH 10<sup>-3</sup>



Test 1/18

Stop Cl for 12 hrs

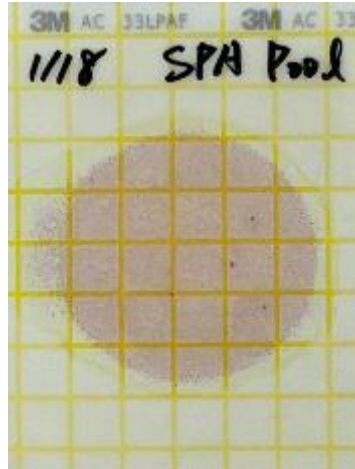
Test 1/19

Circulate for 24 hrs

# SPA Pool 24 hrs Comparison



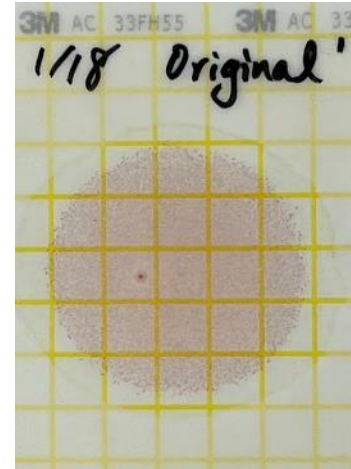
Spa Pool



Original



Original 10<sup>-1</sup>



Original 10<sup>-2</sup>



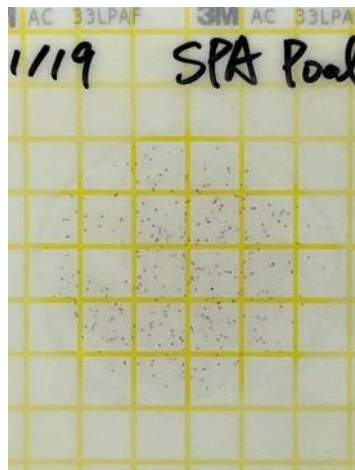
Original 10<sup>-3</sup>



BEFORE

AFTER

Spa Pool



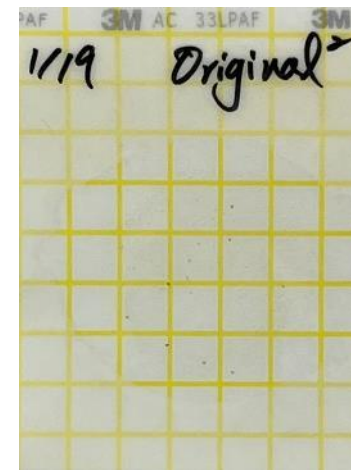
Original



Original 10<sup>-1</sup>



Original 10<sup>-2</sup>



Original 10<sup>-3</sup>



Original 1/18

Stop Cl for 12 hrs

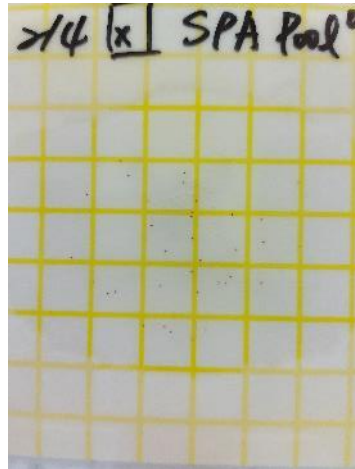
Original 1/19

UV Activated for 24 hrs

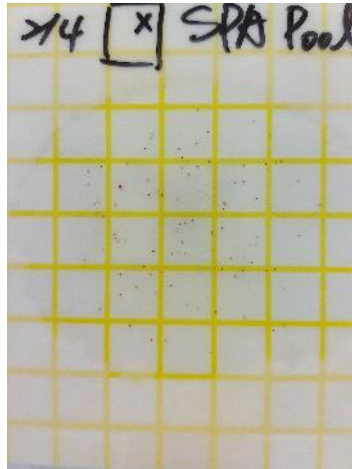
# SPA Pool 7 Days Test



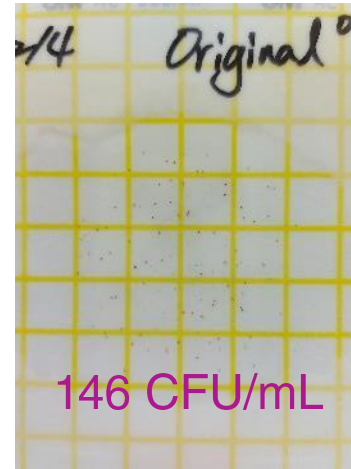
Spa Pool 1



Spa Pool 2



Original



Original 10<sup>-1</sup>



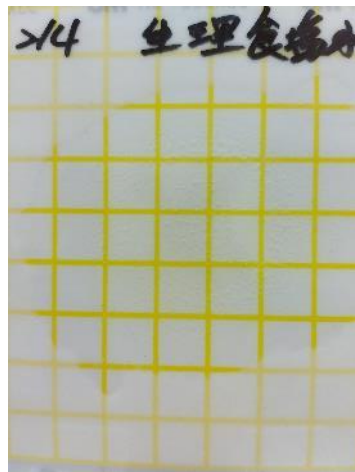
Original 10<sup>-2</sup>



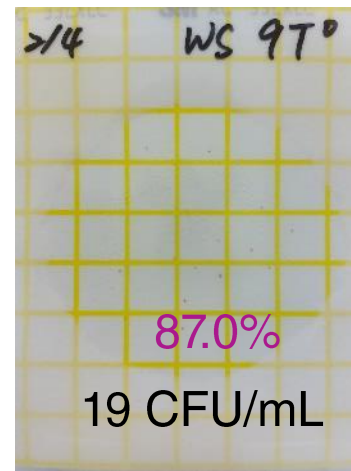
BEFORE

AFTER Normal Saline

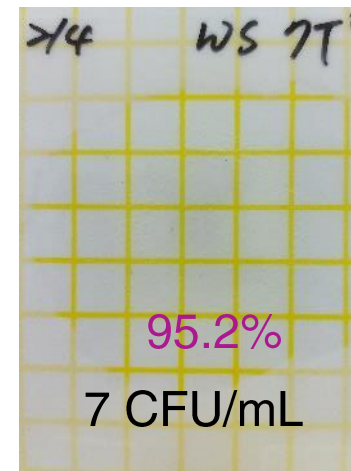
UV circulation for 7 days, no Cl dosing



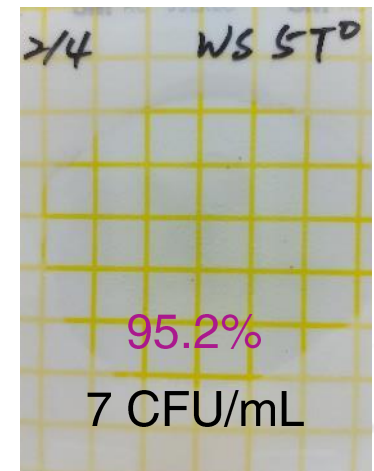
9 TPH



7 TPH



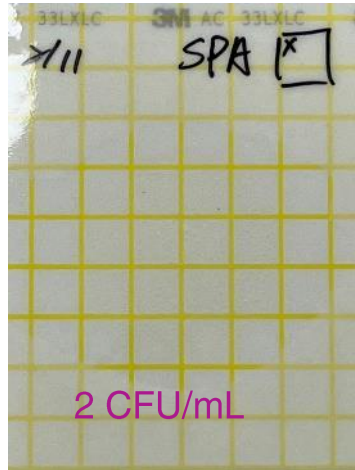
5 TPH



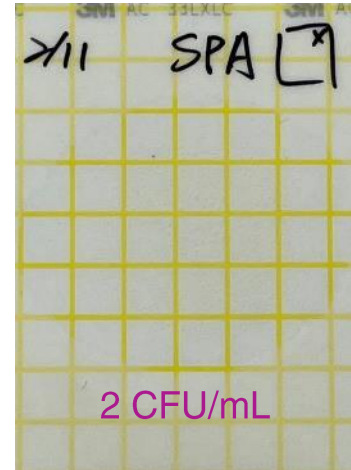
# 2/11 UV + 0.5 ppm Cl



SPA Pool 1



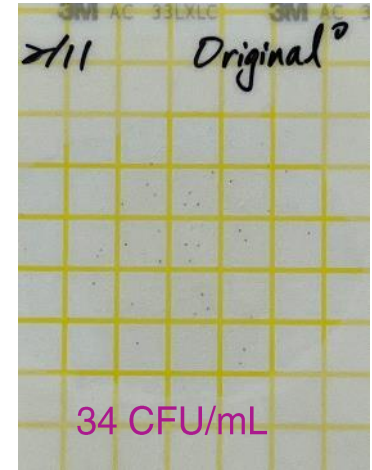
SPA Pool 2



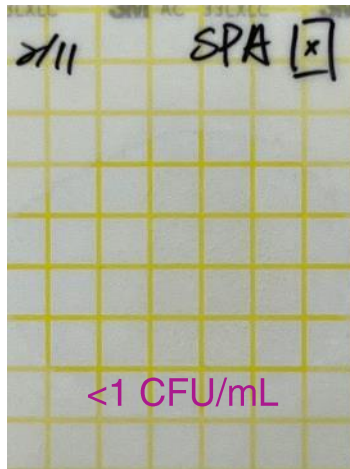
Original Test 1



Original Test 2



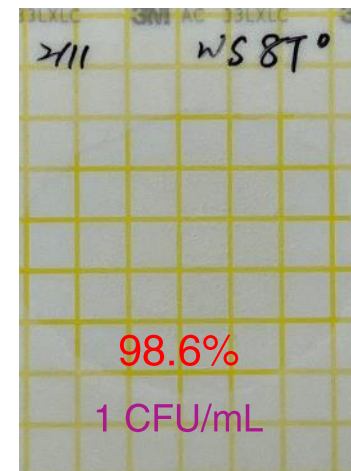
SPA Pool 3



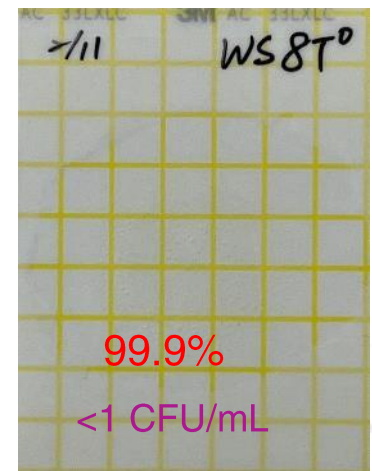
SPA Pool 5



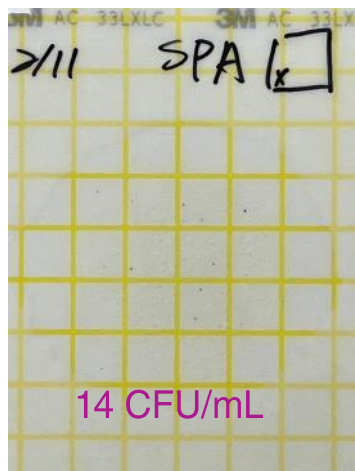
WS 8T Test 1



WS 8T Test 2



SPA Pool 4

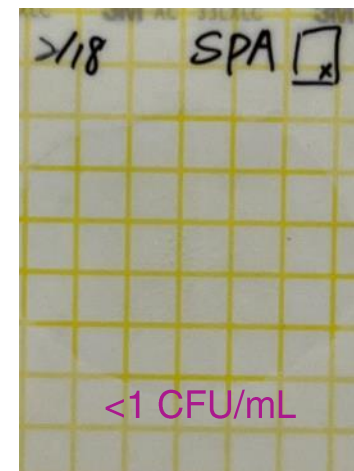
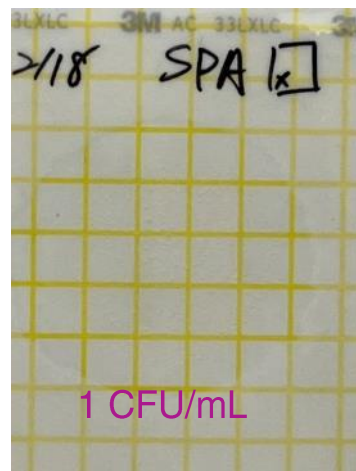
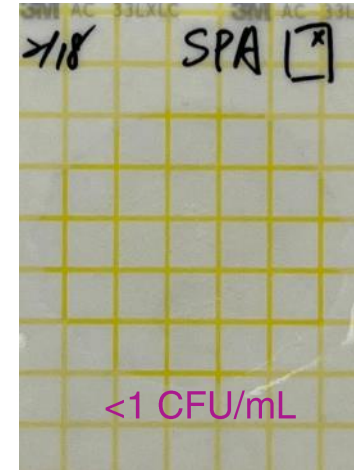
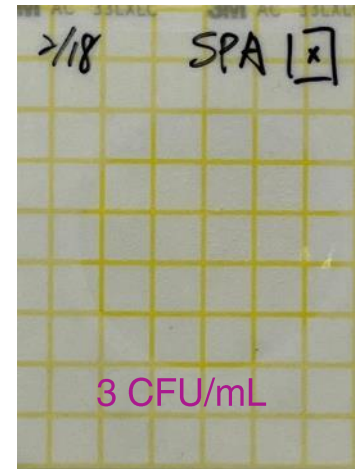
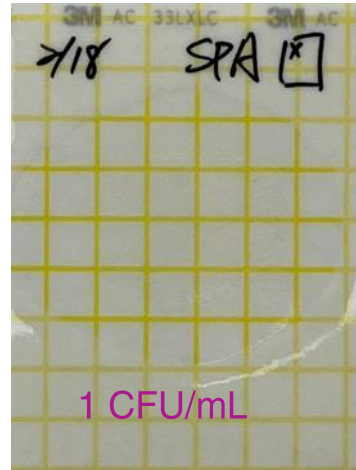


UV circulation  
with 0.5 ppm Chlorine

# 2/18 UV + 0.5 ppm Cl



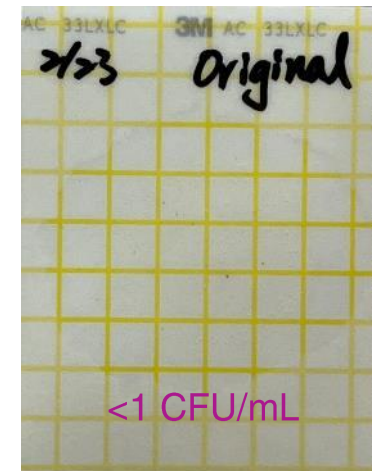
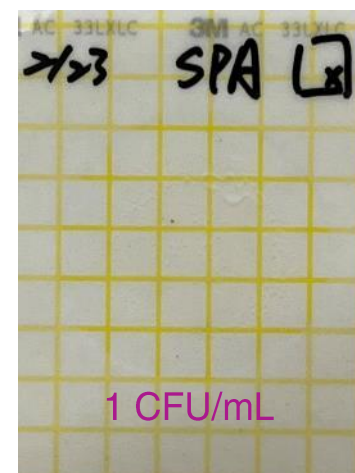
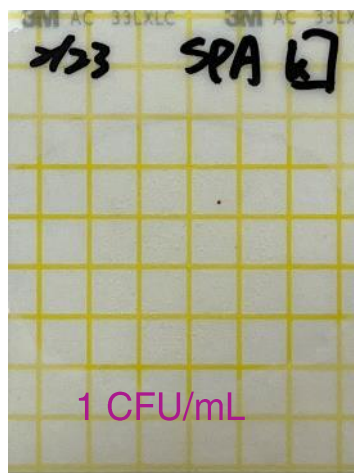
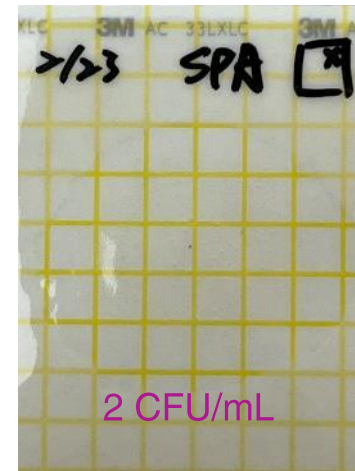
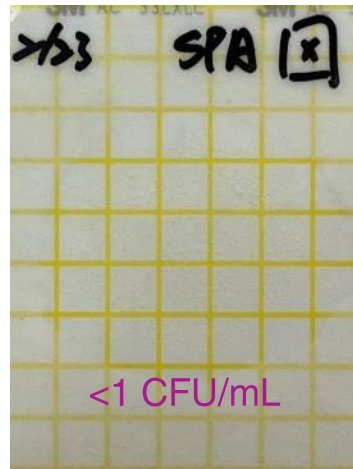
UV circulation  
with 0.5 ppm Chlorine



# 2/23 UV + 0.5 ppm Cl



UV circulation  
with 0.5 ppm Chlorine

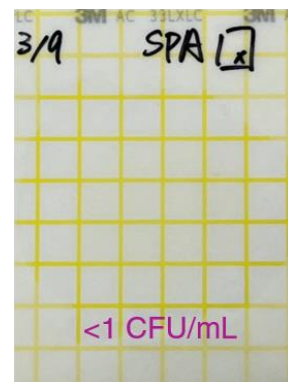
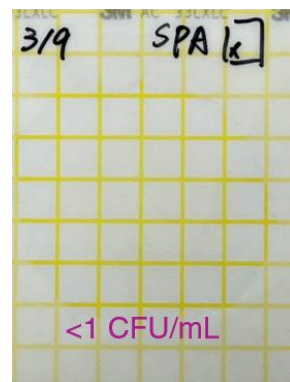
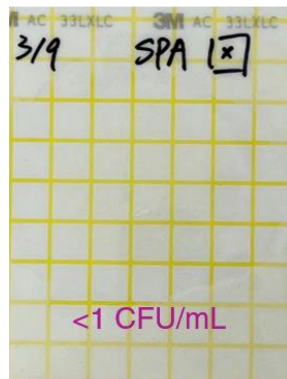
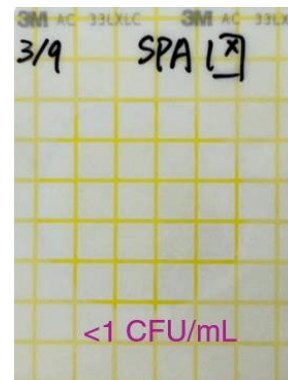


# 3/9 UV + 0.5 ppm Cl

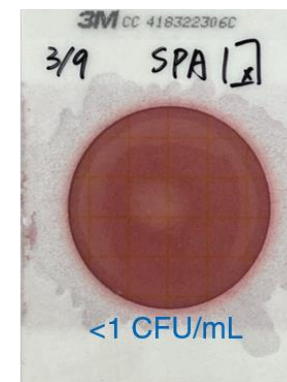
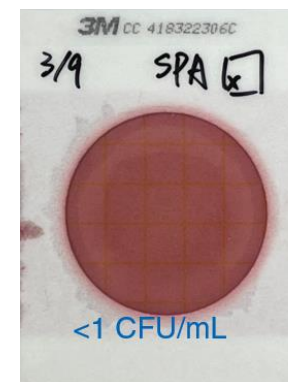
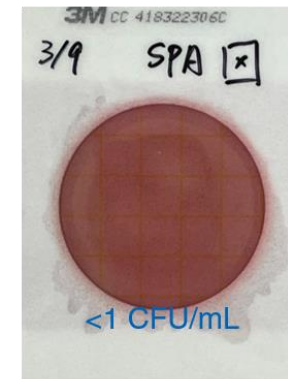
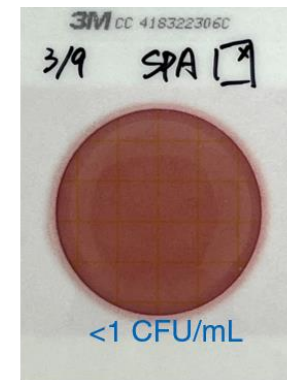
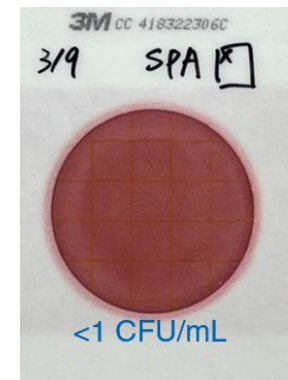


UV circulation  
with 0.5 ppm Chlorine

## Total Bacteria Count



## E. Coli Count





**CRISTAL**

[cristalmat.com](http://cristalmat.com)