Reset lamp hours from the Lamp Hours Screen:

Figure 6 Lamp Hours Screen

Reset Hours for Individual Lamp

1. Lamp Status Screen → Select the 'Lamp Hours' Button.
2. Lamp Hours Screen → Select the white enterable field beside the UV Lamp number to be reset to zero (0).
3. Reset Hours for Lamp # Confirmation Pop-Up Screen → Select 'Yes' to reset the hours or 'No' to cancel.

Reset All Lamp Hours

1. Lamp Status Screen → Select the 'Lamp Hours' Button
2. Lamp Hours Screen → Select the 'Reset All Lamp Hours' Button
3. Reset Hours for All Lamps Confirmation Pop-Up Screen → Select 'Yes' to reset the hours or 'No' to cancel.

System Hours

Displays the total UV System runtime.

Note: *UV Lamps will need to be replaced every 9000 hours of operation (i.e. replace at 9000 hours, again at 18000 hours and so on).*

System Cycles

Displays the total count of on/off cycles for the system.

8.4 Settings Screen

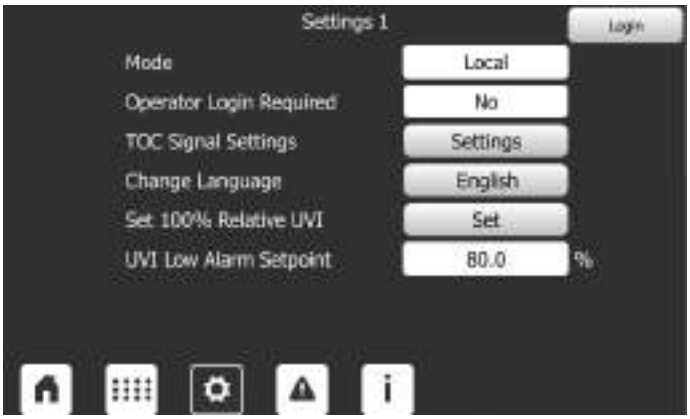


Figure 7 Settings Screen

Parameters	Unit/Range	Description
Mode	Remote - Input	The UV System is set to be remotely controlled and operated using a discrete input.
	Remote - SCADA	The UV System is set to be remotely controlled and operated using the SCADA signal. ***Note:*** *Refer to the SCADA list contained within the Controls Philosophy.*
	Local	The UV System is set to be locally controlled and operated
Operator Login Required	Yes	Operator login is required to view and change parameters at the OP1 login security level.
	No	Operation login is not required to view and change parameters at the OP1 login security level.
TOC Signal Settings	Settings	Select to modify TOC Signal Settings. (Section 8.4.2)
Change Language	English	Select from a list of available HMI Language options
Set 100% Relative UVI	Set	Select to set the 100% UVI value to the current output of the lamps. ***Note:*** *This should be performed when lamps are replaced and the system has all lamps on at 100% power.*
UVI Low Alarm Setpoint	0-100%	The UVI % below which the "UV Intensity Low" alarm is triggered.

Change Settings Screen parameters:

1. Select the white text box → Enter the value on the pop up → Enter

8.4.1 Set 100% Relative UVI

Note: *This process is to be performed after replacing the UV Lamp(s) in the UV Chamber.*

Figure 8 Set 100% Relative UVI

Figure 9 UVI Sensor Calibration Requirements

Parameter	Option / Range	Description
System Power	0% - 100%	Displays the current UV System Power Level
UV Intensity	%	Displays the scaled UV Intensity value

Text/Button	Description
Calibration Requirements	All calibration requirements must be met before the UVI Sensor calibration can be performed. • Control Mode is 100% • Warmup is complete • UVI Signal OK • No Lamp Out Alert • Grouping is Disabled ***Note:*** *If all Calibration Requirements are met, this information will not display.*
✔	Calibration requirement is achieved.
✘	Calibration requirement is not achieved. Resolve the requirement.
Yes/No Buttons	Buttons are visible when all requirements are met.

When all Requirements are achieved:

1. Wait for values to stabilize.
2. Press the "Yes" button to confirm.

When all Calibration Requirements are not achieved:

1. Resolve all unmet calibration requirements.
2. Wait for values to stabilize.
3. Press the "Yes" button to confirm.

8.4.2 TOC Signal Settings

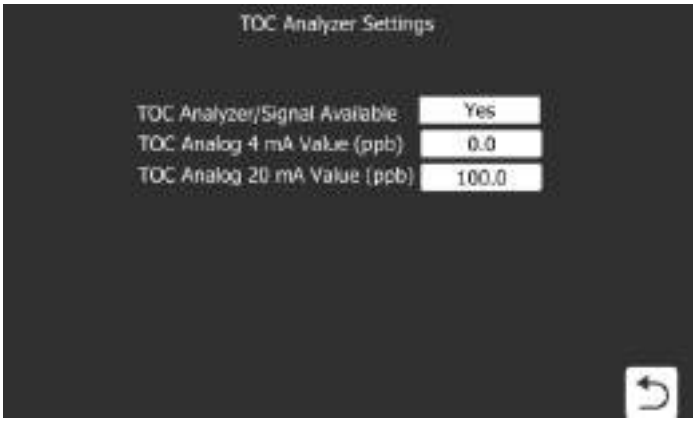


Figure 10 TOC Signal Settings

Parameters	Unit/Range	Description
TOC Analyzer / Signal Available	Yes	A TOC Analyzer / Signal is available and connected to the UV System controller.
	No	A TOC Analyzer / Signal is not available or connected to the UV System controller.
TOC Analog 4mA Value	ppb	Minimum scale (4mA) calibration value used to measure the TOC through the UV System.
TOC Analog 20mA Value	ppb	Maximum scale (20mA) calibration value used to measure the TOC through the UV System.

8.5 Active Alarms Screen

The Alarm Screen shows the most recent alarms in the order they occurred, older alarms will be overwritten when the buffer is full.

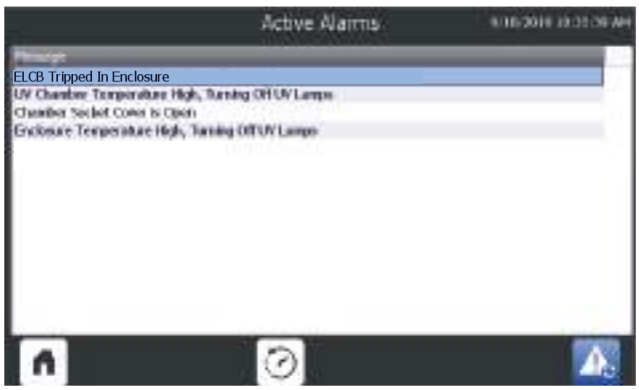


Figure 11 Active Alarms Screen

Reset a Latched Alarm

1. Resolve the cause of the latched alarm
2. Active Alarms Screen → Press the Fault Reset Button

Note: *Fault Reset button is visible only when there is an alarm.*

Reset a Non-Latched Alarm

1. Resolve the cause of the alarm. Once the cause is removed, the alarm will clear automatically.

8.5.1 Alarm History Screen

The Alarm History Screen displays all the alarms that have occurred in the system with a date/time stamp.

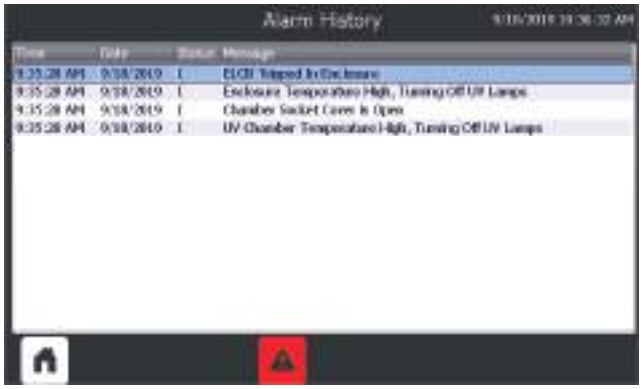


Figure 12 Alarm History Screen

Alarm Status

Alarm Status	Description
I	Indicates an incoming alarm event.
I/O	Indicates an outgoing alarm event ((i.e. the alarm is no longer active).

Active Alarms

The Alarm Icon  will flash red on all main screens when active alarms are present.

8.6 Information Screen

Figure 13 Information Screen

Item	Text	Description
Date / Time	--	Displays current set date and time
Sales Order	######	Displays Aquafine Sales Order Number. This number helps Aquafine Technical Support reference information about the provided system.
PLC	###:###:###:###:###	Displays the PLC Software Version

Item	Text	Description
HMI	###:###:###:###:###	Displays the HMI Software Version
PLC Status	Run	PLC is in RUN mode.
	Stop	PLC is in STOP mode. The program is not being executed.

Button	Description	Refer:
Exit Project	Select to exit UV System user interface to view and adjust Control Panel settings. ***Note:*** *Visible when logged in as OP1 or higher.*	--
Set Time	Set local date and time.	Section 8.6.1
System Diagnostics	Select to view PLC diagnostics. ***Note:*** *Visible when logged in as OP1 or higher.*	Section 8.6.2

8.6.1 Date and Time Screen

Figure 14 Date and Time Screen

Set Date and Time

1. Select the white text box → Enter the value on the pop up → Accept

8.6.2 Diagnostic Overview Screen

The Diagnostic Overview Screen allows the user the see the PLC status and process steps. This screen is used to assist with troubleshooting a failure in the automation system (i.e. a PLC or HMI error).

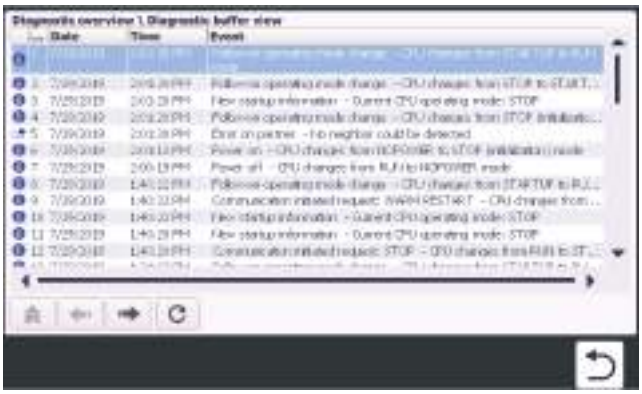


Figure 15 Diagnostic Overview Screen

Section 9 Maintenance

DANGER

Obey all warning and caution statements. Refer to Section 2.

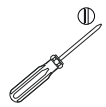
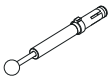
Read and understand this manual before operating this equipment. Read all user documentation before performing operations, inspections, repair, or maintenance on this equipment.

Only competent personnel should undertake operation, repairs, maintenance, or servicing of equipment described in this section of the manual. If you do not understand the information or procedure explanations in this manual, STOP and contact your Service Provider for assistance.

The tasks and safety information described in this section of the manual are external to the UV Chamber.

Refer to Section 11 for replacement part numbers.

9.1 Tools and Materials

Symbols	Description	Symbols	Description
	Screwdriver		Philips Screwdriver
	Wrench - Adjustable		Wrench - Torque
	Clean Water		Mild Acidic Solution (for example, ActiClean® Gel) or approved by Aquafine Service, food grade cleaner
	Isopropyl Alcohol		Lint Free Cloth (Kimwipes®)
	Cotton Swab		Sleeve Bolt Removal Tool
	Sleeve Removal Tool		Wrench
	Spray Bottle		

9.2 Maintenance Schedule

Scheduled maintenance and inspections can extend the life of the system and prevent problems. Routine maintenance may include partial disassembly to access components for cleaning and visual evaluation. Table 3 shows the maintenance schedule. During any maintenance activity, the manufacturer recommends inspection of all components that can be seen. Some of the preventative maintenance tasks may also need to be done to remove a condition that caused a system alarm. Refer to Figure 1 and Figure 2 for components that are accessible for maintenance.

Remember, always using genuine Aquafine parts keeps your warranty and regulatory certifications valid (cULus, CE, UKCA and KC).

Table 3 Preventive Maintenance Schedule

System component	Maintenance requirement	Weekly	Monthly	Semi-Annually	Annually	Every 2 years	9000 hours	On removal	As needed
CPP	Visually inspect the air filter for signs of debris or film. Replace filters as needed (Section 9.11.2).	X							
	Check cooling fan air inlet and outlet for signs of build-up and replace air filters if necessary (Section 9.11.3).		X						X
UV Lamps	Replace UV Lamps (Section 9.6.2)						X		
Lamp Sleeves	Remove a representative sample (i.e. 10%) of Lamp Sleeves (Section 9.8.1) • Check the Lamp Sleeve O-Rings and Sleeve Bolt Washers for UV decay and brittle parts. Replace O-Rings and washers as needed. • Remove any condensation inside the Lamp Sleeve • Inspect Lamp Sleeves for physical damage • Inspect for build-up on the Lamp Sleeves			X					X[3]
	Clean the Lamp Sleeves (Section 9.8.2)				X			X	X
	Replace Lamp Sleeve (Section 9.8.1)				X				X
	Replace Lamp Sleeve O-Ring (Section 9.8.1, Step 5)				X			X	
	Inspect Sleeve Bolts for signs of fluid leakage.		X						
UVI Sensor[1]	Clean the UVI Sensor (Section 9.7.2, Step 3)			X				X	
	Replace the UVI Sensor (Section 9.7.2)								X
	Inspect UVI Sensor O-Rings for UV decay and brittle parts. Replace O-Rings as needed.							X	
	Replace the UVI Sensor O-Rings (Section 9.7.2.1).				X				
UVI Sensor[2]	Clean the UVI Sensor (Section 9.7.1, Step 2)			X				X	
	Replace UVI Sensor (Section 9.7.1)								X
	Inspect UVI Sensor O-Rings for UV decay and brittle parts. Replace O-Rings as needed.				X			X	

Table 3 Preventive Maintenance Schedule (continued)

System component	Maintenance requirement	Weekly	Monthly	Semi-Annually	Annually	Every 2 years	9000 hours	On removal	As needed
UVI Sensor Sleeve[1]	Remove the UVI Sensor Sleeve (Section 9.8.1) • Check the Sleeve O-Ring and Sleeve Bolt Washer for UV decay and brittle parts. Replace O-Ring and washer as needed. • Remove any condensation inside the Sensor Sleeve • Inspect Sensor Sleeve for physical damage • Inspect for build-up on the Sensor Sleeve			X					X[3]
	Clean the Sensor Sleeve (Section 9.8.2)				X			X	X
	Replace UVI Sensor Sleeve (Section 9.8.1)				X				X
	Replace UVI Sensor Sleeve O-Ring (Section 9.8.1, Step 5)				X			X	
	Inspect Sleeve Bolt for signs of fluid leakage.		X						
UVI Sensor Plug[2]	Inspect UVI Sensor Plug O-Rings for UV decay and brittle parts. Replace O-Rings as needed.				X				
UV Chamber	Inspect End Plate O-Rings for UV decay and brittle parts. Replace as needed (Section 9.9.2)					X		X	X

[1] Applies to Liquid Sugar applications only.

[2] Applies to TOC applications only.

[3] Frequency may need to be increased or decreased depending on fluid quality. Refer to your facility's Clean in Place (CIP) process.

9.3 Depressurize and Drain a UV Chamber

The manufacturer recommends that the UV Chamber be depressurized and drained before any maintenance, service or repair task is done. Failure to depressurize and drain the UV Chamber can result in serious injury or death. Always follow all site-specific safety protocols and procedures. Refer to Section 2.

Prerequisites:

- Shut down the UV System. Refer to Section 5 as needed.
- Apply lockout tag out devices as necessary. Refer to Section 4.
- The drainage or fluid bypass provisions are followed until UV system starts.

Materials:

Procedure:

1. Stand off to the side of the end plate, open the vent valve and then the drain valve, as the process fluid level drops, the UV System will depressurize.
2. To depressurize only, open the vent valve.
3. Keep drain valve open until the UV Chamber is empty.
4. When service is complete, assemble the prerequisites in the reverse order of disassembly.

9.4 Pressurize the UV Chamber

Prerequisites:

- Remove UV Lamps (if installed). Refer to Section 9.6.2.
- Remove UVI Sensor. Refer to Section 9.7.2 ***- applies to Liquid Sugar systems only.***
- Inspect condition of sleeves for visible cracks or damage. Replace if necessary.
- Make sure the drain valve is closed.

Materials:

Procedure:

1. Fill the UV Chamber with process fluid.
   a. Stand off to the side and make sure the area is clear of all plant personnel.
   b. Pressurize the UV Chamber.
   c. Check for leaks.
   d. Wait twenty minutes.
2. If leaks are found:
   a. Depressurize and drain the UV Chamber. Refer to Section 9.3.
   b. Fix the leaks.
   c. Fill the UV Chamber and do a pressure test. Check for leaks.
3. If there are no leaks, depressurize the UV Chamber. Refer to Section 9.3.
4. Install the UV Lamps. Refer to Section 9.6.2.
5. Install the UVI Sensor. Refer to Section 9.7.2 ***- applies to Liquid Sugar systems only.***
6. Install the Service End Cap. Refer to Section 9.5.

9.5 Remove and Install the Service End Cap

Prerequisites:

- Shut down the UV System. Refer to Section 5 as needed.
- Apply lockout tag out devices as necessary. Refer to Section 4.
- Depressurize the UV Chamber. Refer to Section 9.3.

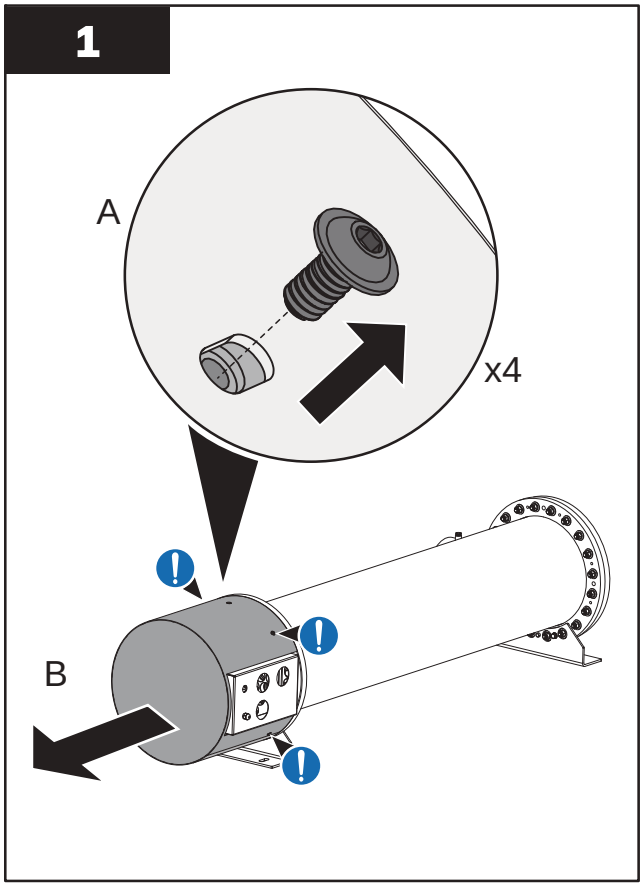
Tools:

Materials:

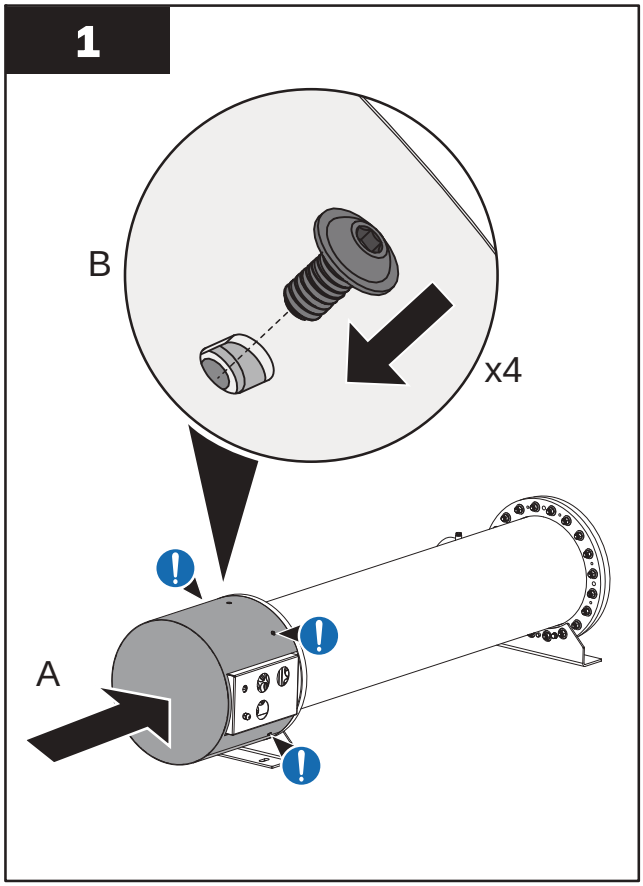
Procedure:

Note: *An ozone inhalation hazard may be present on TOC Systems, adequate ventilation is required.*

Remove:



Install:



When service is complete, assemble the prerequisites in the reverse order of disassembly.

9.6 UV Lamp

UV lamps contain mercury (Section 2).

UV Lamps are made of quartz tubing and are breakable. Do not strike, bend or apply pressure or it will break. Discard UV Lamps appropriately. Follow all local regulations.

9.6.1 Storage Requirements for Used UV Lamps

Put used UV lamps into the replacement UV lamp shipping container, or a similar container. It is preferable that the original packing materials be used where possible, or materials adequate to prevent breakage during storage and transportation.

Boxes of used UV lamps should be labeled as such and stored in a location where the potential for accidental breakage is minimized.

A UV lamp recycler may have specific procedures and UV lamp storage requirements. Consult with a UV lamp recycler to determine all applicable policies.

This component contains Mercury. Dispose according to Local, State, or Federal Laws.

9.6.2 Remove and Replace a UV Lamp

Inspect a UV Lamp as part of scheduled maintenance and when a UV Lamp status alarm occurs.

Replace a UV Lamp for every 9,000 hours (a Lamps Expired alarm occurs) or when the UV Lamp fails inspection.

NOTICE

Failure to replace UV Lamps for every 9000 hours of runtime may cause the equipment to fail. With intermittent use, in no case should the UV Lamps be used for more than 24 months, regardless of number of hours of operation, due to normal operational degradation.

Prerequisites:

- Shut down the UV System. Refer to Section 5 as needed.
- Apply lockout tag out devices as necessary. Refer to Section 4.
- Depressurize the UV Chamber, and stand off to the side. Refer to Section 9.3.
- Wait minimum ten (10) minutes to allow UV Lamps to cool.
- Remove the Service End Cap. Refer to Section 9.5.

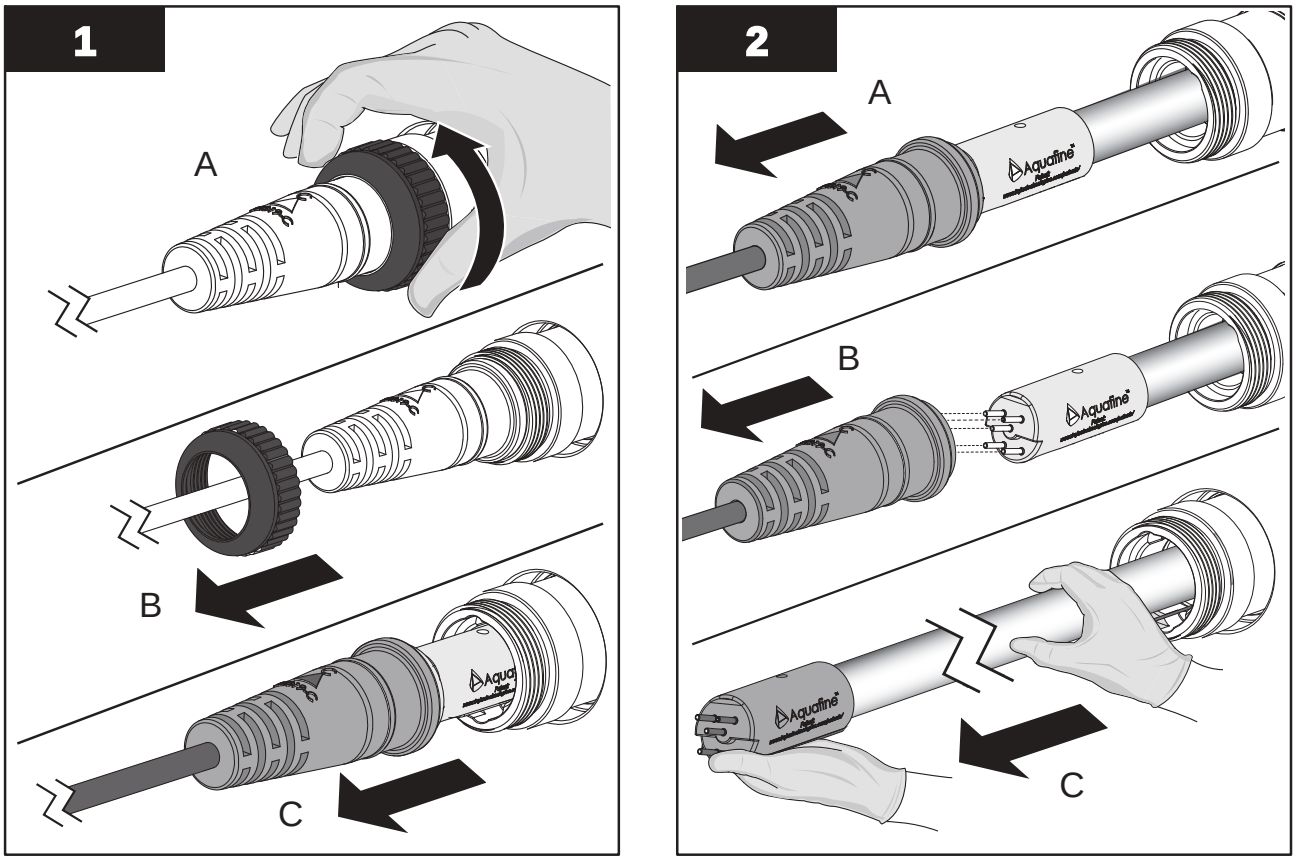
Materials:

- UV Lamp

Note: *Use clean lint free cotton gloves to handle UV Lamps.*

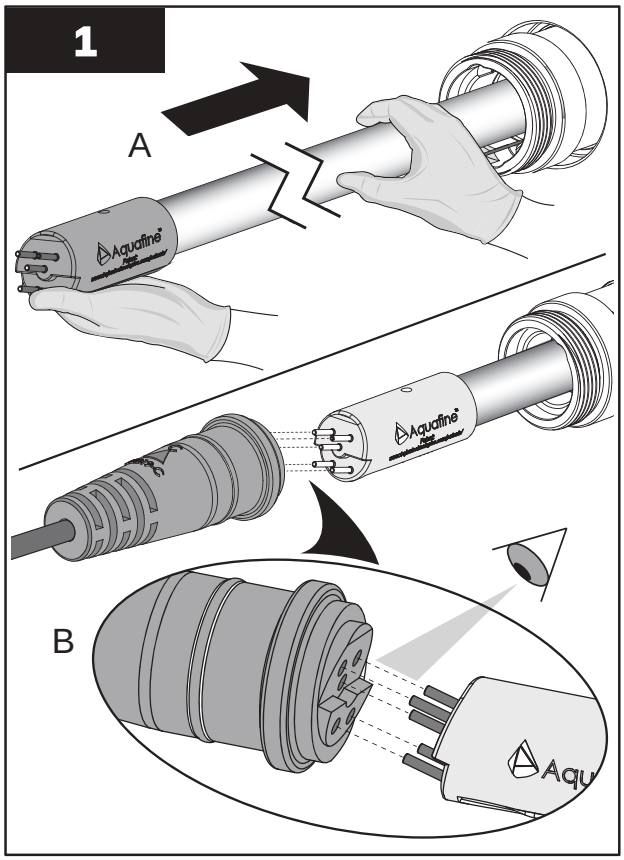
Procedure:

Remove:

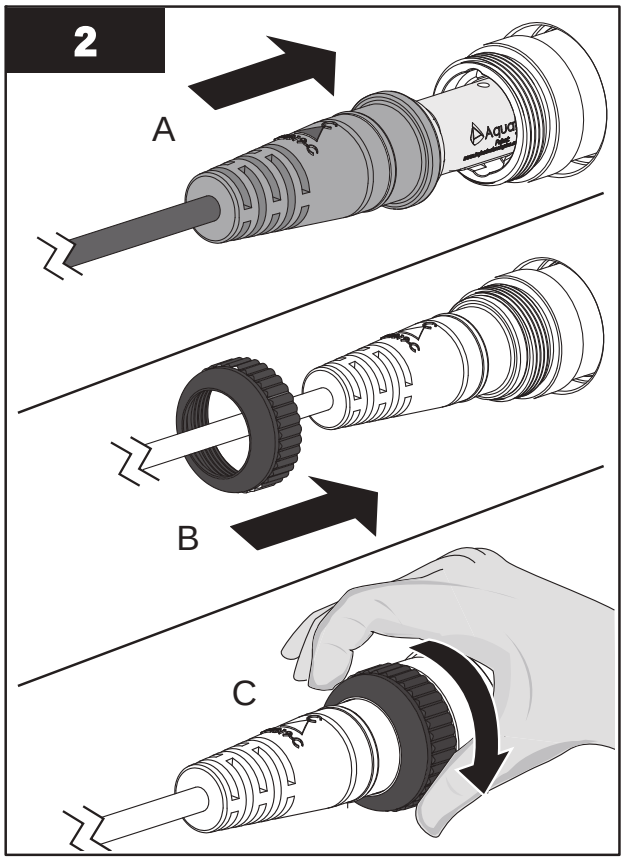


3. Inspect the UV Lamp pins for:
   - Evidence of overheating
   - Moisture
   - Displaced or bent pins (pins are angled at 10 degrees)
4. Inspect the UV Lamp for:
   - Cracks or breaks, loose ceramic ends.
5. If the conditions listed are:
   - Present, replace the UV Lamp.
   - Not present, reinstall the UV Lamp.

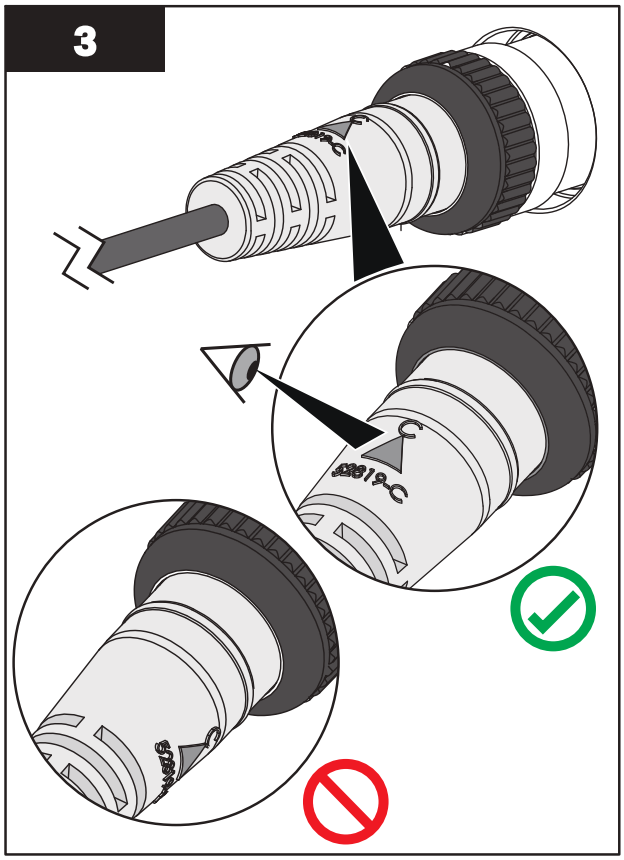
Install:



Note: *Always support the UV Lamp with lint free cotton gloved hands.*



Note: *Hand tighten the cap compression nut.*



Note: *The arrow must be positioned at the top of the Lamp Port.*

Post-requisites:

- Reset the Lamp Hours when installing a new UV Lamp (Section 8.3.4).

9.7 UVI Sensor

Depending on system application, the UVI Sensor design and installation procedure varies. Follow the appropriate procedure in this section.

- **For TOC applications**, the UVI Sensor is UV Chamber body mounted. Refer to Section 9.7.1 for removal and replacement procedure.
- **For Liquid Sugar applications**, the UVI Sensor is End Plate mounted. Refer to Section 9.7.2 for removal and replacement procedure.

9.7.1 Remove and Replace a UVI Sensor - TOC

Note: *Applies to TOC applications only.*

Prerequisites:

- Shut down the UV System. Refer to Section 5 as needed.
- Apply lockout tag out devices as necessary. Refer to Section 4.
- Depressurize and drain the UV Chamber. Refer to Section 9.3.

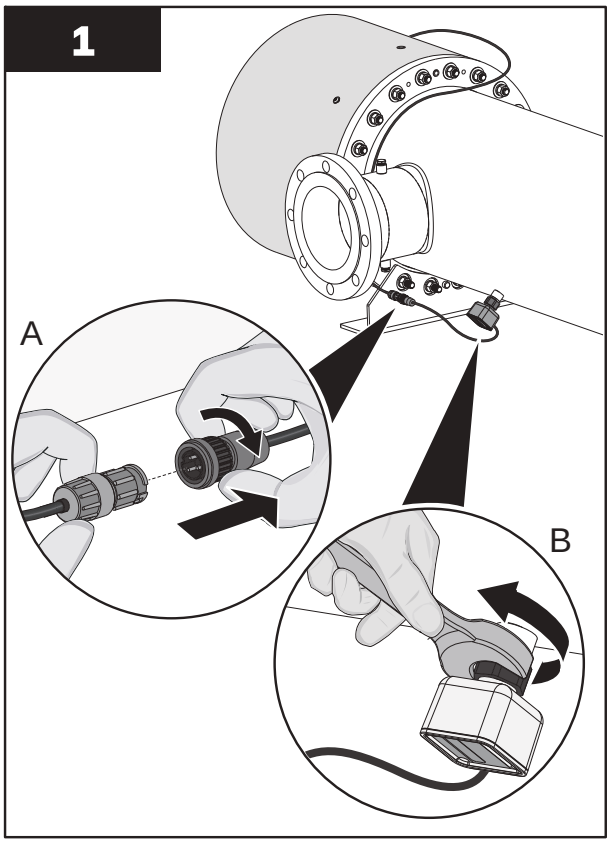
Tools:

Materials:

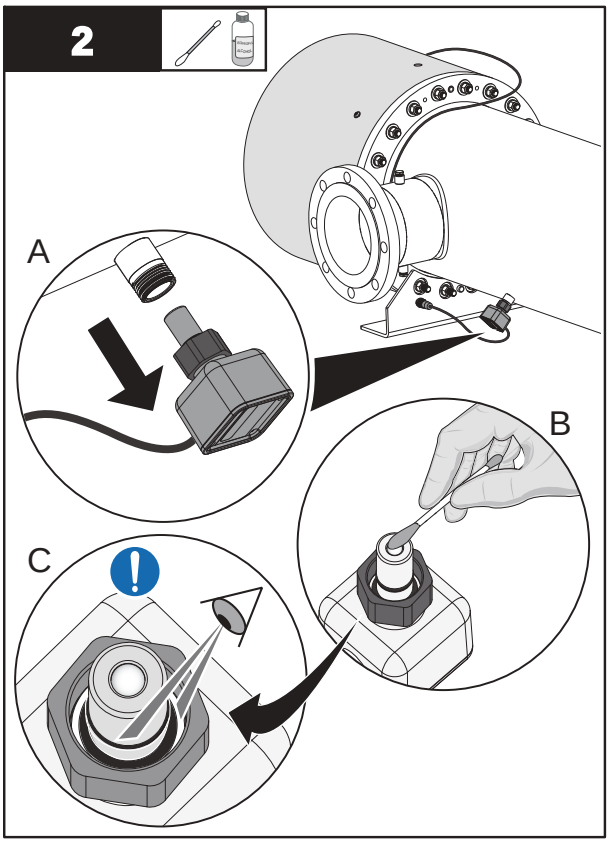
- New UVI Sensor (if required)

Procedure:

Remove:

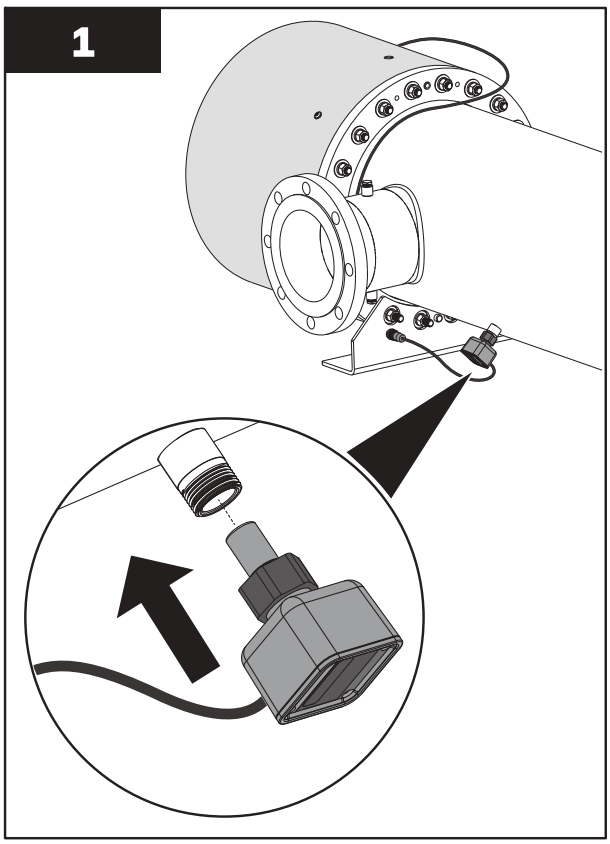


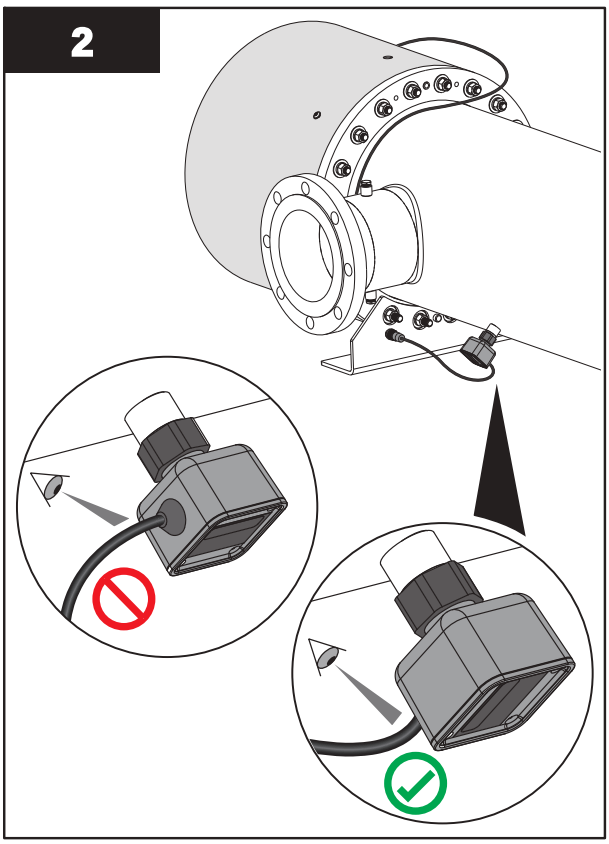
Note: *Loosen the nut securing the UVI Sensor.*



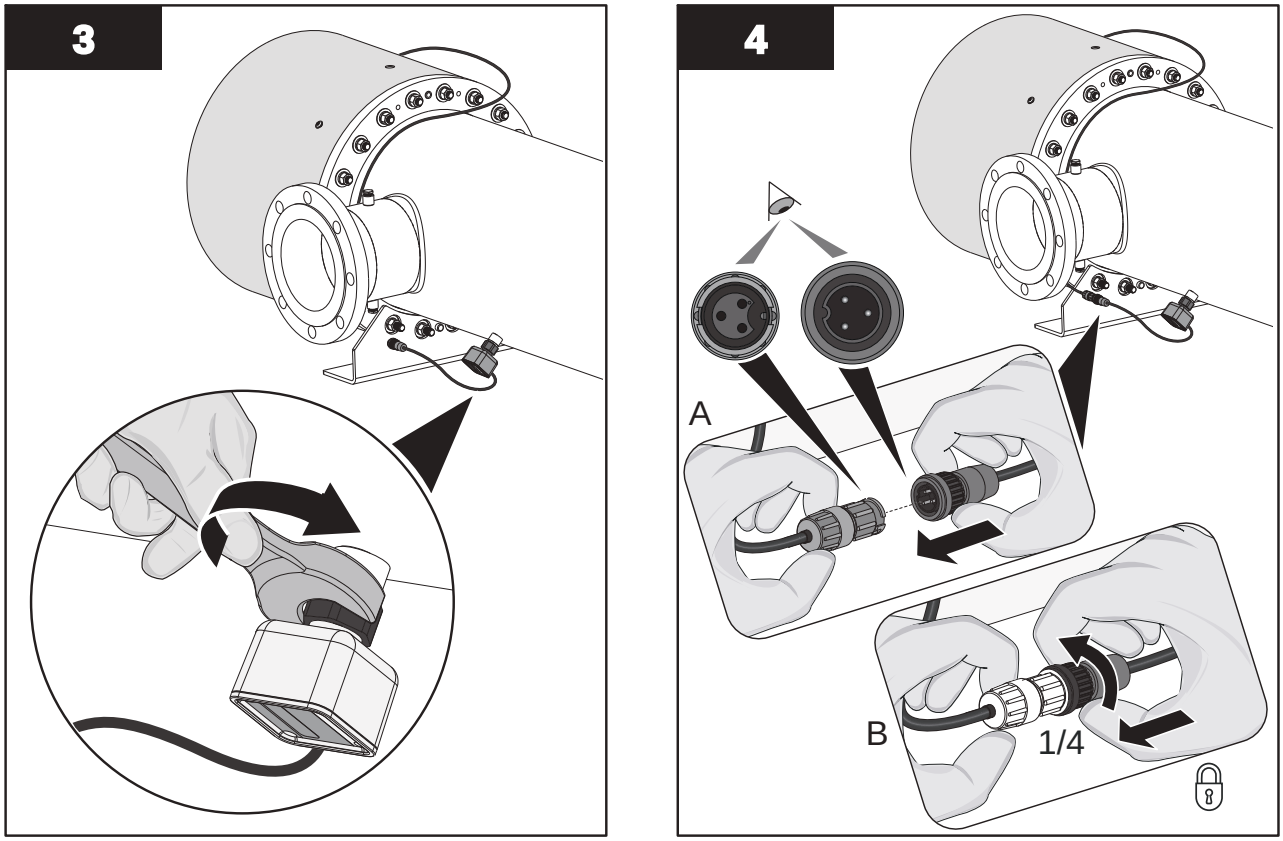
Note: *Inspect O-rings for signs of UV decay or brittle parts. Replace if necessary.*

Install:





Note: *Orientate the UVI Sensor to position the cable at the bottom as shown.*



Note: *Tighten the nut to 40 N.m (29.5 lbf.ft) to secure the UVI Sensor.*

9.7.2 Remove and Replace a UVI Sensor - Liquid Sugar

Note: *Applies to Liquid Sugar applications only.*

Prerequisites:

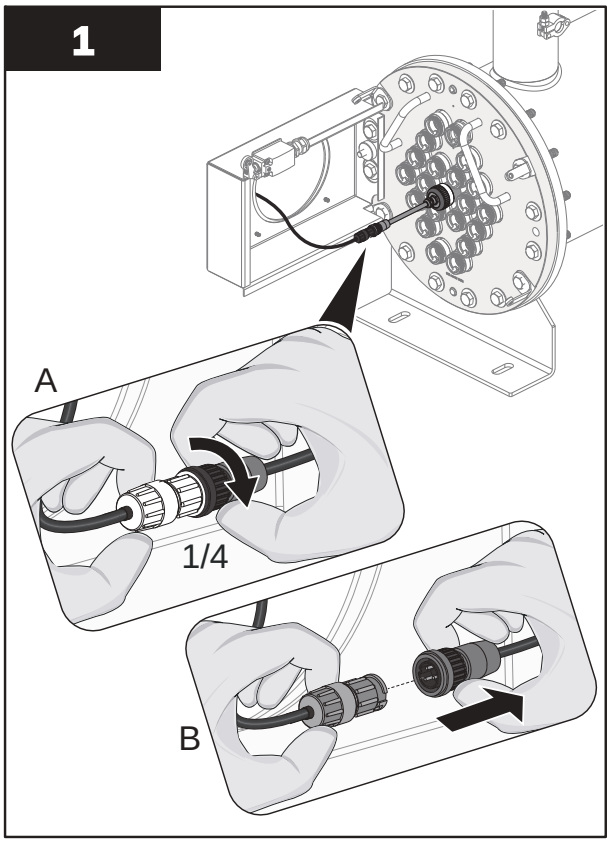
- Shut down the UV System. Refer to Section 5 as needed.
- Apply lockout tag out devices as necessary. Refer to Section 4.
- Depressurize the UV Chamber, and stand off to the side. Refer to Section 9.3.
- Wait ten (10) minutes to allow UVI Sensor to cool.
- Remove the Service End Cap. Refer to Section 9.5.

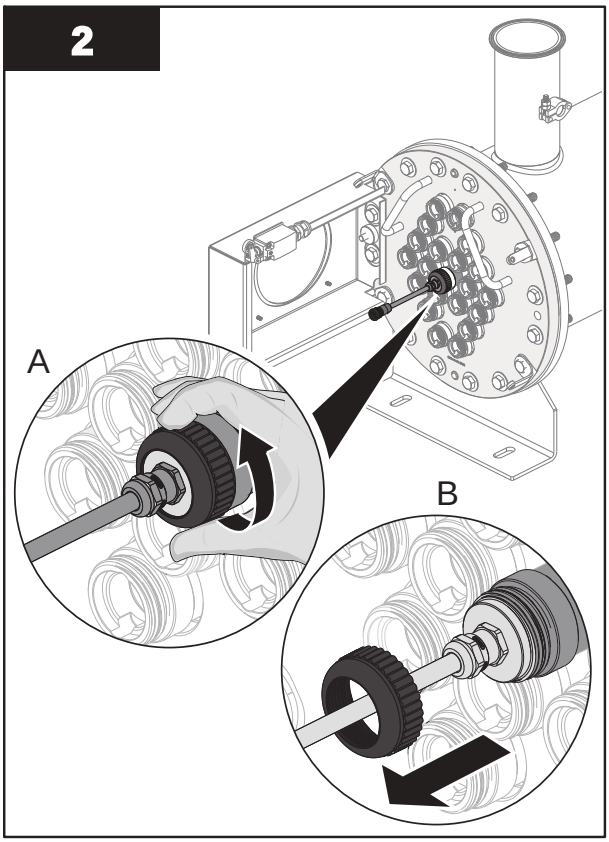
Materials:

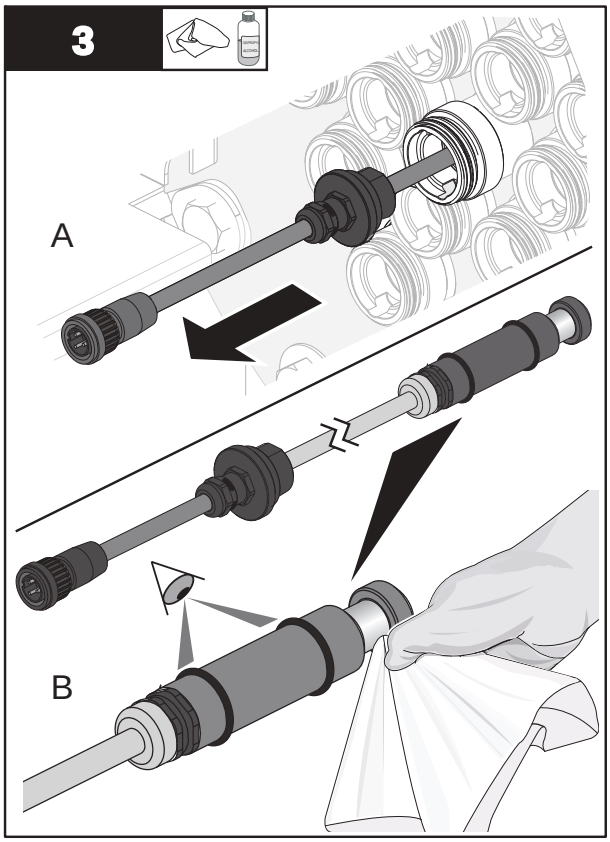
- New UVI Sensor (if required)

Procedure:

Remove:

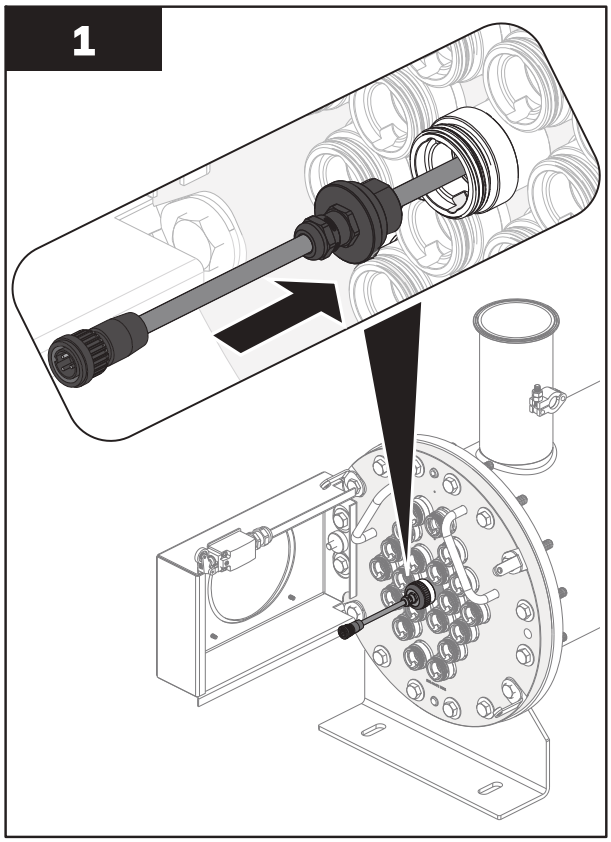


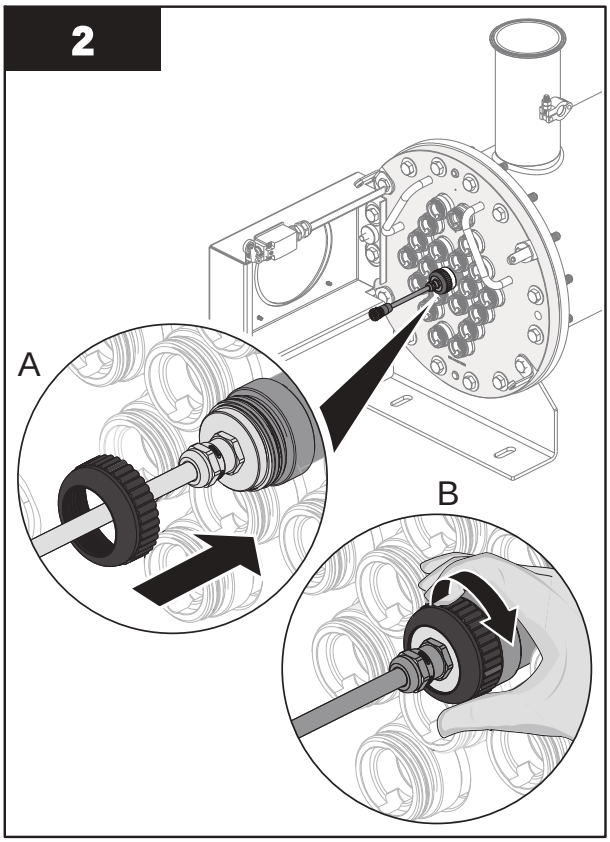




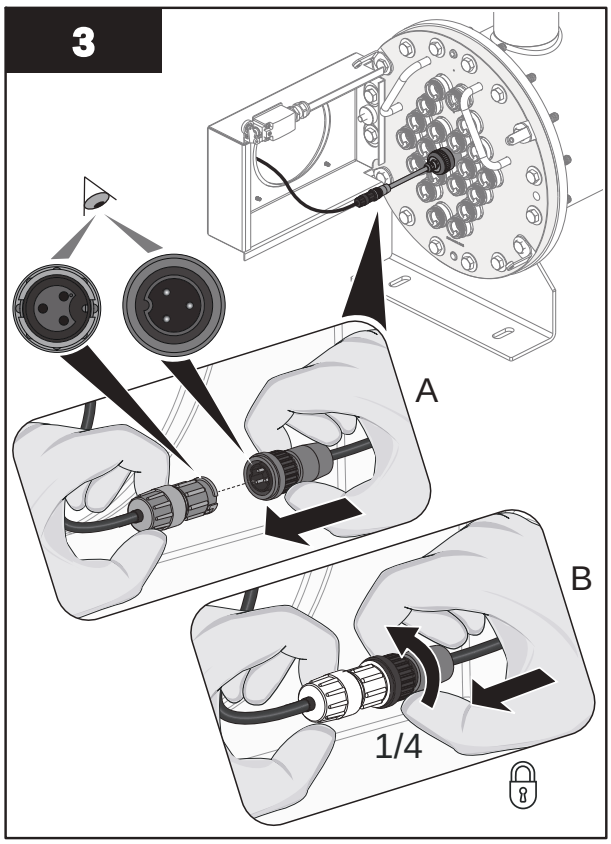
Note: *Inspect O-rings for signs of UV decay or brittle parts. Replace if necessary.*

Install:





Note: *Hand tighten the cap compression nut to secure the UVI Sensor.*



9.7.2.1 Remove and Replace UVI Sensor O-Rings

Note: *Applies to Liquid Sugar applications only.*

Prerequisites:

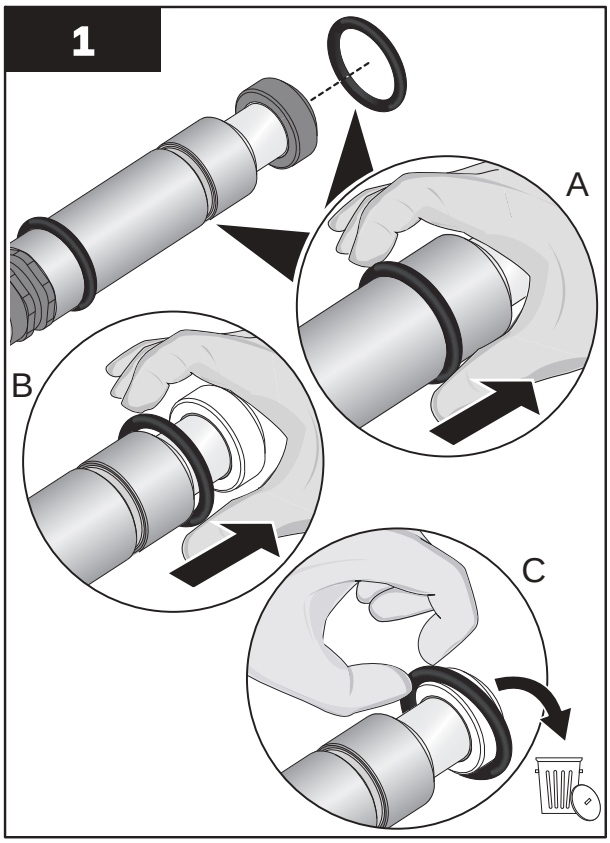
- Remove the UVI Sensor. Refer to Section 9.7.2.

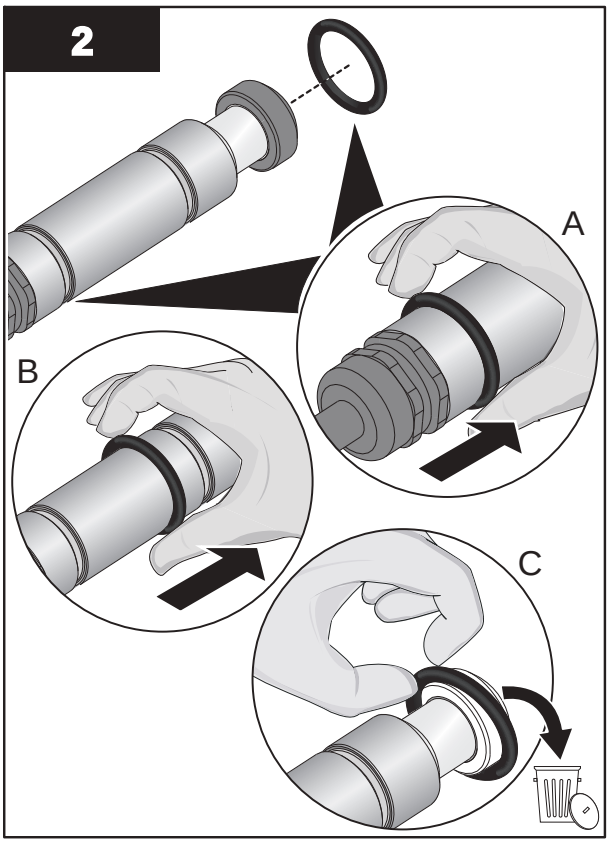
Materials:

- New UVI Sensor O-Rings

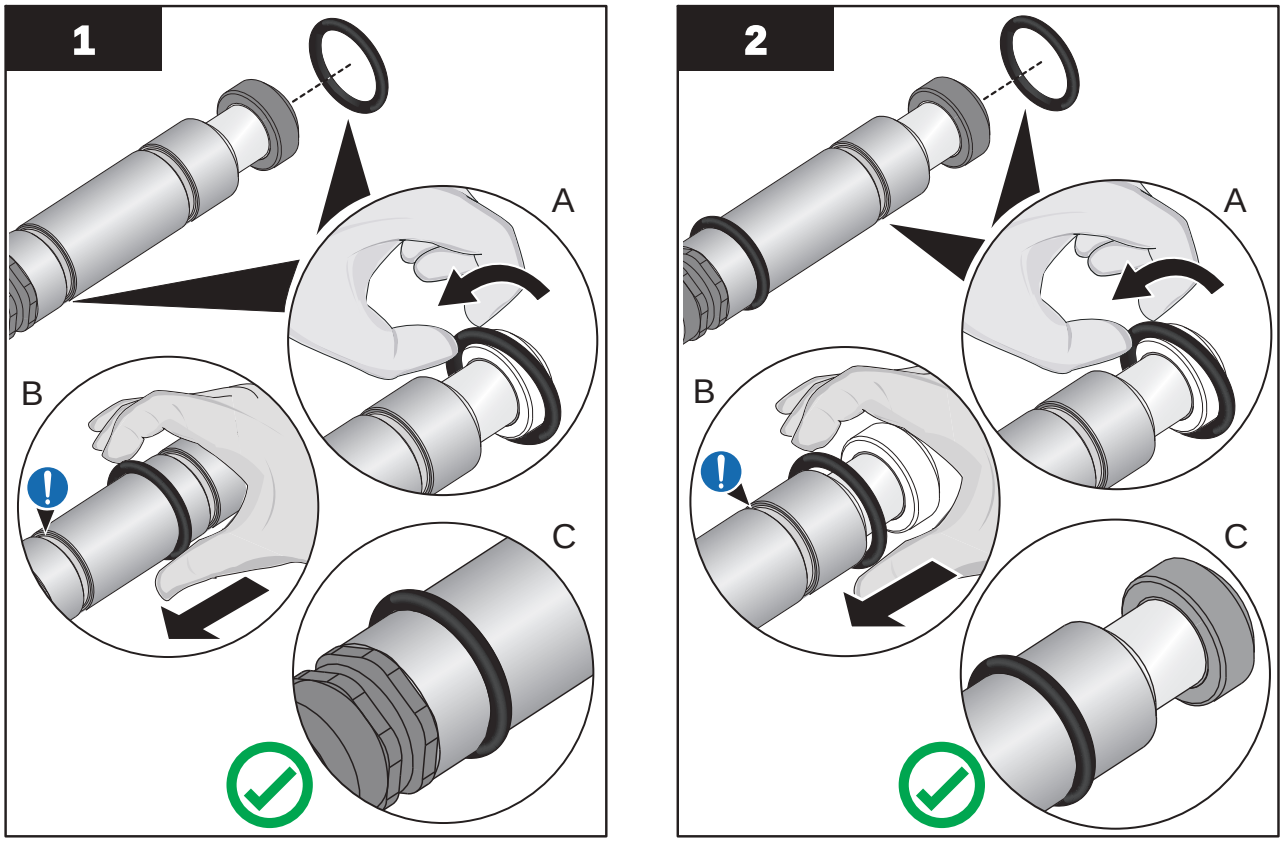
Procedure:

Remove O-Rings:





Install O-Rings:



9.8 Lamp and UVI Sensor Sleeve

Lamp and UVI Sensor Sleeves are made of quartz tubing and are breakable. Do not strike, bend or apply pressure or it will break. Discard Lamp and UVI Sensor Sleeves appropriately. Follow all local regulations.

9.8.1 Remove and Replace a Sleeve

Inspect the Sleeves and Sleeve O-Rings as a part of scheduled maintenance or when a UVI Low alarm occurs.

Replace a Sleeve if buildup cannot be removed, or when the Sleeve shows signs of damage, such as cracks and chips.

Prerequisites:

- Shut down the UV System. Refer to Section 5 as needed.
- Apply lockout tag out devices as necessary. Refer to Section 4.
- Depressurize and drain the UV Chamber, and stand off to the side. Refer to Section 9.3.
- Wait ten (10) minutes to allow UV Lamps to cool.
- Allow residual fluid inside of UV Chamber to cool ***- applies to Liquid Sugar applications only.***
- Remove the Service End Cap. Refer to Section 9.5.

- **For Lamp Sleeves -** Remove the UV Lamp. Refer to Section 9.6.2.
- **For UVI Sensor Sleeve -** Remove the UVI Sensor. Refer to Section 9.7.2 **- *applies to Liquid Sugar applications only.***

Tools:

Materials:

- Lamp Sleeve (if required)
- UVI Sensor Sleeve (if required)
- Sleeve Bolt Washer
- Lamp or UVI Sensor Sleeve O-Rings

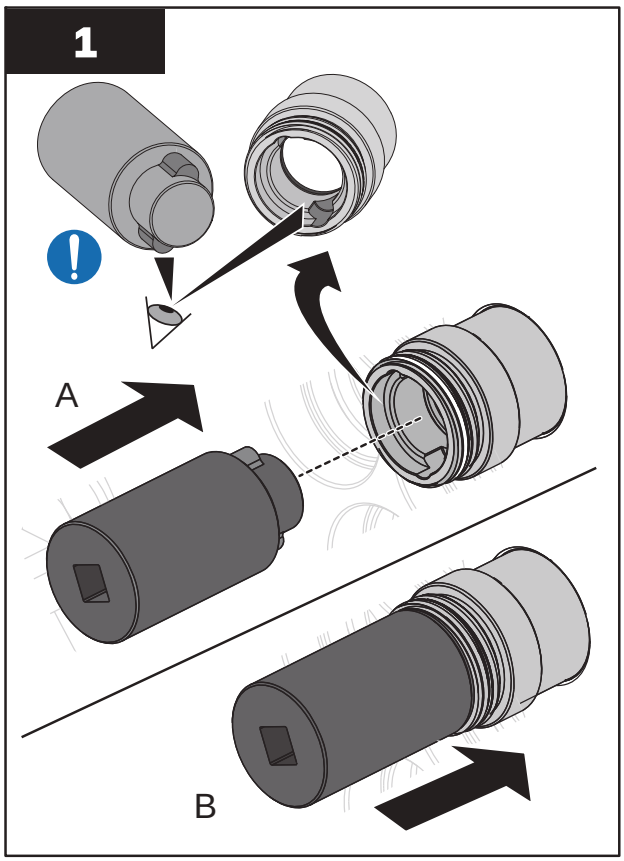
Procedure:

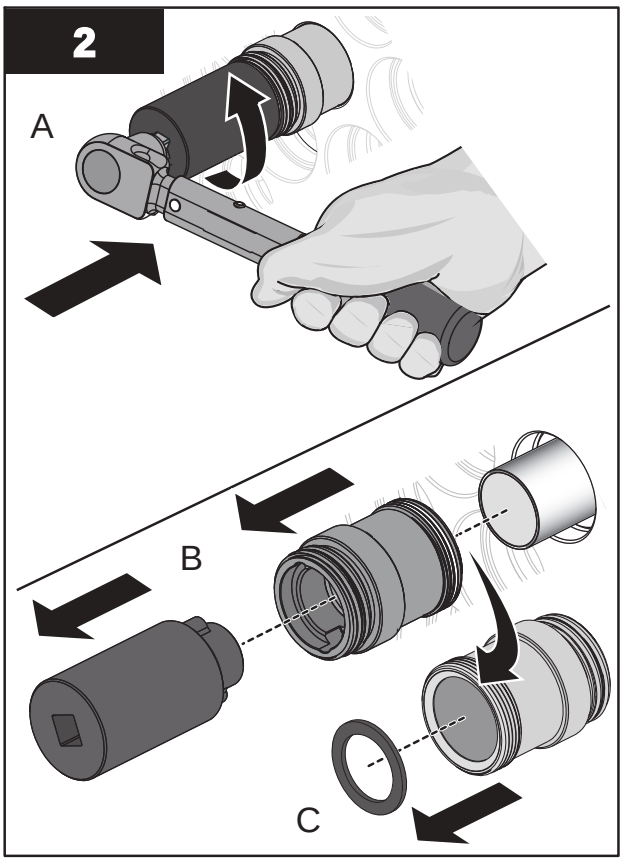
NOTICE

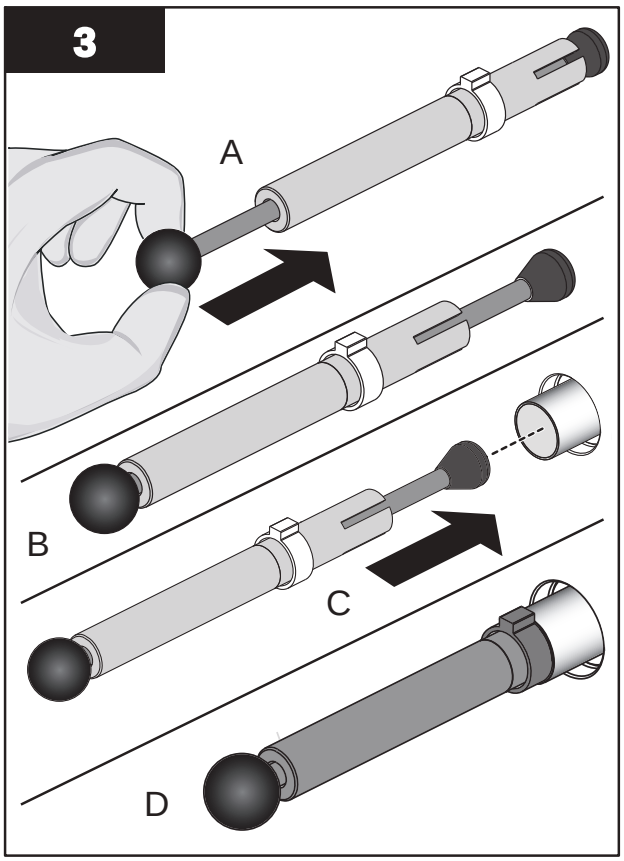
To prevent Sleeve damage during removal, be sure to keep the Sleeve level and perpendicular to the end plate. Physical damage to Sleeves indicates a possible serious condition in the UV Chamber. Full service of the UV Chamber may be needed.

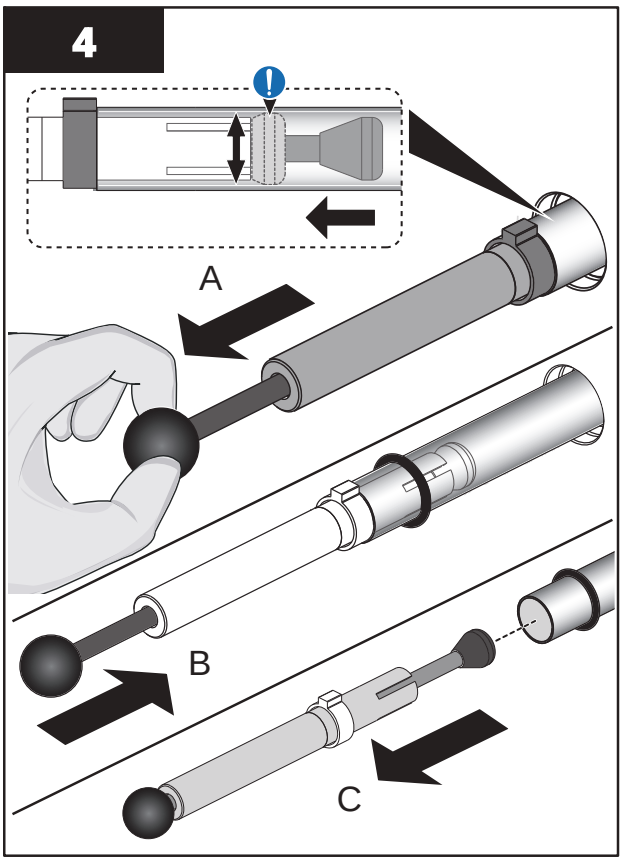
Use caution and apply only 11.3 N.m (100 lbf.in) of torque to the Sleeve bolt. Excessive torque will crack the Sleeve. Low torque may result in fluid leakage into the service end cap. Use only the provided Sleeve Bolt Removal Tool.

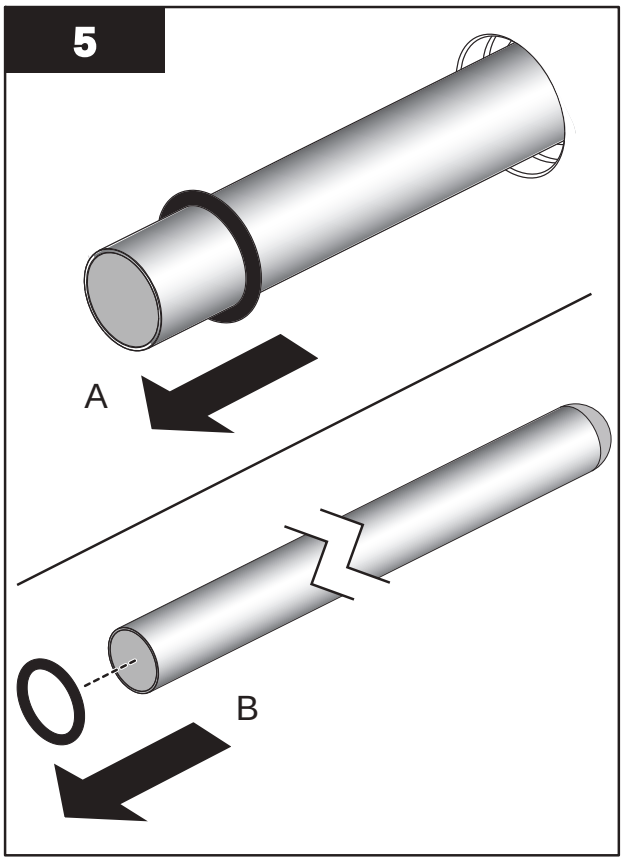
Remove:



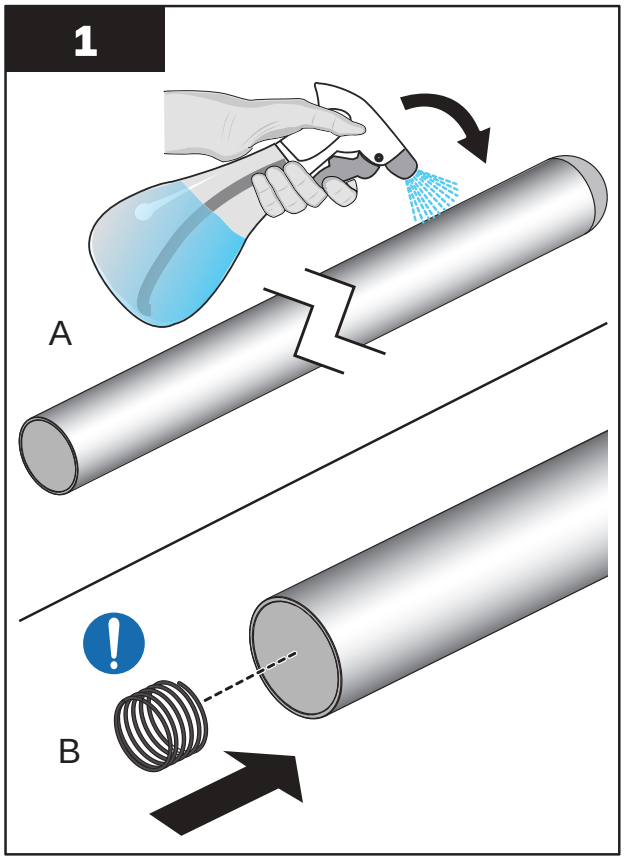



3
A
B
C
D

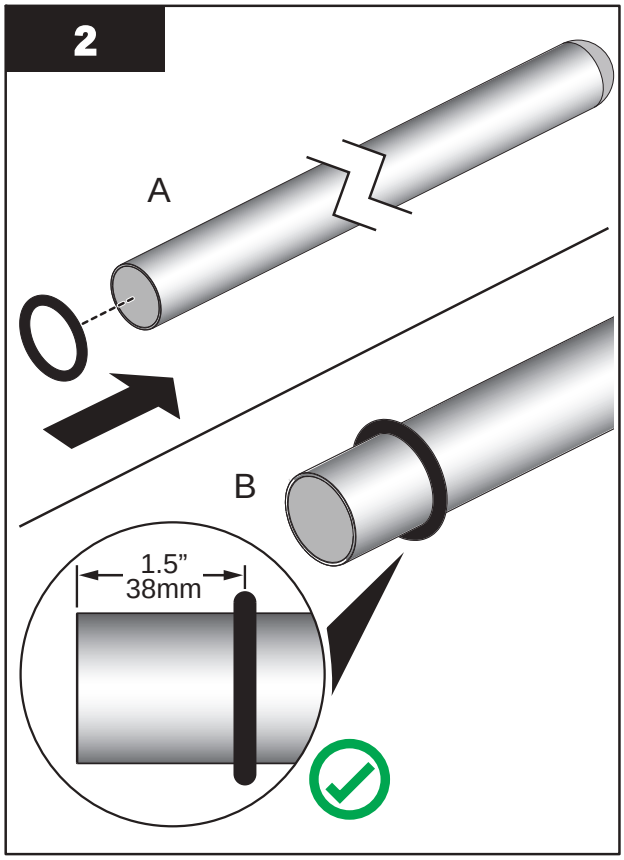

4
A
B
C


5
A
B

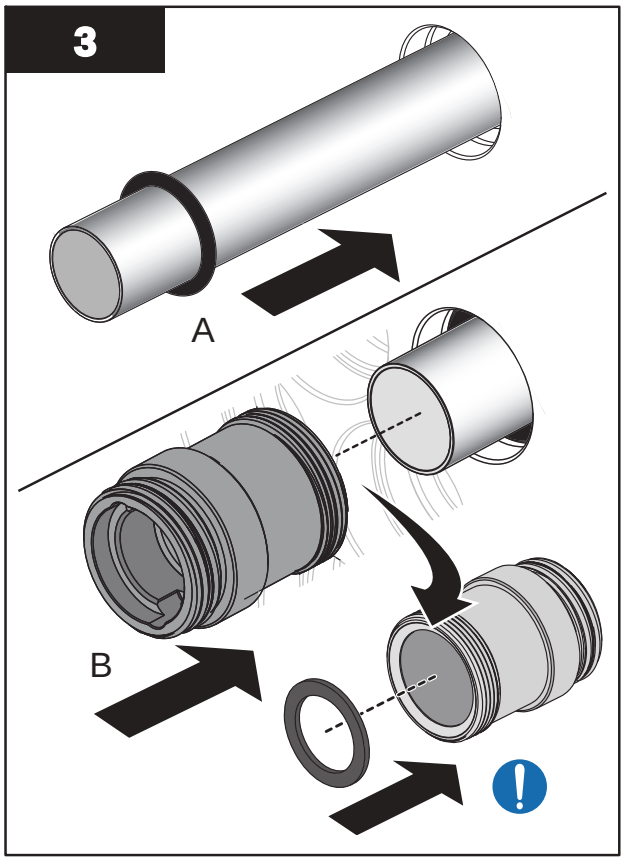
Install:

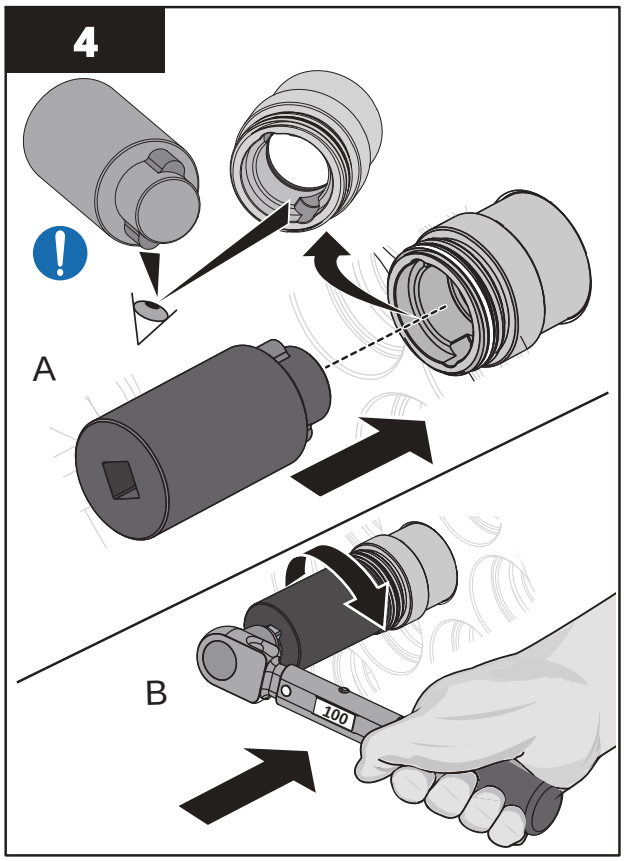


Notes: *1) Verify that compression spring is in the Lamp Sleeve.*
2) If installing UVI Sensor Sleeve, skip step B.



Note: *Ensure the O-Ring is installed at 1.5” (38 mm) from the open end of the Sleeve.*





Note: *Torque the Sleeve Bolt to 11.3 N.m (100 lbf.in).*

9.8.2 Clean a Sleeve

Clean all Sleeves manually if there is buildup on any of the inspected Sleeves.

NOTICE

Do not use abrasive materials to clean a Sleeve. Abrasive materials will scratch and cause damage to the Sleeve.

Keep water and debris out of the Sleeves. Moisture can cause build-up in the Sleeves and corrosion of the lamp shunt and pins, which results in shorter UV Lamp life. Use a lint-free cloth to remove water or debris.

Build-up on the Sleeves decreases the amount of UV light, and can result in higher UV Lamp temperatures and decreased UV Lamp efficiency.

Only use Aquafine Corporation approved cleaning solutions on the Sleeves. Use of unapproved chemicals may result in damage to the equipment. For a list of approved cleaning solutions refer to Table 4.

Table 4 Approved Cleaning Solutions and Dilution Ratio

Solution	Dilution
ActiClean® Gel	Not Required
20% Phosphoric Acid	2 parts water to 1 part acid
40% Phosphoric Acid	5 parts water to 1 part acid
75% Phosphoric Acid	10 parts water to 1 part acid
80% Phosphoric Acid	12 parts water to 1 part acid

Prerequisites:

- Remove the Lamp and/or UVI Sensor Sleeve. Refer to Section 9.8.1.

Materials:

Procedure:

1. Refer to Table 4 for approved cleaning solutions and dilution ratios. Mix the solution thoroughly. Use pH indicator strips to make sure that pH is between 1.0-1.5. The solution is effective in cleaning sleeves when the pH is less than 3.0. Above pH 3.0, the cleaning solution should be replaced.
2. Clean the sleeve with an approved cleaning solution and a lint-free cloth. Wipe up and down the length of the sleeve. Do not wipe across or around the sleeve. Wipe until all the build-up on the sleeve is removed.
3. Rinse the sleeve fully with clean distilled water.
4. Allow the sleeve to air-dry. Make sure the sleeve is completely dry on the inside and outside before installation.

   Notes: *1) Sleeves may look clean when wet.*

   2) A completely clean sleeve will have the clarity of a new, unused sleeve.
5. When service is complete, assemble the prerequisites in the reverse order of the disassembly.

9.9 UV Chamber End Plate

9.9.1 Remove and Install the UV Chamber End Plate

Prerequisites:

- Shut down the UV System. Refer to Section 5.
- Apply lockout tag out devices as necessary. Refer to Section 4.
- Depressurize and drain the UV Chamber. Refer to Section 9.3.
- Allow residual fluid inside of UV Chamber to cool ***- applies to Liquid Sugar applications only.***
- Remove Service End Cap. Refer to Section 9.5.
- Remove the UV Lamps. Refer to Section 9.6.2.
- Remove the UVI Sensor. Refer to Section 9.7.2 ***- applies to Liquid Sugar applications only*.**
- Remove the Sleeves. Refer to Section 9.8.1.
- Disconnect the Temperature Switch.
- Disconnect the Ground Wire.

Tools:

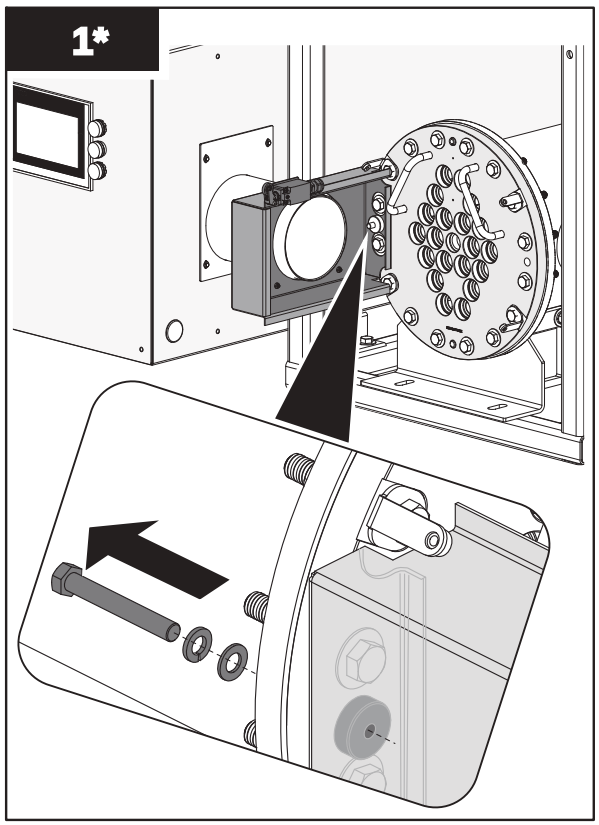
Materials:

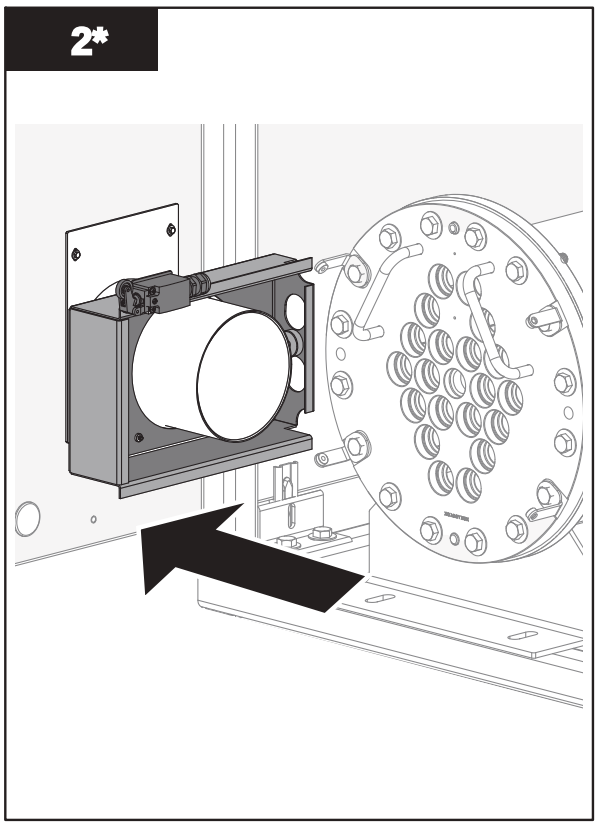
Procedure:

* Tasks performed on UV Systems with Skid mounted CPP.

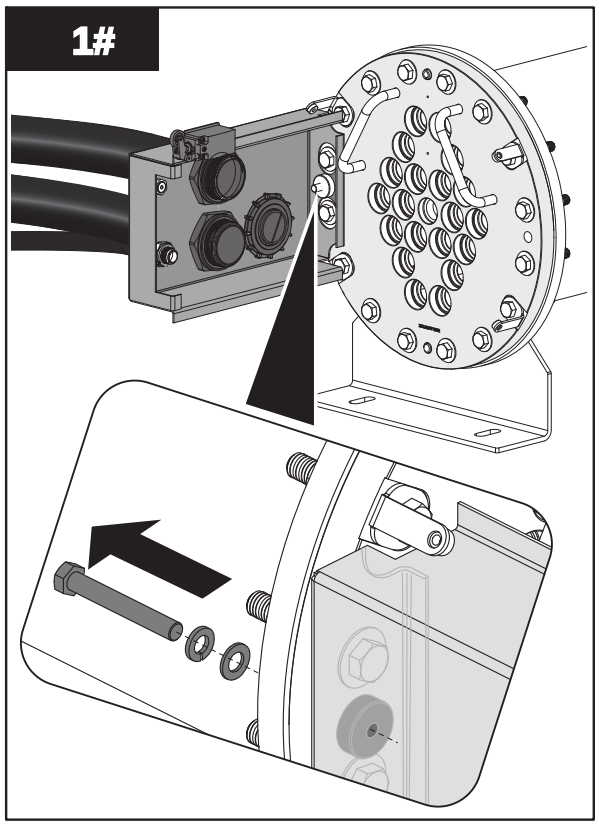
Tasks performed on UV Systems with Standalone CPP.

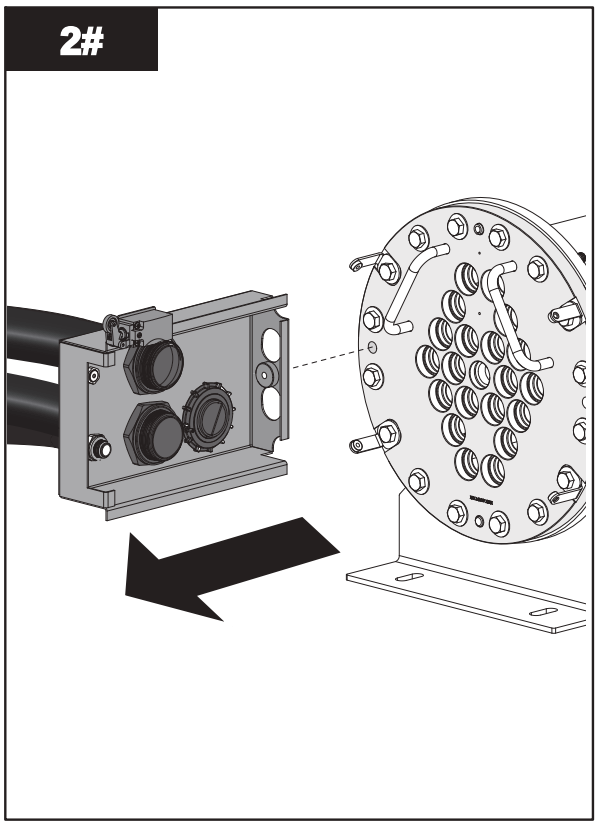
Remove:

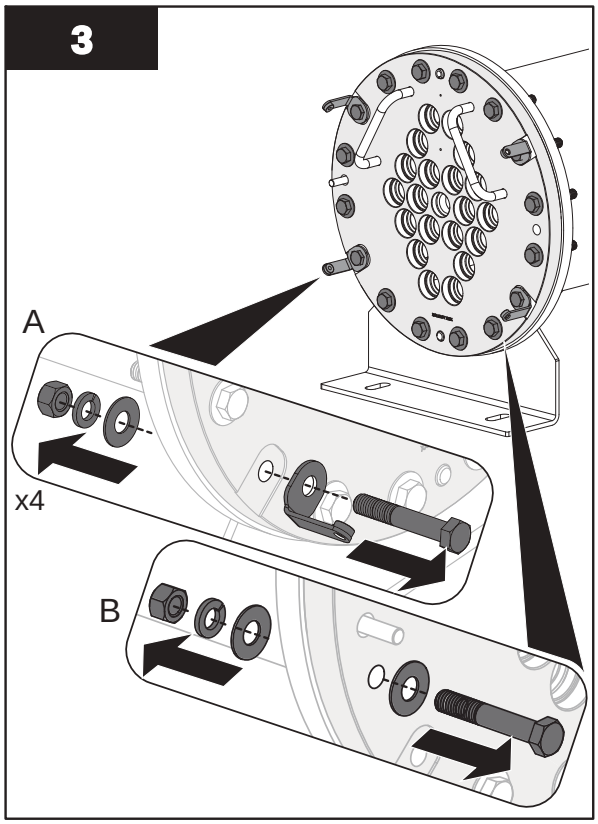


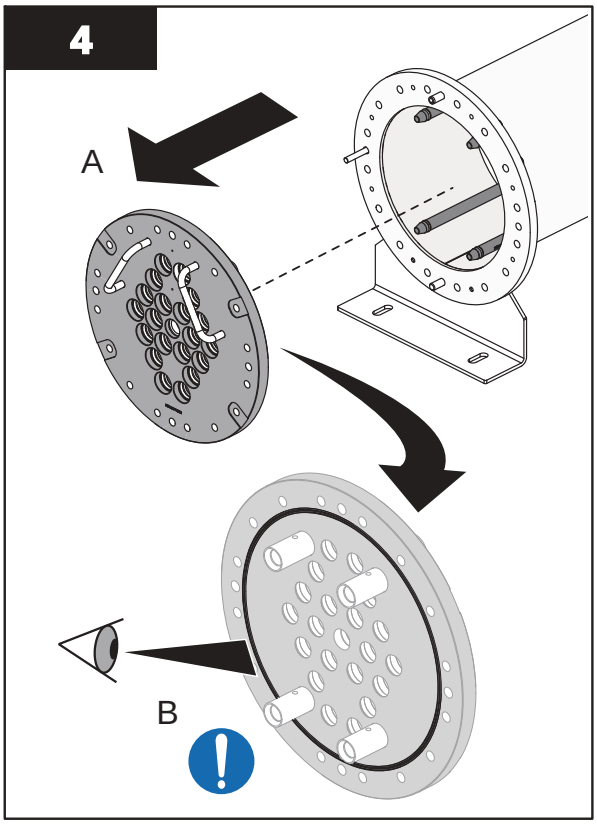


Note: *Slide the Junction Box away from the UV Chamber End Plate.*



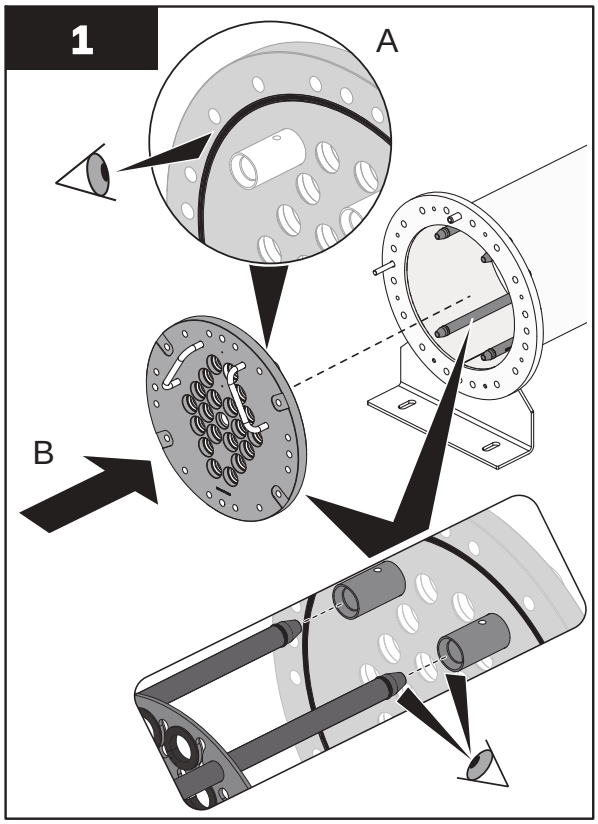


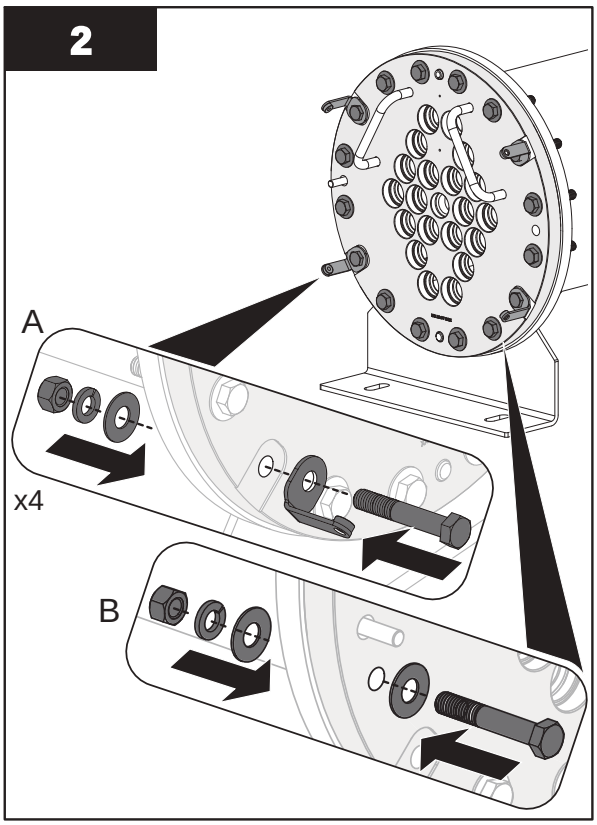




Note: *Inspect the End Plate O-Ring for signs of damage, cracks or wear. Replace if required. Refer to Section 9.9.2.*

Install:



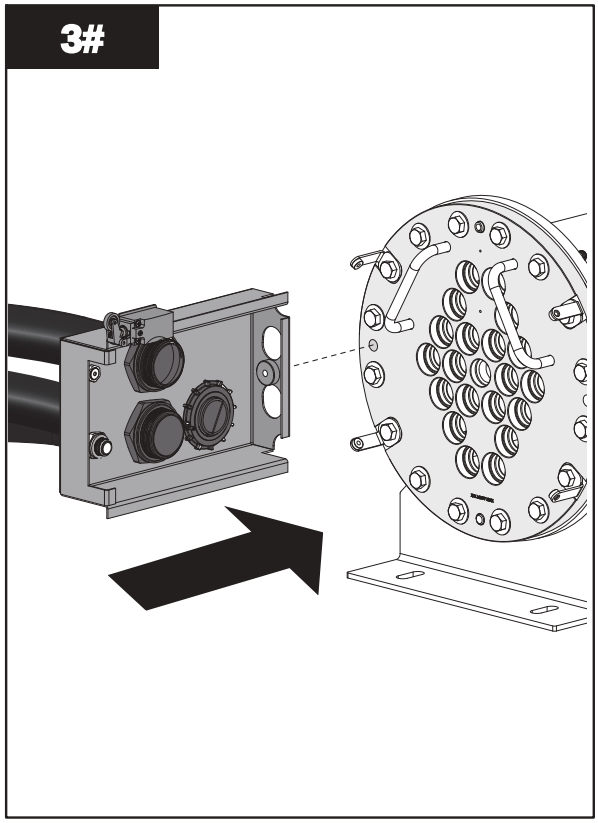


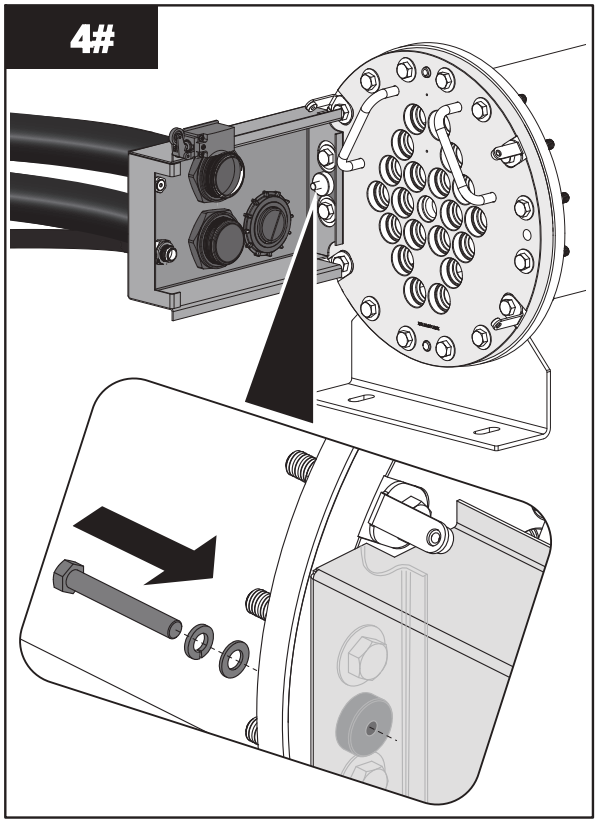
Notes: *1) Make sure the End Plate O-Ring is properly seated in the groove before installing the UV Chamber End Plate.*

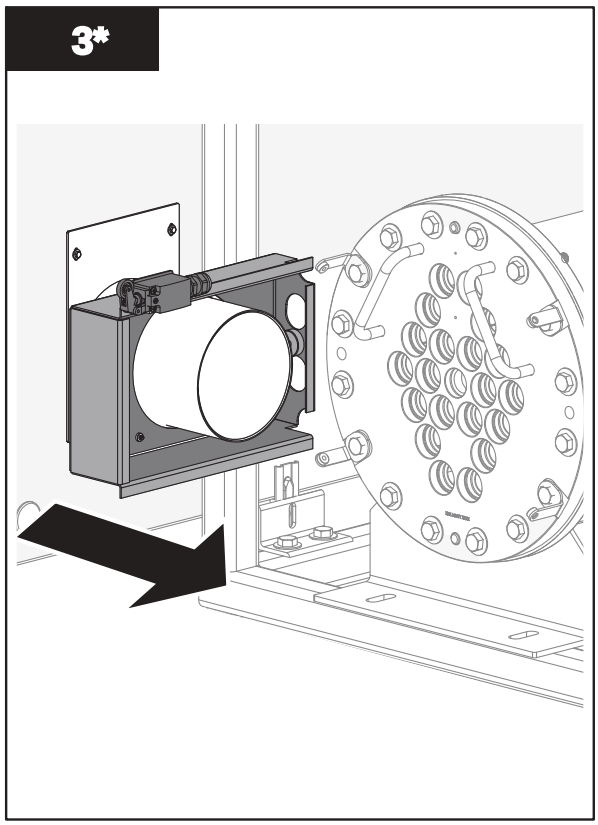
2) Make sure that the O-Ring does not pinch when installing the UV Chamber End Plate.

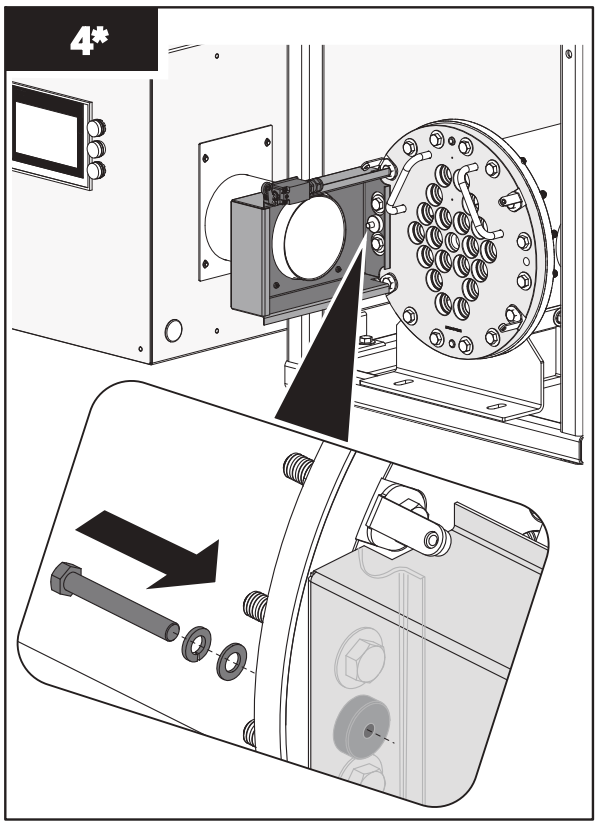
3) Align the Baffle Plate Guide Rods with the locator sockets on the front UV Chamber End Plate.

Note: *Torque the bolts in a star pattern to 58.3 N.m (43 lbf.ft).*









Note: *Slide the Junction Box towards the UV Chamber End Plate.*

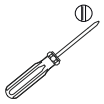
5. When service is complete, assemble the prerequisites in the reverse order of the disassembly.

9.9.2 Remove and Replace End Plate O-Ring

Prerequisites:

- Remove the UV Chamber End Plate. Refer to Section 9.9.1.

Tools:

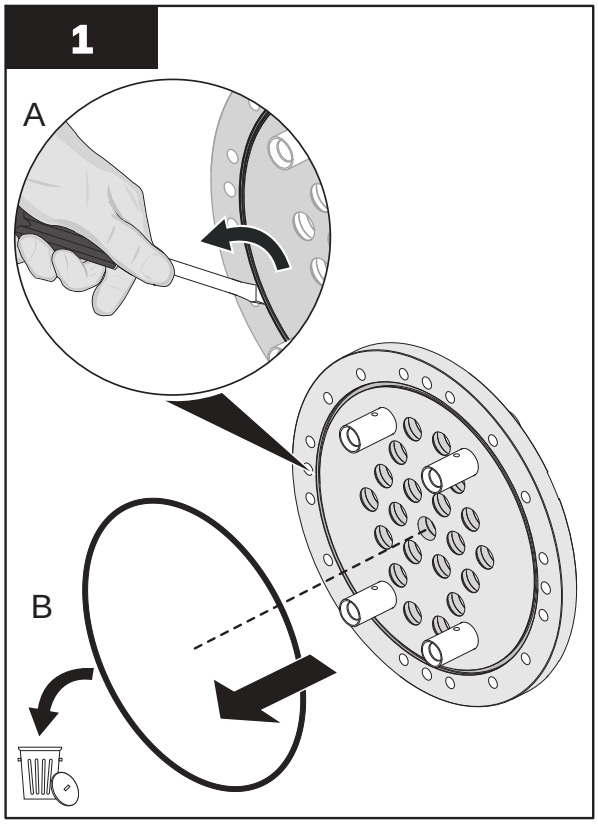


Materials:

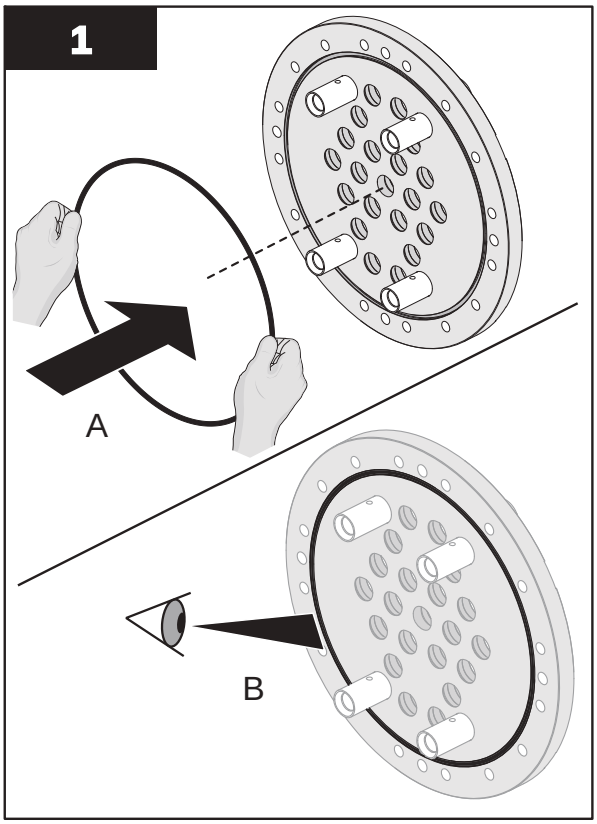
- New End Plate O-Ring

Procedure:

Remove:



Install:



Note: *Make sure the End Plate O-Ring is properly seated in the groove.*

9.10 Baffle Assembly

9.10.1 Remove and Replace a Baffle Assembly

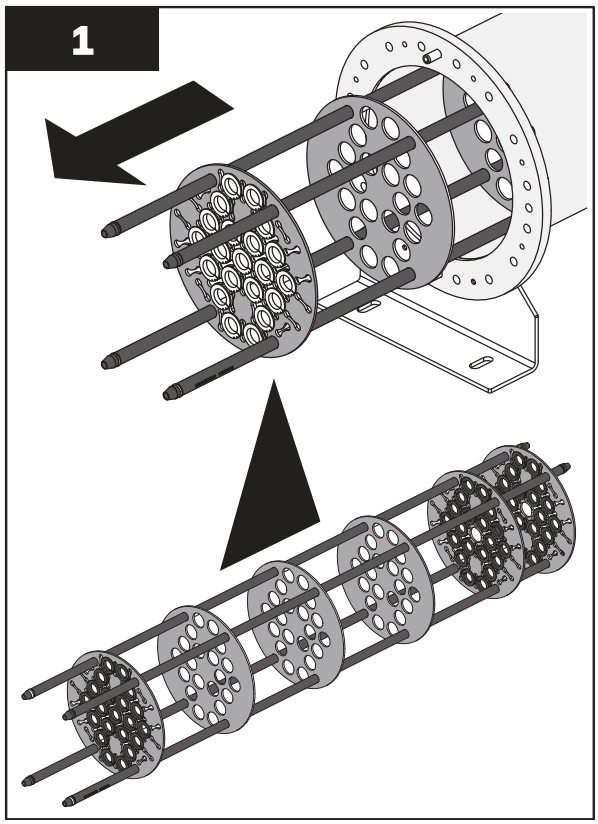
Prerequisites:

- Remove the UV Chamber End Plate. Refer to Section 9.9.1.

Materials:

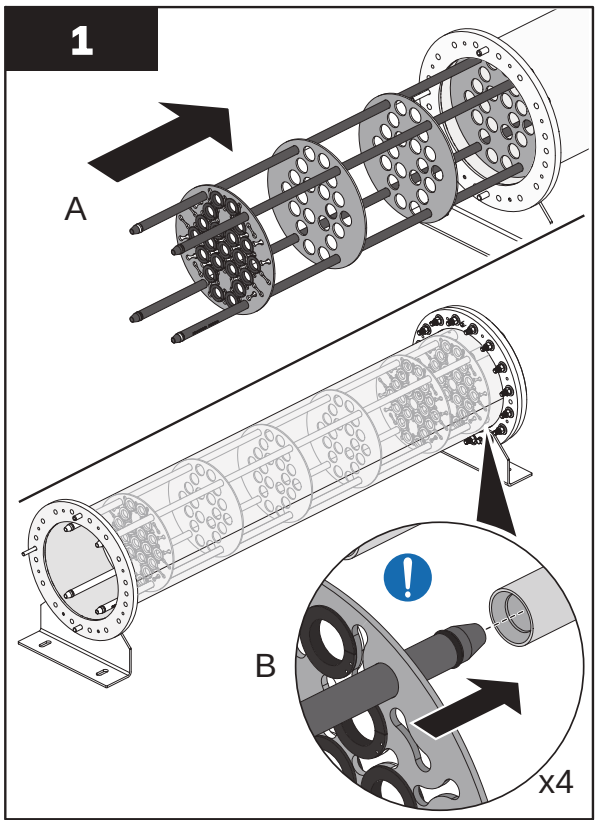
Procedure:

Remove:



Note: *Remove the Baffle Assembly slowly and evenly.*

Install:



Note: *Align the Baffle Plate Guide Rods with the locator sockets on the rear UV Chamber End Plate.*

2. When service is complete, assemble the prerequisites in the reverse order of the disassembly.

9.10.2 Remove and Replace a Sleeve Bushing

Prerequisites:

- Remove Baffle Assembly. Refer to Section 9.10.1.

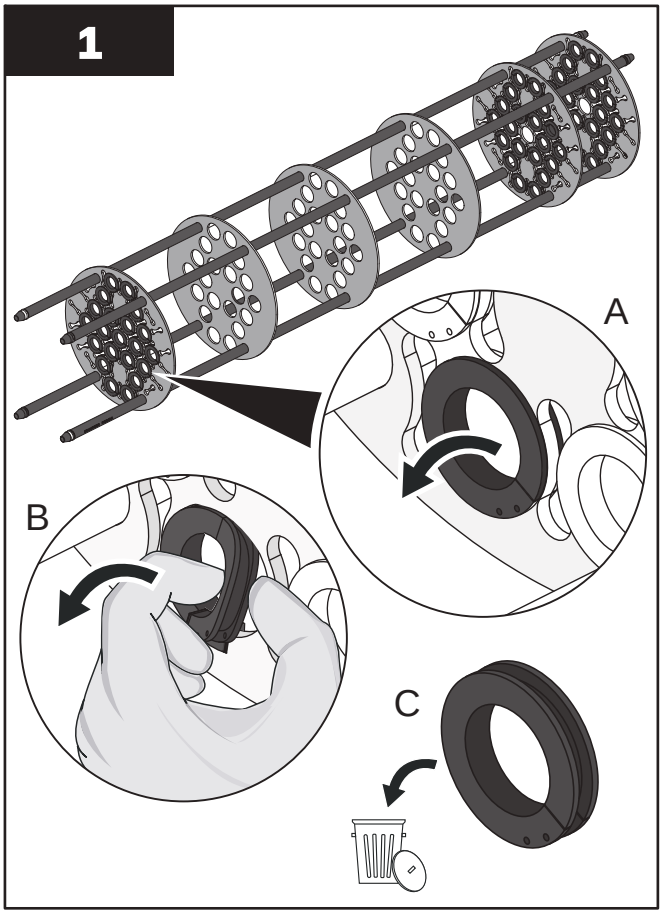
Tools:

Materials:

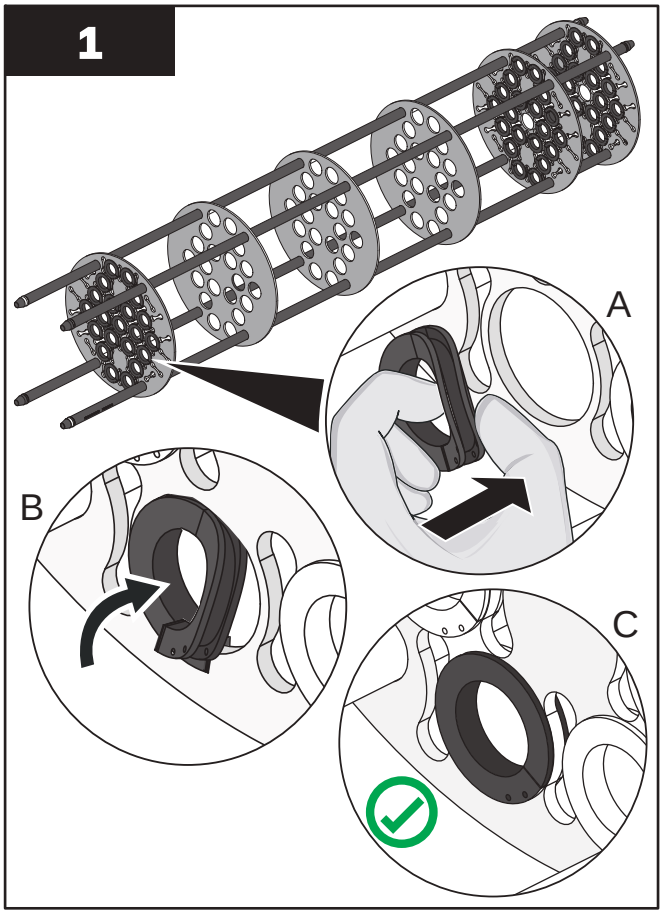
- New Sleeve Bushing

Procedure:

Remove:



Install:

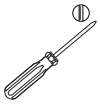


9.10.3 Remove and Replace a Baffle Plate Guide O-Ring

Prerequisites:

- Remove Baffle Assembly. Refer to Section 9.10.1.

Tools:

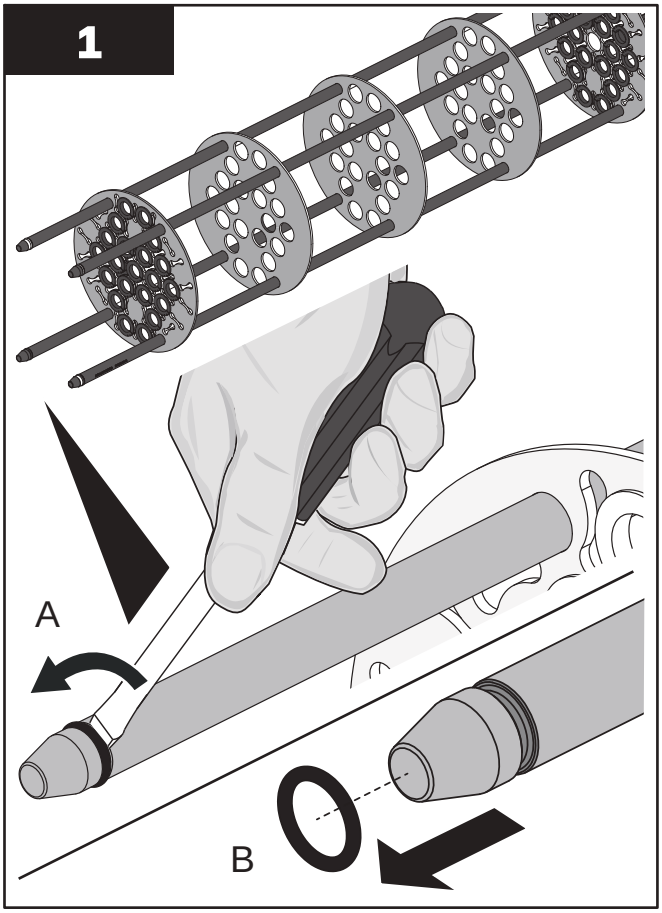


Materials:

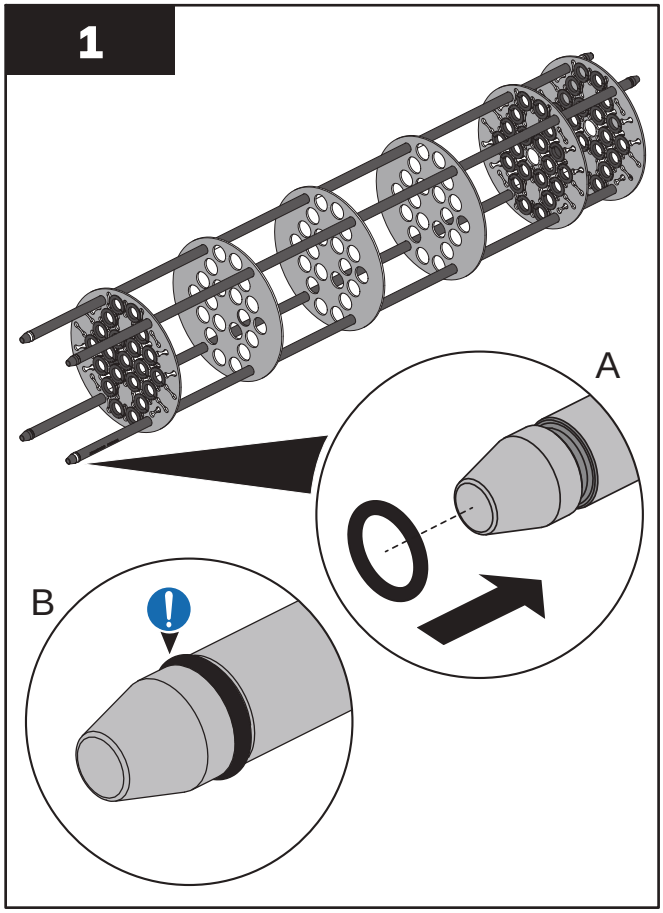
- New Baffle Plate Guide O-Ring

Procedure:

Remove O-Ring:



Install O-Ring:



9.11 Control Power Panel

9.11.1 Remove and Replace a Lamp Driver

Replace a Lamp Driver when a Lamp Driver failure alarm occurs.

Prerequisites:

- Shut down the UV System. Refer to Section 5.
- Apply lockout tag out devices as necessary. Refer to Section 4.
- Wait 5 (five) minutes to allow stored energy to dissipate.
- Record the number that is selected on each rotary switch on the Lamp Driver (address switches).

Tools:

Materials:

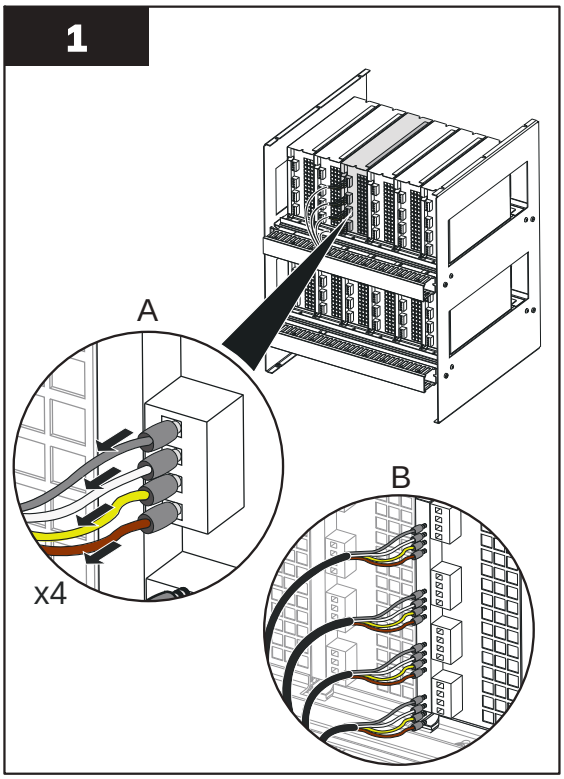
- New Lamp Driver
- Wiring Diagram

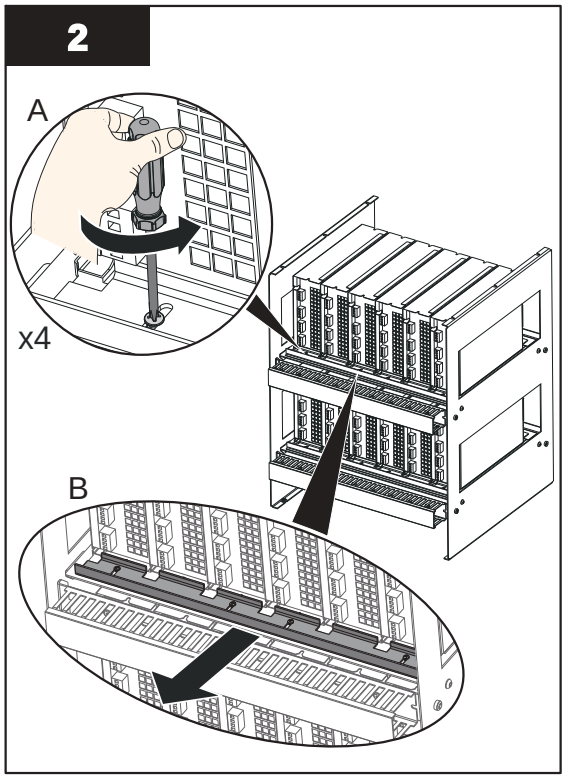
Procedure:

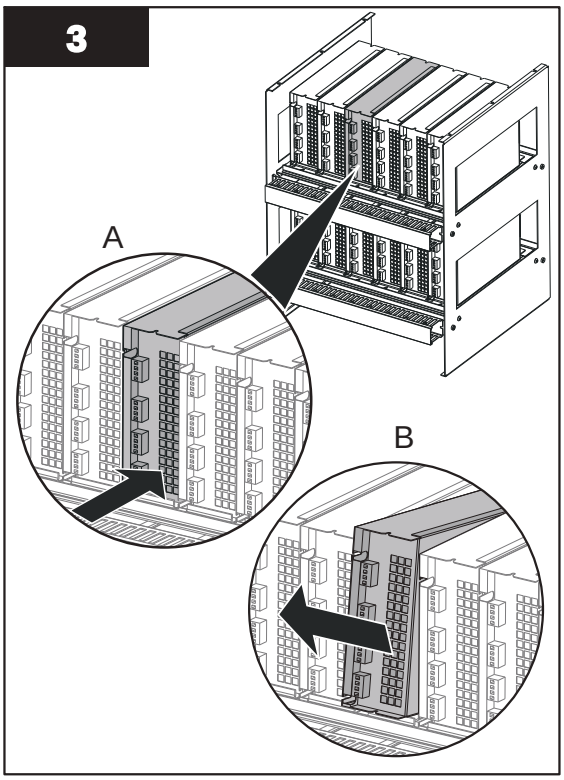
* Tasks performed on all except the last Lamp Driver in series.

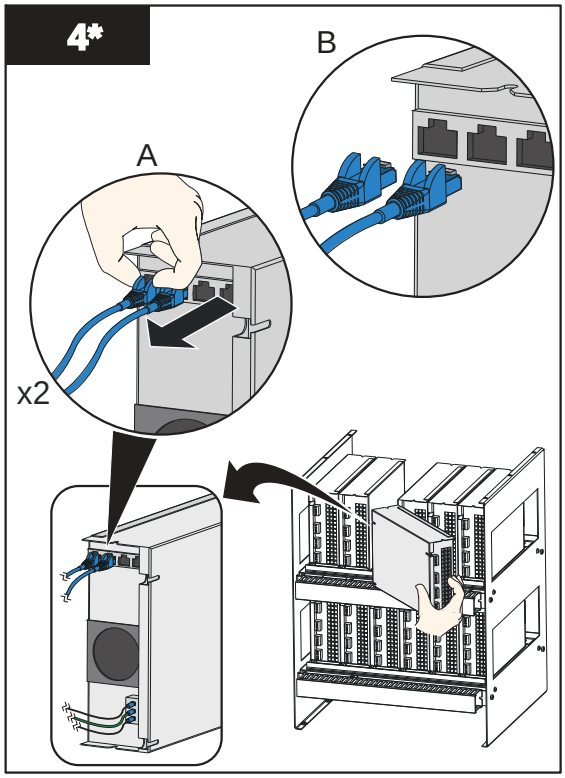
Tasks performed on the last Lamp Driver in series.

Remove:

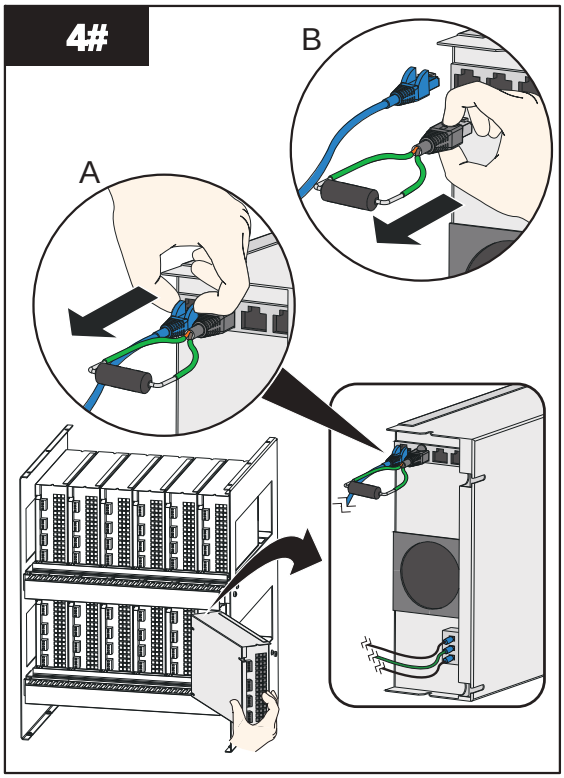


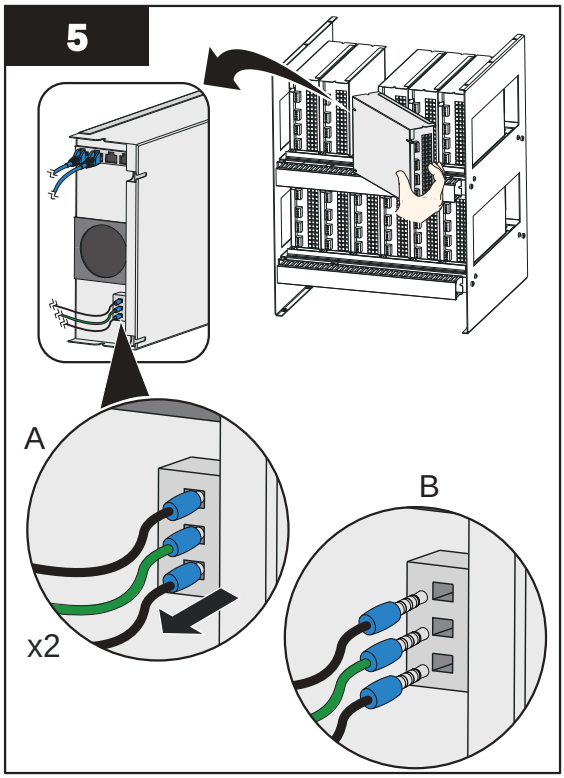






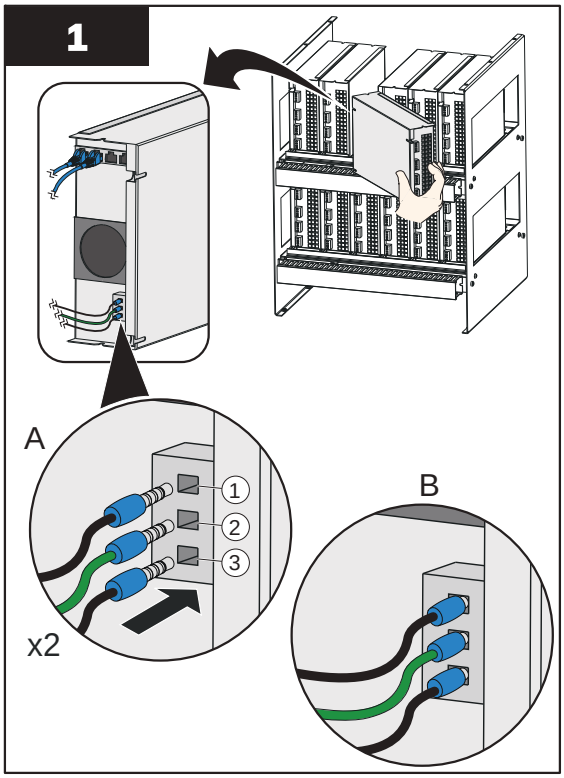
Note: *Disconnect the Ethernet cables from the Lamp Driver.*

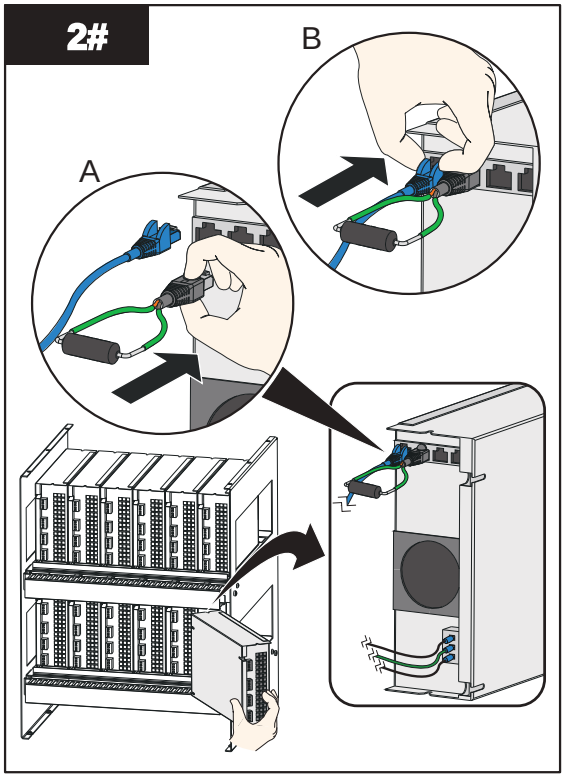




Note: *Disconnect the Ethernet cable and terminating resistor from the Lamp Driver.*

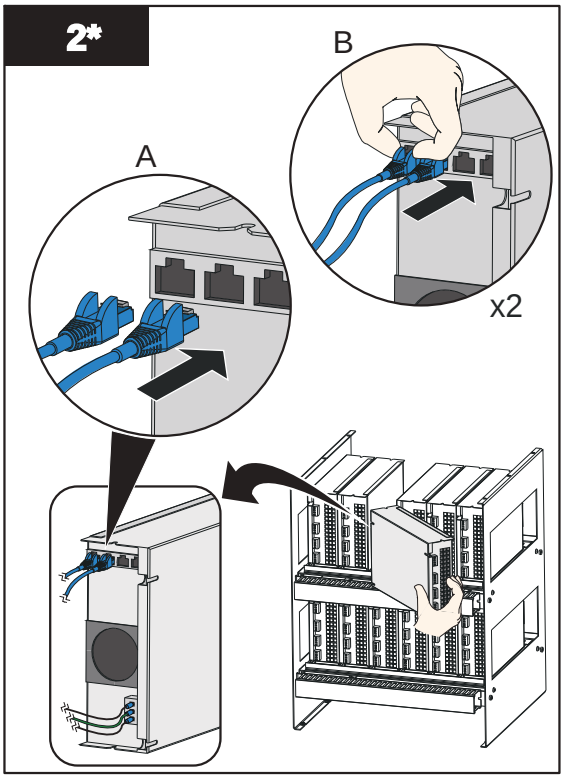
Install:



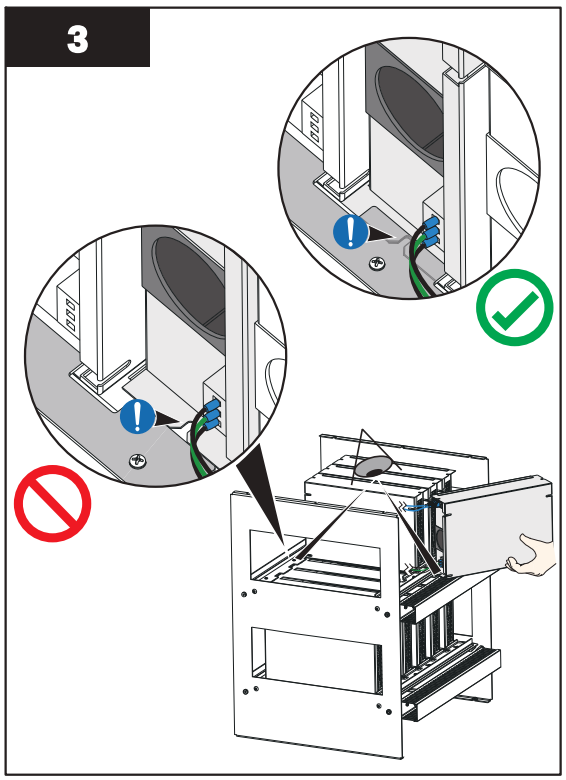


Note: *Install wires in order. 1=Neutral, 2 = Ground, 3 = Line.*

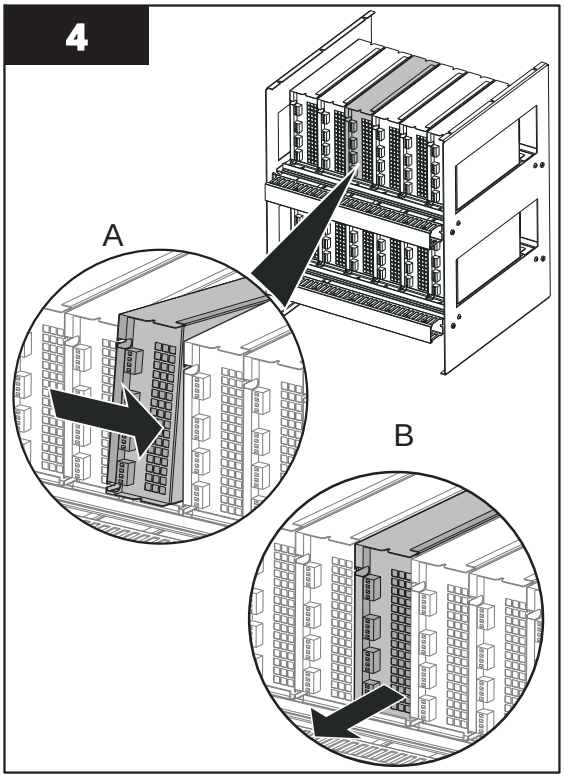
Note: *Connect the Ethernet cable and terminating resistor to the Lamp Driver.*

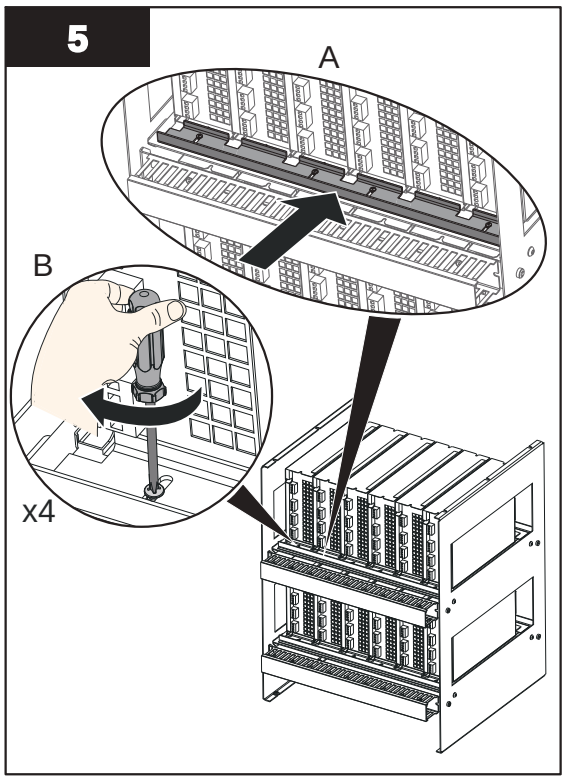


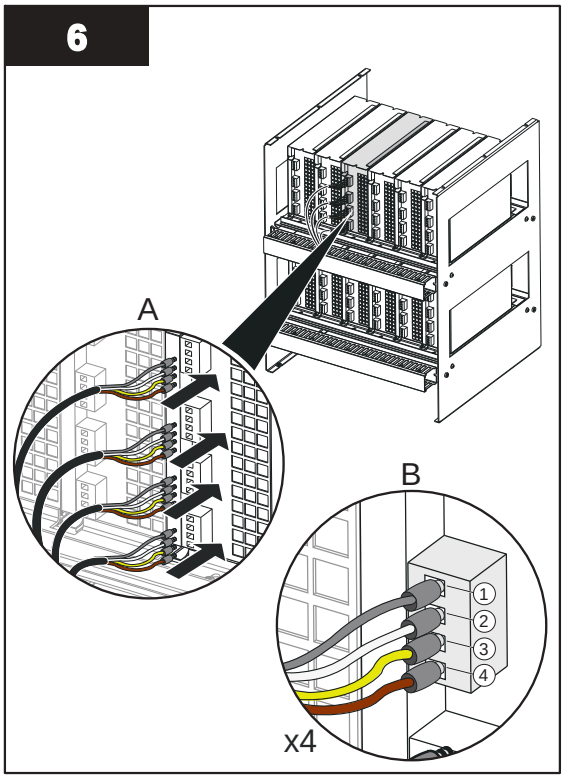
Note: *Connect the Ethernet cables to the Lamp Driver.*



Note: *Make sure the notched tab on the backside of the Lamp Driver is fully seated under the mounting bar tab.*







Note: *Install wires in order. 1 = Grey Wire, 2 = White Wire, 3 = Yellow Wire, 4 = Brown Wire*

7. Change the Rotary Switch addresses on the new Lamp Driver to match the addresses on the removed Lamp Driver.
8. Repeat steps for other Lamp Drivers if required.

When service is complete, assemble the prerequisites in the reverse order of the disassembly.

9.11.2 Air Filters

An air filter is provided for intake fans. The fans are located on the bottom or side of the Control Power Panel. Visually inspect the air filter once a week to see if any debris or film has settled by snapping off the cover and replacing the filter as necessary.

9.11.3 Cooling Fan

If equipped, check the CPP while in normal operating mode for airflow at the exhaust ports and that no obstructions are present. If there is diminished or no airflow, replace fan (s) immediately.

9.12 Clean the UV Chamber

Use a soft cloth with soap and water or any commercial stainless steel cleaner on the outside of the UV Chamber.

9.13 Clean in Place (CIP)

Refer to Document Number **DC0A0601-011** for the Clean in Place procedure.

Section 10 Troubleshooting

⚠ DANGER

Obey all warning and caution statements. Refer to Section 2.

Read and understand this manual before operating this equipment. Read all user documentation before performing operations, inspections, repair, or maintenance on this equipment.

Only competent personnel should undertake operation, repairs, maintenance, or servicing of equipment described in this section of the manual. If you do not understand the information or procedure explanations in this manual, STOP and contact your Service Provider for assistance.

NOTICE

Injury or damage to the equipment due to improper testing, handling or maintenance will not be covered under the manufacturer's warranty and is the responsibility of the individual performing the troubleshooting. If there is any question about a procedure, contact Aquafine Corporation® before service.

10.1 Alarms

Alarm	Description
UV Chamber Temperature High	The UV Chamber Temperature Sensor is mounted on the UV Chamber End Plate. If the UV Chamber End Plate gets too hot, the Sensor shuts down the UV Lamps. Safely check if the chamber is hotter than 120°F (49°C) using a thermometer. The sensor is connected in the Normally Closed configuration.
Chamber End Cap is Open	The Chamber End Cap Sensor confirms that the socket cover is installed properly. When it is not installed properly it will shutdown the UV Lamps. This sensor is connected in the Normally closed configuration.
Enclosure Temperature High	The Enclosure Temperature Sensor is mounted in the Control Power Panel. If the inside of the electrical enclosure gets too hot, the sensor will shut down the UV Lamps. Safely check if the enclosure is hotter than 122°F (50°C) using a thermometer. This sensor is connected in the Normally Closed configuration.
ELCB Tripped in Enclosure	This is an optional sensor. The Earth Leakage Circuit Breaker (ELCB) will shutdown the UV Lamps when triggered. This sensor is connected in the Normally Closed configuration.
Lamp Driver # Fault	The specified Lamp Driver is reporting a fault condition.
Lamp Driver # System Error	The indicated Lamp Driver is reporting a system error.
UV Intensity Low	A discrete alarm that is activated based on the optional UV intensity sensor reading. The alarm is triggered if the UV intensity reading is less than the "UVI Low Alarm Setpoint" (Figure 7). The value is different for Standard and High Performance UV Lamps so it is important to use the correct type of UV Lamps in the system.
Lamp Out Alert	The Lamp Out Alert (LOA) is triggered when there are one or more failed UV Lamps required for operation.
TOC Signal Out of Range	Triggered when the TOC signal is out of range.
UVI Signal Out of Range	Triggered when the UVI Signal is out of range.
Lamp Hours Exceed End Of Life	Triggered when one or more UV Lamps have reached their end of useful life. Indicates that it is time to replace the UV Lamp(s). The 'Hours of Operation' of all UV Lamps can be accessed from the Lamp Hours screen (Figure 6). ***Note:*** *Continued use of the UV Lamps that have exceeded EOL means the system will no longer be able to perform as expected.*
Lamp Driver # Communication Fault	The specified lamp driver is not communicating with the PLC.
Data logging (The data is saved every 10 minutes)	
Chamber Temperature - Alarm	Indicates whether or not there is a Chamber Temperature alarm
ControlMode100%	Indicates if the control mode is set to '100% Mode'
ControlModeManual	Indicates if the control mode is set to 'Manual Mode'

Alarm	Description
ELCB - Alarm	Indicates whether or not there is an ELCB alarm
Enclosure Temperature - Alarm	Indicates that the temperature switch in the enclosure is experiencing temperatures above the allowable limit. The enclosure power will shutdown after 15 minutes if the high temperature condition persists.
End Cap Switch - Alarm	Indicates whether or not there is an End Cap Switch alarm
System Power	Indicates the System Power %
TOCActual	Indicates the TOC actual value as received from the customer
TOCSetPoint	Indicates the TOC set point as set by the customer

10.2 Alarm Conditions

Condition	Possible Cause	Possible Solution
Chamber Temperature Sensor	No fluid flow	Safely check if the UV Chamber is hotter than 120°F (49°C) using a thermometer. Ensure there is fluid flowing through the UV Chamber when the UV Lamps are on.
	Installation error	Safely check if the UV Chamber is hotter than 120°F (49°C) using a thermometer. Check if the Chamber Temperature Sensor is installed properly.
	Faulty Sensor or wiring	Verify that there is no damage to the sensor or wiring. Replace if damaged.
Chamber End Cap Sensor	Installation error	Verify that the Service End Cap is installed and positioned correctly.
		Verify that the Chamber Socket Cover Sensor is installed and positioned correctly.
	Faulty Sensor or wiring	Verify that there is no damage to the sensor or wiring. Replace if damaged.
	Loose Wiring	Verify that the wiring is not loose. Tighten if necessary.
Enclosure Temp Sensor	CPP Fan failure	Safely check if the CPP enclosure is hotter than 122°F (50°C) using a thermometer. If it is too hot check if the Fan Breaker is ON and if it is working correctly.
	Installation error	Safely check if the enclosure is hotter than 122°F (50°C) using a thermometer. Check if the Chamber Temperature Sensor is installed and working correctly.
	Faulty Sensor or wiring	Verify that there is no damage to the sensor or wiring. Replace if damaged.
	Loose Wiring	Verify that the wiring is not loose. Tighten if necessary.
Enclosure ELCB Sensor	There is a wiring error or insulation failure causing the current carrying conductors to come in contact with the electrical enclosure	Check if all the wires insulation is intact and if there are any loose wires in the Control Power Panel.
Lamp Driver Fault Present	Failed Lamp Driver	Inspect the small fan inside the Lamp Driver turns on when the UV Lamp are powered ON. If the fan is off and the Lamp Driver is hot to touch, replace the Lamp Driver (Section 9.11.1)
Lamp Driver System Errors Present	Lamp Driver is not receiving the correct voltage	Verify that the Lamp Driver is getting the correct voltage per the voltage and power requirements of the Lamp Driver.
	Intake air temperature too high or too low	High enclosure temperatures may cause the Lamp Driver to report ambient temperature faults. Inspect cabinet fans for proper operation.
	Internal heatsink temperature too high	Blocked air outlet or blocked air inlet on Lamp Driver.

Condition	Possible Cause	Possible Solution
UVI Too Low	UV intensity reading is less than the UVI Low alarm setpoint	Check if lamps have reached end of life. Replace all EOL UV Lamps. (Section 9.6.2)
	Failed UV Lamp(s)	Check if the UV Lamp(s) closest the UV intensity sensor port is off. Replace failed UV Lamp(s). (Section 9.6.2)
	Lamp and/or UVI Sensor Sleeves are fouled	Remove the Sleeves, inspect the Sleeves for scale or debris buildup. Clean the Sleeves (Section 9.8.2).
	Improper Connection	Inspect cable and cable connections for signs of damage or corrosion.
	Process Fluid quality has dropped below design limit	Any changes in process fluid transmittance or quality will cause the UVI sensor reading to change. In some applications where fluid is blended, transmittance properties can change. Resolve upstream process.
	Change in Process Fluid Temperature	UV Output of the lamps is sensitive to the process fluid temperature. The setting of the relative UV Intensity 100% set point should be completed at the typical process fluid temperature for the application. For fluid temperatures < 15°C (< 60°F) a period of up to 48 hours of operation may be required to ensure the UVI Sensor output signal has stabilized prior to setting UV Intensity 100% set point.
	Damaged Parts due to heat	The UVI Sensor will be damaged by heat when temperatures exceed 194°F (90°C).
	Incorrect UV Lamp or Lamp Sleeve type installed.	Always use the same type of UV Lamp and Lamp Sleeve (i.e. Standard and High Performance) as was used when the system was purchased. A software change is required to change the UV Lamp and Lamp Sleeve type. Contact your local Distributor or Aquafine support.
LOA (Lamp Out Alert)	Improper Connection	The socket should be inspected to ensure that the UV Lamp connection is tight and no damage is present.
	Failed UV Lamp(s)	Swap the suspected failed UV Lamp with a known working UV Lamp (Section 9.6.2). If the error follows the failed UV Lamp, replace the failed UV Lamp. Refer to the Lamp Status Screen on the HMI (Section 8.3).
		Remove the UV Lamp (Section 9.6.2). Inspect the Lamp Pins for evidence of overheating, moisture, displaced or bent pins (pins are angled at 10 degrees)
		Remove the UV Lamp (Section 9.6.2). Inspect the UV Lamp for cracks, breaks or loose ceramic ends.
	Broken Lamp Sleeves	Replace broken Lamp Sleeve (Section 9.8.1). ***Note:*** *Water can cause the lamp sockets to arc, corrosion on the lamp pins, burning of the Lamp Sockets and damage to the electrical components.*
	Faulty Lamp Driver	Where 2 (two) consecutive UV Lamps are out, the Lamp Driver may be faulty. Replace faulty Lamp Driver (Section 9.11.1)
TOC Signal Fault	TOC signal not present but the setting 'TOC Analyzer Present' is set to 'Yes' on Settings 1 page	If a signal from TOC analyzer is not available then the 'TOC Analyzer Present' should be set to 'No' on Settings 1 page
	Incorrect Wiring	Verify that the sensor is wired as per the drawings
	Scaling error	Verify if the TOC scaling on 'Settings 1' page matches the scaling of the TOC analyzer output
UVI Signal Fault	Incorrect Wiring	Verify that the sensor is wired per the drawings

Condition	Possible Cause	Possible Solution
Lamp Hours EOL	One or more UV Lamps have reached the end of their useful life	Replace all EOL UV Lamps (Section 9.6.2). Reset the Lamp Hours (Section 8.3.4).
Driver Communication Errors	Wiring connection broken	Verify that the cables joining all the Lamp Drivers are good and the wiring connection from the first Lamp Driver to the last is not broken.
	Terminating resistor missing	Verify that the terminating resistor is present in the last Lamp Driver.
	Connection error between PLC and Lamp Drivers	Verify that the communication cable that connects the PLC and the Lamp Driver is wired according to the drawings.

10.3 Non Alarm Conditions

10.3.1 UV Chamber

Condition	Possible Cause	Possible Solution
Leaking	Chamber End Plate O-Ring	Ensure that the end plate O-Ring is installed and positioned correctly. Inspect O-Ring for damage, cracks or wear, replace if required. (Section 9.9.2)
	Faulty gasket	Inspect gaskets for signs of damage, wear or deterioration. Replace if required. (Section 7.3.5)
	Sleeve Bolt (washer, O-Ring)	Ensure that the Sleeve Bolt Washer is installed and positioned correctly. Inspect washer for damage, cracks or wear, replace if required. (Section 9.8.1)
		Ensure that the Sleeve O-Ring is installed and positioned correctly. Inspect O-Ring for damage, cracks or wear, replace if required. (Section 9.8.1)
		Ensure the Sleeve Bolt is tightened to 100 lbf.in (11 N-m). DO NOT overtighten. (Section 9.8.1)
	Optical Sensor	Ensure that the Optical Sensor is installed and positioned correctly. Ensure the LED on the Sensor is green.
	UV Chamber pressure exceeds design limit	Depressurize the UV Chamber (Section 9.3).
	Broken Lamp or UVI Sensor Sleeves	Inspect the ends of the Lamp and UVI Sensor Sleeves for cracks or chips. Replace a broken Sleeve. (Section 9.8.1)
	Damaged Parts due to heat	Excessive heat can distort the plastic material, resulting in compression of the O-Ring seal. Replace O-Ring(s). (Section 9.8.1 and Section 9.9.2).
	Water Hammer	Water hammer pressure can be 5 to 10 times higher than the static pressure of a water system and can cause leaking and/or breakage to Lamp Sleeves. Open shut off valves gradually to fully open state.

10.3.2 UV Lamp

Condition	Possible Cause	Possible Solution
Premature Lamp Failure	Lamp Cycling	Systems in which the UV is turned ON/OFF frequently (more than 3 times) will cause the UV Lamp filament damage.
	Low Electrical Power	The electrical power should be within 5% of the name plate voltage. Small transformers may be required to boost low voltages.
	Improper Electrical Connection	Vibration can cause the electrical connects to become loose. The connection should be inspected and repaired.
	Mechanical Vibration	Vibration from water hammer, pumps, and unsupported piping can cause excess stress to the lamp filament and equipment. Take measure to reduce vibration by controlling flow. Ensure proper connection of all pipings.

10.3.3 Lamp Socket

Condition	Possible Cause	Possible Solution
Lamp Socket Burning	Defective Lamp Socket	A defective Lamp Socket can cause a Lamp Socket to fail and burn. Within the Lamp Socket assembly are metallic receptacles. If the receptacles do not make proper contact with the lamp pins, a high resistance short will occur, eventually resulting in heat buildup in the interior of the socket. Replace Lamp Socket and verify proper connection.
	Corroded Lamp Pins	Corrosion of the lamp pins and socket pins can cause a high resistance short. Replace UV Lamp (Section 9.6.2) and Lamp Socket and verify proper connection.
	Lamp connection	The UV Lamps operate under high voltage. If the lamp pins and socket are not properly engaged, the connection can create an electrical arc, eventually generating enough heat to melt the components. Replace UV Lamp (Section 9.6.2) and Lamp Socket and verify proper connection.
	Faulty Lamp Driver	The Lamp Driver controls the electrical power to the UV Lamps. If there is a problem with the Lamp Driver, which results in UV Lamp flickering or over-powering, damage can be done to the lamp connector assembly. Replace Lamp Driver (Section 9.11.1)

10.3.4 UVI Sensor

Condition	Possible Cause	Possible Solution
UVI Sensor Reading Declining	Failed UV Lamp(s)	Inspect the UV Lamp. Replace the UV Lamp, if required. (Section 9.6.2)
	UV Lamps have reached End of Life	Replace the UV Lamp (Section 9.6.2) ***Note:*** *Continued use of the UV Lamps that have exceeded EOL means the system will no longer be able to perform as expected.*
	Lamp and/or UVI Sensor Sleeves are fouled	Remove the Sleeves, inspect the Sleeves for scale or debris buildup. Clean the Sleeves (Section 9.8.2).
	Sensor Window is Fouled	Clean UVI Sensor Window (Section 9.7).
	Process fluid quality has dropped below design limits.	Any changes in fluid transmittance or quality will cause the UVI sensor reading to change. In some applications where fluid is blended, transmittance properties can change. Resolve upstream process.
	Improper Connections	Inspect cable and cable connection for signs of damage or corrosion.
	Damaged Parts due to heat	The UVI Sensor will be damaged by heat when temperatures exceed 194°F (90°C).

10.3.5 Control Power Panel

Condition	Possible Cause	Possible Solution
No Display	Power Loss	Check incoming power to CPP.
	Faulty Wiring	Check for faulty, damaged or loose wiring connections.
UV Lamps Will Not Turn ON	Power Loss	Check incoming power to CPP.
	Blown fuse/circuit breaker	Replace fuse or reset circuit breaker after checking for electrical shorts.

Section 11 Replacement Parts and Accessories

Contact Aquafine Corporation® with the listed information to order replacement parts.

Provide the:

- Product name and model number (refer to the front of this manual)
- Part number and description of the replacement part or accessory

If a replacement part is not listed, contact Aquafine Corporation®.

There are two (2) elastomer types available for use in the UV system. Refer to Table 5 for wetted elastomers types and their intended use. Always refer to site-specific requirements to determine wetted elastomer type required for the provided system.

Table 5 Wetted Elastomers, Intended Use

Wetted Elastomer Type	System Application	
	Liquid Sugar	TOC
EPDM - EU1935, FDA	X	
FKM - FDA		X

11.1 UV Lamp and Lamp Sleeve

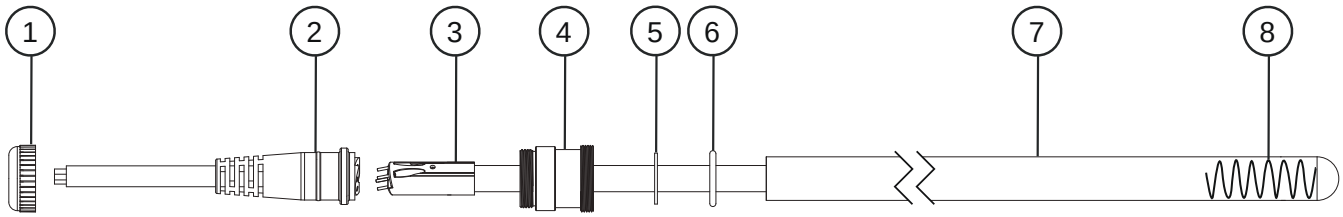


Figure 16 UV Lamp and Lamp Sleeve components

Item	Description	Part Number
1	Sleeve Cup Nut	17489-8
2	Socket Lamp	
	Length, 11 feet	52819-4-300-11-080
	Length, 22 feet	52819-4-300-22-080
3	**System Application: Liquid Sugar**	
	UV Lamp, HX 5P, 60" 254nm - Standard	
	Quantity: 1	52885-DS60Z*
	Quantity: 4 pack	52885-DS60Z-04*
	Quantity: 32 pack	52885-DS60Z-32*
	UV Lamp, HX 5P, 60" 254nm - Validated	
	Quantity: 1	52885-DV60Z*
	System Application: TOC	
	UV Lamp, HX 5P 60" 185nm Standard (Natural Quartz)	
	Quantity: 1	52885-TS60N*
	Quantity: 4 pack	52885-TS60N-04*
	Quantity: 32 pack	52885-TS60N-32*
	UV Lamp, HX 5P 60" 185nm Standard (Synthetic Quartz)	
	Quantity: 1	52885-TS60S*
	Quantity: 4 pack	52885-TS60S-04*
	Quantity: 32 pack	52885-TS60S-32*

Item	Description	Part Number
	UV Lamp, HX 5P 60" 185nm Validated (Natural Quartz)	
	Quantity: 1	52885-TV60N*
	UV Lamp, HX 5P 60" 185nm Validated (Synthetic Quartz)	
	Quantity: 1	52885-TV60S*
4	Sleeve Bolt	52838
5	Sleeve Bolt Washer	53439
6	O-ring, 1 X 1/8	
	FKM, FDA	002190-214F
	EPDM, EU1935, FDA	002304-214
7	Lamp Sleeve, 60"	
	System Application: Liquid Sugar and TOC	
	Natural Quartz	908116-060
	System Application: TOC	
	Synthetic Quartz	52893
8	Spring	52861

**This component contains Mercury. Dispose according to Local, State or Federal laws.*

Note: *UV Lamps that have been burned in for a period of 100 hours and measured are validated.*

NOTICE

Always use the same type of UV Lamp and Lamp Sleeve (i.e. Standard or High Performance) as was used when the system was purchased. A software change is required to change the UV Lamp and Lamp Sleeve type. Contact your local Distributor or Aquafine support.

11.2 UVI Sensor

Note: *Applies to TOC applications only.*

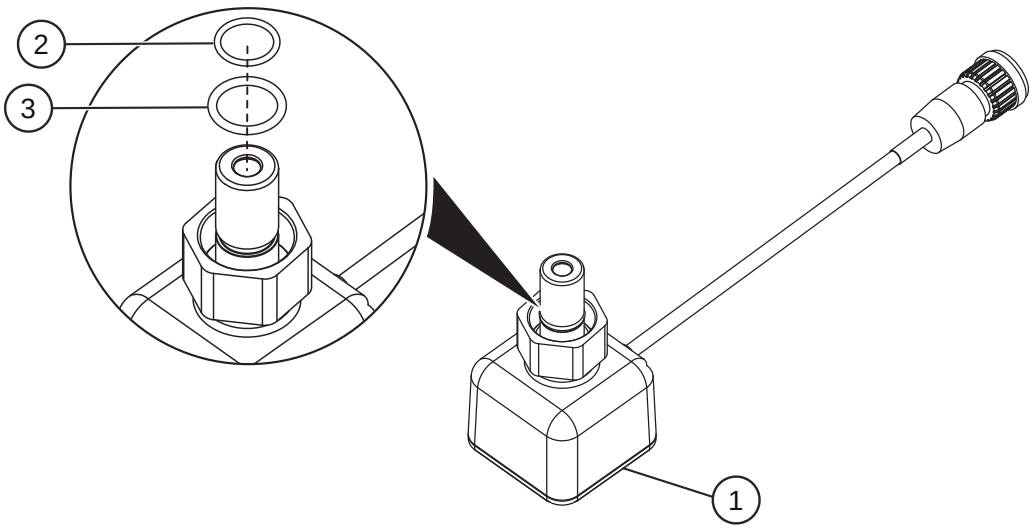


Figure 17 UVI Sensor

Item	Description	Part Number
1	Sensor Assembly	270309R-003
2	O-ring, .426 ID x 0.05, FKM, FDA	002222
3	O-ring, 0.489 ID x 0.07, FKM, FDA	002026

11.3 Systems without UVI Sensor

Note: *Applies to TOC applications only.*

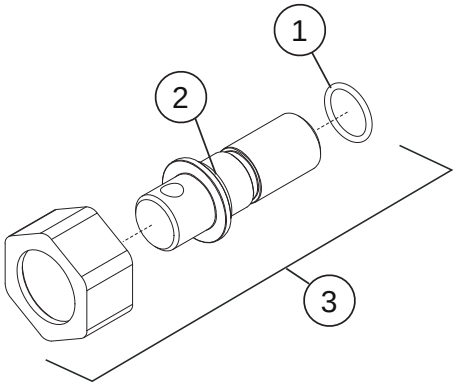


Figure 18 UVI Sensor - Plug Kit

Item	Description	Part Number
1	O-ring, .426ID x 0.05, FKM, FDA	002222
2	O-ring, 1/2 x 1/16, FKM, FDA	002190-014F
3	Sensor Port Plug Kit	52863-V

11.4 UVI Sensor

Note: *Applies to Liquid Sugar applications only.*

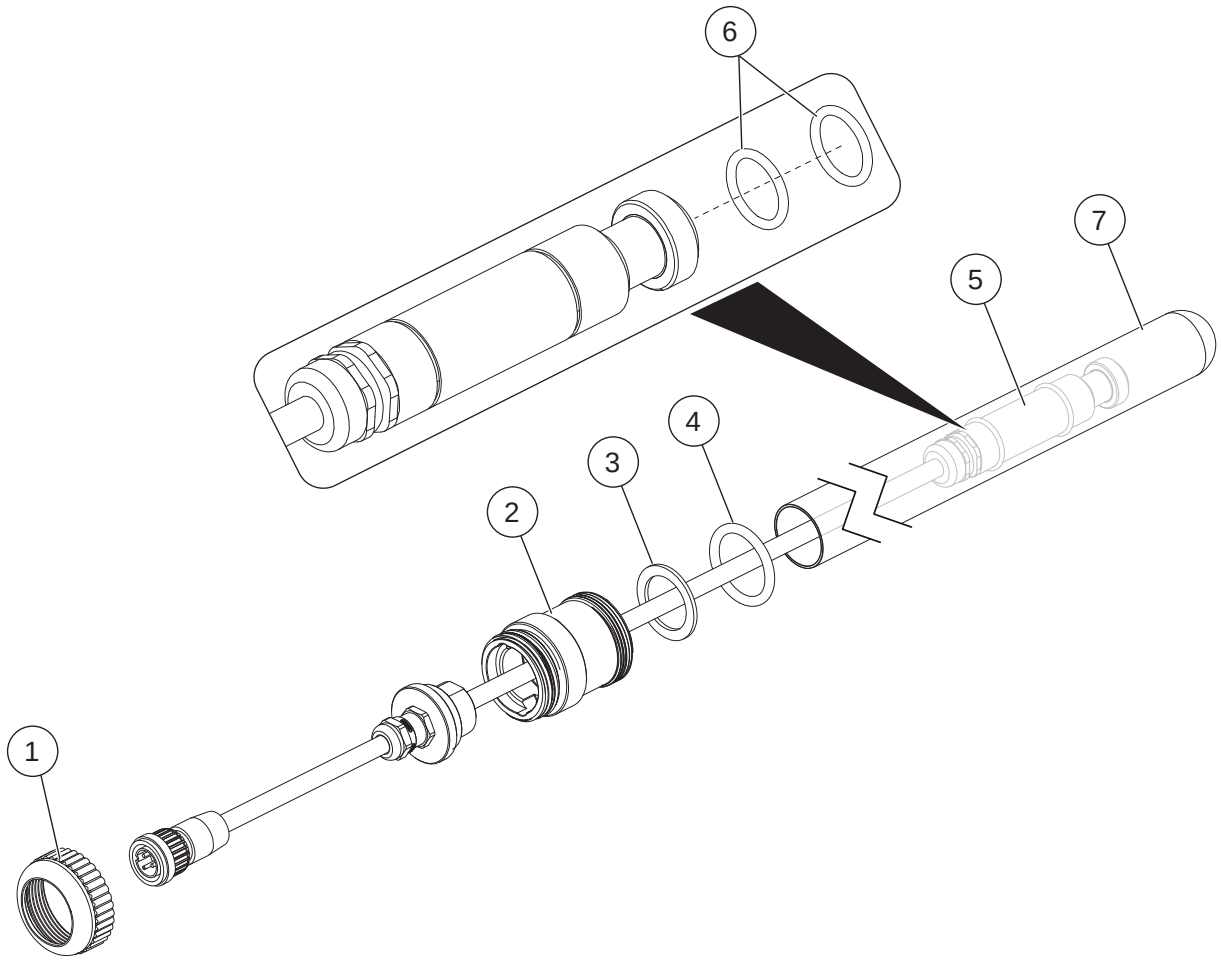


Figure 19 UVI Sensor

Item	Description	Part Number
1	Sleeve Cup Nut	17489-8
2	Sleeve Bolt	52838
3	Sleeve Bolt Washer	53439
4	O-ring, 1 x 1/8, EPDM, EU1935, FDA	002304-214
5	Sensor Assembly	798325
6	O-ring, 1/2 x 1/16, EPDM, EU1935, FDA	002304-014
7	Quartz Sleeve	908116-017

11.5 Baffle Assembly

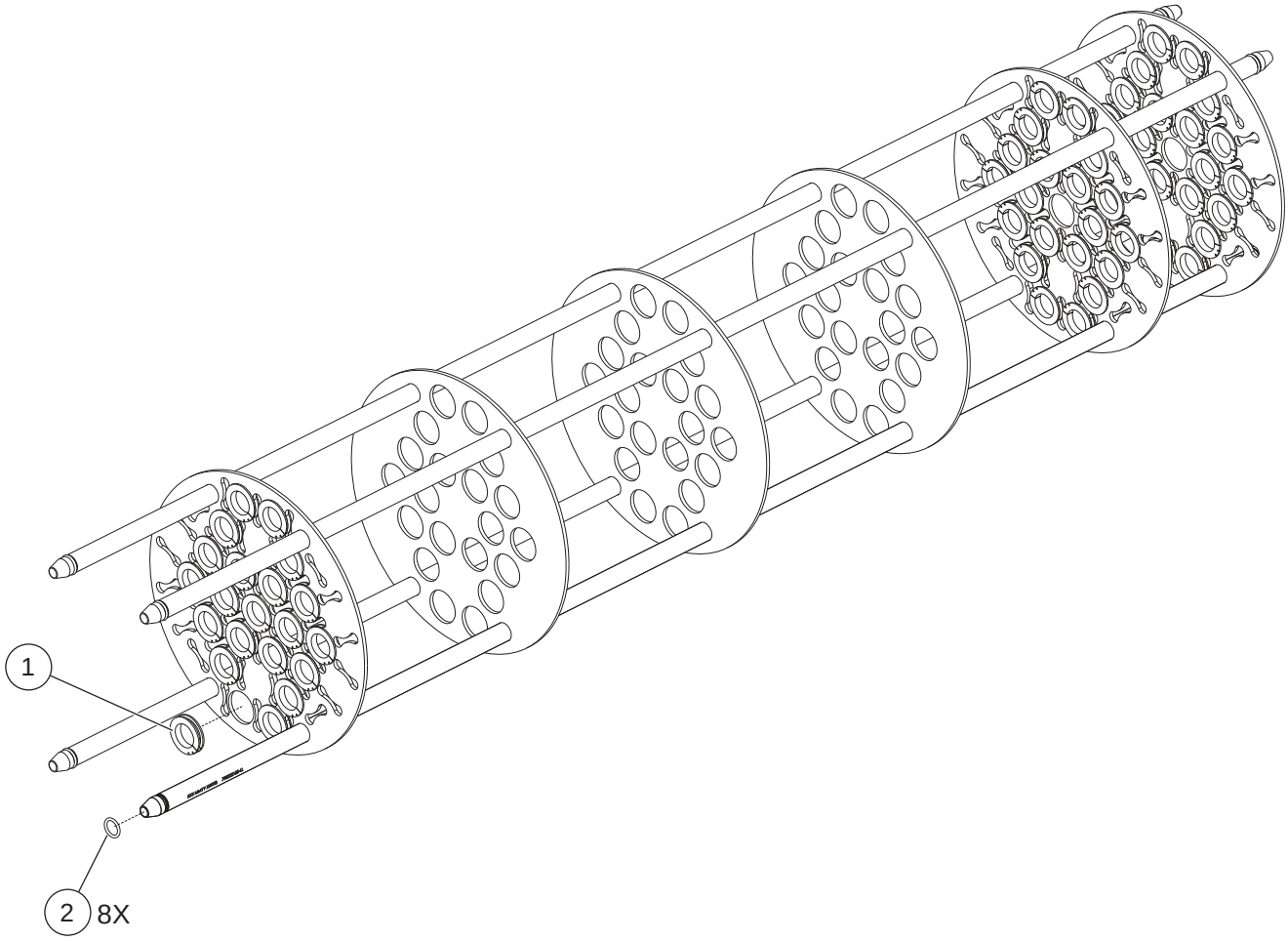


Figure 20 Baffle Assembly

Item	Description	Part Number
1	Sleeve Bushing	798205
2	O-Ring, .605 X .102, FKM, FDA[1]	52796-114
	O-Ring, 5/8 x 3/32, EPDM, EU1935, FDA[1]	002304-114

[1] Refer to Table 5 for wetted elastomer types and their intended use. Always refer to site-specific requirements to determine wetted elastomer type required for the provided system.

11.6 UV Chamber

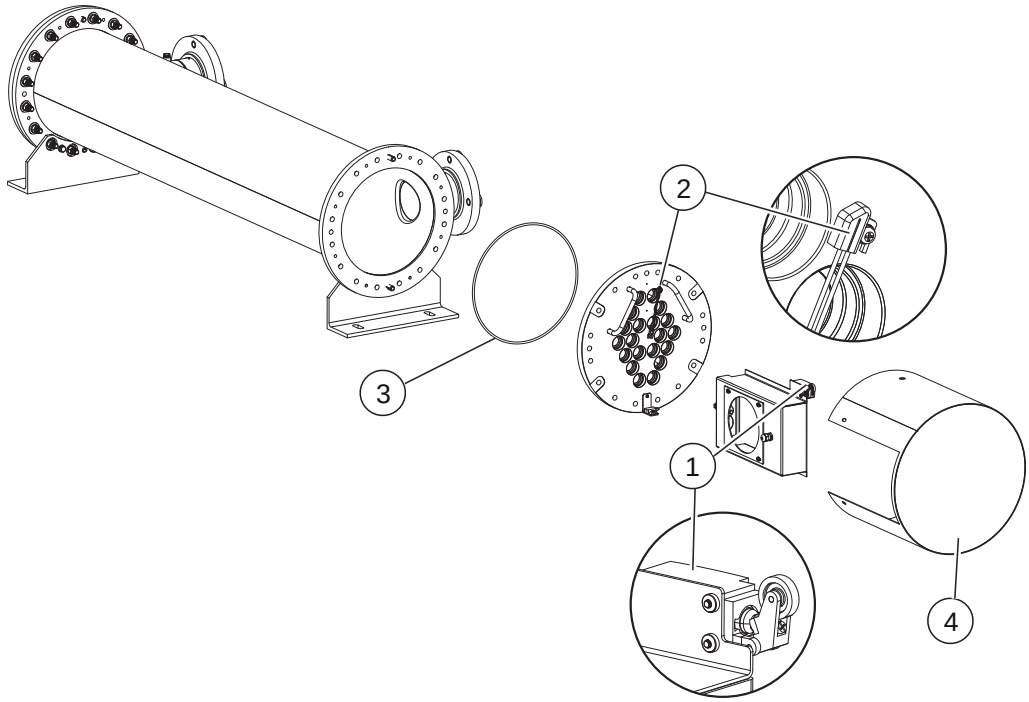


Figure 21 UV Chamber Components

Item	Description	System Model			
		AVT20 / AVT20-HP	AVT36 / AVT36-HP	AVT44 / AVT44-HP	AVT48 / AVT48-HP
		Part Number			
1	Limit Switch	917626-RLVASSY			
2	Temperature Switch, 40C operational temperature	52855			
	Temperature Switch, 55C operational temperature (Liquid Sugar Applications only)	52855-065			
3	O-ring, FKM, FDA[1]	52796-382	52796-384	52796-386	52796-388
	O-ring, EPDM, EU1935, FDA[1]	002304-382	002304-384	002304-386	002304-388
4	Service End Cap Kit	53000-12	53000-14	53000-16	53000-18

[1] Refer to Table 5 for wetted elastomer types and their intended use. Always refer to site-specific requirements to determine wetted elastomer type required for the provided system.

11.6.1 Port Plugs - Flanged Connections - TOC Applications

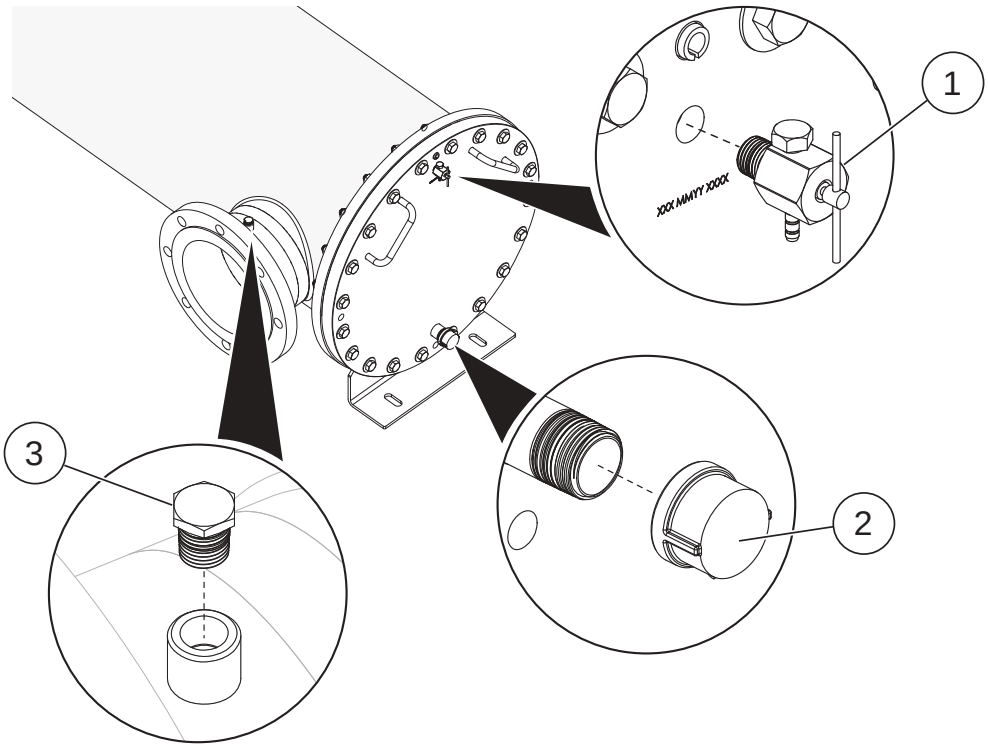


Figure 22 Port Plugs - Flanged Connections

Item	Description	Part Number
1	Valve, Bleed 1/4" MNPT 316	907797-4NBS316
2	Cap, Female 3/4" 316 NPT	53107-1216
3	Sample Port Plug	907782-0422316

11.6.2 Port Plugs - Sanitary Ferrule Connections - Liquid Sugar Applications

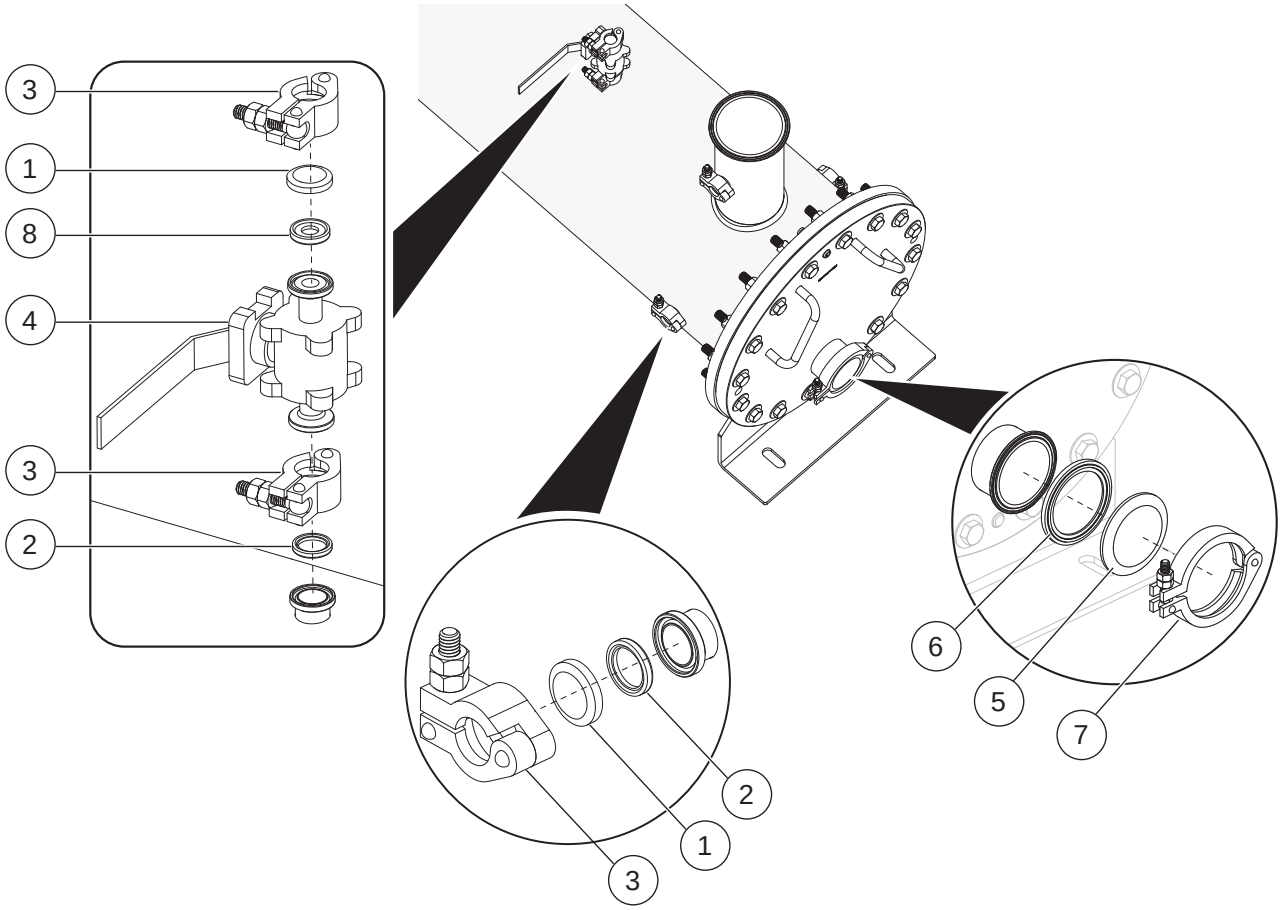


Figure 23 Port Plugs - Sanitary Ferrule Connections

Item	Description	Part Number
1	End Cap, 1/2 & 3/4" Ferrule	793643-001
2	Gasket, Sanitary 3/4"	798291-007
3	Clamp, Sanitary 1/2” & 3/4”	798314
4	Valve, 1/2" Tri-C Ball	798292
5	End Cap, 2-1/2" Ferrule	793643-006
6	Gasket, Sanitary 2.5"	798291-025
7	Clamp, Sanitary 2-1/2" Single Pin Nut	798316
8	Gasket, Sanitary 1/2"	798291-005

11.7 Control Power Panel

Refer to Electrical Drawings, Bill of Materials for additional CPP replacement parts.

Item	Description	Part Number
1	Lamp Driver	53126
2	Temperature Sensor Kit (includes Thermostat) Thermostat	52827 53201
3	Cooling Fan, 230VAC 323/353CFM	916850-3243100
4	Cooling Fan Filter, 13" x 13"	916850-3243200
5	Spring Assembly, Gas 60 LB	901711-060
6	Air Filter, 10" x 10" x 1" - Local Panel Only	52984-101001

11.8 Miscellaneous

Note: *These components are provided with the system.*

Description	Part Number
Face Shield	906002
Operator Kit (includes 1 Sleeve Removal Tool and 1 Sleeve Bolt Removal Tool)	52929
Sleeve Removal Tool	52923
Sleeve Bolt Removal Tool	52917