



OWNERS MANUAL

Operation & Installation Instructions

LK5-A12, LK5-A22, LK5-A42, LK5-A62, LK6-A12, LK6-A22, LK6-A42, LK6-A62

LK5-A12-50, LK5-A22-50, LK5-A42-50, LK5-A62-50, LK6-A12-50, LK6-A22-50, LK6-A42-50, LK6-A62-50

LK5-A12-HW, LK5-A22-HW, LK5-A42-HW, LK5-A62-HW, LK6-A12-HW, LK6-A22-HW, LK6-A42-HW, LK6-A62-HW

LK5-A12-TOC, LK5-A22-TOC, LK5-A42-TOC, LK5-A62-TOC, LK6-A12-TOC, LK6-A22-TOC, LK6-A42-TOC, LK6-A62-TOC

illuminating technologies for life

Congratulations on purchasing this ultraviolet disinfection system. By purchasing a LUMINOR UV Disinfection system you are receiving not only a high quality product but also peace of mind. Protecting your water supply with a UV system gives you reassurance that your family will have access to safe drinking water throughout your entire home with no chance of microbiological contamination. This is chemical free process which is simple in its concept and effective in its abilities to inactivate microorganisms present in the water supply. Simple maintenance, continuous disinfection and ultimately safe water, LUMINOR makes it that easy.

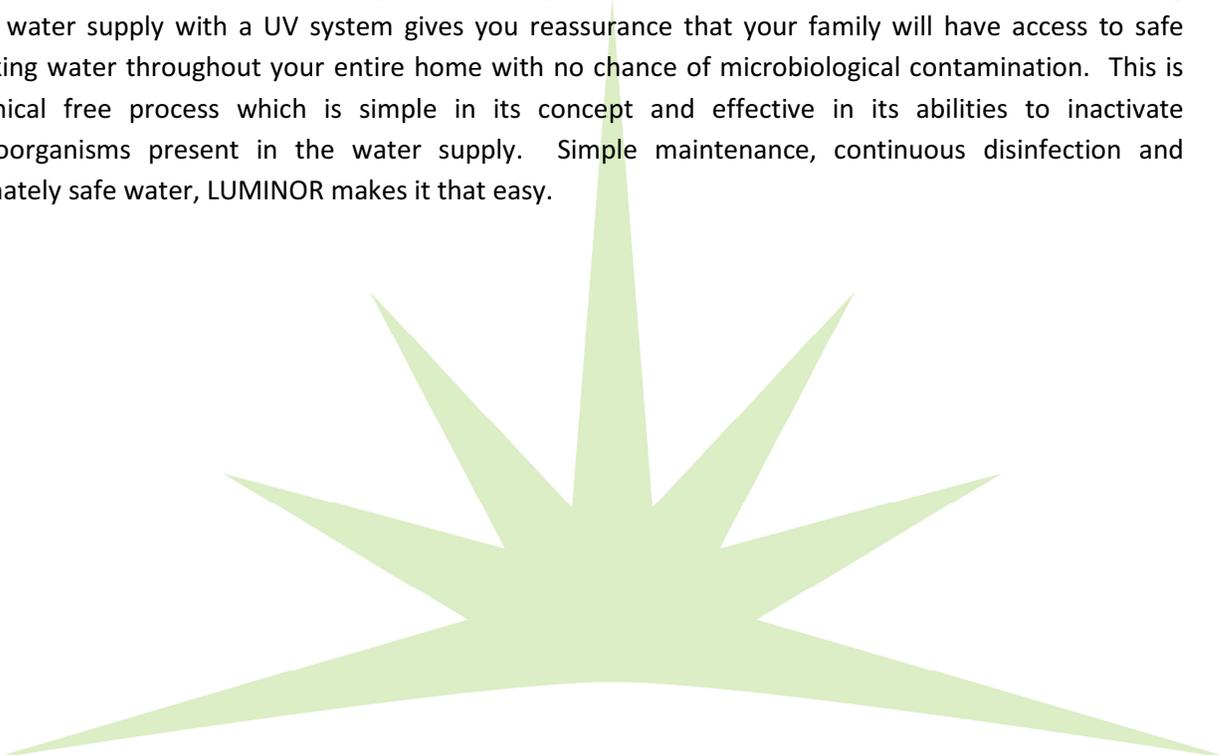


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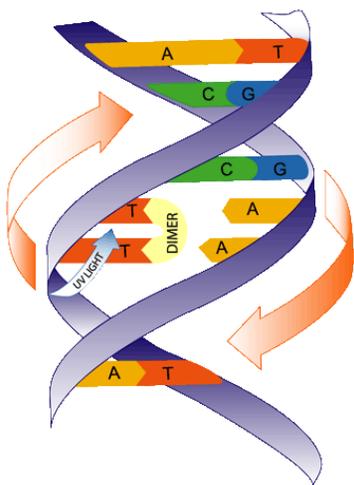
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Section 1 General Information

1.1 UV Disinfection Overview

1.1.1 Disinfection Process

UV disinfection is an extremely rapid physical process, which alters the DNA of the microorganism rendering it incapable of replication. In more detail, DNA is constructed of 4 basic building blocks:



Cytosine (represented by the letter “C” in diagram at left)

Adenine (represented by the letter “A” in diagram at left)

Thymine (represented by the letter “T” in diagram at left)

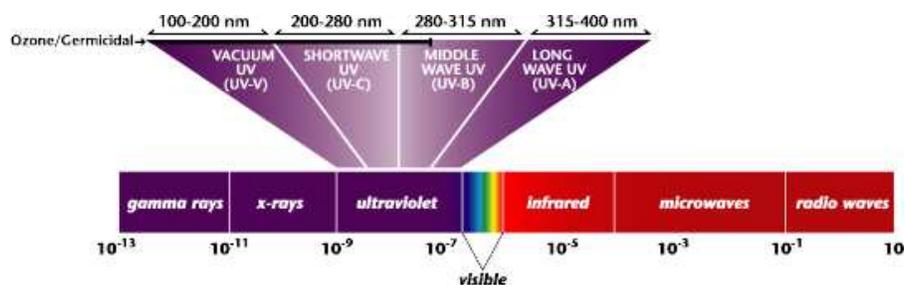
Guanine (represented by the letter “G” in diagram at left)

When germicidal UV (UV-C) light is absorbed by the DNA molecule, T-A bonds are broken and a “thymine dimer” is formed as shown, which makes it impossible for the microorganism to replicate, and consequently its ability to infect.

Due to individual cell make-up, different microorganisms require different levels of UV energy for their destruction.

Once microorganisms are exposed to UV-C light they are rendered ‘inactive’ and can no longer replicate – meaning they can no longer produce colonies.

1.1.2 Germicidal UV Light Defined



Germicidal UV light at approximately 254 nm falls within the UV-C range and is not visible to the naked eye. Exposing skin &/or eyes to UV-C light can cause damage; it will directly burn living tissue.

1.1.3 WARNING: UV LIGHT

**NEVER ALLOW SKIN OR EYES TO BE EXPOSED TO LIGHT
COMING FROM A GERMICIDAL UV LAMP AS TISSUE DAMAGE
WILL RESULT**

1.1.4 Concept of UV Dose

The amount of UV energy delivered to a microorganism as it passes through a UV reactor is commonly referred to as UV dose.

In a very simplistic model, UV Dose is the product of UV Intensity x Exposure Time

$$\begin{aligned}\text{DOSE} &= (\text{INTENSITY}) \times (\text{TIME}) \\ &= \text{millijoules} / (\text{sec})(\text{cm}^2) \times \text{time} \\ &= \text{mJ}/\text{cm}^2 \qquad \qquad (\text{Note: } 10 \text{ J}/\text{m}^2 = 1,000 \text{ microWsec}/\text{cm}^2 = 1 \text{ mJ}/\text{cm}^2)\end{aligned}$$

The degree of disinfection is dependent upon the UV dose received by the microorganisms in the water, as well as the microorganism type's UV sensitivity.

1.1.5 Key Water Quality Parameters Affecting UV Disinfection

Since the degree of disinfection is dependent in part upon the UV dose received by the microorganisms in the water, it makes sense that any obstacles between the microorganism and the UV light source will impede the disinfection process. In order for the germicidal UV light to reach its DNA target, it must pass through several barriers, the three most significant being:

- Quartz sleeve; the sleeve protects the UV lamp from the water. If the outer surface of the sleeve becomes fouled with deposits, the UV light will not reach the water. Water "hardness" is one parameter that can greatly affect sleeve fouling. Note that in some cases a fouled quartz sleeve may look perfectly clear to the eye: this happens as some fouling deposits don't affect visible light, but will severely absorb UV-C light.
- Second, germicidal UV light can be absorbed by compounds in the water, reducing the amount of effective UV energy available to inactivate microorganisms. The key measure is the water's UV Transmittance (UVT), usually expressed as the percentage of 254 nm UV light that passes through a 1 cm water path. Iron and tannin compounds are often found to be problematic in reducing water's UVT. Keep in mind that a water sample can look perfectly clear to the naked eye, but still have a very low UVT at 254 nm: a proper instrument is required to assess UVT at 254 nm.

- Third, turbidity has an effect on scattering of UV light, absorption and light penetration within the water.

For the above reasons, LUMINOR recommends the following minimum water quality guidelines be met for water flowing through the UV reactor.

- Iron: < 0.3 ppm (0.3 mg/L)
- Manganese: < 0.05 ppm (0.05 mg/L)
- Turbidity: < 1 NTU
- Hardness: < 7 gpg (120 mg/L)
- Tannins: < 0.1 ppm (0.1 mg/L)

Should the water quality be of a concern, please contact the factory or authorized representative. UVT and some chemical analysis should always be done prior to specifying a UV disinfection system.

1.2 K2 System Overview

1.2.1 Model Number

System Model Numbers:

NON-MONITORED LK5-A12, LK5-A22, LK5-A42, LK5-A62, LK5-A12-HW, LK5-A22-HW, LK5-A42-HW, LK5-A62-HW, LK5-A12-TOC, LK5-A22-TOC, LK5-A42-TOC, LK5-A62-TOC

MONITORED LK6-A12, LK6-A22, LK6-A42, LK6-A62, LK6-A12-HW, LK6-A22-HW, LK6-A42-HW, LK6-A62-HW, LK6-A12-TOC, LK6-A22-TOC, LK6-A42-TOC, LK6-A62-TOC

1.2.2 Equipment List

Each K2 system is shipped with the following equipment:

QUANTITY	DESCRIPTION	LUMINOR PART #
1	UV SENSOR ASSY (if applicable)	RS-KUV RS-KUV-50 RS-KUV-TOC
1	CHAMBER ASSY	LK-A12 – 300023 LK-A22 – 300024 LK-A42 – 300025 LK-A62 - 30026
Dependent on Model	LAMP ASSY, (lamp shipped external from reactor)	RL-1000A RL-1000A-HW RL-1000A-TOC
Dependent on Model	QUARTZ SLEEVE (sleeves installed per chamber at factory)	RQ-K2
1	LAMP HARNESS,	210020

1.2.3 Operating Environment Limits

For proper operation and best system reliability, the following maximum and minimum limits should not be exceeded:

- All control panels are designed for indoor operation.
- Panel cooling fan and exhaust filters need to be kept clean.
- Maximum ambient air temperature: 40 deg C
- Minimum ambient air temperature: 5 deg C
- Maximum relative humidity, electrical panels: 95% non-condensing
- Reactor maximum inlet water temperature: 40 deg C
- Reactor minimum inlet water temperature: 2 deg C

1.2.4 General Specifications

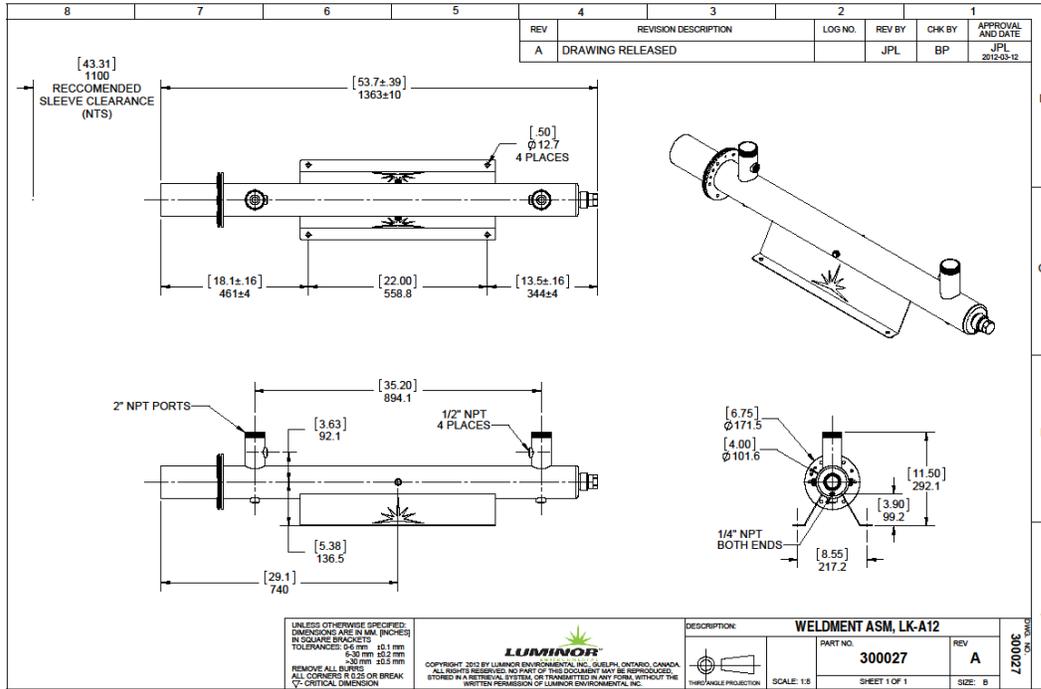
LUMINOR EQUIPMENT SPECIFICATIONS				
K2 ^{5.0} , Commercial/Industrial/Municipal UV systems, non-monitored				
MODEL	LK5-A12 LK5-A12-HW LK5-A12-TOC	LK5-A22 LK5-A22-HW LK5-A22-TOC	LK5-A42 LK5-A42-HW LK5-A42-TOC	LK5-A62 LK5-A62-HW LK5-A62-TOC
Normal Flow Rate 30 mJ/cm ² @ 95% UVT	85 GPM (322 lpm) (19.3 m ³ /hr.)	175 GPM (662 lpm) (39.7 m ³ /hr.)	400 GPM (1500 lpm) (91 m ³ /hr.)	625 GPM (2400 lpm) (142 m ³ /hr.)
Hot Water Flow Rate 30 mJ/cm ² @ 75% UVT	60 GPM (227 lpm) (13.6 m ³ /hr.)	95 GPM (360 lpm) (21.6 m ³ /hr.)	180 GPM (681 lpm) (40.9 m ³ /hr.)	282 GPM (1067 lpm) (64.1 m ³ /hr.)
LOW UVT Flow Rate 30 mJ/cm ² @ 50% UVT	35 GPM (133 lpm) (8 m ³ /hr.)	51 GPM (193 lpm) (11.6 m ³ /hr.)	88 GPM (333 lpm) (20 m ³ /hr.)	140 GPM (530 lpm) (31.8 m ³ /hr.)
TOC Flow Rate 150 mJ/cm ² @ 95% UVT	17 GPM (64 lpm) (3.9 m ³ /hr.)	35 GPM (132 lpm) (8 m ³ /hr.)	80 GPM (303 lpm) (18.2 m ³ /hr.)	125 GPM (473 lpm) (28.4 m ³ /hr.)
Alternate flow @ 16 mJ/cm ² at 95% UVT (US Public Health)	167 GPM ¹ 632 lpm ¹ 37.9 m ³ /hr. ¹	327 GPM 1240 lpm 74.3 m ³ /hr.	758 GPM ² 2870 lpm ² 87.7 m ³ /hr. ²	1170 GPM ³ 4429 lpm ³ 265.8 m ³ /hr. ³
Alternate flow @ 40 mJ/cm ² at 95% UVT (NSF/EPA)	67 GPM 252 lpm 15.1 m ³ /hr.	131 GPM 496 lpm 29.8 m ³ /hr.	148 GPM 560 lpm 33.6 m ³ /hr.	467 GPM 1768 lpm 106.1 m ³ /hr.
Port Size	2"	3" Flange	4" Flange	6" Flange
Electrical	230V./50-60Hz. (hard wired)			
Lamp Watts	207	414	828	1242
Power (watts)	240	460	900	1340
Replacement Lamp (disinfection @ 254 nm)	RL-1000A (1 required)	RL-1000A (2 required)	RL-1000A (4 required)	RL-1000A (6 required)
Replacement Lamp (HOT WATER @ 254 nm)	RL-1000A-HW (1 required)	RL-1000A-HW (2 required)	RL-1000A-HW (4 required)	RL-1000A-HW (6 required)
Replacement Lamp (TOC @ 185 nm)	RL-1000A-TOC (1 required)	RL-1000A-TOC (2 required)	RL-1000A-TOC (4 required)	RL-1000A-TOC (6 required)
Replacement Sleeve	RQ-K2 (1 required)	RQ-K2 (2 required)	RQ-K2 (4 required)	RQ-K2 (6 required)
Chamber Material	316L Stainless Steel, A249 Pressure Rated Tubing, Polished & Passivated			
Maximum Operating Pressure	10.3 bar (150 psi)			
Optimum Water Temperature	2-60° C (36-148° F)			
254nm UV Intensity Monitor	Optional / Upgrade			
UV Monitor Port (upgradeability)	Yes			
Dose Calculations	Optional / Upgrade			
Flow Monitoring	Optional / Upgrade			
Internal Fault History	Yes			
Remote-On	Yes			
Dry Contacts (solenoid ready)	Yes			
4-20 mA Output	Yes			
Lamp Cable Length	standard @ 3.05 m (10'), optional maximum length @ 9.14 m (30'), extra charges apply			
Drain Ports	Yes, 3/8"		Yes, 1/2"	
Lamp Age Counter	Yes			
Visual Lamp-Out Indicator	Yes			
Audible Lamp-Out Alarm	Yes			
Sample Ports	No		Yes	
Shipping Weight	contact factory			
Note:	1. based on flow velocity of 8.2 ft/sec (2.5 m/sec.), flow rate limited to 85.8 gpm (325 lpm) (19.5 m ³ /hr.) for 2" port 2. based on flow velocity of 8.2 ft/sec (2.5 m/sec.), flow rate limited to 325.4 gpm (1232 lpm) (73.9 m ³ /hr.) for 4" flange 3. based on flow velocity of 8.2 ft/sec (2.5 m/sec.), flow rate limited to 738.4 gpm (2795 lpm) (167.7 m ³ /hr.) for 6" flange			

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Port Size	2"	3" Flange	4" Flange	6" Flange
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Replacement Lamp (TOC @ 185 nm)	RL-1000A-TOC (1 required)	RL-1000A-TOC (2 required)	RL-1000A-TOC (4 required)	RL-1000A-TOC (6 required)
Replacement Sleeve	RQ-K2 (1 required)	RQ-K2 (2 required)	RQ-K2 (4 required)	RQ-K2 (6 required)
Chamber Material	316L Stainless Steel, A249 Pressure Rated Tubing, Polished & Passivated			
Maximum Operating Pressure	10.3 bar (150 psi)			
Optimum Water Temperature	2-60° C (36-148° F)			
254nm UV Intensity Monitor	Yes			
UVT Monitoring	Optional / Upgrade			
Dose Calculations	Optional / Upgrade			
Flow Monitoring	Optional / Upgrade			
Internal Fault History	Yes			
Remote-On	Yes			
Dry Contacts (solenoid ready)	Yes			
4-20 mA Output	Yes			
Lamp/Sensor Cable Length	standard @ 3.05 m (10'), optional maximum length @ 9.14 m (30'), extra charges apply			
Drain Ports	Yes, 3/8"		Yes, 1/2"	
Lamp Age Counter	Yes			
Visual Lamp-Out Indicator	Yes			
Audible Lamp-Out Alarm	Yes			
Sample Ports	No		Yes	
Shipping Weight	contact factory			
Note: 1. based on flow velocity of 8.2 ft/sec (2.5 m/sec.), flow rate limited to 85.8 gpm (325 lpm) (19.5 m ³ /hr.) for 2" port 2. based on flow velocity of 8.2 ft/sec (2.5 m/sec.), flow rate limited to 325.4 gpm (1232 lpm) (73.9 m ³ /hr.) for 4" flange 3. based on flow velocity of 8.2 ft/sec (2.5 m/sec.), flow rate limited to 738.4 gpm (2795 lpm) (167.7 m ³ /hr.) for 6" flange				

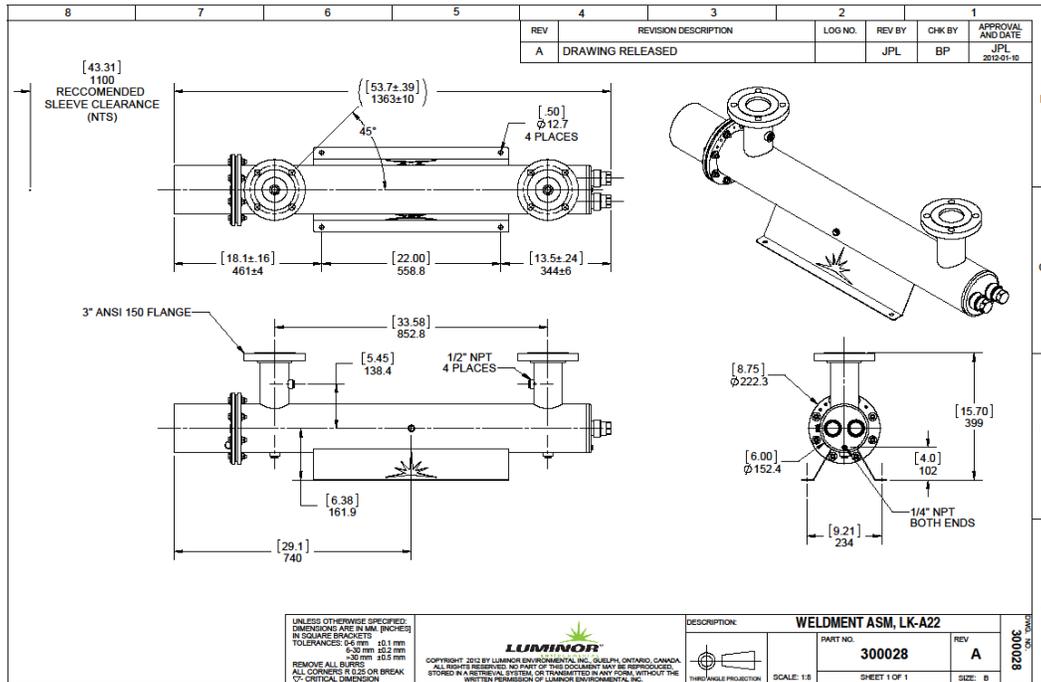
1.3 Installation Guidelines

1.3.1 Reactor Dimensions and Clearances

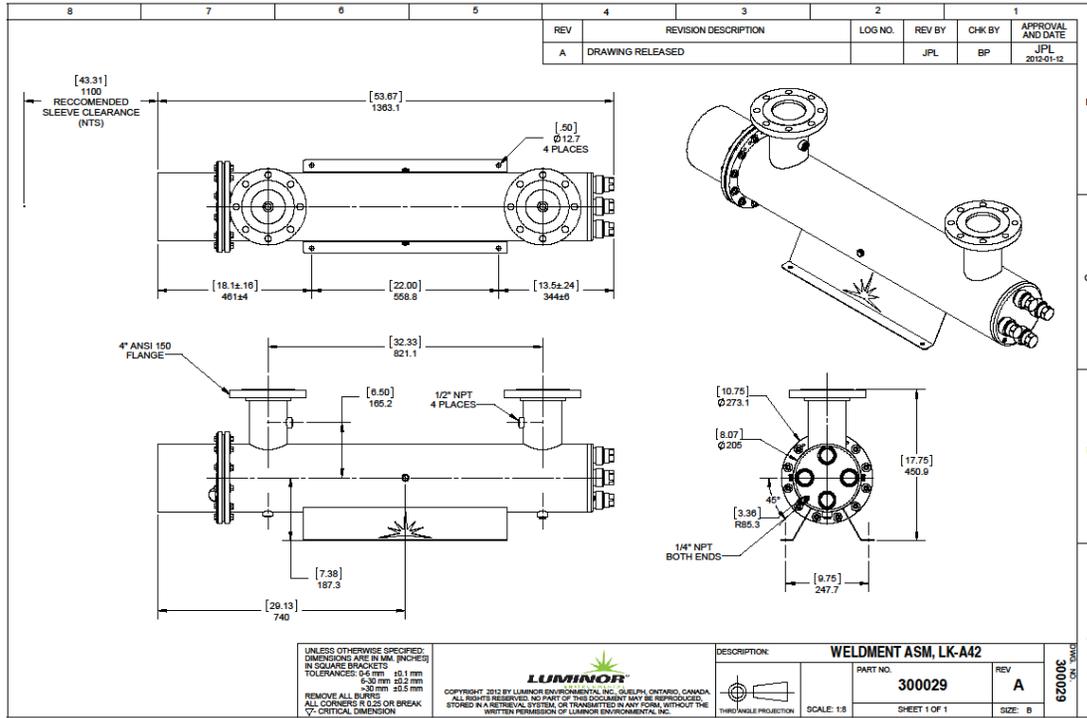
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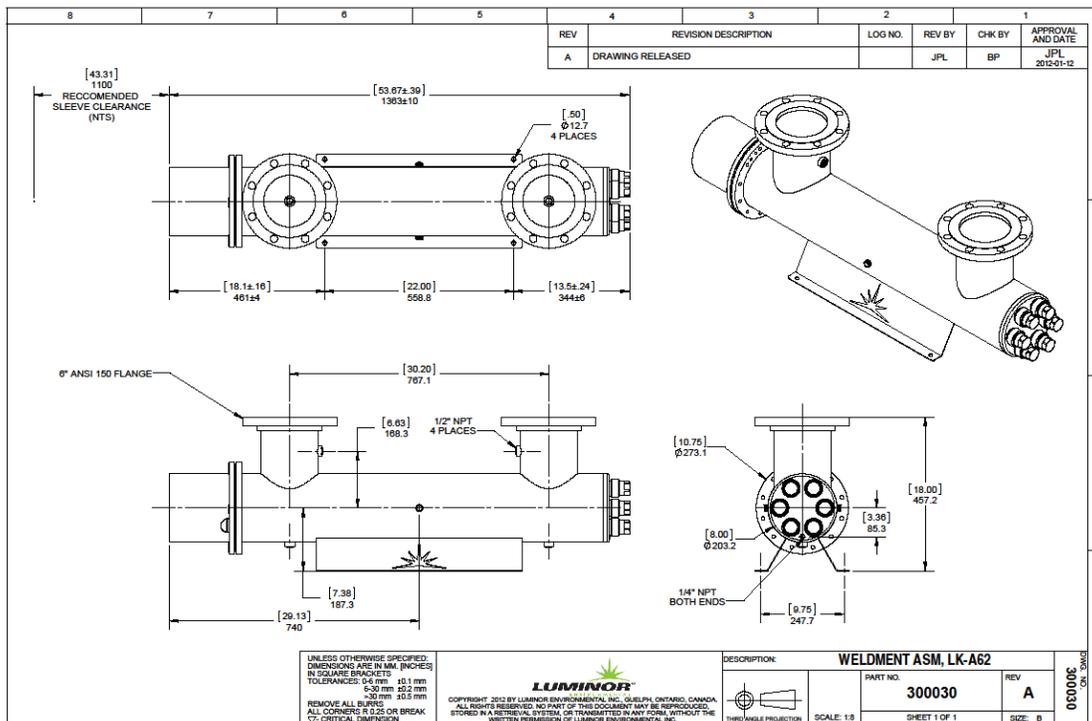
Model: LK5-A22 / LK6-A22



Model: LK5-A42 / LK6-A42



Model: LK5-A62 / LK6-A62



1.3.2 Reactor Installation, Piping, Leak-Test

Although the reactor of your K2 system was pressure tested with sleeves installed before leaving the factory, shipping damage is a remote possibility; therefore it is recommended to do a visual check before connecting piping, looking at each quartz sleeve installed in the reactor and inspecting for signs of broken quartz glass. It is much easier to do this check and clean any broken glass before the connection of pipes.

If the piping layout permits, it is recommended to raise the reactor approximately 600mm (2 ft) above the floor level to make lamp changes and any other reactor maintenance tasks more “user-friendly” and eliminating the need to get down onto the floor level.

Note the required clearance at connector end of the reactor, as shown on the reactor drawing. Although the lamps can be changed entirely from the connector end of the reactor, it is also required to have some access at the other end of the reactor to remove sleeve nuts.

The piping system should be designed with an air purge at its highest point, and the water flow should be as free as possible of entrained air bubbles: UV reactors will not deliver their full design UV dose if they are partially filled with air.

Generally, the reactors may be oriented with either end at the water inlet.

It is recommended to complete the reactor installation and connect related piping before installing lamps and electrical panels. This allows the piping to be leak-tested without risk of soaking electrical equipment, lamps, etc. Please see the next section for warnings on initial filling of the reactor.

Before filling the reactor with water, the UV sensor should be installed. Also, any reactor drain should be connected before filling.

1.3.3 WARNING: INITIAL WATER FLOW

Suddenly filling an empty reactor could potentially break the protective quartz sleeves.

Therefore, during commissioning or any time after the reactor is drained, it is strongly recommended to gradually fill empty reactors.

Also, it is recommended to test the reactor with maximum water flow-rate conditions before installing the UV lamps.

Damage as a result of sudden filling is not covered by warranty.

1.3.4 WARNING: WATER-HAMMER

Quartz sleeves can break inside the reactor if water-hammer occurs. Water hammer is caused by sudden closing of valves elsewhere in the piping system.

Therefore, it is strongly recommended to ensure that the piping and valve system is designed to prevent water-hammer.

Damage as a result of water-hammer is not covered by warranty.

1.3.5 Electrical Panel Installation

The general equipment layout should have been predetermined before delivery of the UV disinfection equipment, taking into account the location of electrical panels, orientation of reactors, and the required clearances and lengths of interconnecting cable runs. If different lengths of factory supplied cables are required, they will have to be ordered at additional charge.

The electrical panels are designed to be wall mounted by bolts of at least 5/16" diameter.

It is the responsibility of the purchaser to ensure that local electrical codes be satisfied during installation.

1.3.6 Reactor Cable Bundle and Ground Connection

The reactor cable bundle is pre-wired at the factory to the control panel and includes the reactor lamp cables with ceramic plugs and reactor ground conductor with ring terminal. At the “reactor end” of this cable bundle is a “cable loom” that guides and protects the individual cable as they enter the reactor end-housing.

Once the cable-loom is secured, it is imperative that the green/yellow ground conductor be fixed via the ring terminal to the end-plate using **the #10-32** screw provided.

1.3.7 UV Sensor Cable Connection

The sensor cable is connected to the six pin connector on the bottom of the control panel. Insert the connector and twist the locking ring clockwise to secure the connection.

Please do not force this connector as damage to the pins may result.

1.4 Warranty

LIMITED WARRANTY STATEMENT

Products manufactured by LUMINOR Environmental Inc., (LUMINOR) are warranted to the original user only to be free of defects in material and workmanship for a period as specified below. This warranty only applies to the original purchaser and is not transferable.

UV SYSTEMS

Ten (10) year Limited Warranty on the stainless steel reactors, from the date of original purchase, or installation (proper documentation required for verification).

ELECTRONICS

Three (3) year Limited Warranty on the ballasts and controllers, from the date of original purchase, or installation (proper documentation required for verification).

UV LAMPS, UV SENSORS & QUARTZ SLEEVES

One (1) year Limited Warranty on all LUMINOR ultraviolet lamps, UV sensors and quartz sleeves from the date of original purchase, or installation (proper documentation required for verification).

LUMINOR warrants that it will repair, replace or refund, at LUMINOR's sole option, any ultraviolet system or component that is defective in materials or workmanship for the period as outlined above, subject to the "Limitations of Warranty" as outlined below. LUMINOR's liability under this warranty shall be limited to repairing or replacing at LUMINOR's option, without charge, F.O.B. LUMINOR's factory or authorized service depot, any product of that LUMINOR manufactures. LUMINOR will not be liable for any costs of removal, installation, transportation, or any other charges which may arise in connection with a warranty claim. Products which are sold but not manufactured by LUMINOR are subject to the warranty provided by the manufacturer of said products and not by LUMINOR's warranty. LUMINOR will not be liable for damage or wear to products caused by abnormal operating conditions, accident, abuse, misuse, unauthorized alteration or repair, or if the product was not installed in accordance with LUMINOR's printed installation and operating instructions.

LIMITATIONS OF WARRANTY

This warranty does not apply to any of the following:

- Water Quality Parameters lie outside of the following ranges
 - Hardness > 120 mg/L (7 gpg)
 - Iron > 0.3 mg/L (ppm)
 - Manganese > 0.05 mg/L (ppm)

- Tannins > 0.1 mg/L (ppm)
- Turbidity > 0.1 NTU
- Transmittance (UVT) < 75%
- A product that has been incorrectly installed according to the technical installation manual.
- A product that has been modified in any manner, unless approved by the manufacturer.
- A product where the serial number has been altered defaced or removed.
- Damage caused by the use of parts that are not compatible, suitable and/or authorized by LUMINOR for use with the product (e.g. non-original lamps or sleeves).
- Damage caused during shipment of the product.
- Water damage is found inside ballast housing or controllers
- Product is installed outdoors in direct contact with the environment (rain)
- Product is installed in freezing temperatures.
- Product is used in conditions that exceed LUMINOR's specifications.

TO GET WARRANTY SERVICE

To obtain service under this warranty, you must first contact LUMINOR Customer Service at 855-837-3801 (519-837-3800 outside of the US or Canada) to obtain a Warranty Return Authorization. You will then need to return the product through the LUMINOR Dealer or Distributor where the product was originally purchased, together with proof of purchase and installation date, failure date, and supporting installation data. Unless otherwise provided, the Dealer or Distributor will contact LUMINOR for instructions on returning the product. Any defective product to be returned to LUMINOR must be sent freight prepaid; documentation supporting the warranty claim and/or a Return Material Authorization must be included if so instructed.

LUMINOR WILL NOT BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES, LOSSES, OR EXPENSES ARISING FROM INSTALLATION, USE, OR ANY OTHER CAUSES. THERE ARE NO EXPRESS OR IMPLIED WARRANTIES, INCLUDING MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, WHICH EXTEND BEYOND THOSE WARRANTIES DESCRIBED OR REFERRED TO ABOVE.

THIS LIMITED WARRANTY IS THE SOLE AND EXCLUSIVE WARRANTY MADE BY LUMINOR WITH RESPECT TO THE PRODUCT, AND IS GIVEN IN LIEU OF ANY OTHER WARRANTY. TO THE EXTENT ALLOWED BY APPLICABLE LAW, ANY AND ALL EXPRESS OR IMPLIED WARRANTIES NOT SET FORTH HEREIN ARE WAIVED AND DISCLAIMED, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR USE. LUMINOR LIABILITY UNDER THIS LIMITED WARRANTY IS LIMITED SOLELY TO THOSE LIABILITIES SET FORTH ABOVE. IN THE EVENT THAT ANY PROVISION OF THIS LIMITED WARRANTY SHOULD BE OR BECOME INVALID OR UNENFORCEABLE UNDER APPLICABLE LAW, THE REMAINING TERMS AND CONDITIONS HEREOF SHALL REMAIN IN FULL FORCE AND EFFECT AND SUCH INVALID OR UNENFORCEABLE PROVISION SHALL BE CONSTRUED IN SUCH A MANNER AS TO BE VALID AND ENFORCEABLE.

1.5 Company Contact Information

Contractor INFORMATION:

Manufacturer INFORMATION:

LUMINOR Environmental Inc

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Guelph, Ontario

N1G 4P5

Phone (519) 837-3800

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Section 2 Operation, Control, Monitoring

2.1 Overview: System Operation, Control, Monitoring

The K2 UV systems utilize a Custom Control circuit board with an LCD display and LED indicators. The Control board and ballast(s) are housed in a 304SS NEMA 12 enclosure to provide maximum protection against external electrical noise, dust, insects, and water ingress.

The UV lamps, similar to general fluorescent lighting, are mercury vapour lamps that require ballasts to regulate the current. The K2 product family use high frequency electronic ballasts to provide stable lamp operation. These ballasts are power factor corrected and present low THD, resulting in minimal disturbance to the electrical utility. There is a cooling fan to regulate the panel temperature, and an intake filter to keep the panel clean. This filter should be cleaned in the spring or each season in hot or dirty environments. The fan turns on when the lamps are on, or the panel temperature is greater than 28°C.

This control system has relay inputs and outputs to facilitate integration into your control system. A 24VDC relay coil serves as an input to turn the lamps on and off. Three output contact sets (NO/NC) give the user a way to monitor if the K2 system is ready for flow, or if there are any alarms.

The following pages detail the operation of the system and how to use the user interface.

2.2 LCD Display Menu System

The menu system is accessed by pressing the up and down button at the same time. The panel will then prompt you to enter your password (00000 by default) by pressing the up and down buttons, and the left button to switch digits. When you have entered your password press the enter key. Press Up and Down to scroll through different menus and options. Press ENT to enter the menu or adjust the option.

- 2.2.1 Shut down menu: With this menu you can choose if the reactor shuts down under certain fault conditions. A setting of "YES" will cause the system to shut down.
- 2.2.2 If the setting has the LAMP FAILURE choice as "YES" the system will turn all the lamps off if a single lamp fails. This alarm will remain set until acknowledged by user (Ref Section 2.4).
- 2.2.3 Setting the REACTOR TEMP choice to "YES" the system will shut down when the reactor temperature is above the REACTOR TEMP setting in the ALARM THESH MENU. **NOTE: If a button is pressed you will exit this mode and the lamps will now be considered off.** This has been implemented as a safety precaution; if a person comes and inspects the system the lamps cannot turn on while they are working on it. *Press the | button to turn the lamps back on.* Otherwise, after the reactor temperature is five degress lower than the setting in ALARM THESH MENU the system will restart the lamps if AUTO FAULT RESET is set to YES.
- 2.2.4 **Alarm Threshold Menu:** This menu sets when the panel will trigger an alarm giving you the freedom to customize your system to suit your needs. All the variables are always visible. If a system has been ordered with this option it will be wired to the IO terminal blocks and visible on the screen. Please consult the factory if you would like to have these options included in your next order.
 - 2.2.4.1 PANEL TEMP – Maximum allowed temperature before alarm. -2°C reset
 - 2.2.4.2 REACTOR TEMP – Maximum allowed temperature before alarm -5°C reset
 - 2.2.4.3 UV MINOR ALARM
 - 2.2.4.4 UV MAJOR ALARM
 - 2.2.4.5 UVT ALARM
 - 2.2.4.6 DOSE
- 2.2.5 **Analog Menu:** This menu sets the maximum scaling for the analog channels
 - 2.2.5.1 UV SCALE
 - 2.2.5.2 UVT SCALE
 - 2.2.5.3 FLOW SCALE
- 2.2.6 **Alarm History:** A list of alarms with the reactor running hour the fault was incurred.
- 2.2.7 **Remote Control:** A setting of "YES" sets the input of the 24VDC REMOTE ON relay as the ON command to the system.
- 2.2.8 **Lamp Warm-up Time:** (Default = 180) Time in seconds the reactor will allow the lamps to stabilize before the system allows flow.
- 2.2.9 **Contrast:** Sets the display contrast. 0=darkest 9= lightest
- 2.2.10 **UV Units:** Output for UV Intensity (if installed)

- 2.2.11 Flow Units:** Output for Flow (if installed)
- 2.2.12 Temp Units:** Celsius or Fahrenheit
- 2.2.13 Auto Fault Reset:** Setting this option to “YES” will cause *temperature* (Panel & Temperature) alarms to automatically reset if they are no longer above the ALARM THRESH MENU. Panel Temperature -2°C, Reactor -5°C for automatic reset.
- 2.2.14 Access Password:** Change this to change the access password. There is no reset so record it in a safe place.
- 2.2.15 Settings** will be applied when you exit the menu system.
- 2.2.16** To acknowledge faults in the user menu press enter while looking at the fault.

2.3 Mode Selection

- 2.3.1 Local Mode: Using this panel as a stand-alone control panel you will turn the lamps on and off with the | and O on the control panel. This is the default setting for the device.
- 2.3.2 Remote Mode: When using this panel as a module on a larger system you will want to set the panel to work in remote mode. Enter the Menu System (UP and DOWN), enter your password using LEFT and RIGHT to set the next digit then press enter. Press DOWN four times, press ENT, press DOWN, press ENT, then press ESC and the panel will now be in ‘Remote Mode’. To turn the lamps on and off +24 VDC to TERMINAL BLOCK #11, and 24 COMMON to TERMINAL BLOCK #10.

2.4 Alarms

This panel monitors the UV system for abnormal conditions and outputs to the LCD screen. The following are the parameters the control panel monitors:

Name	Value	Category	Notes
Low UV Alarm	12mW/cm ²	Minor	Set by User. Clean the Sleeves, Replace the Lamps.
Low UV Alarm	8mW/cm ²	Major	Set by User. Clean the Sleeves, Replace the Lamps.
Lamp X Failure	Lamp Failed	Major	If Multiple Lamps have failed, only the lowest number will be displayed. Replace the Lamp for a single lamp failure, replace the ballast for a double lamp failure.
High Panel Temperature	40°C	Minor	Clean the Intake Filter.
High Reactor Temperature	50 °C	Major	Flow Water. Can be triggered to shut the reactor down until the alarm has been acknowledged.
Lamp Life Alarm	It is set in hours	Minor	Replace your lamps.

2.4.1 Alarm List with Function Details

Alarm Name	Description / Trigger	System Response
Low UV Alarm (Minor)	Minor Alarm. UV is below the Minor UV Alarm Set point.	<ul style="list-style-type: none"> • Display Reads “Low UV Alarm” • Control panel MINOR ALARM indicator lamp ON. • Minor Alarm relay de-energized. • Intermittent buzzer active at 5-second interval.
Lamp Life Exceeded	Minor Alarm. Lamp age exceeds rated lamp life.	<ul style="list-style-type: none"> • System LCD Status screen turns RED. Display reads UV intensity and REPLACE LAMP warning.
Control/ Ballast Panel Temperature High.	Minor Alarm. Ballast panel temperature switch open.	<ul style="list-style-type: none"> • GREEN Panel Temp OK Indicator is OFF • Control panel MINOR ALARM indicator lamp ON. • Minor Alarm relay de-energized. • Intermittent buzzer active at 5-second interval.
Reactor Chamber Temperature High	Major Alarm. Ballast panel temperature switch opens.	<ul style="list-style-type: none"> • GREEN Reactor Temp OK Indicator is OFF • Control panel MAJOR ALARM indicator lamp ON. • Major Alarm relay de-energized. • Intermittent buzzer active at 1-second interval. • Configuration may be set to cause all reactor lamps to shut down in event of a high chamber temperature alarm. Reference DIP Switch Setting and Configuration Section.
Lamp Fault (each lamp has specific indicator)	Major Alarm. System is requesting lamps to be ON AND loses the LAMP OK input signal.	<ul style="list-style-type: none"> • GREEN Lamp Status Indicator is OFF • Control panel Red MAJOR ALARM indicator ON. • Major Alarm relay de-energized. • Reactor Ready relay de-energized. • Intermittent buzzer active at 1-second interval. • Configuration may be set to cause all reactor lamps to shut down in event of a single lamp fault. Reference DIP Switch Setting and Configuration Section.
Major Low UV Intensity	Major Alarm. Value Displayed on the LCD Display Screen AND the lamps are turned on AND the Warm Up Delay timer has expired.	<ul style="list-style-type: none"> • LCD display screen turns RED. Display alternates between UV LOW and UV Intensity display. • Control panel MAJOR ALARM indicator lamp ON. • Major Alarm relay de-energized. • Reactor Ready relay de-energized. • Intermittent buzzer active at 1-second interval. • Alarm threshold level is adjustable through LCD display screen programming to match system operating parameters.

2.4.2 Control Board Output List

UV System Outputs	
Description	Notes
Minor Alarm	Minor Alarm relay: NO/NC dry contact.
Major Alarm	Major Alarm relay: NO/NC dry contact.
Reactor Ready	Dry Contact Set NO/NC to signal the reactor is ready for flow

2.4.3 Remote Control Interface Wiring

Signal Name	Terminal Block	Description
Remote On Signal (24V COMON)	10	Shorting out these two pins with a switch or contactor will activate remote starting of the reactor UV lamps when the LAMPS Off/On/Rem switch is in REM position.
Remote On Signal (+24VDC)	11	
Flow Valve NC contact	12	
Flow Valve Com	13	
Flow Valve NO contact	14	
Minor Alarm NO contact	15	
Minor Alarm common	16	
Minor Alarm NC contact	17	
Major Alarm NO contact	18	
Major Alarm common	19	
Major Alarm NC contact	20	

Section 3 Maintenance

3.1 Routine Maintenance Chart

Check trends of UV Intensity	Visual	Remotely	Daily
Check for new alarm events	Visual	Remotely	Daily
Check alarm display indicator lamps.	Visual	At site	Every visit, at least once per week.
Record any new alarms	Visual	At site	Every visit, at least once per week.
Check for water leaks around reactor.	Visual	At site	Every visit, at least once per week.
Clean Quartz Sleeves	Procedure	At Site	As required. Dependent on water quality and fouling. When UV intensity sensor reading starts to show signs of reduced signal.
Check / Clean cooling fan intake and exhaust filters	Procedure	At site	At least monthly.
Replace Lamps	Procedure	At site	Every 12,000 operating hours.

3.2 UV Lamp Disposal or Breakage

3.2.1 Safety Notes:

- Eye protection is required for any UV lamp or sleeve maintenance due to the possibility of shattered quartz glass.
- Broken quartz glass has extremely sharp edges: do not handle with bare hands. Use thick gloves (not thin latex, as these will cut easily).
- Turn UV lamps OFF and allow them to cool down before touching lamps.
- Do not turn UV lamps ON if they are removed from the reactor, as the UV light will cause burns to skin and eye tissue.
- Shut 230VAC power at ballast panel (red and yellow switch on panel door) before performing any reactor maintenance.

3.2.2 Mercury Considerations for Amalgam Lamps:

- The UV lamps used in LUMINOR's K2 series product do not contain any liquid mercury. Instead, the mercury is bound with another metal (the term "amalgam" literally means a mixture of mercury and another metal). This is similar to amalgam dental fillings (mercury and silver) except that a different metal is used in amalgam lamps.
- Of the total 50mg of mercury in a single lamp, less than 1mg will be in vapour phase when the lamp is fully warmed up: the rest of the mercury is bound in the amalgam mixture. Even less mercury is in vapour phase when the lamp is cold.
- The amalgam blobs, when cold, are quite hard: there is no spill potential and it is securely bonded to the inner surface of the glass. Therefore, if a lamp breaks there is no

liquid mercury to clean up: the pieces of the lamp, including the amalgam blobs, should be swept into a plastic or cardboard container.

What should I do if a CFL breaks?

Because there is such a small amount of mercury in CFLs, your greatest risk if a bulb breaks is getting cut from glass shards. Research indicates that there is no immediate health risk to you or your family should a bulb break and it's cleaned up properly. You can minimize any risks by following these proper clean-up and disposal guidelines:

- Sweep up—don't vacuum—all of the glass fragments and fine particles.
- Place broken pieces in a sealed plastic bag and wipe the area with a damp paper towel to pick up any stray shards of glass or fine particles. Put the used towel in the plastic bag as well.
- If weather permits, open windows to allow the room to ventilate.

3.2.3 Lamp Breaks Inside Reactor

- In this event there will be a lamp failure alarm, and possibly low UV dose: the control system may be configured to shut down the reactor and close the inlet and outlet valves.
- There will be no water leakage or contamination of process water as the sleeve is still intact.
- First remove the large pieces of broken lamp. Then carefully clean the inside of the sleeve by pushing a soft cloth through the sleeve with a clean wood dowel or clean plastic pipe of approximately $\frac{3}{4}$ " diameter. Note that this will require removal of the "blind" sleeve nut at the other end of the reactor so that the cloth can be pushed all the way through. Capture the debris and cloth in a plastic bag dispose of according to local regulations (treat the same as fluorescent lamp).

3.2.4 Lamp and Sleeve Break Inside Reactor

- In this event there will be a lamp failure alarm and possibly low UV dose alarm: the control system may be configured to shut down the reactor and close the inlet and outlet valves.
- Water leakage will be obvious at the lamp-plug end.
- The reactor will have to be drained and cleaned. First recover the broken lamp and sleeve debris and put them into a plastic or cardboard container for disposal.
- The reactor should be further cleaned with soft cloths before reassembly.
- If there is a trap down-stream of the reactor, it should be drained and cleaned of debris that might have been carried through.
- Capture all debris and cloth in a plastic bag and dispose of according to local regulations (treat the same as fluorescent lamp).

3.3 Lamp Installation / Removal

- The K2 reactor is shipped with the quartz sleeves installed inside the reactor, ready to accept the lamps which are shipped in separate protective packaging.
- **SAFETY NOTES:**
 - Eye protection is required for any UV lamp or sleeve maintenance due to the possibility of shattered quartz glass during an accidental breakage.
 - Turn UV lamps OFF and allow them to cool down before touching lamps.
 - Do not turn UV lamps ON if they are removed from the reactor, as the UV light will cause burns to skin and eye tissue.
 - Shut panel power OFF before any reactor maintenance.
- To install lamps, it is only necessary to access the reactor end with the “open” sleeve nuts as shown below and in Section 1.3 Installation Guidelines of manual which shows Mechanical drawings of the reactors.



Open



Closed

- Remove the reactor end cap by unscrewing the three screws on the end cap from the reactor.
- Remove UV lamps from packaging being careful not to touch the lamp surface – when handling the lamps ensure to touch only the ceramic ends of the lamp or use clean cloth gloves. If the clear quartz lamp surfaces become contaminated by finger prints or any other oily substance they must be cleaned thoroughly with isopropyl alcohol.
- Carefully slide each lamp through the open-sided sleeve nut and into the quartz sleeves, such that the plain lamp end (no pins) goes in first.
- Note that there are three springs at the blind end sleeve nut to ensure that the lamp plugs will stay firmly connected.
- Ceramic lamp end with pins should be left protruding approximately 1 inch outside quartz sleeve to allow easy connection of the lamp cable plug without touching the clear quartz part of the lamp.
- Notice that each lamp cable is numbered to correspond to the LED's on the control panel.
- Connect lamp connectors to the lamps.
- Once the lamps are connected, the lamp connectors must be properly inserted into the reactor.
- The lamp installation should be such as to prevent the thin white lamp wires and Teflon rings from being in-line with the UV sensor port.

- Notice on the inside of the sleeve gland nut 2 protruding metal pins: the lamp connector is a “bayonet” style with matching notches that must engage with the two metal pins inside the sleeve nut.
- Once the pins and notches have been lined up the connector will easily push into the sleeve gland nut: There is a reasonably strong spring at the far end of the sleeve pushing back on the connector: this spring force is required to ensure that the lamp and connector remain fully mated over time.
- Once fully inserted, turn the bayonet connector to the right to lock it into position and maintain spring force on the lamp.
- Reset the lamp life hours and counter after installing a new lamp using the control system operator interface.
- **Lamp removal** is essentially a reverse of the above procedure, with a main “tip” being to have a clean safe place to place them outside of the reactor.

3.4 Lamp Change Interval

Germicidal lamps will lose some percentage of their output as they accumulate operating hours. With the ‘state-of-the-art’ lamps utilized in the LUMINOR K2- series, this aging effect is relatively minimal, especially compared to older lower cost technology lamps. However, it is important to recognize that all lamps have a finite life, and therefore the UV lamps must be replaced at a maximum of 12,000 operating hours.

3.5 Sleeve Removal

- To remove quartz sleeves from the system the reactor must be drained of all water.
- Reference mechanical drawings in Section 1.3
- Remove the end cap from the end of the reactor by unscrewing the three screws.
- Both sets of gland nuts must be removed.
- There is an o-ring on both ends of each quartz sleeve that must be removed.
- The quartz sleeves can now be pulled from the reactor from the lamp removal end of the reactor.

CAUTION: Please pull the sleeves very gently from the reactor ensuring that the sleeves stay as level as possible so as to not break the sleeve.

3.6 Manual Sleeve Cleaning

- Once the sleeves have been removed from the reactor they may be cleaned manually. Quartz sleeve may look clear but it is quite common to have deposits on the sleeve that are not visible to the eye but can substantially block UV light.
- Cleaning can be done using a soft cloth and an acid based scale remover such as Lime-Away or CLR. Scale and iron based coatings, even if not visible to the naked eye, can only be removed with an acid: alcohol will have little or no effect.

- Soak the cloth with Lime-Away or CLR and gently begin rubbing the length of the quartz sleeve ensuring that no chemical gets inside of the quartz sleeve.
- Rub the sleeve's entire diameter and length until the entire surface has been wiped down.
- Using a dry, soft cloth wipe away any excess cleaning solution before replacing the sleeve.

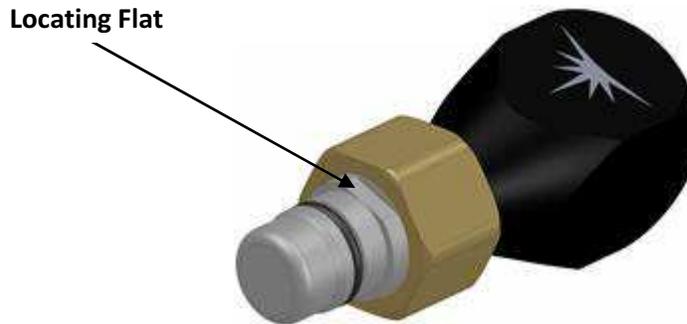
3.7 Sleeve Installation

- Follow the **Sleeve Removal** steps first.
- With gloved hands remove cleaned or new sleeves from packaging, ensuring that the sleeves are free from fingerprints, dirt, dust etc. Fingerprints or other oily contamination should be cleaned with a soft cloth and isopropyl alcohol.
- Slide sleeves into each position on face plate, ensuring that you do not allow the sleeve to fall to the bottom of the reactor.
- Guide each sleeve carefully into its position at the opposite end of the reactor and gently push it through until it reaches the endplate and pokes outside of the reactor approximately $\frac{1}{4}$ " – $\frac{1}{2}$ ".
- Once each sleeve has been replaced slide an o-ring onto each end the sleeve until it butts up against the face plate of the reactor to ensure a sufficient seal.
- NOTE: When replacing the quartz sleeves new o-rings must be installed.
- Ensure that nuts are properly installed on both ends of the reactor
- When installing the gland nuts, on end of the reactor opposite the lamp connectors, a wrench must be used: these sleeve gland nuts will bottom-out against the stainless steel stubs, ensuring maximum o-ring compression before over-tightening occurs.
- The gland nuts on the lamp removal end of the reactor can be hand-tightened: again, these sleeve gland nuts will bottom-out against the stainless steel stubs, ensuring maximum o-ring compression before over-tightening occurs.

3.8 UV Sensor

3.8.1 UV Sensor Installation

- The sensor itself will not be shipped installed in the reactor: it is packaged separately to prevent damage during shipping and reactor installation.
- Reference mechanical drawings in section 1.3
- It is recommended to install sensor before filling the reactor.
- Remove the sensor body from its packaging.
- Remove the plug assembly in the side the sensor is to be installed (if present).
- Raise the brass nut and identify the locating flat as shown below:



- Insert the sensor into the chamber, ensuring the locating flat lines up with the locating tab on the sensor port.
- Hand-tighten the brass nut onto the sensor port.
- Plug the sensor cable into the control panel.

3.8.2 UV Sensor Removal

- Isolate the chamber from the process stream by closing the necessary valves or shutting of the appropriate equipment. Release any pressure in a controlled manner.
- Drain the reactor to at least the level of the sensor port or, alternatively, prepare to “cold swap” the sensor which will cause a small amount of leakage from the port.
- Unscrew the brass nut.
- Pull the sensor out of the reactor. If the reactor was not drained, quickly insert another sensor or plug to prevent excessive spillage of water.
- To reinstall the sensor, follow the steps in section 3.8.1

3.8.3 UV Sensor Cleaning

- Any time the sensor is removed from the reactor the clear quartz window should be cleaned, as UV blocking deposits on the clear quartz window may not be visible to the naked eye. This window must be clean in order for the UV sensor to be able to give an accurate reading of the UV Intensity within the reactor. This reading is used in the dose monitoring algorithm.
- Sensor cleaning should be done using a soft cloth or Q-tip and acid based scale remover such as Lime-Away or CLR.
- Place two drops of Lime-Away onto the UV Sensor lens and let it sit for at least 1 minute.
- Using a soft cloth or Q-tip rub in a circular motion in order to thoroughly clean the lens.
- CAUTION: Make sure all debris/sand/particulate has been removed from the sensor window and that the cloth being used does not contain grit as the window can easily be scratched.
- Rinse sensor window with clean water
- Clean any grit or debris from the sensor body threads to prevent damage to the stainless steel threaded components.

3.9 Cooling Fans and Exhaust Filters

The Control Panel enclosure utilizes filter fans and exhaust vents. These filters provide protection against dirt, dust, and water splash.

However, these filters do become plugged, especially if the environment tends to be dusty, which can lead to shortened life of the ballasts and other electrical components as well as high panel temperature alarms.

Usually it is sufficient to simply clean the filters, which is an easy task as the black grill covers simply snap off from the exterior of the panel: a small flat screwdriver will help to pry the cover off, and a notch for the screwdriver is provided.

If the filters become damaged or can't be cleaned, they can be replaced inexpensively.

Any fans that are not rotating freely or otherwise fail must be replaced.

The cooling fans and exhaust filters should be checked at least once per month.

3.10 Common Replacement Parts

UV Lamps PN : **RL-1000A (K2 system), RL-1000A-HW (K2 Hot Water system), RL-1000A-TOC (K2 TOC system)**

Quartz sleeves PN: **RQ-1000**

Lamp Ballast PN: **RB-K21 (LK5-A12, LK6-A12), RB-K22 (LK5-A42, LK5-A62, LK6-A42, LK6-A62)**

UV Sensor Assembly PN: **RS-KUV (K2 & K2 TOC systems), RS-KUV-50 (K2 low UVT system), RS-KUV-TOC (K2 TOC system)**

4 Field Notes