Aqua Marine Control
www.aquacontrolmarine.com

ULTRA VIOLET LIGHT
SP Series for Marine Systems

Quick Installation Manual
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This manual provides quick installation, operation and maintenance instructions for the Sea Recovery Ultraviolet Disinfection Unit-SP Series. It is intended for individuals with working knowledge of servicing electrical and mechanical equipments.

SAFETY ISSUES

Anyone responsible for the installation of Sea Recovery Ultraviolet Disinfection Unit must read this manual thoroughly and comply with the instructions, guidelines, and safety requirements at all times.

WARNING! Remove all electrical power to the UV unit before servicing. The electrical panel is an electrical hazard. Death can result if precautions and safety requirements are not followed. Before servicing all electrical power to the equipment, including power from signal and monitoring systems, must be isolated.

WARNING! Never service the equipment under pressure. The unit's water source must be closed; unit must be depressurized and drained.

WARNING! Never look directly at the UV lamp. The lamp produces harmful radiation and will damage eyes and skin. Always use protective apparels. The UV lamp contains mercury and must be handled and disposed of properly.

1 Unit Description

The SP Series is appropriate for many low volume indoor applications because of the compact design and easy installation. SP Series combines electrical components and treatment chamber in one integral unit.

The UV unit is comprised of a stainless steel cylinder and a ballast box. The cylinder forms the treatment chamber, houses the quartz sleeve and UV lamp. The cylinder has two ¼" female fittings and compression nuts on each end. The ballast box is attached to the cylinder. Inside the ballast box are the circuit board, UV lamp connector, and the pass-through for the quartz sleeve. Water flows in either direction around the quartz sleeve.

Figure 1 UV Unit-SP Series

1.1 Components

The UV unit consist of the following components.

Cylinder	Main body that forms the treatment chamber with 2 ports and 2 pass-thru.
O-ring	Two O-rings placed at the quartz sleeve ends for sealing.
Compression Nut	Two compression nuts maintain sealing to the treatment chamber. One nut has a viewport; the other has a pass-thru.
Fitting	Two quick fit elbow fittings to connect plumbing to the cylinder ports
UV Lamp	Ultraviolet lamp emits radiation to treat fluid inside the treatment chamber.
Quartz Sleeve	The quartz sleeve protects the UV lamp from fluid inside the treatment chamber.
Ballast Box	The plastic box, attached to cylinder, houses the circuit board that connects to the power cable.

Table 1 SP Series Elements

CAUTION! Operating water should be between 37ºF and 104ºF (3ºC to 40ºC).

CAUTION! Excessive vibration will damage the UV unit electrical components and cause premature failure of the UV lamp.

CAUTION! Ultraviolet light exposure degrades non-metallic piping materials and may lead to material breakdown or failure.

2 Unit Operation

The SP series sterilize water by emitting UV light to penetrate water as the water flows through the treatment chamber.

3 Installation Requirements

The SP Series UV unit is shipped with the UV lamp, quartz sleeve, fittings, and O-rings and need to be assembled before the UV unit can be used.

1. Install the UV unit in a sheltered, well ventilated area.
2. Install the UV unit as close as possible to the point-of-use to avoid potential contamination discharge from pipes, fittings, etc.
3. The UV unit should be mounted on stable support to avoid straining or warping. Allow sufficient clearance around the unit for servicing.
4. Verify the location is free from vibration.
5. All UV units are rated for maximum operating pressure at 50psig (8.24 bar).
6. The UV unit must be properly grounded for safe and proper operation. Failure to properly ground the UV unit automatically voids all unit warranty.
7. Line voltage must be within 10.56V to 16.50V. Voltage outside the range will compromise the performance of the UV unit.

3.1 Plumbing Requirements

All piping, tubes and hoses leading to the UV unit connection points must be leak-free before the UV unit can be installed.

NOTE! The UV unit may be installed horizontally or vertically. For vertical installation, make sure the inlet port is positioned at the bottom.

4 Installation Procedure

NOTE! Do not assemble or install damaged parts. Quartz sleeve and UV lamp are fragile and must be handled with care.

4.1 Install Fittings

Perform this procedure to prepare the UV unit for installation.

1. Inspect each port and fitting to ensure threads are free of dirt, burrs, and excessive nicks. If threads are badly nicked, replace the fitting.
2. Wrap ¼" wide PTFE tape 2 to 3 turns counter-clockwise around the male threads of the ¼" fitting. Do not wrap tape around the first thread.

3. Screw the fitting into cylinder ports to finger tight position to achieve desired alignment.

4. Do not back-off fitting. Do not over-tighten fitting. Over-tightening could strip the fitting threads and cause leak.

4.2 Install Quartz Sleeve

Perform this procedure only when water piping for UV unit is in place and ready for service.

1. Visually inspect quartz sleeve for cracks and damages.
2. Remove the four screws holding the ballast box cover and remove the cover.

3. Remove the rubber boot and pull out the 4-point lamp connector.

4. Remove the compression nuts.

5. Insert the close-end of the quartz sleeve into the cylinder through the ballast box pass-thru.

6. Allowing ½" of the quartz sleeve to expose on the viewport pass-thru.

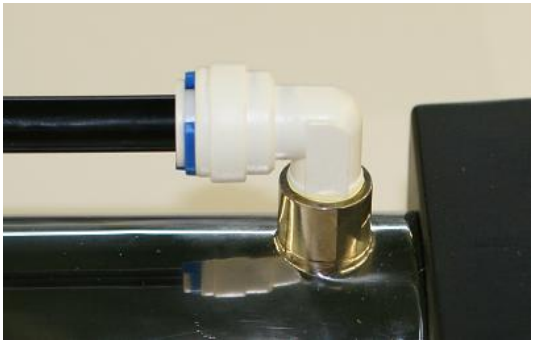
7. Lubricate the tips of the quartz sleeve with clean water and insert new O-ring. Ensure the O-ring has all-round contact with the cylinder pass-thru.
8. Tighten the compression nut while making sure the nut does not contact the quartz sleeve. Adjust O-ring position as necessary. The compression nut should be snug and tight, not over-torque.

9. Repeat Step 7 & 8 on the ballast box compression nut.

4.3 Connect Plumbing

Tube or hose ends must be cut squared and clean; must have no rough edges. The quick fit elbow fitting has a C-clamp that will lock the tube in place once inserted.

1. Insert the supply pipe into one cylinder port and label the port "Inlet".



2. Insert the temporary pipe into the other cylinder port to direct water into a container.

3. Slowly fill the cylinder with water and flush cylinder for 1 minute.
4. Remove temporary pipe and insert the return pipe into the cylinder port and label the port “Outlet”.
5. Slowly pressurize the UV unit by filling the cylinder with water while checking for leaks.
6. If leaks are found on the compression nuts, depressurize the unit and slightly tighten the leaking compression nut.
7. Retest until a leak-free installation is verified.
8. Once UV unit is leak-free, the quartz sleeve installation is complete and the UV lamp can be installed.

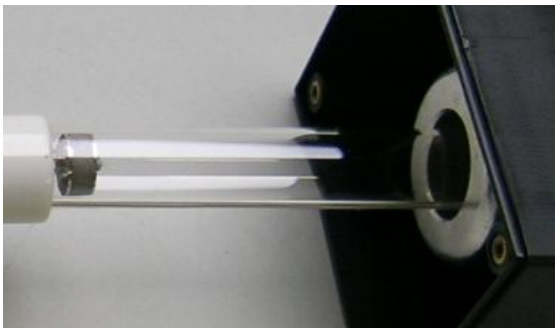
NOTE! To remove tube from fitting, first remove the C-clamp then push fitting sleeve down. Once the fitting sleeve is down, pull the tube out of the fitting.

4.4 Install Ultraviolet Lamp

Perform this procedure only after the quartz sleeve installation and leak-tests are completed successfully

1. Connect the UV lamp to the 4-point receptacle. If the lamp is not installed properly, lamp breakage will occur.

2. Insert lamp into quartz sleeve through compression nut pass-thu.



3. Install rubber boot over compression nut.

4. Connect unit power cable to power source.
5. Tighten the 4 screws to secure ballast box cover.

6. Turn ON the power to the unit.
7. Verify UV lamp operation from the viewport.

8. Allow one minute for the UV lamp to warm up prior to flowing water through the UV unit.

⚠ **CAUTION!** Use the viewport to verify the proper operation of the UV lamp.

⚠ **CAUTION!** Rapid successive cycling of the power to the ballast can cause premature failure of the unit.

⚠ **CAUTION**! Prior to energizing the lamp, make sure there is no water leaking from the quartz sleeve compression nuts.

4.5 Mounting the Unit

Once the UV unit is assembled and tested successfully, it can be mounted onto its permanent operational location. The unit must be mounted in a manner that will prevent

excessive vibration and warping which will damage the quartz sleeve.

5 Operational Guidelines

a) Release the pressure in the UV treatment chamber before breaking the compression nut seals.

b) Disconnect all power to the UV unit before servicing.

c) Do not allow the inlet water temperature to drop below 35ºF (2ºC).

d) Do not allow the flow rate to exceed 2 GPM.

e) Do not cycle the UV unit more than 3 "ON/OFF" cycles in a 24-hour period.

f) Ensure all plumbing connections are tightly sealed before applying pressure.

g) Before connecting the return tube, flush the unit to rinse out any debris left from the installation process.

WARNING! UV LIGHT EXPOSURE CAN SEVERELY BURN AND DAMAGE EYES AND SKIN.

WARNING! DO NOT look at the blue UV light. DO NOT operate the UV lamp outside of the UV treatment chamber.

CAUTION! The unit operates on high voltage and must be serviced by qualified personnel only.

CAUTION! Standard flow rate are based on water temperature 35ºF to 100ºF. If the inlet water temperature exceeds 100ºF (38ºC), please contact your local CSR.

CAUTION! Cycling more than 3 cycles will reduce the end-of-life (EOL) output and/or cause premature lamp failure.

6 Preventative Maintenance

Follow the preventative maintenance procedures to maximize the efficiency, reliable, and longevity of the UV unit.

Refer to Table 2 Periodic Maintenance Table for recommended maintenance schedule.

WARNING! The most important consideration is operator safety. The following directly relates to operator safety. All personnel must review and comply with the following.

CAUTION! Operators must observe Safety Requirements at all times

6.1 Safety Requirements

The following safety requirements are mandatory. Failure to comply can cause injuries and/or damages to the UV unit.

1. Never look directly at the blue ultraviolet lamp when it's "ON". Never operate the ultraviolet lamp outside the stainless steel cabinet. UV light exposure can severely burn and damage eyes and skin.
2. Properly ground the UV unit. Failure to properly ground the UN unit can cause severe electrical shock hazard.
3. Provide watertight piping and compression nut seals. Failure to provide watertight seals can cause damage to electrical components or cause electrical shock hazard.
4. Disconnect power before servicing the UV unit. The UV lamp and electrical components operate with high voltage electrical power. Do not attempt to service the UV unit without first disconnecting the power source. Shut off the source of power at the main panel breaker and use appropriate tag-out or lock-out procedures to prevent accidental power-up.
5. Only qualified service personnel should perform services to the UV unit.
6. Remove pressure before servicing the UV unit.
7. Never operate the UV unit for more than 30 minutes without water flow. Elevated water temperature can damage the UV unit.
8. Do not exceed 3 "Start/Stop" cycles per 24-hour period. Exceeding 3 cycles will subjected the lamp filament to excessive thermal stress leading to premature failure of the UV lamp.

6.2 Unit Maintenance

The exterior surfaces of the UV unit should be kept clean and dry. In most cases it may be necessary to clean the exterior of the unit once a month. Use soft cloth and soapy water, or any commercial stainless steel cleaner.

Interior of the ballast box should be inspected for debris. Any debris should be removed using vacuum.

6.2.1 Quartz Sleeve

Debris and other matter in the water will settle onto the quartz sleeve and eventually block the ultraviolet rays from penetrating into the water. It is necessary to determine a cleaning schedule for the quartz sleeve. The frequency will depend on the specific type of water being processed and the duty cycle of the unit.

Inspect the quartz sleeve 30 days after initial installation to assess the amount of contamination collected over the

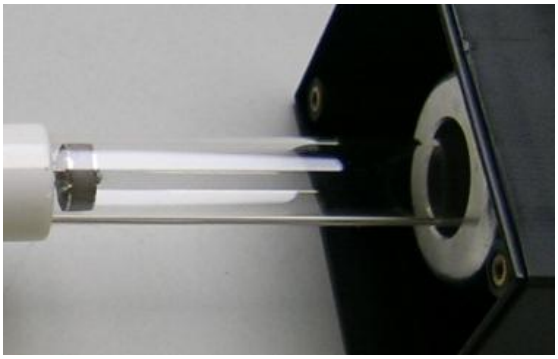
30-day period. Use the finding to determine a reasonable schedule and frequency for periodic cleaning.

Clean-In-Place (CIP) cleaning is sometimes effective in removing debris from the quartz sleeve. Conduct a CIP cleaning test to determine its effectiveness. If CIP cleaning is not effective, then a manual cleaning or replacement is required.

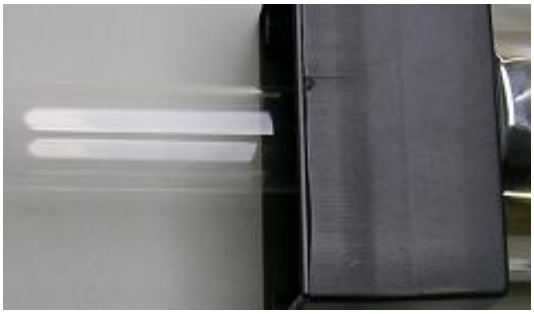
When the quartz sleeve is due for cleaning, use the following procedures.

1. Turn off the water source to the UV unit.
2. Disconnect the power source to the UV unit.
3. Drain the UV treatment chamber.
4. Remove the ballast box cover.

5. Remove rubber boot and carefully pull out the UV lamp through the compression nut pass-thru.



6. Use a channel lock to remove the compression nuts.
7. Remove the Quartz Sleeve carefully.



8. Wash the Quartz Sleeve with mild soapy water and rinse in clean hot water.

If dirt remains after rinsing, the quartz sleeve should be replaced. Contact your local CSR to order a replacement.

> **NOTE!** Failure to perform quartz sleeve maintenance may reduce the efficiency of the UV light to adequately treat water in the treatment chamber.

6.2.2 Checking for Leaks

Visual inspect the UV unit exterior for signs of leakage. The cause of any leakage must be located and repaired.

If a leakage is detected, perform the following.

1. Shut off all electrical power. Shut off the source of power at the main panel breaker and use appropriate tag-out procedures to prevent accidental power-up.
2. Depressurize the UV unit.
3. Remove ballast box cover and remove the rubber boot.
4. Locate which end of the quartz sleeve is leaking.

6.2.3 Repairing Leaks

If both ends of the quartz sleeve are leaking, perform the following on both ends.

1. Use a channel lock to loosen and remove the compression nut.
2. Remove the quartz sleeve O-ring without pulling the quartz sleeve out.

3. Lubricate the quartz sleeve tip with clean water and place new O-ring. Ensure the O-ring has all-round contact with the cylinder pass-thru.
4. Replace and tighten the compression nut.
5. Refill the treatment chamber and verify a leak-free condition.

6.2.4 Measuring Performance

Every UV unit must be tested periodically to verify its efficiency. Regardless of the intended application or any optional equipment provided with the UV unit, the most accurate procedure is the Post-UV Analysis. The Post-UV Test must be performed in accordance with standard testing methods, see Section 6.2.7 below.

6.2.5 Verifying Lamp Operation

The UV lamp is “ON” when the blue light is emitting thru the viewport.

6.2.6 Obtaining Water Samples

Vast majority of unsatisfactory Post-UV Test results are directly related to the improper sample-taking techniques. Although several commercial sample collection apparatuses are available, the proper manufacturer’s sample procedures must be followed.

NOTE! Sea Recovery recommends a valve with a discharge orifice not to exceed ¼” (6mm).

6.2.7 Sampling Procedure

Use sterile sample bottles obtained from reliable laboratory that has been autoclaved and kept in plastic bag for this procedure.

1. Use temporary tube to direct water from UV unit to container or drainage.
2. Pressurize the UV unit and flush unit with sample valve fully opened for 3.5 minutes. After flushing for 3.5 minutes, reduce valve opening to 50% and flush for 3 minutes.
3. Open the sample bottle and keep the inside of the cap facing down.
4. Fill the sample bottle and avoid breathing directly into the bottle or touching the inside of the bottle, cap, or neck.
5. Immediately cover and secure the cap after filling the sample bottle.
6. Label the sample bottle and place in a clean plastic bag.
7. Take sample bottle to the laboratory for plating as soon as possible.

NOTE! Sample processing must begin within 3 hours after sample collection and must comply with accepted standard methods.

7 Periodic Maintenance Table

The table below represents the recommended Periodic Maintenance (PM) for the SP Series UV Unit.

Description	Init.	Daily	Mn	Ann.	Other
Quartz Sleeve Cleaning	x				
Quartz Sleeve Replacement*	x				
Operating Condition	x				
Unit Cleaning	x		x		
Leak Inspection	x	x	x		
UV Lamp Inspection	x	x	x		
UV Lamp Replacement-SP-1				x	4,400 hrs
UV Lamp Replacement-SP-2				x	8,000 hrs

Table 2 Periodic Maintenance Table

* Quartz Sleeve replacement will occur more frequently for systems operating with continuous high flow rate or low water quality water, and less frequently for systems operating with low flow rate or high water quality.

8 Replacement Parts List

Part	Part No.
Stainless Steel Cylinder	40000300CV
UV Lamp	40000100CV
Quartz Sleeve	40000400CV
Compression Nut	40001400CV
O-ring	40001300CV

Table 3 Replacement Parts List

9 UV Unit Specifications

Type	12 VDC Operating UV Sterilizer for 2 gallon per minute of water flow
Ballast Type	Solid State
Bulb Type	16 Watts Single Ended
Bulb Life	8000 Hours minimum
Materials	Body: SS304; Ballast Box: PVC
Power Cord	4 meters 2 conductors
Weight	500g Body

Table 4 General Specifications

Temperature Range	Operating: +3ºC to +40ºC; Dry Storage: -25ºC to +85ºC

Table 5 Environmental Specifications

Operating Voltage Range	10.56V minimum; 16.50V maximum
Current	1.45A maximum @ Standard Test Voltage
UV Dosage	22mJ/cm^2 @ 254nm

Table 6 Electrical Specifications

Operating Pressure	50psi
Inlet/Outlet Ports	¼" NPT Female
Flow Rate	2 gpm
Disinfection Rate	99%

Table 7 Mechanical Specifications