dioxide PACIFIC

Installation, Operation and Maintenance Manual

Chambered Ultraviolet Disinfection System

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SAFETY INSTRUCTIONS

In order to protect end users and operators from injury, safety precautions must be followed. This Installation, Operation and Maintenance Manual outlines important safety issues. The following WARNING SYMBOLS will be found throughout the manual to alert the end users to take important precautions:

INFORMATION. This symbol signifies helpful information.

CAUTION This symbol indicates a potentially dangerous situation. Failure to adhere to this warning may lead to serious injury and or death.

ELECTRIC SHOCK. This symbol signifies helpful information.

EYE PROTECTION. This symbol indicates that eye protection must be worn to protection from UV light as well as debris.

QuickTime™ and a
TIFF (Uncompressed) decompressor
are needed to see this picture.

HAND PROTECTION. This symbol signifies that hand protection must be worn to protect the lamps from skin oils as well as protect the operator from UV light and sharp materials caused by a broken lamp/quartz.

1) Information

Please read this manual prior to installing, starting up and operating the equipment. The equipment uses sophisticated technology, but has been designed to make operation and maintenance easy.

The UV system needs to be maintained and does require replacement parts. We recommend that key spare and replacement parts be kept on hand. In order for the system to operate properly, please only use genuine factory parts. Failure to use genuine parts will void the warranty and may damage the system.

2) About Ultraviolet (UV) Disinfection

The technology uses UV light to target and disable disease-causing microorganisms (pathogens).

Over 100 years ago, scientists discovered that if you exposed pathogens to UV light, their reproduction was limited. The UV light source that they used, resided in the UVC range of the light spectrum. Specifically, they discovered that light in the 254 nanometer (nm) range was the most effective wavelength.

When many pathogens are exposed to UV light, their cells become damaged and this damage inhibits reproduction. The UV light, produced by a special UV lamp, damages the cell's DNA and RNA and once damaged, they are unable to replicate. This physical process renders them harmless. The amount of damage is a result of the intensity of the UVC output multiplied by the time the pathogens are exposed to the light. The applied dosage is commonly referred to as microwatts and is often expressed as mJ/cm2. Most drinking water systems general require a dosage of 40 mJ/cm2.

Why are plants and operators selecting UV technology?

a) UV is considered a green technology
b) No chemicals are added, so there is no need for chemical removal
c) No chemical storage
d) UV works instantly without requiring a residence time
e) Easy maintenance

What are limitations of UV technology?

a) The quality of the liquid entering UV system needs to be monitored.
b) The UV system needs to be cleaned on a periodic basis based on liquid conditions.

3) Preparation for Installing UV System

The following information is meant to be used by engineers, contractors, operators and owners to help better understand the technology, it benefits and potential hazards.

a) Important Safety Information

UV light is extremely harmful to eyes and skin and will cause burns. Do not look directly or indirectly at the UV light. Do not expose your skin for any prolonged time. Use

protective clothing and eyewear (make sure it is UV resistant) when servicing equipment.

If accidentally exposed to UV light for an extended period, immediately seek medical attention. Symptoms for eye exposure include burning, itching and redness. Symptoms for skin exposure are similar to sun burn.

Use gloves when handling lamps and quartz. The reason why is that skin oils will adhere to the lamps and jackets and prevent UV light from properly emanating. If the jackets become dirty, wipe them with a lint free cloth with denatured alcohol.

UV lamps and their quartz jackets can become razor sharp if broken. Take care when installing and removing the quartz jackets. Only hand-tighten compression fittings. Do not use wrenches or other tools..

b) Optimizing System Performance

The UV lamps and their corresponding quartz jackets need to be maintained. As a general rule, the lamps need to be changed after a year of usage (9,000-12,000 hours). Quartz jackets should be changed every three (3) to five (5) years or when they show wear.

Quartz jackets also need to be cleaned on a periodic basis based on real world plant conditions. The factory recommends using a ScotchBrite™ pad and a commercially available cleaning product like LimeAway™ or CLR™. In addition to cleaning, please remember to wear gloves when handling lamps and jackets.

c) Facility and Flow Design

Your UV system has been designed on a set of parameters. These parameters are described below and are based on the entire plant operating properly. Ensure that pre-processes are providing liquid that meets the design parameters.

d) Environmental Issues Relating to UV Lamps

UV lamps need to be recycled like fluorescent lamps because they contain mercury. Please follow your local recycling laws. Please visit www.lamprecycle.org to find a recycler in your area. In the event that you are unable to find a disposal location, please contact manufacturer's representative.

e) Receiving UV Equipment and Spare Parts

It is important to compare the shipment's contents to the actual packing list. Any deviations must be brought to the factory's attention. Additionally, lamps and quartz jackets need to be inspected for damage. If shipment or parts are damaged, immediately contact factory and hold broken contents and their containers for inspection by shipping company.

f) Electrical Configuration and Maintenance

The UV disinfection system uses sophisticated electronics and specialty lamps. Unlike other equipment in the wastewater plant, the UV system's electronics require clean power. The system has been designed to use a certain specified voltage. UV equipment must be protected from surges. If the plant is susceptible to brown outs, please contact factory.

4) Major Components

The UV disinfection system will come with a number of components. The following list highlights the main ones:

a) Disinfection chamber (aka vessel)

b) Ballast Control Center (BCC)

c) Ultraviolet lamps

d) Quartz jackets

e) Spare parts (optional)

f) Safety and cleaning supplies (optional)

g) Warranty information

a) Disinfection Chamber

The chamber is manufactured from high-grade stainless steel. All welded surfaces have been ground and smoothed. The vessel has been passivated and electropolished to insure a higher purity finish.

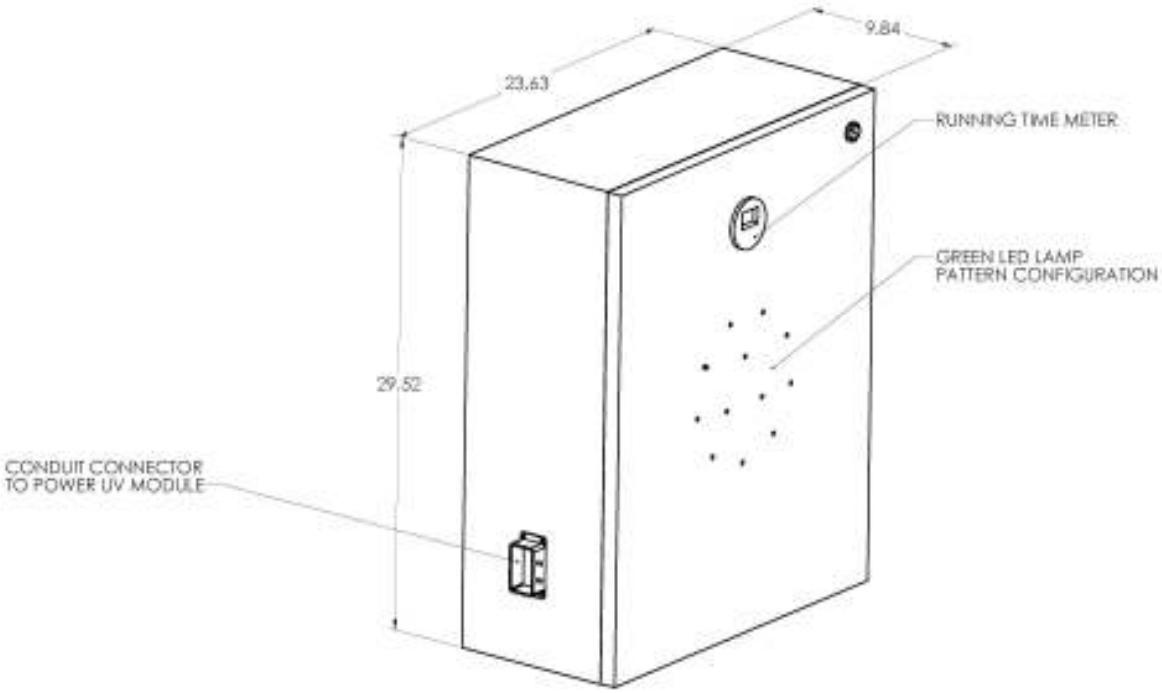
The chamber will have an inlet and outlet. In most cases, these are interchangeable. The chamber will also have a variety of drain, inspection, and monitoring ports.

b) Ballast Control Center (BCC)

The BCC will need to be mounted near the chamber. Prior to final placement on a wall or unistruts, insure that the factory-supplied cable length is adequate to reach between the BCC and the chamber.

The BCC requires clean power. Information on voltage and cycle will be on the nameplate. Equipment should be kept off lines where there are surges or brownouts.

The BCC will contain the ballasts and other electrical controls. Fans have been integrated to cool the electrical components (many smaller systems do not require the cooling and therefore will not have them). The BCC will display operation status (individual lamp status, run time and optional UV output).



c) Lamps and Quartz Jackets Inspection

QuickTime™ and a
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are needed to see this picture.

Insure that lamps and quartz have not been broken in transit. Use gloves when handling lamps and quartz jackets to prevent them from becoming dirty. If lamps or quartz have broken, take extra care to prevent yourself from becoming injured.

If the lamps and jackets have been damaged in shipment, please put to the side in the original packaging and contact factory. A claim will have to be made immediately to the shipping company.

5) Installation

Qualified professionals (contractors, plumbers and electricians) should install the mechanical and electrical components as per code as per the engineering documents.

a) Chambers

Pictured is a shorter chamber that uses a closed quartz jacket (aka domed)

Pictured is a longer chamber that uses open quartz jacket (quartz extend through each side)

Insure that you had adequate space on one side of the vessel to insert and remove the quartz jackets and UV lamp (40” for smaller chambers and 70” for larger chambers is preferred). If thought is not given to this aspect, the lamps and jackets will be impossible to install.

b) Quartz Jacket Installation for open jackets

Installation of the quartz jackets is perhaps the most difficult part of the installation as well as the most difficult process for continued operation and maintenance. Proper planning and space allocation are the most important.

With systems that use automatic cleaning systems, the actual wiping mechanism will help guide the jackets through. Since the wipers have integral EPDM rings, the jacket should be moistened with water to make them slippery. This will help guide the jacket through the blades.

When working on this task, two workers are required.

The quartz jackets seal by using a compression nut and compressing a stainless steel washer over an oring. This task requires no tools. Prior to that, the quartz jacket needs to be inserted into the head and slowly and steadily directed through to the other side where the second operator stands ready. As the jacket approaches the opposite end, the other worker will need to guide the jacket all the way through. Sometimes a finger is good to catch the end or in some cases the preferred method is to use a dowel.

Once through, insure that each end of the jacket protrudes the same amount. Each technician should then slide and oring over the end of the jacket. Clean water is good to lubricate both the oring and jacket. Once on and pushed in snuggly, the stainless steel washer should be slid on.

The compression fittings should be hand tightened and the process should be completed for each and every jacket.

Once secure and once all other ports are closed, it is time to pressurize the system to look for any leaks at the compression seals.

Slowly fill the vessel with water. Prevent any onrush of water or water hammer as this may damage the jackets. Also insure that the UV lamps have not been placed in the vessel. In the event of a water hammer, the quartz jackets may break and if the lamps are installed, they too will break.

Once pressurized, let stand for 10 minutes and inspect the seals. If some are found to be leaking, stop water, release pressure, drain system and then redo the seals. Once redone, run the pressurization test and insure that all seals are good.

c) Quartz Jacket Installation for closed jackets (domed)

When working on this task, a single operator is appropriate.

The quartz jackets seal by using a compression nut and compressing an oring. This task requires no tools. Prior to that, the quartz jacket needs to be inserted into the nipple (domed/closed end first) on the head and slowly and steadily directed through to the dome sits firmly at the end of the vessel.

The compression fittings should be hand tightened and the process should be completed for each and every jacket.

Once secure and once all other ports are closed, it is time to pressurize the system to look for any leaks at the compression seals.

Slowly fill the vessel with water. Prevent any onrush of water or water hammer as this may damage the jackets. Also insure that the UV lamps have not been placed in the vessel. In the event of a water hammer, the quartz jackets may break and if the lamps are installed, they too will break.

Once pressurized, let stand for 10 minutes and inspect the seals. If some are found to be leaking, stop water, release pressure, drain system and then redo the seals. Once redone, run the pressurization test and insure that all seals are good.

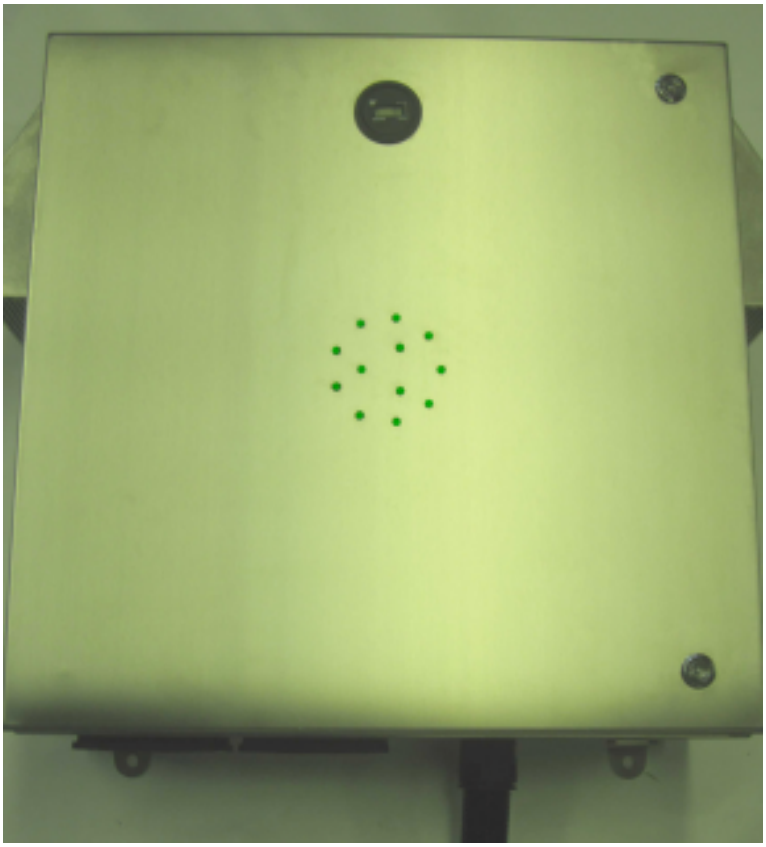
d) Lamp Installation

Slide the lamp into the jacket (making sure that the end with the pins stays on the side where the socket is). Repeat for each lamp. Once in, secure the protective cap. The caps prevent the light from coming out.

6) Operation, Monitoring and Maintenance

a) Ballast Control Center (BCC)

The BCC will be the focal point for system Operation and Monitoring.



1. Lamp Status

The BCC will display lamp status indicators in the form of Light Emitting Diodes (LEDs) located on the front door. The LEDs glow green when the lamp is on. An extinguished LED indicates a lamp problem.

If the LED goes off, then it may mean that a lamp is no longer functioning. However, it may indicate a problem with the LED, the lamp's corresponding ballast or a problem located within the lamp holder.

2. Run Time Monitoring

A digital non-resettable time meter has been integrated into the front door of the BCC. This run time meter tracks operational hours on the system as a whole. It does not track individual lamp run hours nor does it indicate when to service. The run time meter is a tool to help track running hours to help operators know when it is time to change lamps.

Operators should keep tracking logs in order to know when it is time to change lamps (9,000 hours is equal to a year. Many facilities decide to replace on a yearly basis).

7) Maintenance

a) Lamp Maintenance

Lamps need to be replaced on a yearly basis. Lamp status should also be checked on a periodic basis by inspecting LEDs on the BCC.

Keep spare lamps available.

b) High Heat

Many applications only require periodic liquid needs. To prevent the lamps from overheating and the quartz jacket fouling, a thermistor (high heat cut off) may have been provided as an option.

A sensor is screwed into a port in the vessel head. Teflon tape is used to insure a tight seal. The probe is attached to the electronics via a plug in connector. The probe generally shuts down at 115F. This is meant to protect the lamps. The system will turn back on with fresh cool water.

c) Quartz Jacket Maintenance

In order to insure proper disinfection, the quartz jackets need to be inspected, monitored and maintained.

The UV lamps produce heat and UVC output, which may cause certain water characteristics to adhere to and bond on the jacket. This can cause the quartz jackets to foul.

Fouled jackets will prevent the UVC from reaching the targeted pathogens.

Manual Cleaning

Plant operators would have to remove the jackets and clean by hand. Denatured alcohol, mild citric acid or a lime/calicium/rust removal product (LimeAway or CLR) and a ScotchBrite pad can be used to aid in the cleaning of the jackets.

Automated Cleaning

The system can be piped and can be cleaned by the facilities as part of their Clean In Place (CIP) maintenance program.

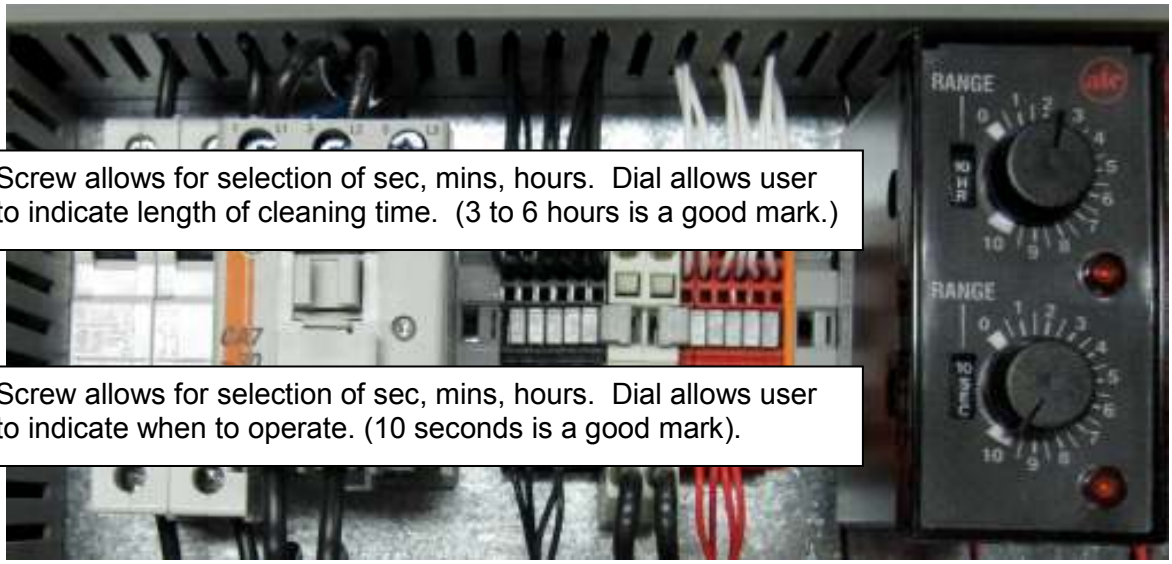
Other cleaning kits can also be integrated. The kit would be comprised of a tank with a pumping system. The tank would be filled with a food grade citric acid and would re-circulate through the chamber.

Automatic Pneumatic Cleaning

The automatic cleaning system incorporates a piston that pushes and pulls a wiping mechanism over the quartz jackets. A solenoid will control the direction of air.

Clean, dry, compressed air is delivered to the piston. The piston pushes and pulls a stainless steel mechanism, which holds EPDM (UV resistant) wiper rings. These rings need to be changed every 3 to 5 years. The process requires a complete system breakdown.

The frequency and duration of the cleaning cycle is determined by a user adjustable timing mechanism.



Screw allows for selection of sec, mins, hours. Dial allows user to indicate length of cleaning time. (3 to 6 hours is a good mark.)

Screw allows for selection of sec, mins, hours. Dial allows user to indicate when to operate. (10 seconds is a good mark).

The piston screws into the wiper mechanism and then into the head compressing oring.

d) BCC Maintenance

The primary concern is to maintain proper clean protected manner to the BCC.

Routine maintenance should include checking and cleaning the filters on the air intake fans. Fans have been integrated to keep the electronics cooler to insure optimum performance. Many of the smaller systems do not require the cooling and therefore will not be provided with the fans.

Prior to cleaning the filters, power down the BCC. Spinning fans can cause injury. Once powered off, snap the covers off by hand, remove and wash the filter with warm water, dry and then reinstall.

Since the BCC has been modified to include displays, controls and fans, do not hose clean of wash down the enclosure. Water will damage the electronics and will cause corrosion.

e) Chamber Maintenance

The chamber requires periodic maintenance. The scope and complexity of the maintenance will be dictated by quality of the liquid. Some liquids introduce solids, minerals and other debris into the vessel. Systems operating in these types of environment require regular cleaning as well as gasketing replacement.

Investigating Internal Parts of the Vessel

> Since the vessel is sealed by the inlets and outlets as well as having all the ends sealed, it is difficult to look inside the chamber. There are a few ways to accomplish this observation task.

Prior to performing inspection, insure that the power to the BCC and that the water supply has been turned off before and after the chamber. Once isolated, drain the system. Prior to draining, release pressure in line by opening a valve. Failure to do these tasks can result in serious injury and property damage.

Once drained, the operator can remove a lamp (make sure not on or not still hot) and quartz jacket and look through the quartz hole in the machined head. Use a small flashlight to shine inside to see if there is debris. This same observation can be done using another monitoring port.

Chamber Break Down – Removal of Heads

Once determined that there is reason to believe that the vessel needs to be cleaned, the operators will need to set aside some work time to perform a complete system break down.

As with inspection, the vessel needs to be powered off, completely drained and allowed to cool down.

The operators will need to remove the lamps, the compression nuts, washers, orings and quartz jackets. All of these parts should be checked for wear and should be stored in an area where they will not get lost.

At this point, there should be two (2) operators depending on the complexity of the system and weight of the heads.

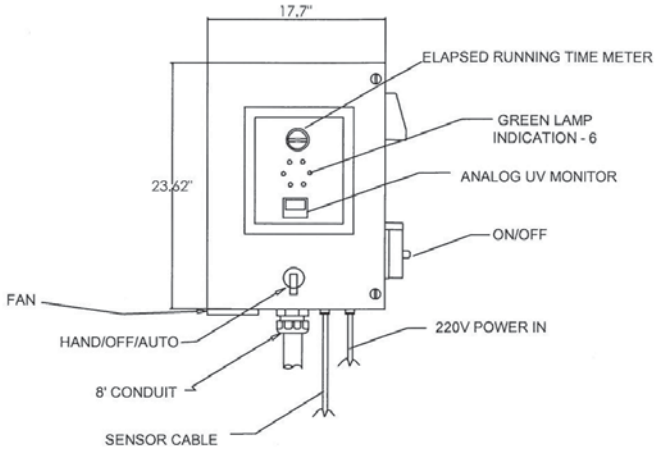
Operators will need to loosen the nuts and bolts on one head (to start with). Once loosened, the nuts, bolts and washers need to be removed and stored.

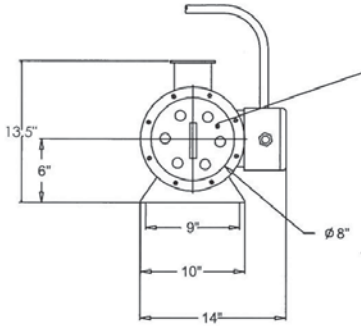
The head will need to be replaced in the exact position in which it was removed. A good trick is to use a Sharpie to mark the head and the end flange. This will allow for easy alignment when reassembling.

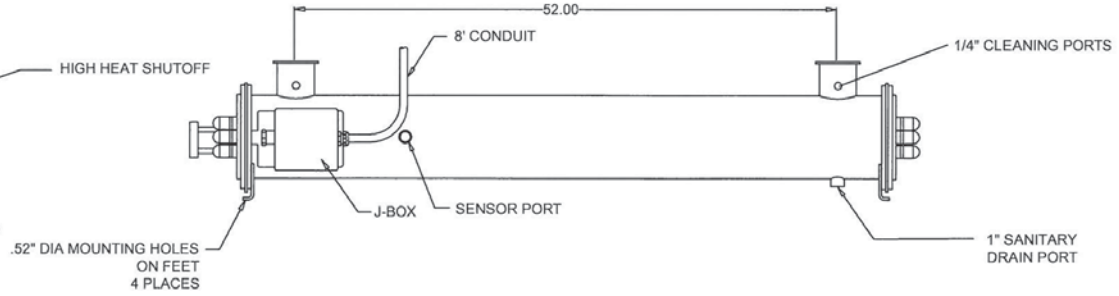
Lower the head to the ground. The gasket should be inspected for wear and also stored in a safe place. Having one head off will allow for both visual inspection and cleaning.

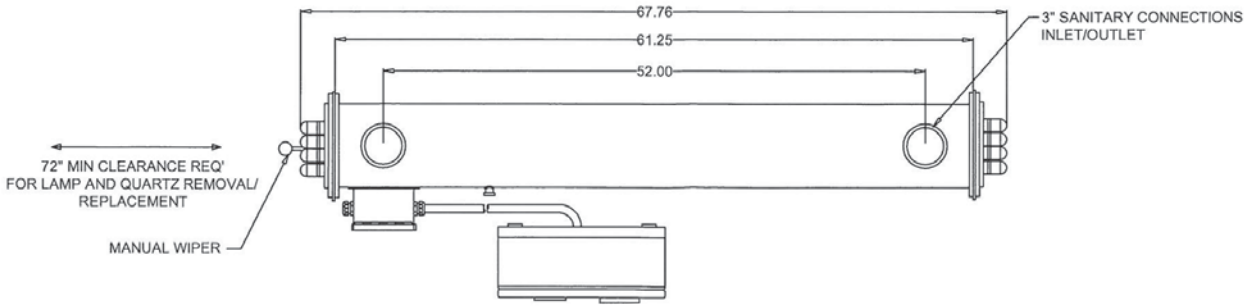
Once cleaned, perform maintenance on the quartz jackets and replace any gaskets/orings.

When re-installing the head, use a crisscross pattern to tighten the nuts. This is similar to putting a tire on a car.









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SPARE PARTS GUIDE Model No. IL-5000-6-MAN with 3" Sanitary

July 2011

220V 50/60Hz 12Amp

COMPONENT	PART NO.	QTY PER SYSTEM	NOTES
Ultraviolet lamps	L-020760	6	High Output 4P Replace every 10,000 hours
Quartz sleeves	Q-051064	6	Replace every three to five years or when found to be scratched or broken – 64" Open
Compression nut	M-004ICN-A	12	Replace if defective – Green Aluminum
Compression cap	M-004IBC-A	6	Replace if defective - Green Aluminum Blank
Lamp harness	P-C42ULH	6	Replace if defective
Compression cap	M-005IHC-A	6	Replace if defective – Green Aluminum Hole
Ballast	E-07230B	6	Replace if defective Electronic ballast 230V/50/60Hz runs a single lamp
Running Time Meter	E-5210RM	1	Replace if defective - digital
Green LED	E-5100LD	6	Replace if defective
O-ring	M-70875O	12	Replace if defective
SS Washer	M-1125SW	12	Replace if defective
UV Monitor Board	E-10MSRS	1	Replace if defective, Analog with 220V TF
UV Monitor Face	E-833MSF	1	Replace if defective
UV Sensor Window	M-1000SW	1	Remove and clean if dirty
UV Sensor O-ring	M-70112O	1	Replace if defective
Head Gasket	M-0810CG	2	Replace if defective 8"
Fan	E-4230FN	1	Replace if defective – 220V

ANALOG UV MONITORING SYSTEM – OPERATION, CALLIBRATION & MAINTENANCE

The UV monitoring system uses a single sensor to read the relative UV output of a single lamp. The output is displayed by a needle that ranges from 0 – 100%. The system should be set to 100% with new lamps and with running water. This should be done with each new lamp change and done after the initial one hundred (100) hour burn in.

The output is relative and is not traceable to standards and should be used as a tool for system maintenance.

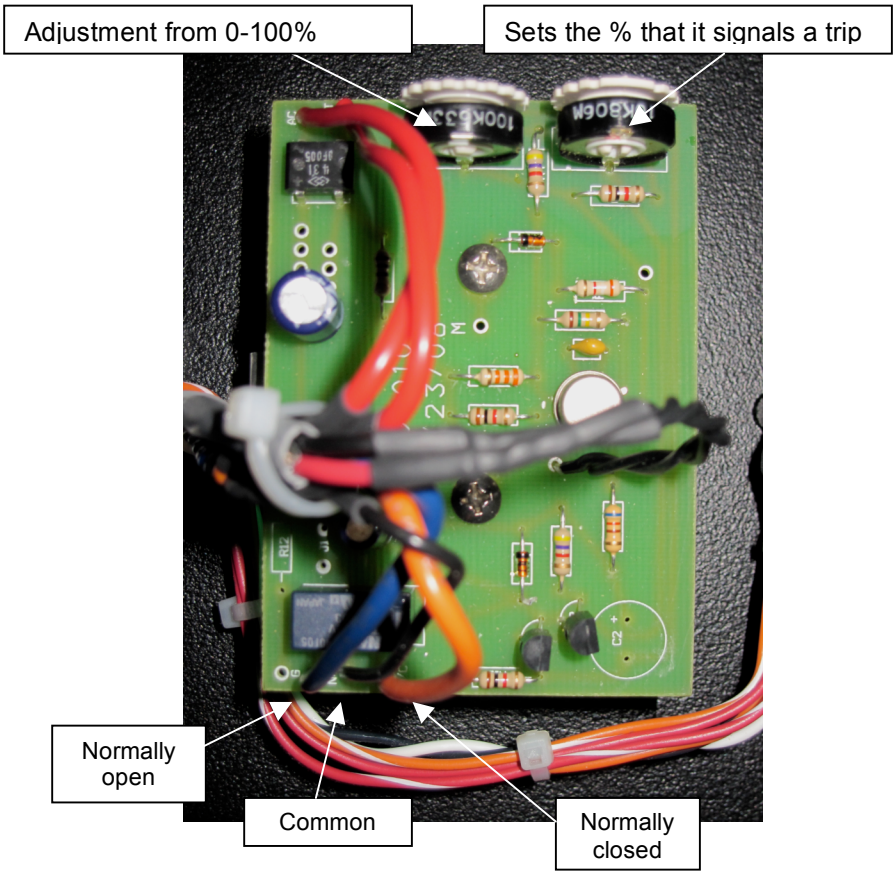
Installation and Calibration

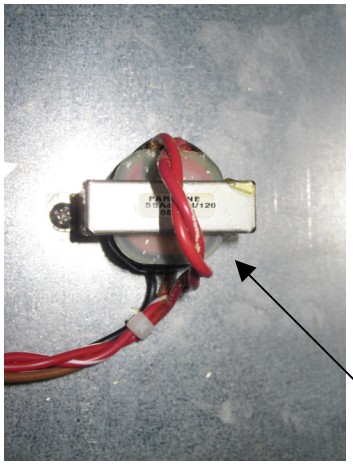
The following items have been integrated and are required for operation. Please insure that all items are provided and in their appropriate places.

a. UV Sensor with connector pigtail
b. Sensor glass to protect sensor from water
c. O-ring to seal
d. Analog meter
e. Electronics with adjusting wheels

Once located and checked, the manufacturer recommends the following:

a. Find the UV sensor port located on the vessel. If the port is closed with a cap or with the actual UV sensor, stop working. Insure that the vessel is not under water pressure. If it is, relieve pressure to inspect what is in the port.
b. The port should be completely dried with a dry cloth. This will prevent fogging.
c. Take the small o-ring and seat it firmly in the port. The glass window will be put on top.
d. Take the small round window and carefully place it on top of the o-ring. Make sure not to get oils or dirt on the window. In many cases, the sensor is going to be located on the side. This will make it a little more difficult to place the window because it is going to want to fall out. Use the sensor to hold it in place.
e. The sensor should be slowly pushed into until it compresses the window and the o-ring.
f. Slide the retaining cap over the sensor (pulling pig tail through), and hand-tighten. Do not over-tighten because it will break the window.
g. Plug the pigtail connectors into the corresponding connectors going to the power center.
h. Power on the UV lights.
i. Check to see if the analog needle is moving. If so, then proceed.
j. Check the vessel to insure that all ports are secured and that all compression seals are tight.
k. Fill the vessel with water and let the system warm up.
l. View the analog meter to see if it is reading UV output.
m. Adjust the output to 100% using the thumbwheels located on the back of the electronics located in the power control center.


Adjustment from 0-100%
Sets the % that it signals a trip
Normally open
Common
Normally closed


110 Volt
220 Volt optional

The UV monitoring system has been designed for simple operation. From time to time, you will need to perform maintenance to discover why your UV output is falling off.

Since there are many reasons, including:

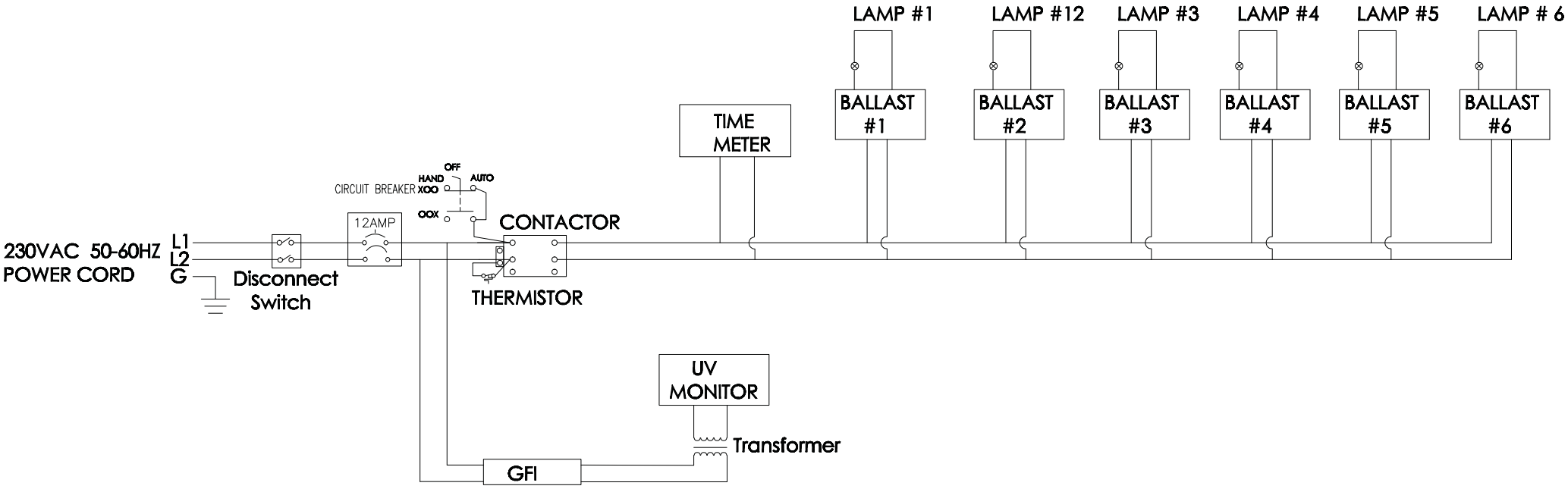
a. Old lamps starting to fall off
b. Lamp failure
c. Excessively hot or cold water
d. Dirty water impacting transmission
e. Dirty quartz sleeves
f. Cracked sensor quartz window (allows moisture into the sensor and a potential leaking situation)
g. Broken sensor

It is important to understand how the system operates. It is also important to understand which replacement parts are required.
The system is not NIST traceable, does not provide output in uWs/cm2 and does not provide for remote monitoring via a 4-20mA output. These more sophisticated requirements are available in our higher end models.

The system does provide dry contacts in the form of normally open and normally closed contacts. These can be used to trigger an alarm or control a solenoid valve. To be used effectively, you will need to set the trip wheel to a point where you want it to alarm (usually at 70%).

UV MONITORING PARTS:

Sensor Glass	E-1000SW
Sensor O-ring	M-70112O
UV Sensor	E-10MSRS
Meter Face Plate	E-833MSF
Meter Electronic Board	E-10MSRB
Black Retainer Cap	M-1058SC



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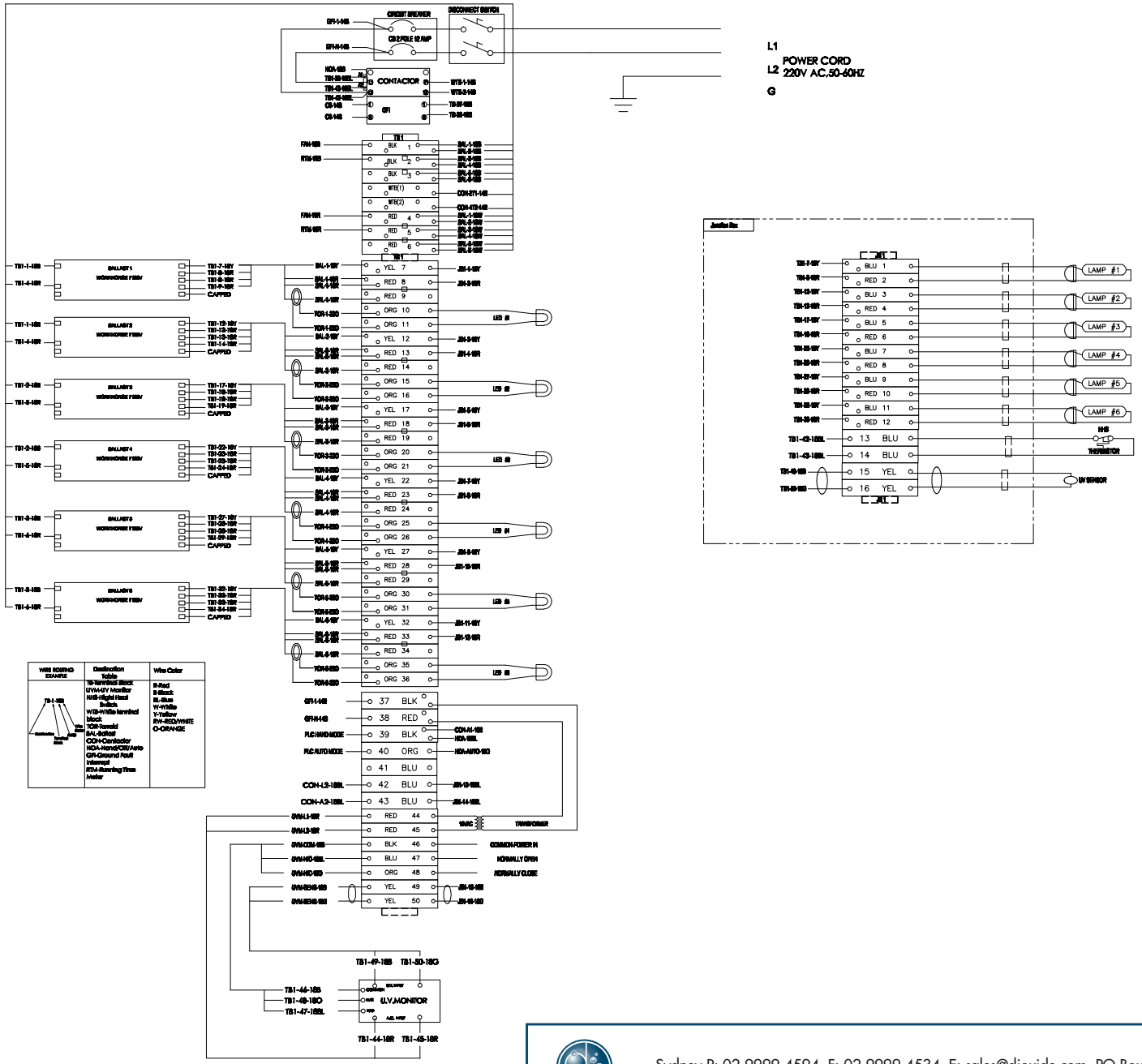

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