

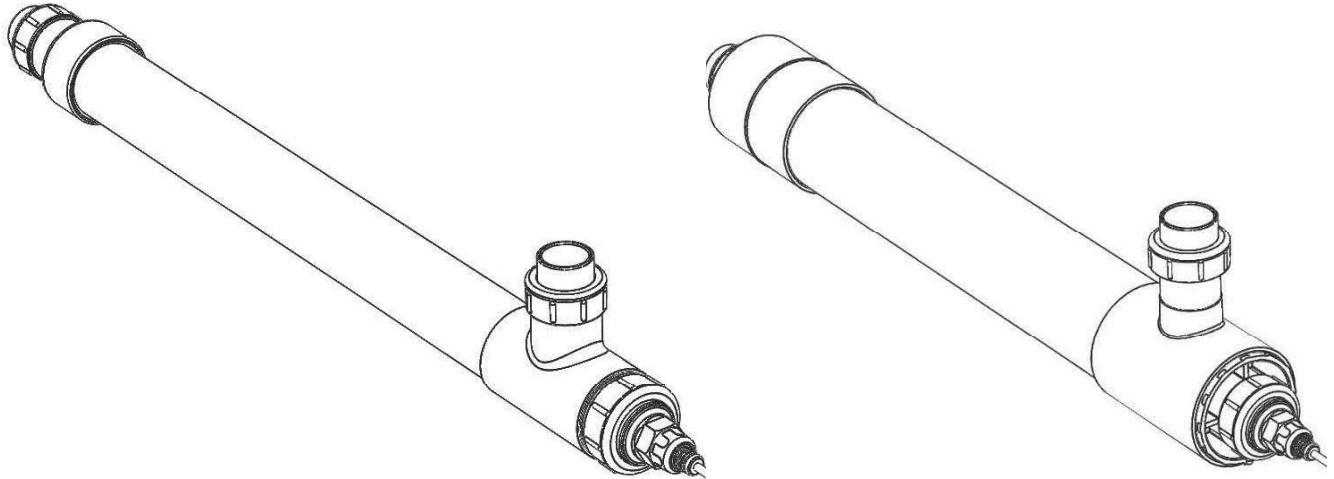


XFLO™ Single Lamp UV Treatment Systems

Operation and Maintenance
Installation

User Manual: UOM0002

Edition R1



READ THIS MANUAL PRIOR TO INSTALLING, SETTING UP, OPERATING, SERVICING, OR
MAINTAINING THIS UV TREATMENT SYSTEM

1.3 Definitions and Terms

Table 2 below provides definitions of the terms used within this manual.

Table 2: Terms and Definitions Continued

Term	Description
UV-C	Germicidal Range of the UV light spectrum (200 – 280 nm)
254nm	The predominant UV-C disinfection wavelength of LPHO X-Flo lamps in nanometers.
UV Intensity mW/cm ²	The amount of UV-C energy being imparted into the fluid from the lamp.
Minimum UV Intensity	Required value at end of lamp life (alarm threshold value) to maintain the minimum UV dose at a given flow rate and a given fluid UVT.
End of Lamp Life (EOLL)	Lamp has reached 80% of its original UV-C output EOLL is the UV-C output level where UV-C treatment systems are sized. Operating beyond EOLL does not guarantee minimum dose delivery. EOLL is typically between 9,000 and 12,000 hours depending on lamp type. Since you may not meet dose requirements beyond EOLL, it is strongly recommended to replace the lamp at this point.
Target Organism	Organisms of concern in the fluid being treated.
Target Dose mJ/cm ²	The Dose level required to achieve the amount of inactivation required of the target organism. Different organisms have differing Dose Responses to UV-C and therefor differing inactivation rates. Rates are expressed in Logarithmic reductions that correspond to UV-C dose in mJ/cm ² .
Dose mJ/cm ²	UV-C dose corresponding to the required inactivation level of the target organism. Calculated via: UV-C Intensity x Time of exposure. UVT also affects dose.
Ultraviolet Transmittance (UVT)	<p>The amount of UV-C light at 254nm that can pass through 1cm of the fluid being treated. Described in %UVT.</p> <p>The UV-C energy that is absorbed in that distance does not do disinfection 'work' and is considered lost energy. Effectively acts as a reduction in UV-C Intensity.</p> <p>Relatively low UVT fluids require more lamps than do High UVT fluids at the same flow rates and dose targets for this reason.</p>

(Continued)

Terms and Definitions, Continued

Flow Rate	System flow rates, UV intensity and UVT determine the UV-C dose imparted on the target organism. Flow rate determines organism residence time within the UV-C treatment zone = Time.
Fouling	Build-up of minerals, scaling or biological material on quartz sleeves and/or sensors. Fouled lamp sleeves effectively reduce UV-C intensity and fouling directly reduces Dose.
TSS	Total Suspended Solids
Personal Protective Equipment (PPE)	Face Shield, Hard Hat, Safety Glasses, Rubber Gloves, Safety Shoes
Dynamic Water Pressure	Pressure in the UV Vessel generated by a pump or gravity head (elevated storage tank)
Static Water Pressure	Pressure in the UV System that is contained in a closed system. As water is non-compressible, relatively no energy is present if no air is trapped in the system. Note: air IS compressible and is a form of stored energy.
Power Supply	Where main power is converted into lamp start and run power. Commonly called a ballast.
Vessel or Chamber	The 'zone' where the UV lamps are situated and where UV treatment occurs.
UV-C Lamp	Device used to generate and emit UV-C energy into the fluid being treated
UV System Bypass	Valve(s) and piping used to bypass water flow around the UV system during maintenance or service.
Quartz Sleeve	Device that houses the UV-C lamp. Optimizes lamp temperature that is critical for optimum output. Protects lamp and isolates electrical connections.

2 Safety Information

The information in this manual has been carefully checked and is believed to be accurate. However, the manufacturer assumes no responsibility for any inaccuracies that may be contained in this manual. In no event, will the manufacturer be liable for direct, indirect, special, incidental or consequential damages resulting from any defect or omission in this manual, even if advised of the possibility of such damages. In the interest of continued product development, the manufacturer reserves the right to make improvements in this manual and the products it describes at any time, without notice or obligation.

Revised editions of this manual can be found on RK2's website.

IMPORTANT: READ THIS MANUAL!





The information in this manual is intended to protect you and anyone who operates, uses, services, maintains or installs a RK2 UV system. Please read and become familiar with this entire manual prior to physical contact with the UV system, either directly, remotely, or via a third party. Please pay attention to all danger, warning and caution statements in this manual. Failure to do so could result in serious personal injury, infrastructure damage or damage to the equipment.

Make sure that the protection provided by this equipment is not impaired. Do not use or install this equipment in any manner other than that specified in this manual

2.1 Safety and Precautionary Labels






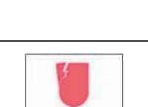



Read all labels and tags attached to the equipment and within this manual. Personal injury or damage to the equipment could occur if not observed. A reference table of symbols used on labels and tags is below, see Table 4.

Table 3: Safety and Precautionary Symbols






Symbol	Urgency	Description
	Warning	This is the safety alert symbol. Obey all safety messages that follow this symbol to avoid potential injury. If on the instrument, refer to the instruction manual for operation or safety information.
	Important	READ AND OBEY ALL INFORMATION CONTAINED ON ALL UNIT LABELS. REMOVAL OF PRODUCT LABEL WILL VOID WARRANTY.
	Warning	Electrocution and/or Shock potential. Read and follow all instructions and standard safety procedures.
	Warning	UV-C light exposure potential. UV-C can cause serious harm to eyes and skin. Read and follow all instructions and standard safety procedures.
	Warning	Cutting or severing injury potential. Lamp and Sleeve quartz can be very dangerous if not handled properly or if system is not serviced following all instructions and standard safety procedures.
	Warning	High temperature surface or fluid may be present. Read and follow all instructions and standard safety procedures.
	Warning	UV System may be under pressure. Severe injury or death could result on working on vessel if not de-pressurized. Lock out source and de-pressurize prior to servicing. Read and follow all instructions and standard safety procedures.
	Caution	This symbol indicates that a risk of electrical shock and/or electrocution exists. All appropriate Lockout/Tagout procedures must be followed.

(Continued)

Safety and Precautionary Symbols, Continued

	Caution	UV-C Light Exposure Potential. UV-C can cause serious harm to eyes and skin. Wear protective clothing. Recommended UV rated face shield and UV rated safety glasses.
	Caution	Read and follow all instructions and standard safety procedures.
	Caution	Always lock out power panels prior to working on or maintaining system.
	Caution	Do not inhale or ingest. Prevent contact with skin and eyes. Follow MSDS safety recommendations.
	Caution	High Voltage present. Power panels and lamp connections have high voltage potentials when on. Read and follow all instructions and standard safety procedures. Always lock out power panels prior to working on or maintaining system.
	Caution	Lamps, Sleeves and Sensors are fragile. Damage can occur if not installed, handled, or shipped accordingly. Read and follow all instructions and standard safety procedures.
	Caution	This symbol indicates that the marked item is pressurized. Read and follow all instructions and standard safety procedures. DO NOT exceed unit PSI rating at any time. Maximum pressure rating is on product label.
	Caution	Crush hazard. Power panels and treatment units are heavy. Read and follow all instructions and standard safety procedures.
	Caution	Pinch hazard. Power panels and treatment units are heavy. Read and follow all instructions and standard safety procedures.

(Continued)

	Reference	Please read the appropriate referenced section in the manual.
	Recommendation	Wear Eye Protection.
	Recommendation	Do Not Touch. Fingerprints on Lamp bulbs can cause premature failure.
	Recommendation	Electro Static Discharge sensitive device. Observe industry standard precautions and procedures.
	Recommendation	<p>In order to conform to European local and national regulations (EU Directive 2002/96/EC), European electrical equipment users must now return old or end-of life equipment to the Producer for disposal at no charge to the user.</p> <p>Note: For recycling, please contact the equipment producer or supplier for instructions on how to return end-of-life equipment, producer-supplied electrical accessories, and all auxiliary items for proper disposal. No equipment is to be returned without authorization. Local recycling programs may be used.</p>

2.2 Hazard Information

Table 5 below contains general hazard information for the UV treatment system.

Table 4: Hazard Information

WARNING	Use Caution. Water and electricity can be a dangerous combination.
IMPORTANT	For your safety, the quartz sleeve and/or the UV lamp in this product may have been broken or damaged during shipping. It is ESSENTIAL that the unit be CAREFULLY INSPECTED BEFORE CONNECTING TO ELECTRIC POWER.
DANGER	If a lamp or lamp cable falls into the water, DO NOT REACH FOR IT! First make sure the system is unplugged and then retrieve it. If the internal electrical components of the unit get wet, unplug the unit immediately.
DANGER	If the unit shows any signs of a water leak, immediately unplug it from the power source.
DANGER	To avoid possible electric shock special care should be taken since water is employed in the use of the UV System. For each of the following situations, do not attempt repairs yourself. Call RK2 Systems at 760-746-7400 and ask to speak to someone in technical support
DANGER	DO NOT operate this unit if it has a damaged cord or plug, if it is malfunctioning, or if it has been dropped or damaged in any manner.

3 Energy in a UV System and Potential Hazards

3.1 Remove Hazardous Energy and Hazardous Energy Sources

Before doing maintenance, service or repair:

- Identify the hazardous energy sources that must be removed in order to eliminate the risk of personal injury.

3.2 General Energy Hazard Guidelines

- Prior to shutdown, make sure no hazards will be created by the shutting down the UV system.
- Shut down the UV system.
- Remove the hazardous static and dynamic energy sources in the UV system
- Remove any stored hazardous energy from the UV system, such as water pressure, heat, or stored electrical energy.
- Remove any dynamic energy sources such as line power and pump or water head energy.
- Apply Lockout/Tagout devices as necessary to prevent the unexpected release of hazardous energy during UV system during inspection, maintenance, service or repair.
- Follow local Lockout/Tagout policies and procedures for both electrical and hydraulic systems.

DANGER

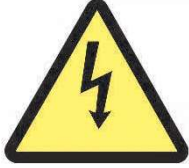
Only qualified personnel should conduct the tasks described in this manual.

Always remove power to the UV system using an isolating device, such as the PP mains fuse or breaker panel prior to servicing electrical equipment.

Always relieve static and dynamic system pressure from the UV system vessel prior to working on lamps, sleeves, or other sensors.

3.3 Hazardous Energy Sources:

3.3.1 Electrical Energy:



- Incoming main electrical power to Fuse Panel, inside the Fuse Panel, and leaving the Fuse Panel
- Main power coming into the Power Supply Enclosure(PSE) and connecting to the controls and lamp ballasts within the PSE
- High Voltage leaving the ballasts within the PSE and leaving the PSE
- Controls voltage within the PSE and leaving the PSE (below main voltage)
- High Voltage at the Lamp Plug connector and within the lamp-sleeve envelope
- Low Voltage at the sensors on the treatment vessel.
- Stored energy in ballast and PSE capacitors

DANGER

Electric shock hazard.

High voltage is present in the Power Supply Enclosure and at the lamp plug/socket connector.

Remove electrical power from the UV reactor before electrically or mechanically disconnecting a UV system lamp or other component.

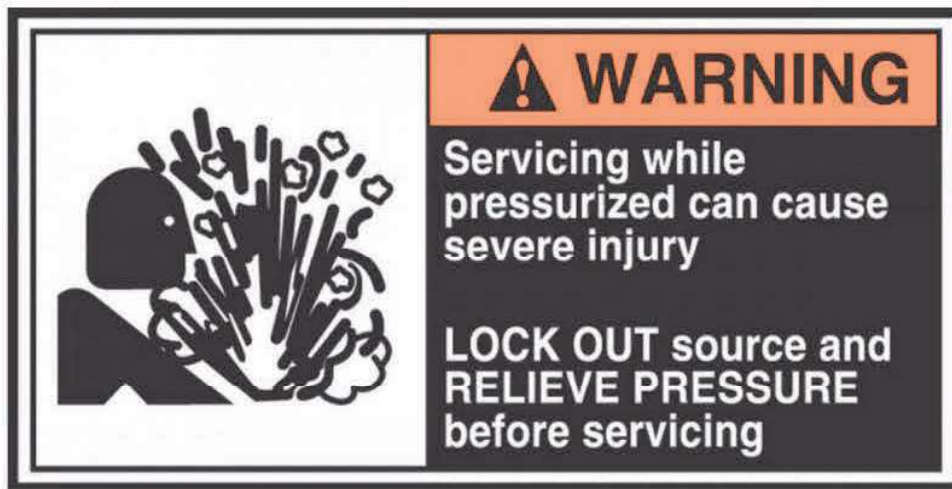
Electricity may be stored in capacitors within the Power Supply Components. Allow 3 minutes' post shutdown so as to ensure dissipation.

Apply Lockout/Tagout as necessary to prevent unexpected exposure to high voltage.

3.3.2 Hydraulic Energy:



- Systems may be pressurized either with static or flowing water. Although static water is not compressible injury could occur. Flowing pressure systems are considered stored energy systems can be very hazardous. Always isolate and depressurize systems prior to lamp, sleeve or sensor maintenance, service, or inspection.
- If a sleeve nut is removed when there is dynamic water pressure inside the UV system, the lamp sleeve will eject from the end plate with enough force to cause personal injury.
- If there is a crack in a lamp sleeve and water pressure has built up inside the sleeve, the UV lamp may eject from the UV system with enough force to cause personal injury when the lamp nut is removed. If water comes out of the Lamp Nut and plug during lamp removal, stop and remove the static and dynamic pressure sources and drain the water so as to be able to inspect the unit.



DANGER

Pressurized water may be a hazard.

Obey all site-specific safety protocols.

Always remove static AND dynamic water pressure from the UV reactor before doing any maintenance task.

Apply Lockout/Tagout as necessary to prevent unexpected exposure to high water pressure or projectiles ejecting from the end plate.

When removing a lamp nut or sleeve nut, always stand to the side of the end plate of the UV reactor until the first lamp sleeve bolt cup nut is removed to avoid the potential for personal injury. Do this even when system has been depressurized as a secondary precaution.

3.3.3 UV-C Energy:



- UV-C is always exiting the lamp when the lamp is energized. During normal operation, this energy is shielded by the vessel and vessel components.
- Never energize a UV-C lamp in air where the energy emitted can be imparted upon skin or eyes. Serious injury can occur.
- Never Energize UV systems that are not installed into piping. Looking at the lamps through the Inlet/Outlet ports can cause burns and serious eye damage.

DANGER

UV-C light exposure is a hazard.

Unprotected exposure to the ultraviolet light from a UV lamp can cause severe burns to the eyes and skin.

Always remove power to the UV lamps before doing a maintenance task related to the lamps, sleeves, sensors or where the vessel must be internally inspected or worked on.

Apply Lockout/Tagout as necessary to prevent unexpected exposure to UV light.

As secondary protection, wear a UV resistant face shield to protect your eyes and face from unexpected exposure to UV light.

Never look directly at energized UV lamps.

3.3.4 Thermal Energy:



- Lamps, ballasts and other electronics may be hot and could burn your skin if not given enough time to cool down. Ensure that components are electrically disconnected, locked out, and cool before performing maintenance.
- Use the lockout-Tagout procedure as necessary in order to prevent burns.



WARNING: POTENTIAL FOR BURNS!

UV Lamps may be very hot when energized. In addition, lamp ballasts and other components may also become very hot when energized. Ensure that once components are de-energized, a sufficient cool down period is given. If hot components must be handled, use protective gear as required.

3.4 UV System Safety features

The UV system has safety features that help to prevent personal injury:

- Ballast supplies are fully tested
- Non-Metallic polymer construction prevents shorting situations with vessel ballast

IMPORTANT

It is the Operators responsibility to fully understand this manual and what is required for the safe operation of this UV treatment System!

4 Patents and Permissions

The UV System in this manual may be protected by one or more patents in the United States of America, Canada, and/or other countries. For a list of patents owned by RK2 Systems, go to www.rk2.com.

No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means without written permission of RK2 Systems.

5 XFLO™ System Overview

The XFLO™ UV system is a pressurized UV light reactor that uses Low-Pressure (LP), or Low-Pressure-High-Output (LPHO or HO) UV lamps in an 'L' configuration, as shown in Figure 1.

The ballast is housed in a polymer container in the electrical feed line. One end of the ballast incorporates the incoming power cordset, and the other end of the ballast incorporates the lamp power cordset.

5.1 General System Features

- L' inlet and outlet configuration. Flow enters reactor in parallel with lamps, maximizing disinfection efficiency. See Figure 1
- Robust corrosion proof PVC design.
- LP (Low Pressure) or LPHO (Low Pressure High Output) lamps; lifetime rated at 80% UV-C output at 12,000 hours.
- Single ended lamp design; provides ease of maintenance and smaller footprint required for installation.
- High quality quartz sleeves protect lamp and ensure optimal lamp operating temperatures.
- Designed for ease of maintenance.
- Union Inlet and Outlet ports. 3" LP systems use a 1 ½" union and 5" LPHO systems use a 2" union.
- **Ballast enclosure designed to IP66.**

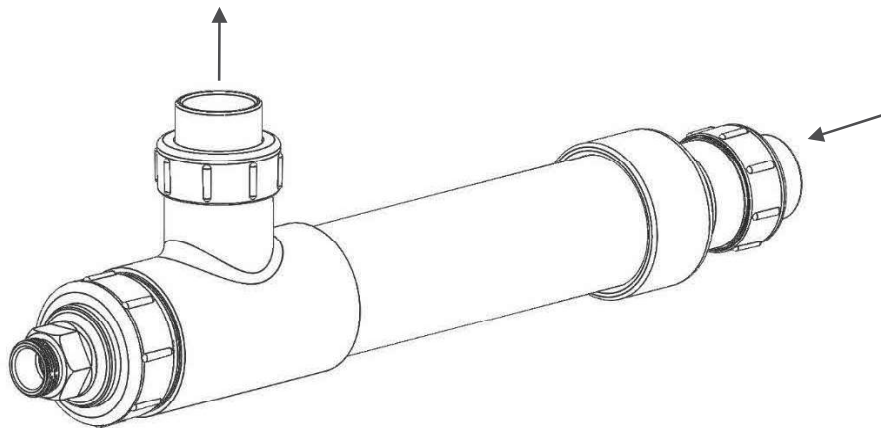


Figure 1: UV Reactor 'L' Flow Path

5.2 UV Treatment Vessel

The XFLO™ series of UV treatment systems are all designed and sized using the same methodology. Reactor size, port configuration, number of lamps, and port sizes are derived through a thorough understanding of your application. Prime considerations in designing your system are:

- Required Flow Rate
- Required UV-C Dose
- Application, Single Pass or Re-Circulation
- Water Quality, including:
 - UVT
 - Water temperature
 - Other such as TSS and Iron content
- Physical Environment, including:
 - Available space
 - Location
 - Piping

An example of a XFLO™ UV treatment system is shown in Figure 3, and consists of the following components:

1. UV treatment vessel – The UV treatment vessel houses the lamp and sleeve assembly.
2. Quartz sleeve – The quartz sleeve acts as barrier for the lamp, preventing it from coming in contact with the fluid being treated. The quartz sleeve is sized to ensure the lamp operates at optimum lamp temperature.
3. UV lamp.
4. Lamp and Sleeve Mount Assembly - The lamp and quartz sleeve assembly is coupled with the vessel chamber with this assembly.
5. Sleeve Nut and Seal - Secures the quartz sleeves in place.
6. Lamp support - The lamp/sleeve assembly is supported at the domed end of the sleeve by a component best described as a 'sleeve cup'.
7. Lamp Nut Assembly – holds the lamp in place

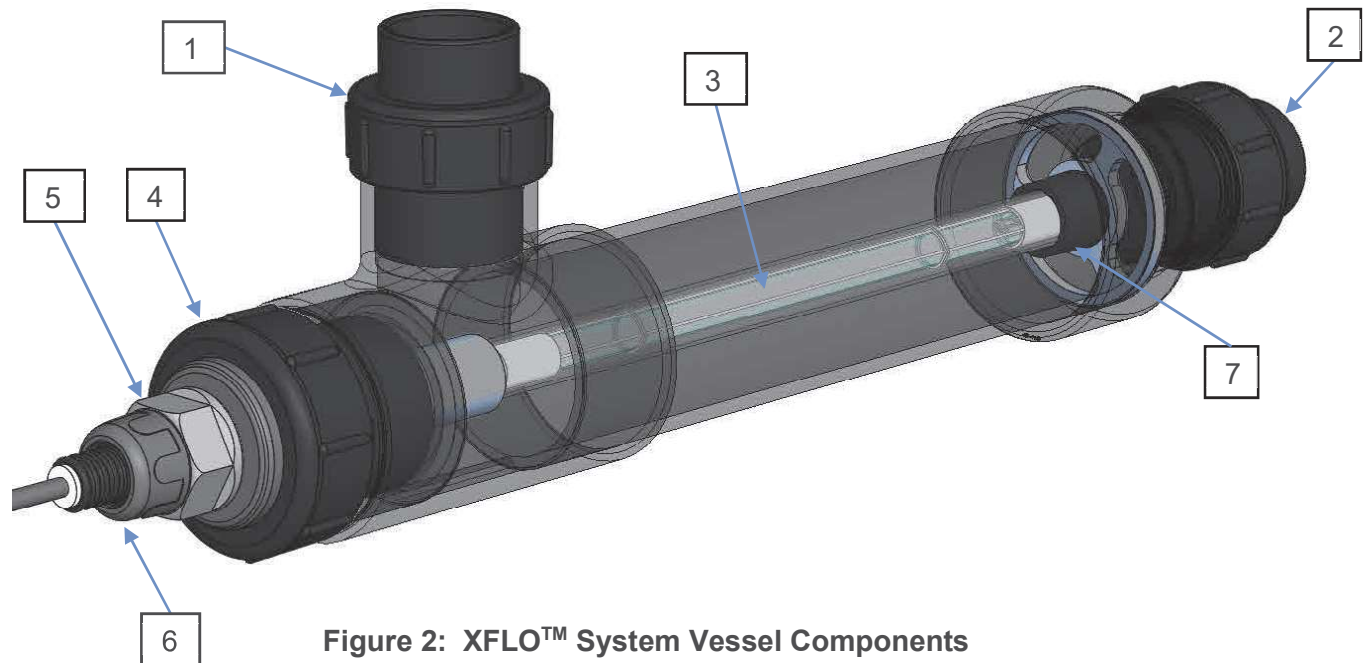


Figure 2: XFLO™ System Vessel Components

On the side of the vessel multiple ports have been provided for various sensors, see Figure 4. Ports include:

1. Outlet
2. Inlet
3. Lamp and Sleeve
4. Retainer Nut
5. Sleeve Nut
6. Lamp Nut and Cable Assembly
7. Sleeve Cup

5.3 Ballast and Cable Assembly Components

The XFLO™ Ballast Assembly contains the electrical and electronic equipment required to power your UV treatment system, Primary Components of the Power Supply Enclosure

General components include:

1. Input power cable.
 1. Cable includes standard 115V NEMA plug.
 2. If the supplied ballast is capable of operating on 220v (See Ballast Label) the 115V plug must be removed and the appropriate 220V plug added.
2. Lamp Output Cable (From Ballast to Lamp)
 1. Includes: A - Lamp Cable, B - Lamp Connector, C - Cable Crimp Sleeve and D - Crimp, E - Cable Crimp Sleeve O-ring, and the F - Lamp Nut.

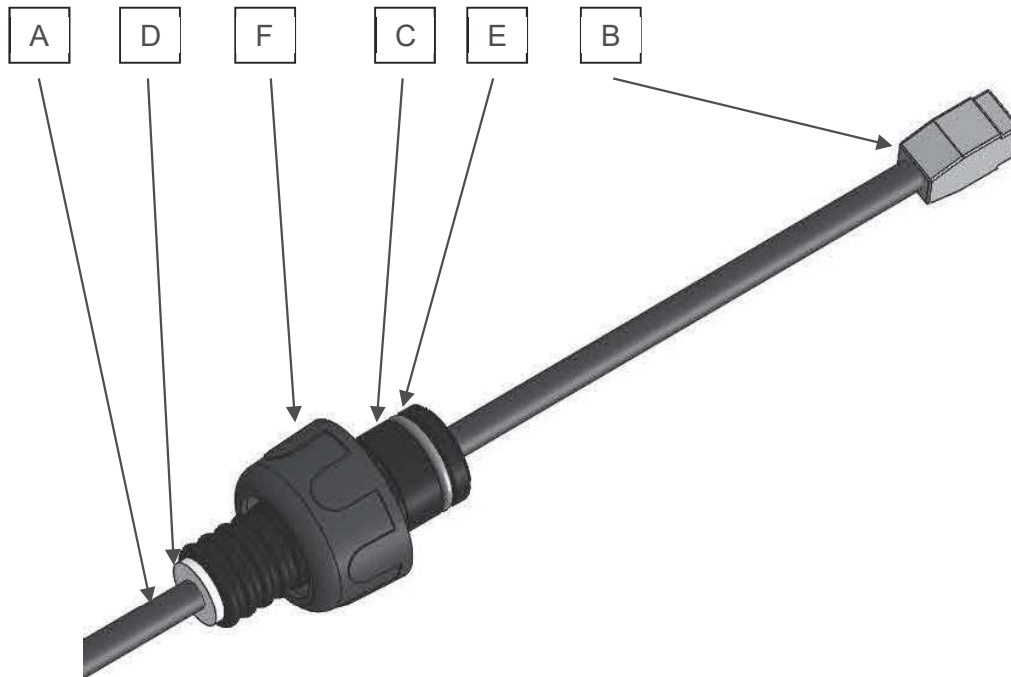


Figure 3: XFLO™ Lamp Cable Assembly

3. Encapsulated Ballast Assembly

6 UV Vessel and Ballast Installation

WARNING	Pressure may be present in piping or in vessel during commissioning.
WARNING	Quartz lamps and sleeves are fragile, and if broken may present an injury risk. Handle with care.



6.1 Parts and Required Equipment

Supplied:

- Vessel Mounting Brackets
- Power Supply

Owner Provided:

- Required Isolation Valves
- Plumbing Components
- Optional Bypass Kit
- Tools as required

6.2 UV Vessel Installation: Vessel Orientation, Air Bleeding, Ports

Air Entrapment and Orientation

The XFLO™ UV Treatment systems may be oriented in 2 ways, 1) vertical outlet, horizontal chamber and 2) vertical vessel with outlet at top.

Dependent on customer requirements, the vessels may be orientated as shown in Figure 4: Vertical Outlet, Horizontal Orientation and Figure 5: Outlet at Top, Vertical Orientation

Air Bleeding and System Location

UV systems must not be situated at the highest point of a piping run unless provision for automatic air removal is provided. If this event that automatic air removal is not provided, it is likely that overheating and possibly damage to the UV system will occur.

Care must be taken during installation and operation so as to ensure air cannot become trapped within the treatment chamber. Trapped air can cause numerous issues such as lamp and vessel overheating. If air entrapment is a concern, please contact RK2 for assistance

Note: Manual air removal may work in startup, but if the pump is stopped and drain-back occurs, air will then be trapped again. Proper use of valves and check-valves may be able to stop this from occurring.

Horizontal installation requires the vessel outlet port to face upwards or be tilted sideways to within 45 degrees from vertical. This range of orientation allows for trapped air to escape.

Trapped Air

Failure to remove trapped air can result in rupture or heat damage to the vessel. Please ensure that methods of removing trapped air are present.

Note: It is highly recommended that a method to release or remove trapped air is incorporated into the piping system.

Inlet and Outlet Port Locations

In XFLO with an 'L' flow configuration, the outlet port is always at the end of the vessel near the lamp and sleeve end plate, whether horizontal or vertical in orientation. The outlet port is perpendicular to the vessel chamber.

The inlet port is furthest away from the lamp/sleeve endplate. In an 'L' flow configuration inlet piping is in line with the reactor vessel chamber.

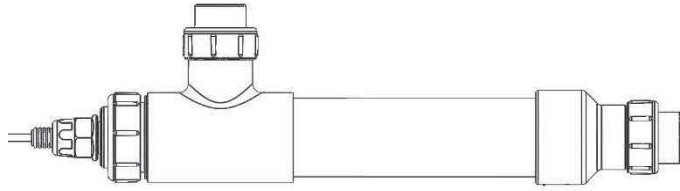


Figure 4: Vertical Outlet, Horizontal Orientation

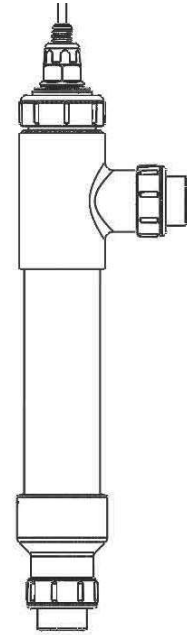


Figure 5: Outlet at Top, Vertical Orientation

IMPORTANT

It is important not to orient the UV vessel in ways that will trap air. Please contact RK2 for special installation requirements.

6.3 UV Vessel Installation: Flow Isolation, Bypass and Drain

Maintenance Isolation Valves

Isolation Valves are highly recommended for vessel removal if the process water must be left on during a system change or major maintenance. Ball valves, or other valve types that do not induce turbulence, are recommended as they do not present a turbulent flow to the UV treatment system when fully open. It is highly recommended to install the ball valves directly into the inlet/outlet ports of the vessel. If using turbulent valve types, it is recommended to place the valves 5 pipe diameters away from the I/O ports.

System Flow Bypass Loop

A system bypass loop is recommended when continued flow is required during UV system maintenance. The bypass incorporates 2 UV system isolation valves (one at the inlet and one at the outlet), and one bypass valve in the bypass piping.

During normal operation both of the isolation valves are open, and the bypass valve is closed.

During UV system Service both of the isolation valves are closes and the bypass valve is open. Open the bypass valve prior to closing the isolation valves so as to avoid deadheading the system pump(s).

Service Vessel Drain

Periodically when servicing your UV treatment system, a method of draining the vessel will be required. An example of this is when removing the sleeve for cleaning. This drain should be within the boundary of the isolation valves/bypass, i.e. in the UV chamber section of the isolation.

Note: It is highly recommended that a method to drain the UV treatment system vessel is incorporated into your piping layout.

6.4 UV Vessel Installation: Mounting, Location, Flowrates

Vessel Mounting

Vessel is to be supported by mounting brackets when possible so as to minimize stress on the I/O unions and chamber.

UV Treatment Systems must be installed downstream from mechanical filtration if present. This eliminates the possibility of debris entering the UV treatment vessel. Debris can potentially damage the quartz sleeve and UV lamp.

Install UV vessel mounting brackets if required (to be supplied by customer).

Bond unions to system piping with proper established methods.

System Footprint and Clearances for Maintenance:

For XFLO™ UV systems, both the lamp and sleeve are maintained from one end of the reactor. Clearance is needed at this end of the reactor so that lamps and sleeves can be removed during time of installation, service and inspection. See Figure 6 and Figure 7.

Hydraulic and Treatment Flow Rates

Exceeding the design maximum flow limit of the reactor can be detrimental to the systems components. If treatment or non-treatment flow rates exceeds the units specified disinfection flowrate contact RK2 in order to determine if you are within safe operational limits.

IMPORTANT	The installation of the UV system must be carried out in accordance with local regulations and codes.
NOTE	Exceeding the design maximum flow limit of the reactor can be detrimental to the systems components. If treatment or non-treatment flow rates exceeds the disinfection flowrate contact RK2 in order to determine if you are within safe operational limits

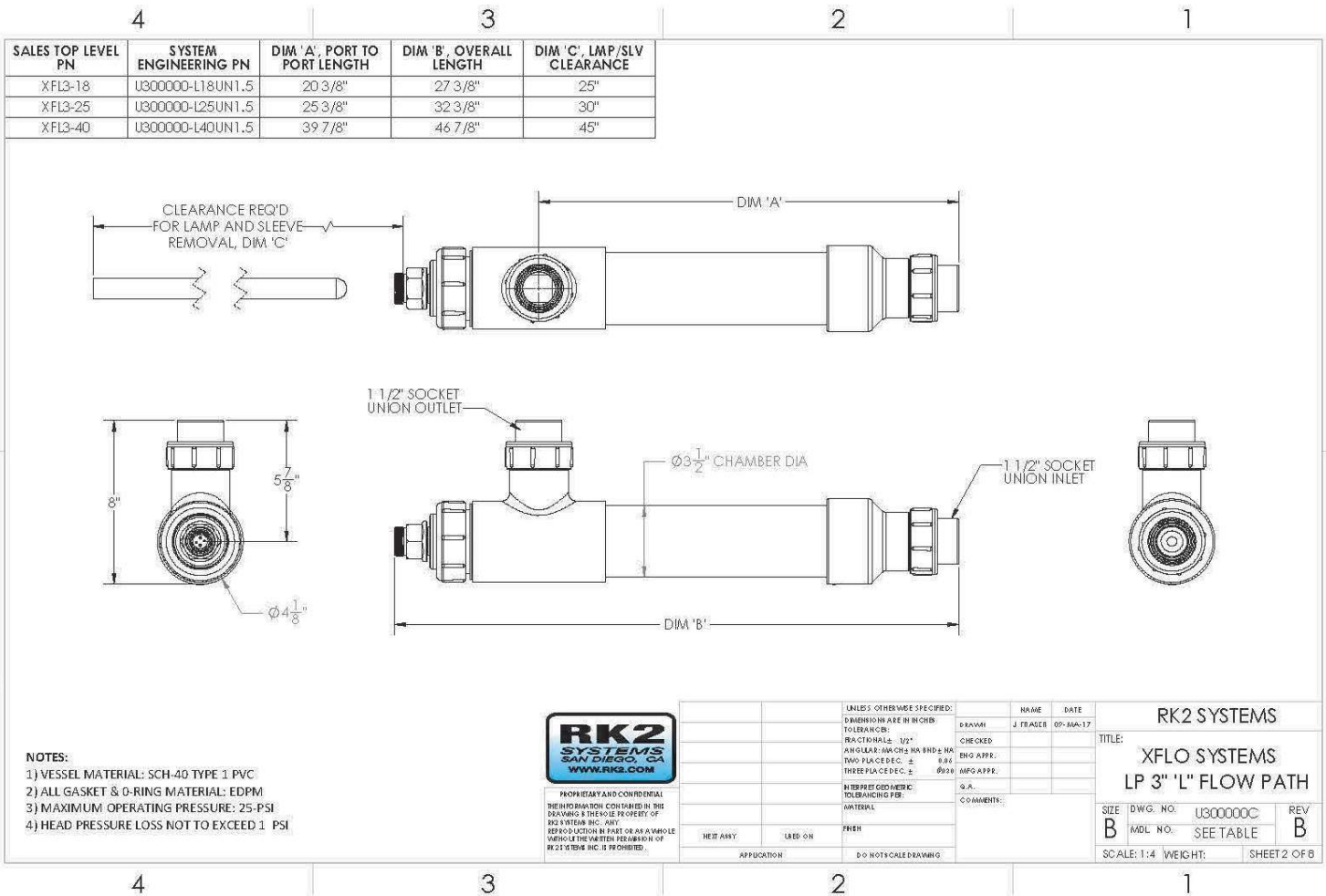


Figure 6: 3" LP Layout Drawing Showing Lamp and Sleeve Maintenance Clearance Requirements

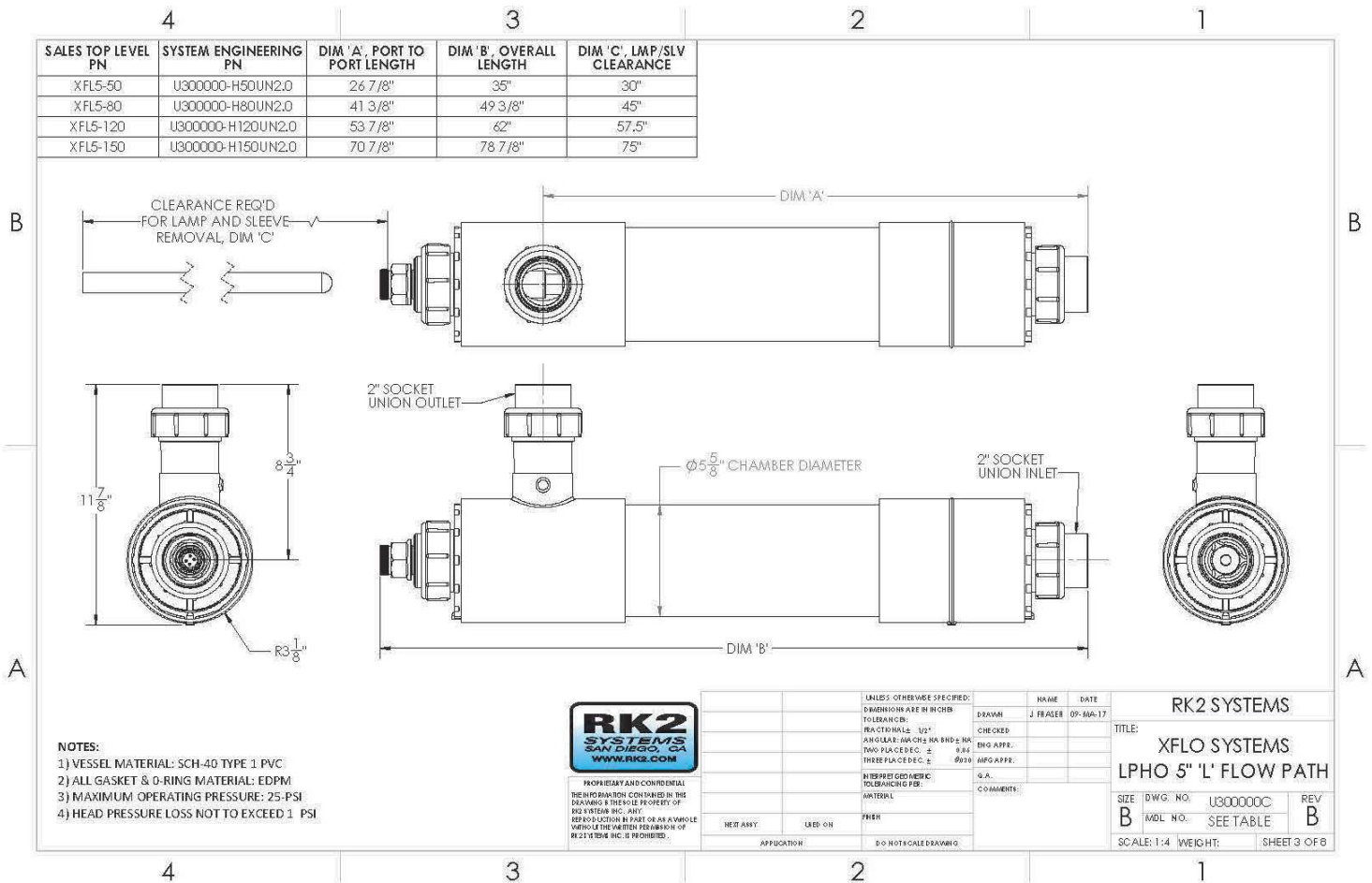


Figure 7: 5" LPHO Layout Drawing Showing Lamp and Sleeve Maintenance Clearance Requirements

6.5 Ballast Installation: Location and Mounting

System Location

Ensure that the ballast and cabling is located in an area that avoids:

- Direct rain or immersion in water
- Being stepped on or run over with carts, forklifts, etc.
- Direct heat and if possible sun loading (the cooler you keep electronics, the longer they will last.)
-

If possible mount the ballast on a panel or on a wall, this will avoid most damage scenarios

Ensure that adequate droop is available for both the input cord and the lamp cord. Continuous stress on the cord may damage connection.

Ballast Power

Various input power single phase voltages have been and are available for XFLO™ UV treatment systems. Ensure that the power you are supplying to the ballast matches the specified input power on the ballast label. See label sample located at the beginning of this manual.

Some systems incorporate a multi-volt ballast. If this is true for your ballast, ensure that the lamp plug matches the power input as per current local codes or regulations. These ballasts come standard with a 115v NEMA 3-prong plug that will need to be removed and replaced if operating at other voltages.

Note: Using the incorrect ballast input power can damage or destroy your lamp ballast and/or lamp.

Important: GFCI Protection

Note: When plugging in your ballast ensure that the outlet used is GFCI protected. If this is not done risk of shock, injury or death could occur!

Note: If the ballast is to be hardwired to a breaker panel, ensure that the panel and/or breaker is GFCI protected.

DANGER	Use GFCI ground fault protection, your or another's life may depend on it!
WARNING	Use the correct input voltage for your ballast, or damage may occur.

7 Lamp Installation: Parts and Required Equipment

Supplied:

- UV Lamp

Owner Provided:

- Adjustable Wrench
- Cotton or silicone gloves
- Isopropyl Alcohol rated gloves
- Personal Safety Equipment
- Isopropyl Alcohol

Lamp Installation Procedure

IMPORTANT	Mandatory Vessel Leak Test MUST be performed prior to installing UV Lamp! See Section 11
NOTE	Always use clean cotton or silicon gloves when handling lamps. Oils and acids from skin can contaminate the lamp bulb and may significantly shorten lamp life.

1. Holding the UV lamp with 2 hands, gently slide the lamp into the sleeve while ensuring that no side load is placed on the lamp. The electrical connection pins will be protruding from the reactor.
2. With six inches of the UV lamp protruding from the sleeve, attach the lamp cable 4-Pin Connector on to the four pins on the ceramic lamp base.

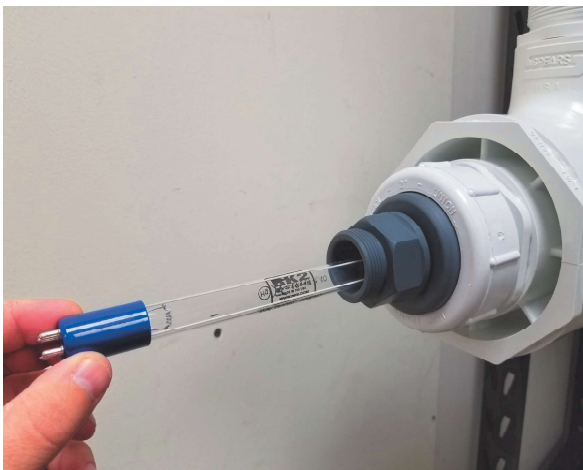


Figure 8



Figure 9

- Slide the remainder of the lamp with cable through the Sleeve Nut and into the Quartz Sleeve. With the lamp now inside the quartz sleeve, gently continue to push the lamp (with connected lamp cable) into the quartz sleeve until the cable crimp sleeve bottoms. This will position the lamp properly inside the UV treatment system ensuring maximum disinfection performance and will also prevent damage to the vessel endplate and its corresponding components. Once the cable crimp sleeve is in position, hand tighten the lamp nut over the sleeve nut



4. NOTE If the lamp comes into contact with the domed end of the sleeve prior to the cable crimp sleeve being in the correct position, STOP. If the lamp connection has moved and the lamp is within a few inches of the crimp sleeve, STOP. The lamp is too close to the lamp and sleeve nut assembly.

The lamp cable length will need to be adjusted.

- The far end of the lamp should be approximately $\frac{3}{4}$ " or an inch from the end of the lamp sleeve (dome area).
- Pry white crimp ring from end of cable crimp sleeve. Slide cable through crimp sleeve.
- Slide the lamp cable until 6.25" to 6.50" inches of cable are protruding, as per Figure 10: Lamp Inner Cable Length Check



Figure 10: LampInnerCable LengthCheck

IMPORTANT

Leaving the lamp quartz section within the guide tube and other lamp and sleeve mount components may cause damage to your UV treatment system!

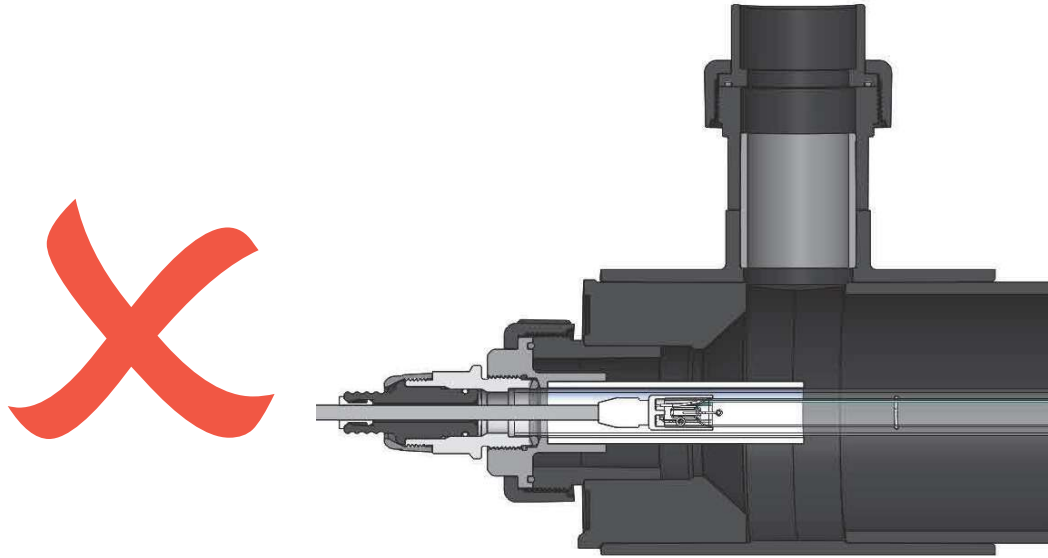


Figure 11: Improper Lamp Position

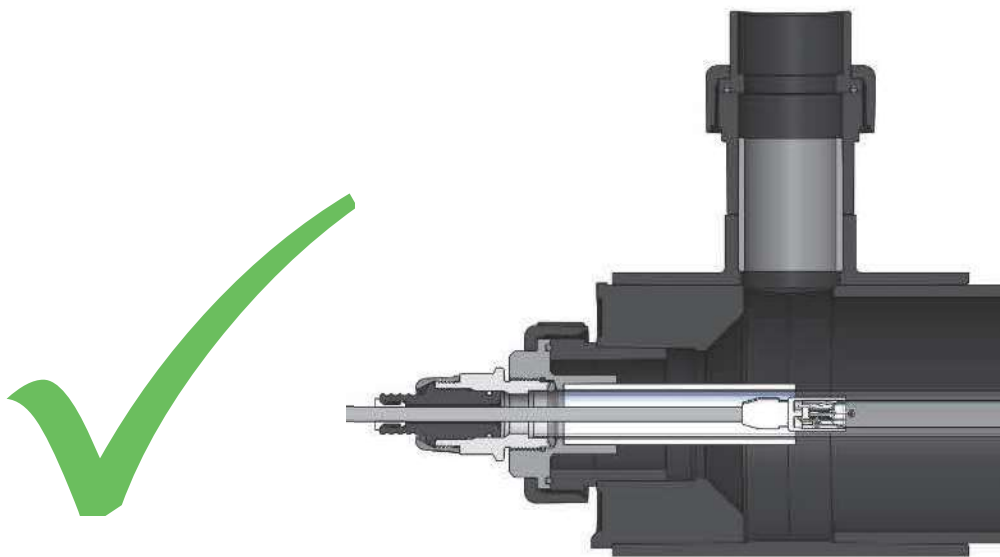
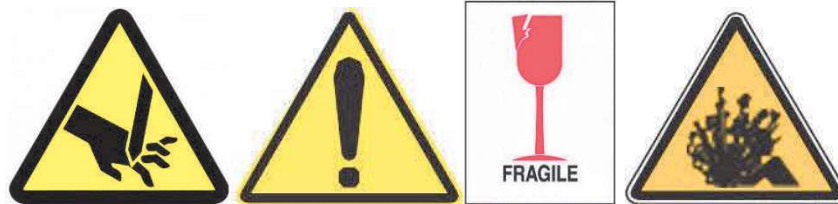


Figure 12: Proper Lamp Position

8 Lamp and Quartz Sleeve Removal Procedure

DANGER	Ensure that the UV Vessel is Depressurized and Drained prior to undertaking this work! Failure to do so could result in serious injury or even death due to ejected quartz sleeves!
DANGER	Ensure Lockout/Tagout procedure is undertaken for valving and pumps if required so as to prevent inadvertent pressurization of unit.
WARNING	Quartz lamps and sleeves are fragile, and if broken may present an injury risk. Handle with care.



Frequency

UV lamps must be replaced after 12,000 hours of continual use (manufacturer's suggested useful lamp life rating) or when a lamp does not light.

Quartz sleeves are installed and removed during system startup, during system maintenance and for cleaning purposes. Permanently fouled sleeves can also block UV-C, preventing it from getting to the water, and reduce system performance. Always replace permanently discolored, gouged, etched, cracked or broken sleeves.

For a typical application, it is recommended that the Quartz Sleeve(s) be removed, inspected and cleaned every 6 months, however the treated water at each site may be significantly different with regards to sleeve fouling potential. If your water quality is relatively poor, more frequent cleaning may be required. If your water is of very high quality, an annual cleaning cycle may be appropriate. Talk to your RK2/XFLO™ support team so as to determine the best sleeve maintenance cycle for your application.

Required:

- Adjustable Wrenches
- Rubber, Latex, Cotton or Silicone gloves
- Personal Safety Equipment

1. Turn off or isolate the UV system from its electrical source. They may require unplugging, or a via a switch panel or breaker.
2. Use a Lockout/Tagout procedure so as to ensure the UV system cannot be energized accidentally.
3. Hydraulically isolate the UV Vessel from piping so as to ensure pump pressure cannot accidentally be present in the vessel. It is recommended that a Pump and Valve lockout procedure be used. Depressurize and drain the vessel completely.
4. Loosen the lamp nut from the quartz nut, no tool should be required. Once lamp nut is removed you can then remove the cable crimp sleeve



5. Gently slide the lamp and cable until 4-8" of the lamp is removed from the reactor. Disconnect the lamp plug from the lamp by grasping the lamp end and plug firmly and pulling apart. Care must be taken not to damage the lamp, plug, and sleeve

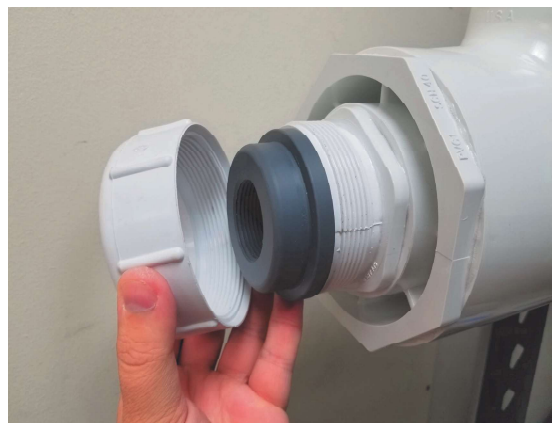


To remove quartz sleeve, undo the sleeve nut and remove completely



Once sleeve nut is removed, place thumb or finger in the open end of the quartz sleeve and pull back gently. Use both hands to remove quartz sleeve from reactor.

At this time you may also clean the reactor itself. To clean reactor you must first undo the outer retainer nut.

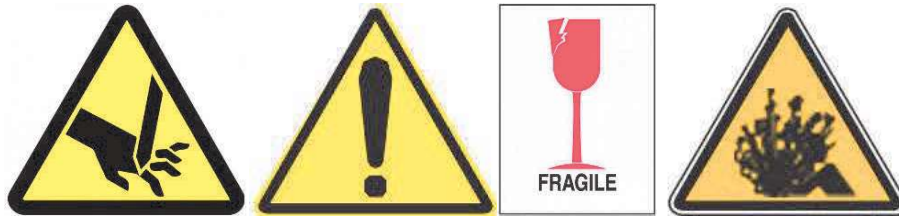


Once the outer retainer nut is removed, you can now access the quartz sleeve retaining module. Pull back on the module to remove. Please note there is a small o-ring behind the retainer module, be careful not to lose when removing module.



9 Quartz Sleeve Installation

WARNING	Pressure may be present in piping or in vessel during commissioning.
WARNING	Quartz lamps and sleeves are fragile, and if broken may present an injury risk. Handle with care.



Quartz sleeves are installed and removed during system startup, during system maintenance and for cleaning purposes. Permanently fouled sleeves can also block UV-C and reduce system performance. Always replace permanently discolored, gouged, etched, cracked or broken sleeves.

9 Quartz Sleeve Installation:Parts and Required Equipment

Supplied:

- Quartz Sleeve
- Sleeve Seal
- Sleeve Nut

Owner Provided:

- Adjustable Wrenches
- Cotton or silicone gloves
- Personal Safety Equipment

9.2 Quartz Sleeve Installation Procedure

1. Apply water (wet) or a small amount of water soluble lubricant such as Ideal Industries Clear Glide to the domed-end of the quartz sleeve **ONLY**. Lubricating will aid in inserting the domed-end of the quartz sleeve into the vessels internal quartz sleeve coupler “port”.
2. Inspect the quartz sleeves for:
 - Cracks, scratches, fractures or other physical damage. If there is physical damage to the lamp sleeves, remove all the lamp sleeves for inspection and replace as required.
 - Excessive fouling or scale build-up.
3. If required, clean the quartz sleeve(s) as described in Section 12.3 Quartz Sleeve Cleaning.
4. If required, replace a discolored, damaged, cracked, or chipped quartz sleeve.
5. **Using a new O-ring**, Carefully slide the quartz sleeve into the retaining module leaving approximately 4" of the quartz sleeve protruding. The domed end of the sleeve goes in first.

NOTE

Take care not to get any lubricant into the open end of the sleeve as this can damage the lamps.



6. Slide the o-ring over the open end of the quartz sleeve. Finish pushing quartz sleeve into reactor until it aligns with the sleeve cup at opposite end. The o-ring should then rest in the quartz sleeve retaining module (grey piece) Figure 9



Figure 9: Fitting the Sleeve seal

Vessel Leak Testing: Parts and Required Equipment

Owner Provided:

- Personal Safety Equipment
- Paper towels and other spillage cleanup tools

The vessel leakage test is *required* any time the vessel liquid boundary layer is broken, be it via commissioning, or via routine maintenance or repair.

This leakage test will help the operator to identify a potential quartz sleeve assembly seal failure. During normal UV system operation, a quartz sleeve assembly failure can result in extensive damage to the UV lamp, quartz sleeve and ballast.

IMPORTANT	Failure to perform and document a successful vessel leak test could lead to conditions that may void the product warranty.
NOTE	All XFLO™ systems are testing for leak tightness at the factory, however it is YOUR responsibility to ensure leak tightness at the time of installation, and beyond.

1. The Vessel Leak Test is to be performed with the Quartz Sleeve installed.
2. Into the Sleeve Nut slide a rolled-up piece of paper towel, approximately 4 inches into the port (Figure 25). Ensure that the rolled paper towel is tight enough and large enough to prevent slippage into the sleeve in a vertically oriented reactor. A leaking Sleeve Nut will become apparent by wetting the paper towel during the leak test.



Figure 19: Leak Test Set up

3. Confirm that all system piping connections and valves are in the correct position for testing.
4. Slowly fill with vessel with water, and bleed off any trapped air. Methods may include a manual air bleed valve(s) at points higher than the vessel that are placed in the piping.
5. Pressurize the system to maximum operating pressure and isolate from dynamic system pressure.

6. Let sit for 15 minutes. If fitted with a pressure gauge, look for significant pressure drop that may signify a leak. Note that a pressure drop may signify a leak in a system isolation valve (If equipped), not the UV vessel. Inspect all ports, and the Sleeve Nut zone, for leakage. If leakage is detected, remove process flow and pressure prior to adjusting. Repair as required.
7. If Static test is satisfactory:
 1. Open flow valves and increase flow to maximum flow rating.
 2. Run the system with process flow present for 15 minutes then inspect all sensor and other ports, and the Sleeve Nut zones, for leakage. If leakage is detected, remove process flow and pressure prior to adjusting.

IMPORTANT

Do not overtighten union connectors or the Sleeve Nut! If leakage persists after a proper tightening sequence has been used, with all components installed correctly, please contact your XFLO™ team at RK2.

11 System startup and shutdown

WARNING	Do not operate the UV system until the UV reactor is completely filled with water. Ensure ALL air is bled from the reactor. Failure to do so may cause system overheating and subsequent damage.
WARNING	To prevent lamp and vessel overheating water level and flow within the reactor must be maintained at all times when lamps are in operation.
WARNING	Ensure that at least one pressure relief path is available in a situation where UV lamps are energized and no flow is present.

11.1 Startup and Shutdown

IMPORTANT	Ensure that the UV System(s) are totally filled with water, with no air pockets, prior to system startup.
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Ensure That:

- The UV reactor is fully assembled
- There are no water leaks coming from the UV vessel.
- The air vent is operating correctly (optional)
- Drainage or water bypass procedures are obeyed until disinfection starts (if applicable)

12.2 Quartz Sleeve Cleaning

Required

- Quartz Sleeve
- Caustic and acidic rated gloves
- Cleaning Agent (dish detergent, soporific or muriatic acid)
- Acid-Proof Bucket
- Clean Cloth
- Acid-Proof Drop Cloth
- Clean Cotton or Silicon Gloves
- Freshwater
- MSDS Sheet
- Personal Protective Equipment

FIRST AID MEASURES

General Risk dues to caustic cleaning agent. Always wear your Personal Protective gear as described in the product related MSDS sheets.

In case of skin exposure to cleaning agent remove by washing with soap and water immediately.

In case of eye exposure to cleaning agent wash eyes for several minutes with water and contact a physician immediately. In case of ingestion of cleaning agent contact physician immediately.

For a typical application it is recommended that the Quartz Sleeve be removed, inspected and cleaned every 6 months, however the treated water at each site may be significantly different with regards to sleeve fouling potential. If your water quality is relatively poor, more frequent cleaning may be required. If your water is of very high quality, an annual cleaning cycle may be appropriate. Talk to your RK2/XFLO™ support team so as to determine the best sleeve maintenance cycle for your application.

Procedure

1. Inspect quartz sleeve and clean as needed with a soft, clean cloth and mild dish detergent.
2. While wearing your product appropriate Personal Protective Equipment, use muriatic or soporific acid or Lime-A-Way®¹ to dissolve/clean fouling such as calcium deposits.
3. Use cleaner on a soft clean cloth to wipe the surface down.
4. For more engrained fouling, soak the lamp sleeves in the mild acidic solution to loosen the build-up. Note: Keep the interior of the lamp sleeve clean and dry. Moisture can cause deposits to form when the lamps are turned on.
5. Rinse quartz sleeve thoroughly with clean freshwater.
6. See Section 9 for quartz sleeve installation. Use a mild acidic solution and a lint-free cloth to wipe down the outside of the lamp sleeves to remove all solid particles.
7. Rinse the outside of the sleeve thoroughly with clean water. Keep the inside of the sleeve clean and dry. Moisture can cause deposits to form when the lamps are turned on.

¹ Lime-A-Way is a registered trademark of Ecolab.

Table 5: Commissioning Checklist

Item	Description	Completed Y/N	Date of Completion
1	Ballast Assembly		
1.1	Power supplied to ballast is of proper voltage as per system ballast label		
1.2	Connection of power to ballast follow local, state, and/or federal codes and regulations		
1.3	Power to ballast is GFCI ground fault protected		
1.4	Ballast Mount Inspection Complete		
1.5	Ballast Mounted to Panel/Wall 1. Adequate Maintenance and operational clearances 2. Adequate Protection from the environment		
1.6	Power Connected, 3. Voltage Correct 4. Grounding Complete		
2	UV Vessel		
2.1	Clearance Provided for unit installation and for lamp and sleeve Maintenance		
2.2	Vessel supported so as to be able to withstand unit, piping, water weight and system vibration due to pumps		
2.3	Optional but recommended UV Vessel Isolation Valves and Maintenance Bypass Installed		

(Continued)

Table 6: Scheduled Maintenance and Inspections

System component	Maintenance requirement	Daily	1 Month	6 Months	Annually	12,000 hours	As needed
Ballast	<ul style="list-style-type: none"> - Inspect for overheating - Inspect for function (LED indicators if equipped) - Inspect for damage 	X					X
UV Vessel and Piping	Visual check for leaks	X					
All	Inspection for Damage of Vessel, Ballast and all cabling.		X				
Quartz Sleeves and Sealing O-rings	<p>Inspect lamp sleeve.</p> <ol style="list-style-type: none"> 1. Inspect sleeve for fouling, i.e. the sleeve is not clear. If sample is fouled, remove and clean. 2. Inspect sleeve nut O-rings for UV decay or other damage. Replace if suspect. 3. Remove any condensation present inside the quartz sleeve. <p>Visually inspect quartz sleeve for physical damage, i.e. cracks, grooves. Replace if damaged. Damage typically occurs near the open or domes ends but may occur in the middle portion of the sleeve if debris was introduced into the flow stream of if sever water hammer occurred.</p>			X			
Lamp Inspection	<p>Inspect the UV lamp, connectors and lamp pins</p> <ol style="list-style-type: none"> 1. Look for burning, corrosion, or signs of overheating 2. Look for frayed or discolored components or wires 3. Look for cracks or damage to the lamp bulb or end caps. 				X		
Lamp Replacement	Replace all the UV lamps when EOLL (end-of-lamp-life) occurs (12,000 hours).					X	

13 Troubleshooting Guide

Table 7: Trouble Shooting Guide

Trouble Condition	Check, Inspect	Solution
Ballast Overheating	<ol style="list-style-type: none"> 1. Ballast not located in a location that allows for heat dispersion 2. Ballast located near heat source 3. Ballast in direct Sunlight in Hot climate 4. Ambient Air Temperature over 145° F 5. Ballast has failed 	<ol style="list-style-type: none"> 1. Relocate Ballast 2. Remove heat source, or relocate ballast 3. Shade or relocate ballast 4. Cool down Ambient Air or enclose ballast and provide cooler air 5. Replace Ballast
Power Indicator Light on Ballast is OFF	<ol style="list-style-type: none"> 1. Power source 2. LED: Check if lamp is operating, i.e. warm vessel with temporary no flow (NOTE: Only do this test for a short time so as to prevent vessel overheating! Do not do this in a closed system that does not have a pressure relief valve! Allow pressure due to thermal expansion to release.) 3. Ballast failure 	<ol style="list-style-type: none"> 1. Rectify input power problem 2. If ballast functions, ignore LED error or replace ballast. 3. Replace Ballast
Water leaking from Sleeve Nut Zone or Water Present Inside of Sleeve	<ol style="list-style-type: none"> 1. Loose Sleeve Nut 2. Incorrect or damaged O-Ring 3. Cracked or Broken Quartz Sleeve 4. Lamp left out of unit (Open Lamp Port) in hot humid air with very cold process water around sleeves. Condensate formed inside of sleeve. Also rain or rinse spray got into sleeve. 	<ol style="list-style-type: none"> 1. Properly tighten Sleeve Nut 2. Replace O-ring 3. Replace Sleeve. 4. Close ports when lamp not installed <ol style="list-style-type: none"> a. Dry sleeve if condensation has accumulated in sleeve
Lamp Not Functioning	<ol style="list-style-type: none"> 1. Replace lamp with known operating one and test 	<ol style="list-style-type: none"> 1. If good lamp operates, replace failed lamp. If good lamp does not operate check power to ballast. If power to ballast is ok, replace ballast.

14 Replacement Parts

XFLO™ UV treatment systems are available in an 'L' flow configuration. There are 2 types of lamps available for these units. The lower powered lamps are of the Low Power or LP version. The LP lamps are found in the 3" diameter XFLO™ systems. The 5" HO XFLO™ systems use Low Pressure High Output or LPHO lamps which are sometimes described as 'HO' lamps. These lamps also come in various lengths. LP and LPHO lamps all use 25mm diameter quartz sleeves.

As there are various size and lamp types used in XFLO™ systems, it is important that when contacting RK2 regarding replacement parts, you have ready the units:

- Serial Number
- Model Number

These can be found on the system labels which are affixed to the Ballast and the UV Vessel.

14.1 Common Part Numbers and Recommended Spares Quantities

Table 8: 3" XFLO Units:

Replacement Part Numbers and Recommended Quantity on Hand

3" XFLO™ LP Systems			
Part Number and Description	Unit Model: Sales PN, Engineering PN	Unit Model: Sales PN, Engineering PN	Unit Model: Sales PN, Engineering PN
	U300000- LP18WUN1.5	U300000- LP25WUN1.5	U300000- LP40WUN1.5
U240000-L18W281A LAMP, 18W LP 281MM ARC	1	-	-
U240000-L25W387A LAMP, 25W LP 387MM ARC	-	1	-
U240000-L40W767A LAMP, 40W LP 767MM ARC	-	-	1
U200000-25MM521D DQTZ SLV, 25MM, 521MM,20.50"	1	-	-
U200000-25MM648D DQTZ SLV, 25MM, 648MM,25.50"	-	1	-
U200000-25MM1016D DQTZ SLV, 25MM,1016MM,40.00"	-	-	1
U003003-318-50D O-RING, EPDM, -318, 50D	1	1	1
U003003-232-70D O-RING, EPDM, -232, 70D	1	1	1
U150004C BLST ASSY, 425 POD 18 25 40	-120 OR -240	-120 OR -240	-120 OR -240

17 Product Registration

Please complete the Product Registration Card on the next page and Mail, Fax or email to RK2 Systems at the address below:

RK2 Systems
225 S. Bent Ave
San Marcos, Ca
92078

760.746.7400
www.RK2.com
Email: sales@RK2.com
FAX: 760-746-7460



PRODUCT REGISTRATION

Purchaser/Owner Information

Company Name: _____

Phone: _____

Street Address: _____

City: _____ State: _____ Zip: _____

Prime Contact for UV System: _____

Email Address: _____ FAX No : _____

Equipment

Model # _____

Serial # _____

Purchase Date: _____

Site Arrival Date: _____

Commissioning Date: _____

Return Completed Registration to:

RK2 Systems
225 S. Bent Ave
San Marcos, Ca 92078
760.746.7400
www.RK2.com
Email: sales@RK2.com

Owner/Operator Feedback

We take your comments about our products very seriously. Please take a few moments to answer these questions and return this form with your product registration.

1. Thoughts on our product?

2. Was Packaging and Shipping Satisfactory? Yes No Other

3. Did you receive all of the parts and instructions with the unit? Yes No Description

4. Does this Product Manual satisfy your needs? Yes No Description

5. Are you satisfied with the product quality? Yes No Description

6. Are you satisfied with the product's performance? Yes No Description

7. Are you satisfied with the ease of Installation and Maintenance? Yes No Description

8. Would you recommend our products to someone else? Yes No Description

10. Where did you purchase the unit?

11. What is the Application?

12. Other Concerns or Comments
