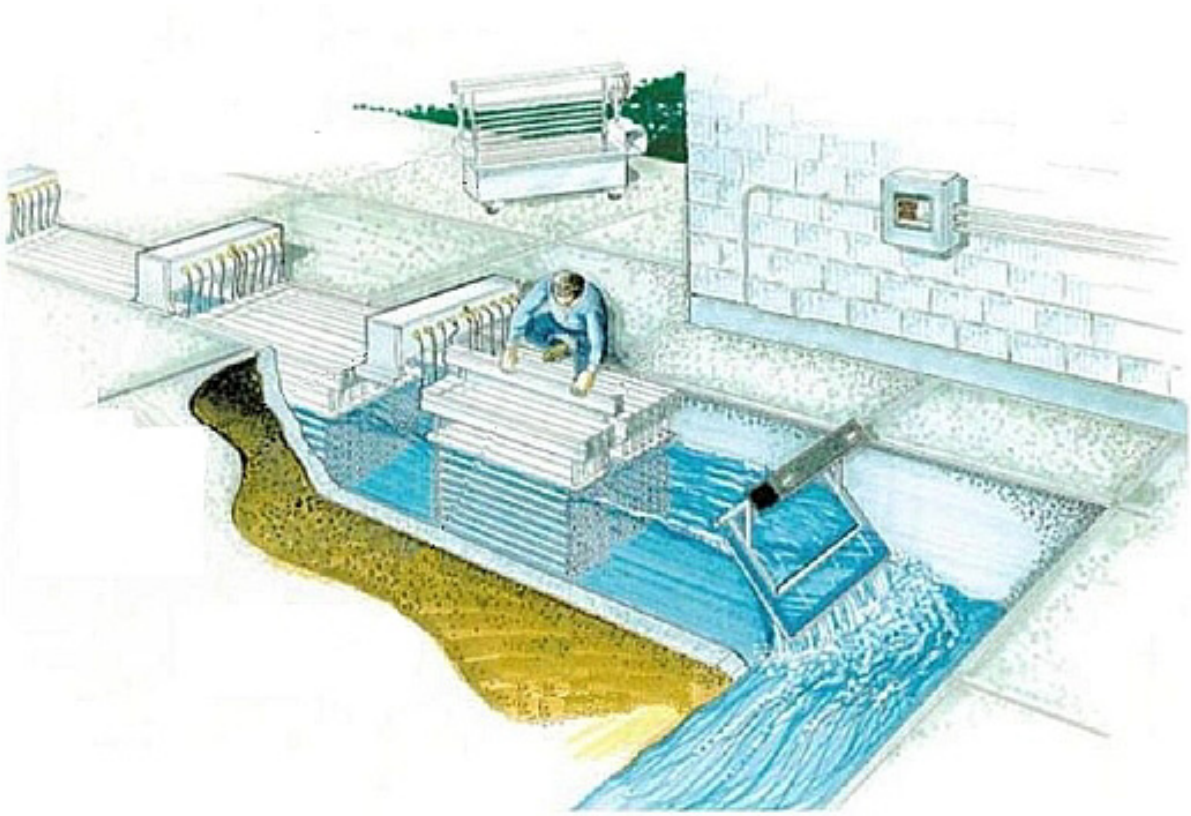
TROJAN UV™
A TROJAN TECHNOLOGIES BUSINESS

TROJANUV3000®B

Operation and Maintenance User Manual

Original Instructions

Edition 11



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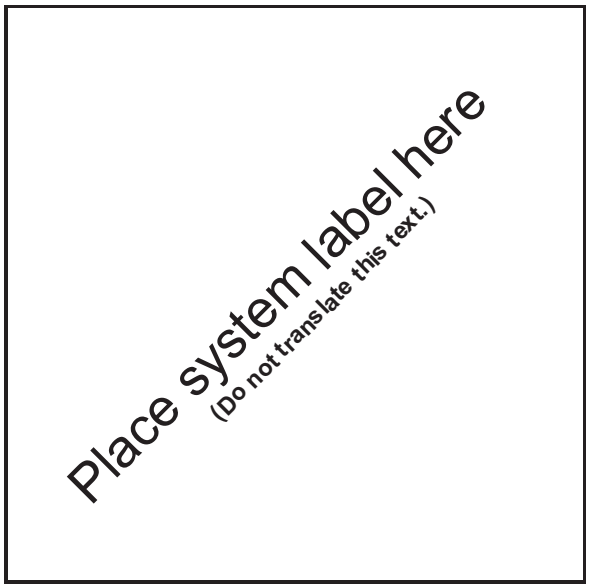


If you require technical assistance, please contact the Technical Assistance Center (TAC) using the contact information below:

North America:	1-866-388-0488
All other areas:	1-519-457-2318
E-mail:	tac@trojantechnologies.com

At the time of publishing, the information within this document is current. Due to continuous improvements, we may have future changes and recommendations which will be sent via product bulletins.

Table of Contents

Section 1 Specifications

Specifications are subject to change without notice.

System Control Center	
Power	120 or 230 VAC input
Power Distribution Center	
Enclosure	Refer to System Description
UV Module	
Lamp Driver enclosure material	Anodized aluminum
UV module frame	Stainless steel, 316
Lamp Driver	
Input	120 VAC ± 10%, 1.6 A, 50 - 60 Hz; 175 W
Output	2 x 78 W
Lamp Sleeves	
Material	Type 214 clear fused quartz circular tubing
UV transmittance	No less than 90.8% UV light
UV Sensor	
Input power	UV sensor is designed to function with a supply voltage between 15 and 30 VDC
Cable	Twisted pair, shielded
Wavelength	UV sensor responds only to ultraviolet energy
Storage temperature	-40 ºC to +80 ºC (-40 ºF to 176 ºF)
Operating temperature	0.5 ºC to 60 ºC (33 ºF to 140 ºF)
UV Module Rack	
UV module rack	Stainless steel

Section 2 Safety Information

Please read this entire manual before operating this equipment. Pay attention to all danger, warning and caution statements in this manual. Failure to do so could result in serious personal injury 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 installation manual.

2.1 Use of Hazard Information

⚠ DANGER
Indicates a potentially or imminently hazardous situation which, if not avoided, will result in death or serious injury.

⚠ WARNING
Indicates a potentially or imminently hazardous situation which, if not avoided, could result in death or serious injury.

⚠ CAUTION
Indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury.

NOTICE
Indicates a situation that is not related to personal injury.

2.2 Precautionary Labels

Read all labels and tags attached to the equipment. Personal injury or damage to the equipment could occur if not observed.

	Electrical equipment marked with this symbol may not be disposed of in European public disposal systems. In conformity with 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. ***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. For the manufacturer recycling UV lamp program or producer-supplied electrical accessories and auxiliary items, contact the equipment supplier for proper disposal instructions.*
	This symbol indicates there is Mercury present.
	This is the safety alert symbol. Obey all safety messages that follow this symbol to avoid potential injury. When on the equipment, refer to the Operational and Maintenance manual for additional safety information.
	This symbol indicates a risk of electrical shock and/or electrocution exists.
	This symbol indicates the marked item has stored energy. Obey procedures to wait 5 (five) minutes after disconnecting main power, to allow stored energy to dissipate.
	This symbol indicates corrosive material. Avoid inhalation, ingestion, or exposure to eyes and skin. Wear appropriate clothing and personal protective equipment.

	This symbol indicates the components of the system have been exposed to biohazardous waste and / or bioaerosols.
	This symbol indicates a trained and competent lift operator should be used to move the equipment.
	This symbol indicates a body crush hazard. People should stay clear from under overhead loads.
	This symbol indicates there is a potential fall from height hazard.
	This symbol indicates surfaces may be slippery and there is a potential fall hazard.
	This symbol indicates there is a potential UV hazard. Proper protection must be worn.
	This symbol indicates the marked item could be hot and should not be touched without care.
	This symbol indicates the marked item should not be touched.
	This symbol indicates that a risk from a hazardous energy source exists, and that all appropriate Lockout Tag Out procedures must be obeyed.
	This symbol indicates to secure the device with a safety device / hook.
	This symbol indicates a safety glasses with side protection is required for protection against UV exposure.
	This symbol indicates a UV rated full face shield is required. Face shields are to be worn with safety glasses or safety goggles.
	This symbol indicates gloves must be worn.
	This symbol indicates safety boots must be worn.
	This symbol indicates a hard hat must be worn.

	This symbol indicates safety harness or fall protection equipment must be worn.
	This symbol indicates that the operator must read all available documentation to perform required procedures.

2.3 Safety Precautions

Read the safety precautions in this section before doing maintenance, service or repair. Obey the instructions in the safety precautions. Failure to follow the instructions in the safety precautions can result in serious injury or death.

⚠ DANGER


Arc Flash and Shock Hazard - Live Electrical Circuit Present.

- Failure to follow these instructions will result in electrical shock, injury or death from electrocution.
- Lockout tag out all sources of power before performing any inspection, repair, or maintenance. ***There may be more than one source of power!***

⚠ DANGER

Shock Hazard.

- Failure to use manufacturer approved parts, including UV Lamps, may result in significant thermal damage to insulation systems which may result in the exposure of live parts.

⚠ DANGER


Fall Hazard.

- Failure to follow these instructions will result in injuries due to fall.
- Always use appropriate fall resistant procedures and equipment while working near an uncovered channel, when a fall hazard is present, in compliance with local regulations.

⚠ WARNING

Personal Injury Hazard.

- Use of parts not approved by the manufacturer may cause personal injury, damage to the UV system or malfunction of the UV System and may void the manufacturer's warranty.
- Use of UV Lamps and Lamp Drivers, not approved by the manufacturer, will void UL and CE product safety certifications.
- The parts listed in Section 11 are approved by the manufacturer.

⚠ WARNING


Body Crush Hazard.

- Failure to follow these instructions could result in serious injury or death due to improper lifting procedures, underrated lifting equipment, and moving parts.
- ALWAYS secure with safety device.
- ALWAYS stay clear of elevated loads.
- ALWAYS comply with local safety regulations.

⚠ CAUTION


UV Light Hazard.

- Failure to follow these instructions may result in serious burns to unprotected eyes and skin.
- ALWAYS use UV protective gear, including gloves and clothing and face shield, when UV light is present.
- NEVER look directly at illuminated UV lamp, even with protective gear.
- NEVER illuminate UV lamp if personnel may be directly exposed to UV light.

⚠ CAUTION


Burn Hazard.

- Failure to follow these instructions may result in minor or moderate injury due to burns.
- NEVER touch hot surface.
- Allow UV lamps to cool for a minimum of 10 (ten) minutes before handling.
- If accidental exposure occurs, immediately cool affected area. Consult physician.

⚠ CAUTION

Slip and Fall Hazard.

- Failure to follow these instructions may result in injuries from slip and fall.
- ALWAYS ensure safe footing.
- ALWAYS clean up spills promptly.
- ALWAYS comply with site-specific safety protocols and procedures.

NOTICE

Mercury Chemical

- UV lamps contain a small amount of mercury in either elemental or bound amalgam state, depending on lamp type. These lamps are similar to fluorescent and compact fluorescent lamps (CFL). Always comply with local regulations governing the disposal of lamps containing mercury and the waste associated with breakage.
- NEVER use a vacuum cleaner to clean up broken lamps containing mercury. Vacuuming could spread mercury-containing powder or vapor.
- Thoroughly collect broken glass and trace amounts of mercury and place into a sealable bag or container. For further reference see the U.S. EPA guidelines http://www.epa.gov/cfl/cleaning-broken-cfl.
- If you have further questions about the safe clean-up of mercury containing lamps, contact the TrojanUV Technical Assistance Center at tac@trojantechnologies.com.

NOTICE

Personal Protective Equipment Required.

- ALWAYS use appropriate eye, hand, and foot protection.
- ALWAYS wear UV-C safety glasses when around equipment or a UV-C faceshield with safety glasses or safety goggles when inspecting open running equipment.
- ALWAYS follow plant safety procedures and protocols.
- ALWAYS take all necessary precautions when working around, operating, or working on this equipment, if contamination of components is expected within this application due to effluent biological or chemical contaminants.

NOTICE

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

NOTICE

The **TrojanUV3000®B** has been validated through microbial testing. Through this testing, performance data has been generated for UV dose delivery to inactivate *Escherichia coli (E.coli)* and fecal coliform.

NOTICE

The product has only the approvals listed and the registrations, certificates and declarations officially provided with the product. The usage of this product in an application for which it is not permitted is not approved by the manufacturer.

WARNING: This product can expose you to chemicals including phthalates, which is known to the State of California to cause cancer, and mercury, which is known to the State of California to cause birth defects or other reproductive harm. For more information go to www.P65Warnings.ca.gov.

Notes: *1) Dispose of contaminated parts/components as per country requirements.*

2) Refer to Safety Data Sheets for additional safety information.

Section 3 General 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.

3.1 Acceptable Noise Levels

The airborne noise emissions, A-weighted emission sound pressure level, is not more than 70 dB(A).

3.2 Patents and Permissions

The products described in this document 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 Trojan Technologies, go to: www.trojantechnologies.com/patents.

3.3 Abbreviations and Acronyms

Table 1 describes the abbreviations and acronyms included in this manual.

Table 1 Abbreviations and Acronyms

Abbreviation/Acronym	Description
EMI	Electro Magnetic Interference
EOL	End of Life
HMI	Human-Machine Interface
I/O	Input/Output
MCB	Module Control Board
PDC	Power Distribution Center
SCC	System Control Center
UV	Ultraviolet
UVI	Ultraviolet Intensity
UVT	UV Transmittance

3.4 System Overview

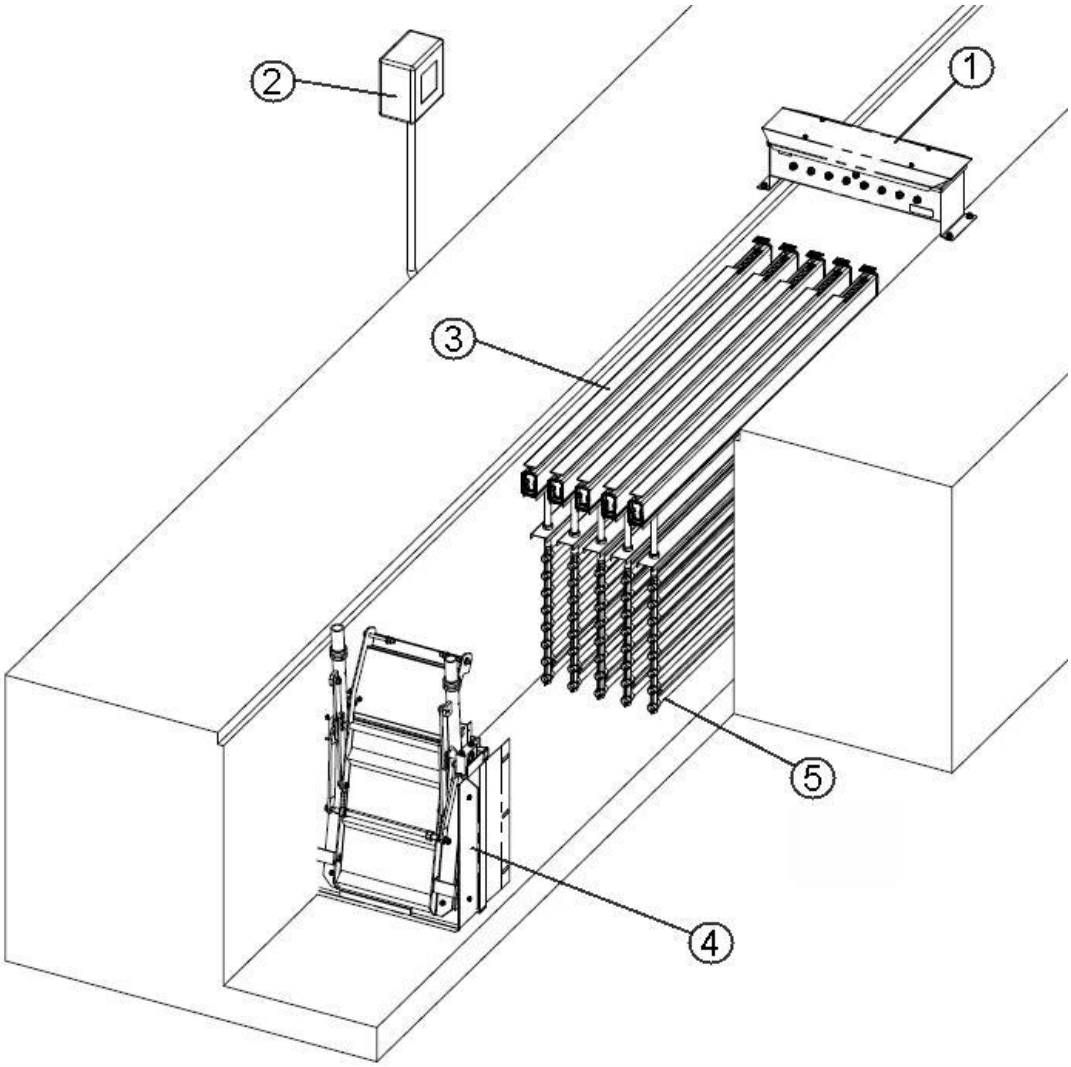


Figure 1 System Components

1	Power Distribution Center (PDC)	**4**	Water level controller (ALC shown)
2	System Control Center (SCC)	**5**	UV lamps
3	UV module		

System Control Center

The System Control Center (SCC) provides control of all UV functions, tracks lamp hours, and uses a submersible UV sensor (one per UV bank) to monitor UV intensity. The SCC is capable of “flow pacing” - automatically turning UV banks of UV lamps OFF or ON in response to changes in the flow rate in order to conserve power and prolong lamp life.

Power Distribution Center

The Power Distribution Center (PDC) distributes power to individual UV modules and allows electrical isolation of each UV module for easy service.

UV Module

UV lamps are mounted on UV modules installed in open channels. The UV lamps are enclosed in lamp sleeves, and positioned horizontally and parallel to water flow. Multiple UV modules are configured into UV banks and work in parallel. All lamp drivers and UV lamp wiring is inside the UV module frame.

The UV module enclosure contains the electronic lamp drivers (one for every two UV lamps), which supply power to the UV lamps, and a Module Control Board (MCB). The UV module power cable is located at one end of the lamp driver enclosure.

The module support rack supports the UV modules at the correct height in the channel.

UV Lamps and Lamp Sleeves

The germicidal UV lamp is a low pressure, low output UV lamp, preheated to promote longevity and contains a rugged filament to withstand shock and vibration. UV lamps are also designed to produce zero levels of ozone.

Each UV lamp is enclosed in its individual lamp sleeve, to prevent moisture from entering the UV module frame, and each UV lamp is rated for continuous submergence. One end of the lamp sleeve is a closed dome shape, and is held in place by a retaining O-ring. The other open end is sealed against the UV lamp holder seal assembly with an O-ring and a Ryton Sleeve Nut. A compression spring is located inside the domed end of the lamp sleeve. The spring is used to support the UV lamp during shipping, and to supply a continuous connection while in use.

UV Sensor

The UV sensor continuously measures the UV intensity produced in each UV bank. The submersible UV sensor measures only the germicidal portion of the light emitted by the low-pressure UV lamps.

Section 4 Lockout Tag Out

⚠ DANGER

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

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

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

The procedure in Section 4.1 is the minimum lockout requirement. Use additional precautions, as needed. Obey all site-specific protocols.

4.1 Lockout Tag Out Procedure

4.1.1 Equipment Shutdown

Contact the plant manager or shift supervisor for help regarding equipment location and identification.

1. Ensure that no hazards will be created by equipment shutdown.
2. Shut down all equipment that will need lockout tag out.
3. Ensure that all moving parts come to a complete stop.

4.1.2 Deactivate Energy Sources

A hazardous energy source is any energy source that can cause serious personal injury or death. The potential hazardous energy sources in this system are:

1. Identify and deactivate the main isolating device of each energy source:
   -  Electrical Energy (Incoming Power)
   -  Thermal (Thermal Energy)
   -  UV Light (Radiation Energy)
2.  Disconnect all electrical equipment from power:
   - Disconnect all electrical equipment.
   - Power off and disconnect electrical power to hard-wired equipment.
3.  Dissipate stored electrical energy in capacitors.
4. Close all shut-off valves.
5. Disconnect electrical power to pumps and compressors.
6. Ensure that the hydraulic lines are not pressurized.
7. Secure moving parts to avoid unintended movement.

4.1.3 Lockout Tag Out Energy Sources

1. Use a multi-lock scissor adaptor to lockout each energy source.
2. Attach a completed lockout tag. Include the required information:
   - Person and company applying the lockout
   - Reason for the lockout
   - Date of the lockout
3. Apply a personal lock.

4.1.4 Verify Lockout

1. Ensure the volt meter is working correctly with a test before and after measuring the de-energized source:
   a. Test the voltmeter to a known, energized 24 VAC/120 VAC source.
   b. Use the same voltmeter to verify the locked-out energy sources to confirm that there is no voltage.
   c. Test the voltmeter again to a known, energized 24 VAC/120 VAC source.
2. Ensure that the stored energy sources have dissipated.
3. Try to start the de-energized equipment and verify that it does not start.

4.2 Remove the Lockout Tag Out

When the work is finished and the system has been restored to full operational condition, including closing all enclosure doors, the lockout tag out can be removed.

1. Ensure that no hazards will be created by removal of the lockout.
2. Obey manufacturer's instructions and safe work procedures to energize and start the equipment.

Section 5 Shipment and Storage

The following instructions outline the duties and responsibilities of the contractor on receiving the equipment. The contractor assumes responsibility for the system equipment after it has arrived at the project site.

These instructions define the minimum requirements for care of the system equipment prior to the system being commissioned. Additional care must be demonstrated by the contractor, as necessary, to ensure that the equipment is not damaged.

5.1 Shipping the Equipment

The system is delivered to the site by truck. System components are packed in wooden crates labeled with the component name. Other labels identify components which are fragile or breakable and components which must be kept dry.

5.2 How the equipment is shipped

The system is delivered to the site by truck. System components are packed in wooden crates labeled with the component name. Other labels identify components which are fragile or breakable and components which must be kept dry.

To prepare for installation, remove only the shipping straps and bolts that secure the panel to the pallet.

5.3 Storage requirements before the install

The manufacturer recommends indoor storage of the system equipment. The equipment should be stored in a dry warehouse. Heating is not necessary during storage. However, before system start up, the equipment must be warmed to more than 15 ºC (60 ºF) for a period of 24 hours.

Storage area conditions:

- Ambient air temperature between -40 ºC to 55 ºC (-40 ºF to 130 ºF)
- Relative humidity from 10% to 90%, non-condensing
- Free from dust and dirt ingress
- Must not contain corrosive or explosive gases
- Free from salt air
- Vermin free

If indoor storage is not possible, the UV Modules, and PDC's may be stored outdoors, with additional conditions:

- Equipment is stored on high ground that is not susceptible to flooding.
- Equipment is elevated a minimum of 300 mm (12 inches) above the ground or as appropriate to prevent damage from flooding.
- Equipment is completely covered with waterproof tarps to prevent exposure to the elements (e.g., rain, snow, sand, dust etc.). Tarps must be tight fitting, attached securely and examined regularly. Water and snow accumulation should be removed regularly.
- Equipment stored in crates should not be exposed to direct sunlight.
- Equipment can be stored in sea containers.

All other equipment including the SCC, UV photometer (if applicable), and spare parts should be stored as specified.

⚠ DANGER

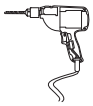
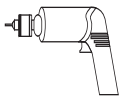
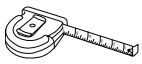
Obey all warning and caution statements. Refer to Section 2.

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

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

No special tools are required for installation, other than those used in the day-to-day operation of a mechanical and electrical contracting firm. An appropriately sized crane may be required for off loading and installation of the unit. Size is dependent upon each project configuration.

6.1 Tools and Materials

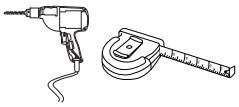
Symbols	Description	Symbols	Description
	Hammer Drill		Hand Drill
	Measuring Tape		Cloth

6.2 Module Support Rack

Prerequisites:

- Make sure channel is free of water upstream and downstream

Tools:



Materials:

- M12 (1/2in)ø expansion anchors (by others)

Procedure:

1. Modules are supported in the channel by the rack, which is fixed to the channel walls. For the support rack eight (8) expansion anchor bolts are required (2 in each corner). Positioning of the rack(s) and the rack detail are shown on the project layout drawing. When the modules are placed in the rack, the distance from the channel floor to the center of the bottom lamp must be 38mm (1.5 inches).

6.2.1 UV Module Installation

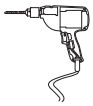
Do not install the UV modules until manufacturer personnel have confirmed the placement of the module support racks and thoroughly examined all UV modules and channels.

Do not submerge the module enclosures under water or the electrical components may be damaged. Module enclosures are water resistant, not waterproof.

Prior to the arrival of the manufacturer's personnel, examine the UV modules and report any damage.

6.3 Power Distribution Center

Tools:



Materials:

- M10 (3/8 in.)ø Anchor Bolts (x4) (by others)

Procedure:

1. Place the PDC in the location and position specified in the project layout drawing.
2. Mark the hole locations on the concrete by using the holes on the PDC legs.
3. Remove the PDC and drill holes to accommodate anchor bolts.
4. Install the anchors in the concrete, and place the PDC onto the anchors. Make sure that the PDC legs are flush with the channel walls. Refer to Figure 2.
5. Connect the UV module power cords to the respective receptacles on the PDC.
6. Connect the power cords from the UV sensor into the PDC
7. Repeat steps 1 through 6 for each PDC.

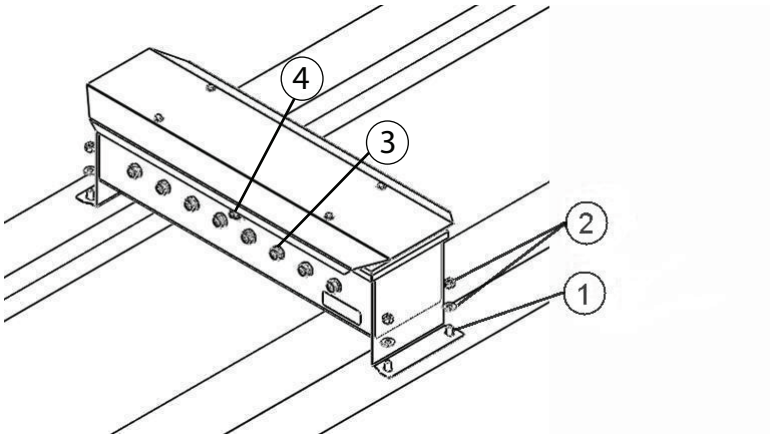


Figure 2 PDC Installation

1	Anchor Bolt*	**3**	UV Module Power Receptacle
2	Mounting Hardware*	**4**	UV Sensor Port

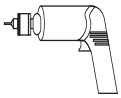
** Indicates item is to be supplied by customer or Contractor.*

6.3.1 Electrical Installation

Prerequisites:

- Apply lockout tag out devices as necessary. Refer to Section 4.
- Refer to PDC electrical drawings and layout drawings to determine wire sizes, routing and connections to other devices.
- Install the PDC. Refer to Section 6.3.

Tools:



Materials:

Procedure:

1. Locate the appropriate end where the electrical connections are to be made.
2. Put a cloth over equipment inside the PDC enclosure to protect from metal filings.
3. Drill holes into the PDC enclosure for incoming power feed.
4. Carefully remove the protective cloth without dropping metal filings inside the PDC. Remove all metal filings in the PDC.
5. Install the power feed. Obey all local codes for main incoming power supplies and applicable field wiring.

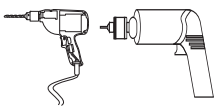
   Note: *All connections must be watertight and weather-proof. Obey TYPE 4X or IEC IP66 standards for all electrical connections to the PDC.*
6. Repeat steps 1 through 5 for each PDC.

6.4 System Control Center

Prerequisites:

- Apply lockout tag out devices as necessary. Refer to Section 4.
- Refer to SCC electrical drawings and layout drawings to determine wire sizes, routing and connections to other devices.

Tools:



Materials:

- M6 (1/4 in.) expansion bolts (x4) (by others)

Procedure:

1. Put the SCC enclosure in the final installed position.

   Note: *The SCC is wall or pedestal mounted.*
2. Attach the SCC enclosure to the wall as required with expansion bolts. Place the user interface at a height that will allow the operator to read the screen easily.
3. Drill holes in the bottom of the SCC enclosure.
4. Attach and terminate the power supply (in the appropriate conduit, wire tray, etc.) to the termination strip. Refer to the enclosure assembly drawing in the electrical drawings.

5. Attach the communications cables from the PDC(s) and terminate as needed.

   Note: *All connections must be watertight and weather-proof. Obey Type 4X or IP66 standards for all connections.*

6. Attach remaining analog and discrete control wiring and terminate as required.

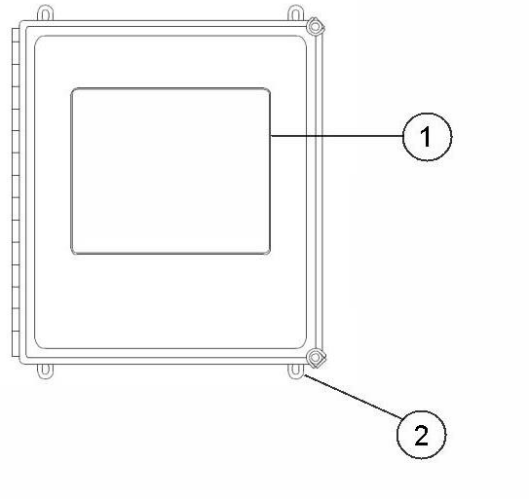


Figure 3 SCC Installation

1	Operator Interface	**2**	Panel Mounting Lugs

6.5 Startup and System Commission

After the shipment of the UV system, the contractor will be issued documentation for a start-up request. These documents must be completed and returned to the issuer before a commission date can be scheduled.

Section 7 System Startup and Shutdown

⚠ DANGER	
	Obey all warning and caution statements. Refer to Section 2. Read and understand this Operation and Maintenance Manual before operating this equipment. Read all user documentation before performing operations, inspections, repair, or maintenance on this equipment.
	Only competent personnel should undertake operation, repairs, maintenance, or servicing of equipment described in this section of the manual. If you do not understand the information or procedure explanations in this manual, STOP and contact your Service Provider for assistance.

7.1 Start up the UV System

1. Ensure main power to the SCC is turned ON.
2. Ensure main breaker in the SCC is turned ON.
3. Put all UV banks in the OFF mode via the SCC.
4. Turn on the main power switch (disconnect switch or breaker) for the Power Distribution Center (PDC). Turn on the 24 VDC output in the PDC.
5. Place all UV banks in the Manual ON mode via the SCC.
6. Allow five minutes for warm-up time for lamps to reach optimum UV output.
7. Introduce effluent to the channel.
8. Ensure all UV lamps are submerged.
9. Place UV banks in Automatic mode of operation via the SCC.

7.2 Shutdown the UV System

For sites with seasonal treatment, the manufacturer recommends that the UV equipment is winterized while not in use.

1. At the SCC, go to the bank control screen and set all UV banks to REMOTE OFF.
2. Disconnect and lockout the main high voltage service to each PDC.
3. Protect female connectors on the PDC with molded Delrin caps supplied with shipment.

   Note: *The manufacturer recommends that all UV modules be removed from the channel and stored in a clean and dry environment in the upright position.*
4. Make sure the UV modules are disabled at the SCC. Disconnect the UV module power from the PDC and place the protective caps onto the UV module power cables. Lift each UV module out of the channel.
5. Store UV modules in a clean dry environment.

7.3 Winterization Procedures

7.3.1 UV Modules

The primary concern for UV modules during the winter season is the potential for damage to the lamp sleeves and UV lamps if effluent is allowed to freeze. Where possible, de-water the channel before winterization, or remove UV modules from the channel.

After removal, each UV module should be cleaned immediately to prevent dirt and debris from drying onto the lamp sleeves and stainless steel frame.

7.3.2 De-water the Channel and Winterize the UV System

1. Bypass effluent from entering channel. De-water the UV channel before de-energizing UV banks. Make sure that untreated effluent is not discharged.
2. De-energize UV module banks by placing each UV bank in the OFF position via the operator interface of the SCC.
3. Unplug the UV modules from the PDCs.
4. Remove UV modules from the channel and store in an indoor location.
5. Protect female connectors on the PDC with molded Delrin caps supplied with shipment.

7.3.3 Winterize the UV System without De-watering the Channel

1. De-energize UV module banks by placing each UV bank in the OFF position via the operator interface of the SCC.
2. Unplug the UV modules from the PDCs.
3. Remove UV modules from the channel and store in an indoor location.
4. Protect female connectors on the PDC with molded Delrin caps supplied with shipment.

⚠ DANGER

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8.1 System Control Center (SCC)

The operation of the system is managed at the SCC, which houses a Type B based controller and the operator interface. The Type B controller evaluates inputs and outputs from the system's components, monitors system status, makes adjustments, and triggers the alarm system.

Information processed by the Type B controller is displayed at the operator interface and is used by the operator to further monitor and control system functions.

The Type B controller is programmed to provide safe and efficient control of the UV system's lamp UV banks as it interfaces with the Power Distribution Center (PDC), Termination Board, and effluent flow signal. Information from these sources is used to maintain the required UV treatment dosage for the effluent conditions.

The system is designed to run in either automatic mode (the Type B controller monitors and controls the UV dosage produced by the UV banks) or manual mode (the operator selects the UV bank operation).

An alarm reporting system notifies the operator when the UV intensity drops below the Low UV Intensity alarm setpoint. UV lamp failure status can be seen on the LED display directly on each UV module.

8.2 SCC Components

The SCC is made up of an I/O board and an operator interface. The operator interface consists of the following components:

- 3 LED displays (a one character, 3 character, and 5 character display), and
- 2 x 3 keypad.

8.2.1 LED Display

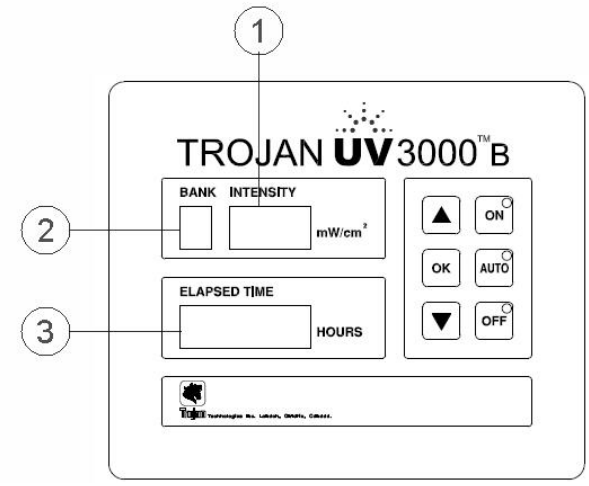

Figure 4 Operator interface

1	Intensity	**3**	Bank
2	Elapsed time		

8.2.2 BANK (One Character LED)

The current bank is displayed on the one character 7-segment LED display.

8.2.3 INTENSITY (Three Character LED)

UV intensity in milliwatts per square centimeter (mW/cm^2) is displayed on the three character 7-segment LED display. This display flashes should the UV intensity drop below the Low UV Intensity alarm setpoint.

8.2.4 ELAPSED TIME (Five Character LED)

The elapsed time in hours is displayed on the five character 7-segment LED display. Once the display reading reaches 65,535 hours, the hour counter is automatically reset to 0 hours.

Once 10,000 hours have accumulated on a given UV bank, its associated lamps are approaching the end of their life and should be replaced.

8.2.5 2 x 3 Keypad

The 6 permanent keys are:

Key	Used to
ON	Control the UV banks
OK	Acknowledge current alarms, and accept system configuration parameters.
AUTO	Control the UV banks
OFF	Control the UV banks
▲ & ▼	Scroll from one UV bank to another and select variables while configuring the system parameters.

8.2.6 Input/Output Board

The I/O board provides signal communication capabilities to allow the SCC to interface with the required discrete and analog signals. The I/O board is pre-configured at the factory for each system. Trojan Technologies configures the functionality of each of the signals in the control strategy.

8.2.7 Power

A 120 or 230 VAC supply is filtered, transformed, and rectified on-board to supply all circuits with their required power.

8.2.8 Discrete I/O

Up to 4 output discrete signals can be utilized for monitoring. Output UV modules are used for sending the UV bank status and alarm information to the plant.

8.3 Operation

The operator may run each UV bank in:

- Automatic mode, which allows the controller to monitor and control the UV dose, or
- Manual mode via the operator interface.

A detailed description of the operation of each operator interface screen is provided in this section.

8.3.1 Power Up/Power Down

To power up the SCC, follow the Start Up procedure in Section 7.

Once the system is powered up, the operator must verify that the system is communicating with the UV banks and displaying the correct UV bank and lamp status on the appropriate screen.

Once powered up, all three LED displays will scroll from one UV bank to the next every 3 seconds. To stop the scrolling, use the arrow keys (▲ & ▼). If no other key is pressed, the display resumes its scrolling action.

8.4 Using the Operator Interface

8.4.1 Acknowledge Alarms

A common alarm Form C dry contact is provided for remote indication purposes of either a Low UV Intensity alarm or Lamp Failure alarm condition existing in any UV bank.

8.4.2 Low UV Intensity Alarm

The 3 character LED display flashes and the common alarm relay energizes when the UV intensity of a UV bank drops below the Low UV Intensity alarm setpoint for a time period greater than the alarm delay period. The display will flash until the operator acknowledges the alarm condition.

To acknowledge the alarm:

1. Scroll to the proper UV bank using the arrow keys (▲ & ▼).
2. Press the OK key.

The display stops flashing and the common alarm relay de-energizes.

8.4.3 Lamp Failure(s) Alarm

The 5 character LED display flashes and the common alarm relay energizes when a lamp in a UV bank fails for a period of time greater than the alarm delay period. The display continues to flash until the operator acknowledges the alarm condition.

To acknowledge the alarm:

1. Scroll to the proper UV bank using the arrow keys (▲ & ▼).
2. Press the OK key.

The display stops flashing and the common alarm relay de-energizes.

8.4.4 Change Bank Status

A bank status Form C dry contact is provided for remote indication purposes of current bank status for each UV bank.

8.4.5 Place UV Bank in Manual Mode

The ON command energizes a UV bank for manual or hand operation. The UV bank will remain ON but will no longer respond to control signals or timers that are required for the Automatic mode of operation.

To place a UV bank in Manual ON mode:

1. Scroll through the UV banks using the arrow keys (▲ & ▼) until you reach the UV bank you wish to place in Manual mode of operation.
2. Press the ON key.

When a UV bank is in Manual mode, the indicator light situated in the upper left corner of the ON key will illuminate for that particular UV bank.

8.4.6 Turn UV Bank OFF

The OFF command de-energizes the UV bank(s). A UV bank will remain off until the operator places the UV bank in Manual mode (ON) or in Automatic mode (AUTO).

To turn off a UV bank:

1. Scroll through the UV banks using the arrow keys (▲ & ▼) until you reach the UV bank you wish to turn OFF.
2. Press the OFF key.

When a UV bank is off, the indicator light situated in the upper left corner of the OFF key will illuminate.

8.4.7 Place UV Bank in Automatic Mode

The AUTO command places a UV bank in the Automatic mode of operation causing the UV bank to respond to control signals and timers. Once a UV bank is placed in AUTO, the controller decides whether the UV bank is ON or OFF as it automatically responds to control signals and timers.

In Automatic mode, a typical system responds to an effluent flow monitor, cycles UV banks for equal wear, and responds to pre-set minimum off time to prevent frequent on/off cycling. The cycling and delay features are designed to minimize lamp replacement costs. The number of UV banks on will respond directly to the flow signal received to minimize power consumption.

To place a UV bank in AUTO mode:

1. Scroll through the UV banks using the arrow keys (▲ & ▼) until you reach the UV bank you wish to place in the Automatic mode of operation.
2. Press the AUTO key.

When a UV bank has been place in Automatic mode the indicator light situated in the left corner of the AUTO key will illuminate. Either the ON or OFF key indicator light will also be illuminated for that UV bank depending on the controller's response to various signals and timers.

8.4.8 Reset Lamp Hours

Once a UV bank's lamps have reached approximately 10,000 hours of operation, the UV bank's lamps are replaced. Once the UV lamps are replaced, the operator must manually reset the UV bank's hours to 0.

Note: *The UV bank's hours are not reset for individual UV lamp replacements.*

To manually reset the hours of a UV bank:

1. Press an arrow key (▲ & ▼) to stop the display from scrolling.
2. Press the ON and ▼ keys simultaneously to access the 'resetting of elapsed time' mode.
3. Scroll to the desired UV bank using the arrow keys (▲ & ▼).
4. Press the OK key once the desired UV bank is reached to reset the selected UV bank's hours to 0.
5. Exit the 'resetting of elapsed time' mode by pressing the ▼ key several times. The system will resume its normal mode of operation.

8.4.9 Configure System Settings

The 'configuration' mode is used to enter or revise the following setpoints:

- Number of UV banks in the system
- Flow pacing setpoint (100 for single UV bank system, 50 for 2 UV bank system, and 33 for 3 UV bank system)
- Auto cycle setpoint (used to alternate the lead and lag UV bank/s creating equal wear)
- Timed off delay period (used to minimize cycling of the UV banks)
- Alarm delay setpoint (used to time delay alarm activation)

- Low UV intensity alarm setpoint
- UV intensity scaling selection

To enter the ‘configuration’ mode and adjust system settings:

1. Press an arrow key (▲ & ▼) to stop the display from scrolling.
2. Press the OFF, OK, and AUTO keys simultaneously to access the ‘configuration’ mode.
3. Enter the number of UV banks in the system by pressing the arrow keys (▲ & ▼) to increase or decrease the numeric value displayed in the Elapsed Time window.
4. Press the OK key once the correct number of UV banks is reached. The system automatically goes to the next configuration setpoint.
5. Enter the flow pacing setpoint by pressing the arrow keys (▲ & ▼) to increase or decrease the numeric value displayed in the Elapsed Time window.

   Note: *For a single UV bank system, scroll to a value of 100. For a two UV bank system, scroll to a value of 50. For a three UV bank system scroll to a value of 33.*
6. Press the OK key once the correct flow pacing setpoint is reached. The system automatically goes to the next configuration setpoint.
7. Enter the automatic cycling setpoint value by pressing the arrow keys (▲ & ▼) to increase or decrease the numeric value displayed in the Elapsed Time window.

   Note: *This value is used to alternate the lead and lag UV bank(s) creating equal wear. Typically this value is set at 168 hours but may be altered at different intervals if desired.*
8. Press the OK key once the correct automatic cycling setpoint is reached. The system automatically goes to the next configuration setpoint.
9. Enter the UV bank’s timed off delay value by pressing the arrow keys (▲ & ▼) to increase or decrease the numeric value displayed in the Elapsed Time window.

   Note: *This value is used to minimize cycling of the UV banks. Typically this value is set at 15 minutes but is a site-specific requirement. If flow rates fluctuate up and down quite frequently, it will be necessary to prevent the UV banks from cycling. In most cases a flow increase or decrease is predictive and a minimal time off of 15 minutes is adequate.*
10. Press the OK key once the correct timed off delay period is reached. The system automatically goes to the next configuration setpoint.
11. Enter the alarm delay setpoint value by pressing the arrow keys (▲ & ▼) to increase or decrease the numeric value displayed in the Elapsed Time window.

    Note: *This value is used to time delay the alarms. Typically this value is set to 3 minutes (i.e. the fault condition must exist for 3 minutes before the alarm is activated).*
12. Press the OK key once the correct alarm delay setpoint is reached. The system automatically goes to the next configuration setpoint.
13. Enter the low UV intensity alarm setpoint value by pressing the arrow keys (▲ & ▼) to increase or decrease the numeric value displayed in the Elapsed Time window.

    Note: *Typically this value is set at 1.6 mW/cm².*
14. Press the OK key once the correct low UV intensity alarm setpoint is reached. The system automatically goes to the next configuration setpoint.

Section 9 Maintenance

⚠ DANGER

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Refer to Section 11 for replacement part numbers.

9.1 Preventive Maintenance Schedule

Scheduled maintenance and inspections can extend the life of the system and prevent problems. Routine maintenance may include partial disassembly to access components for cleaning and visual evaluation. Table 2 shows required periodic maintenance tasks. During any maintenance activity, the manufacturer recommends inspection of all components that can be accessed during the task. Other maintenance tasks in this section may be required when system conditions trigger alarms.

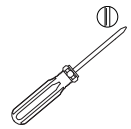
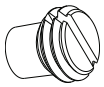
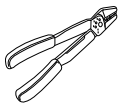
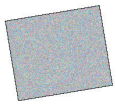
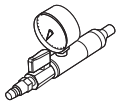
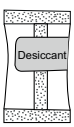
Table 2 Daily Visual Walk-about Inspection Checklist

System Component	Inspection Activity
SCC	Check Alarm Status screen for new faults and record new alarms
	Check the Alarm History screen to get an overview of past faults
	Check the Overview screen(s) on the user interface to make sure that all the UV banks are in REMOTE AUTO and all UV modules are enabled.
UV module	Check the top of the UV module for UV lamp status
Water level control	Clean any algae or debris build-up on the weir

Table 3 Preventive Maintenance Schedule

System Component	Maintenance Requirement	On Removal	Daily	Monthly	Every 2 Months	Annually	12,000 hour
UV system	Visual walk-about inspection (refer to Table 2)		X				
	Clean the channel around the UV system. Perform semi-annually for poor water quality conditions.					X	
UV Module	Inspect and if required remove debris from UV module. Use low pressure washer (e.g. a garden hose). Perform once every two months for poor water quality conditions.	X			X		
	Replace lamps and sleeve O-ring seals at 12,000 hrs End of Life (refer to Section 9.4).						X
	Check the UV module power cable strain relief for tightness (refer to Figure 6, item 3).			X			

9.2 Tools and Materials

Symbols	Description	Symbols	Description
	Slot screwdriver		Set Screw
	Phillips screwdriver		Rubbing alcohol
	Pail		ActiClean™ Gel (or approved cleaning solution as per Table 4)
	Open wrench		Isopropyl alcohol
	Adjustable wrench		Socket wrench
	Allen wrench		Household cleaner
	Soapy water		Lint free cloth
	Wire stripper		Sand paper
	Pliers		Air pressure test tool - Trojan Part Number 907631
	Silicone lubricant		Sponge
	Desiccant bag		Water

9.3 UV Module

9.3.1 Remove a UV Module

Remove the UV modules for cleaning, UV lamp replacement and lamp driver replacement.

Prerequisites:

- Make a note of the UV lamp(s) that are not energized.
- Shut down the UV system. Refer to Section 7.2.
- Apply lockout tag out devices as necessary. Refer to Section 4.

Materials:

Procedure:

1. Unplug the UV modules.
2. Use two people to lift the UV modules out of the channel.

   Note: *The manufacturer recommends that when there are more than five UV modules, the remaining UV modules should be removed from the opposite side of the channel.*

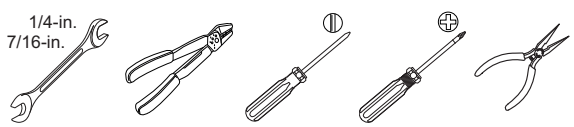
9.3.2 Lamp Driver

9.3.2.1 Remove and Install the Lamp Driver Tray

Prerequisites:

- Shut down the UV system. Refer to Section 7.2.
- Apply lockout tag out devices as necessary. Refer to Section 4.
- Remove the UV module. Refer to Section 9.3.1.
- Brush or wipe away any large debris from the End Cap by using a soft bristled brush or rag.

Tools:



Materials:

Procedure:

NOTICE

Use caution when sliding Lamp Driver Tray into extrusion. Avoid damage to the Lamp Driver Tray wiring.

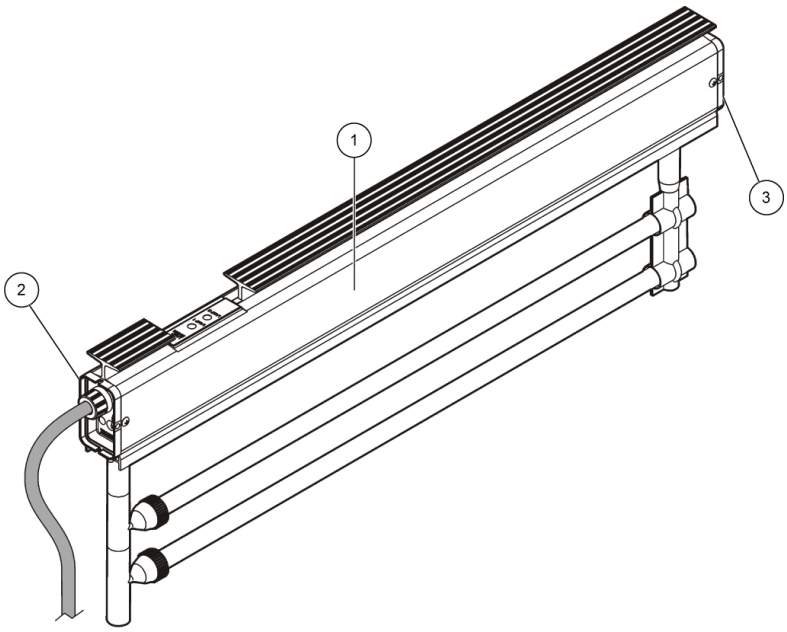
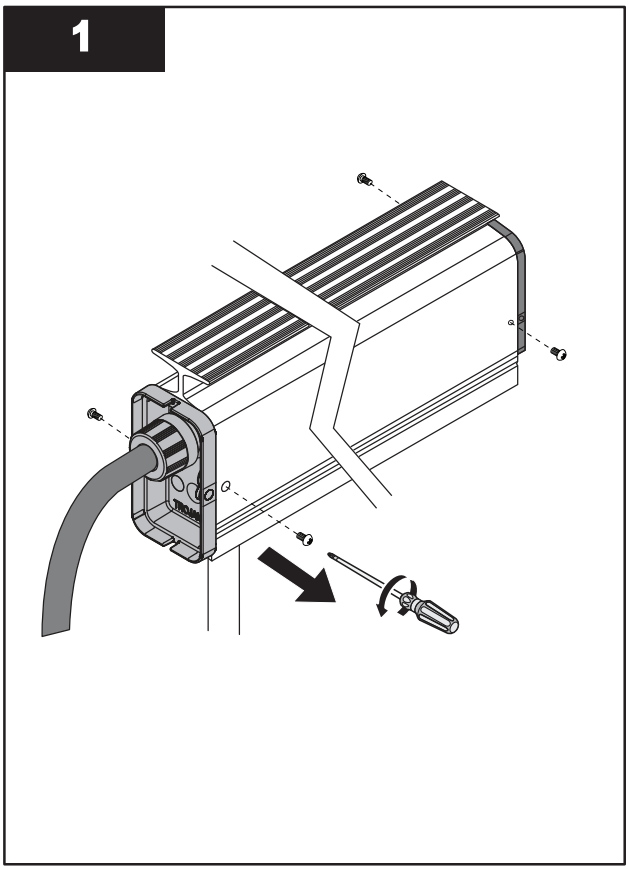
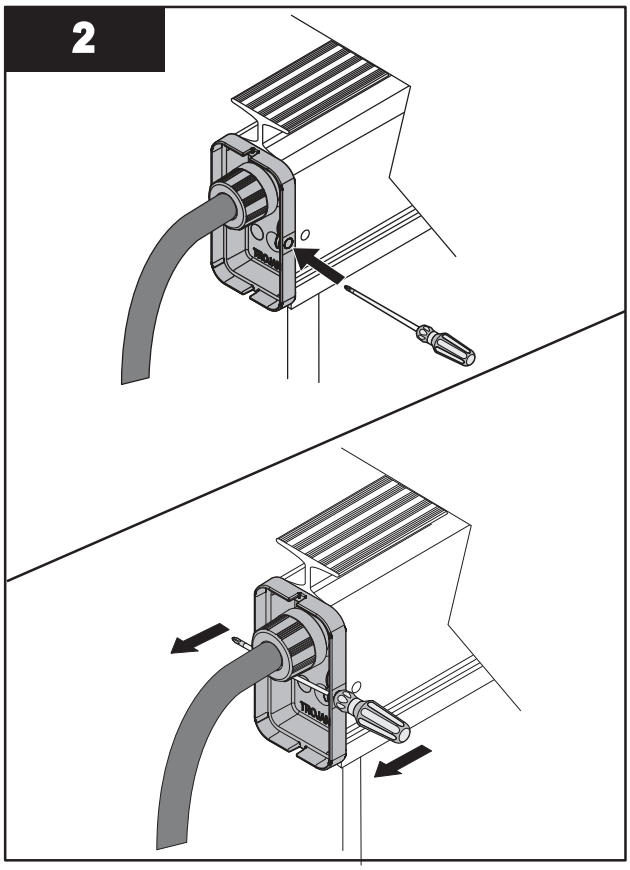
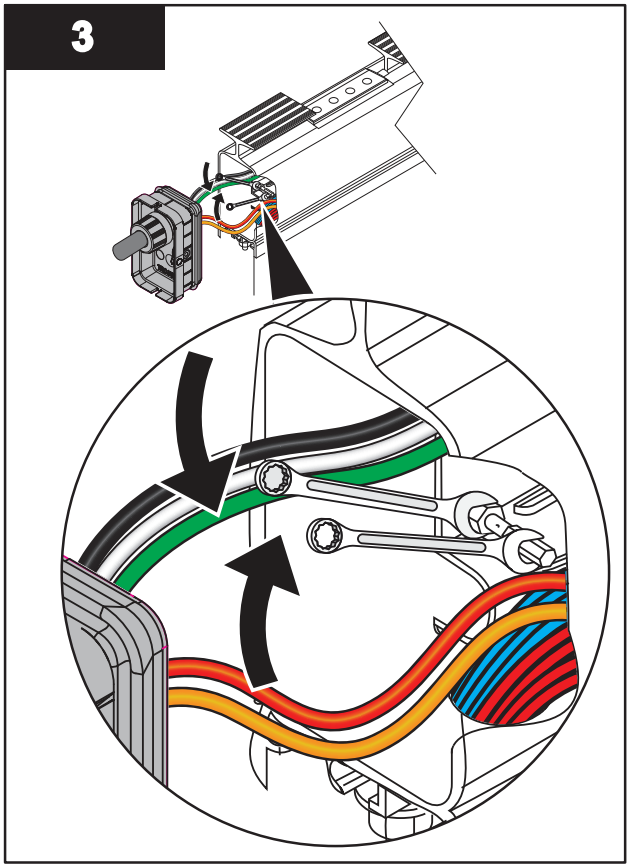


Figure 5 Lamp Driver Enclosure for the UV Module

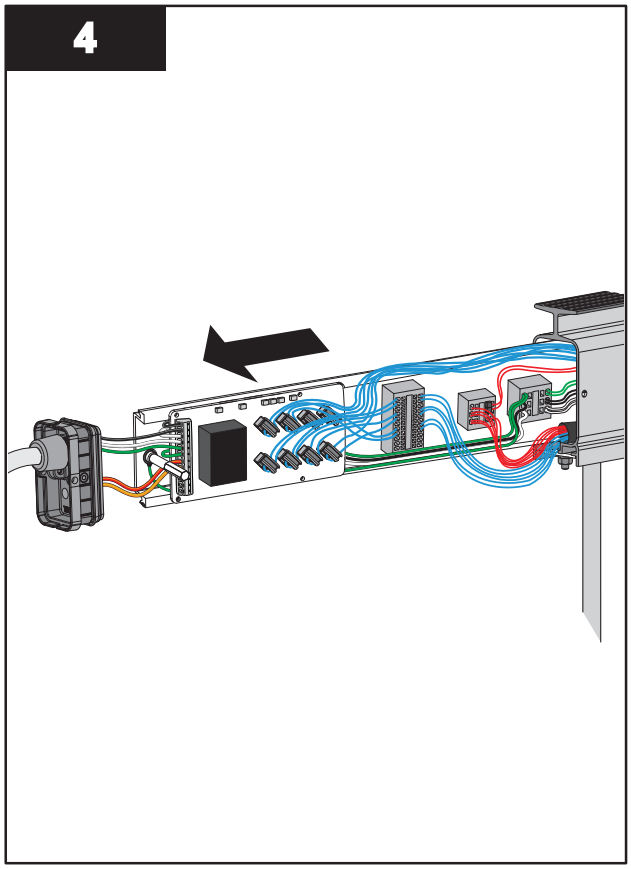
1	Lamp driver enclosure	**3**	Plain service end cap
2	Power service end cap		



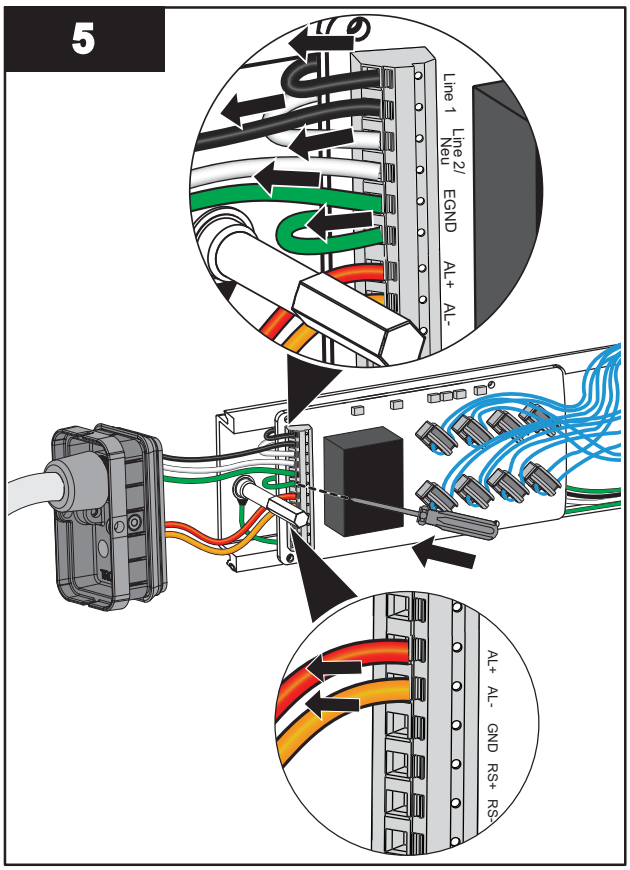


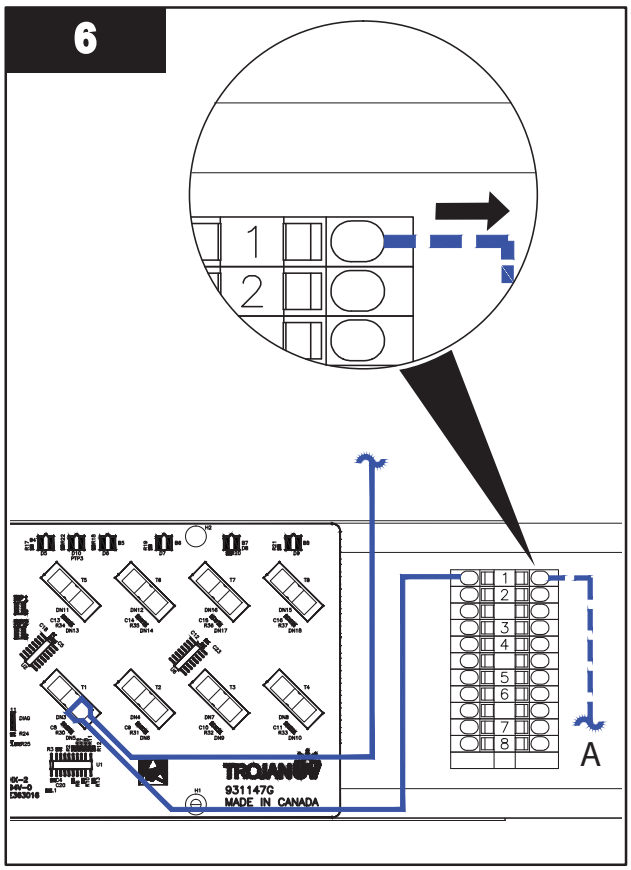


Note: *Loosen the pressure cone and nut at each end of the enclosure.*

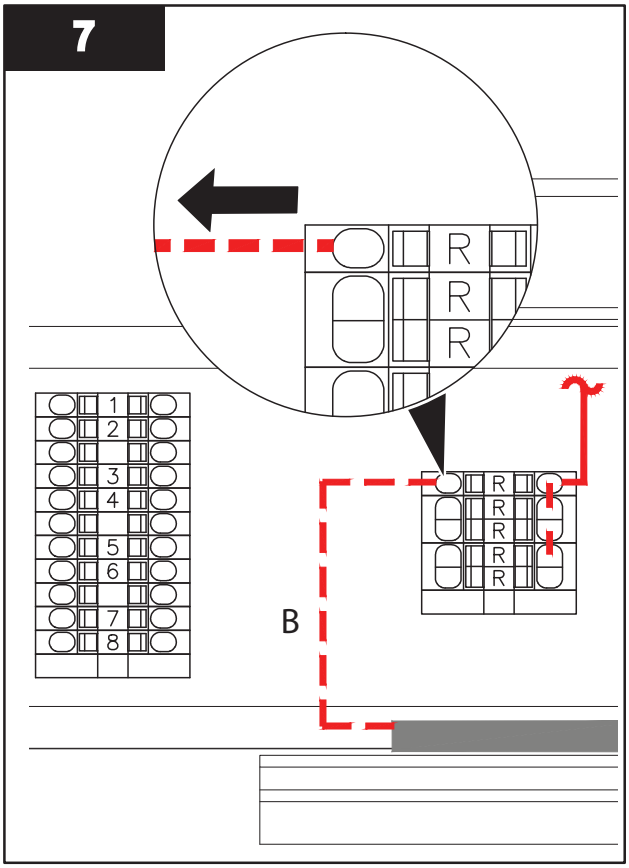


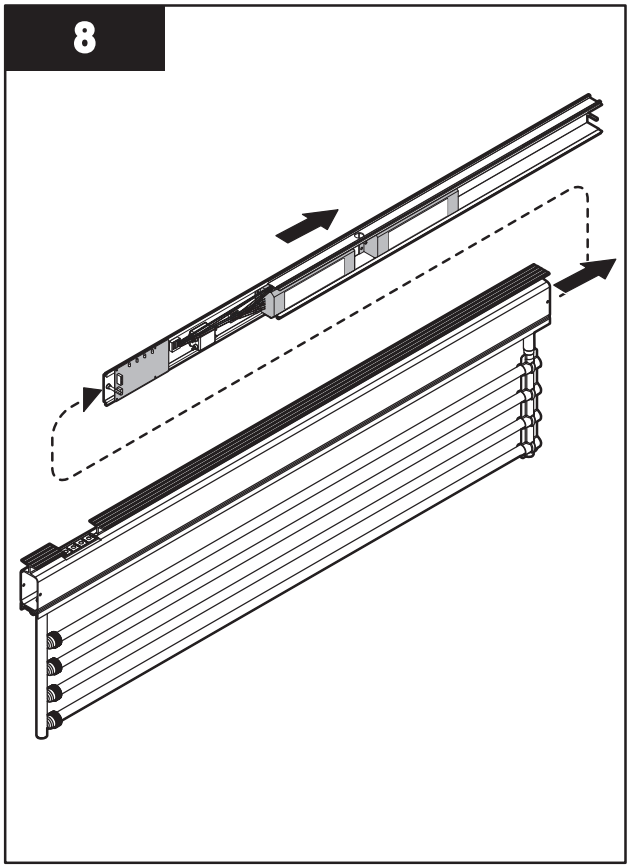
Note: *Partially remove the Lamp Driver Tray from the enclosure.*





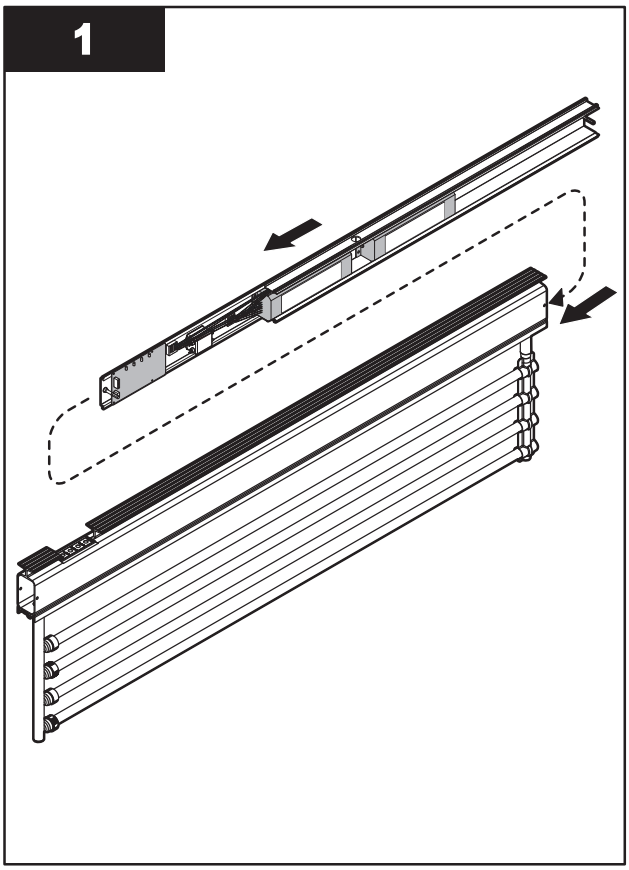
Note: *Disconnect all blue lamp wires (A) from the terminal block.*

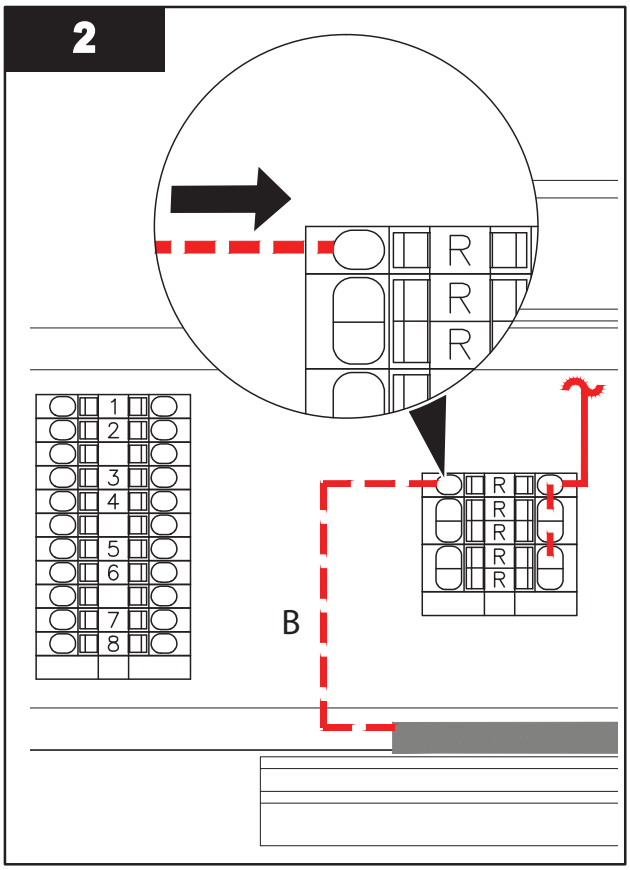




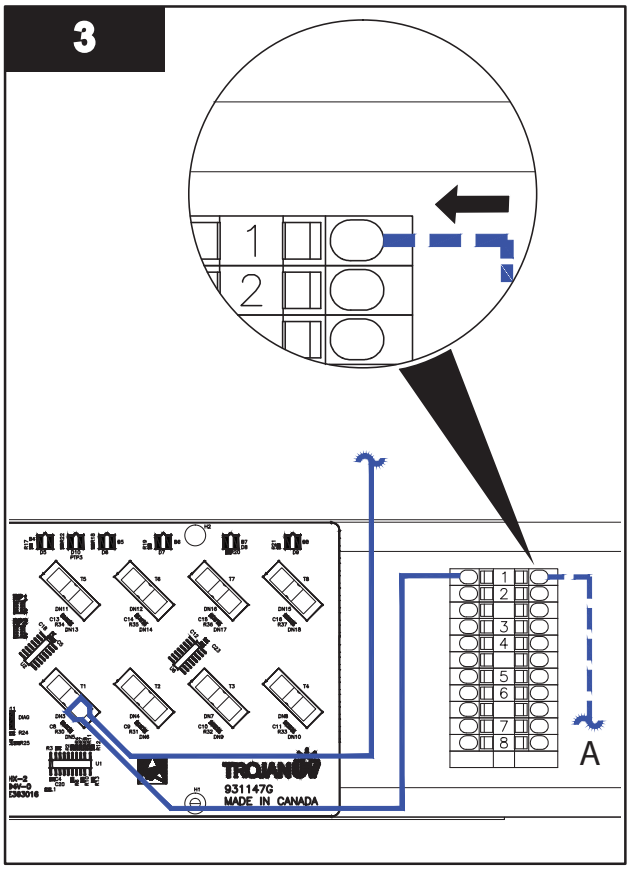
Note: *Disconnect all red lamp wires (B) from the terminal block.*

Install:

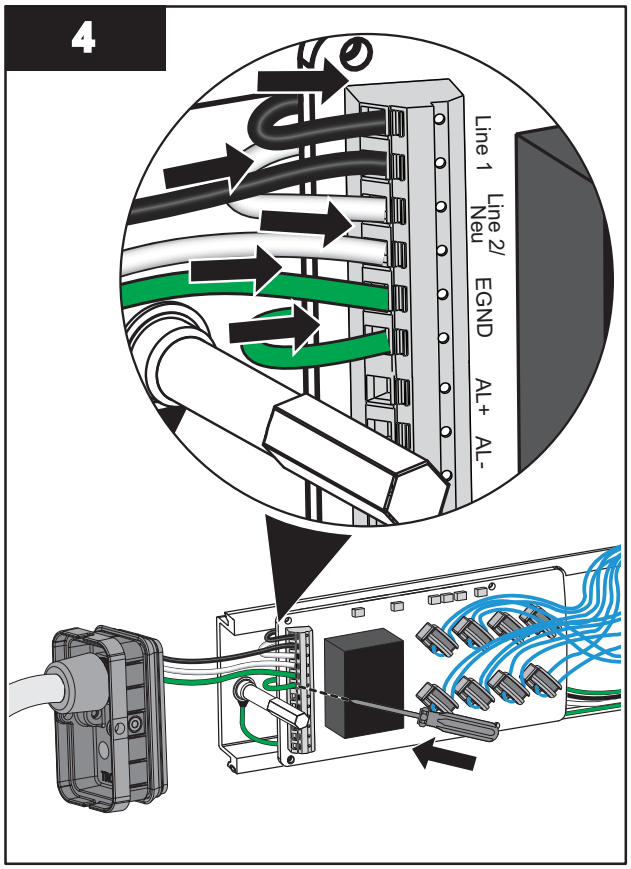




Note: *Connect all red lamp wires (B) to the terminal block.*

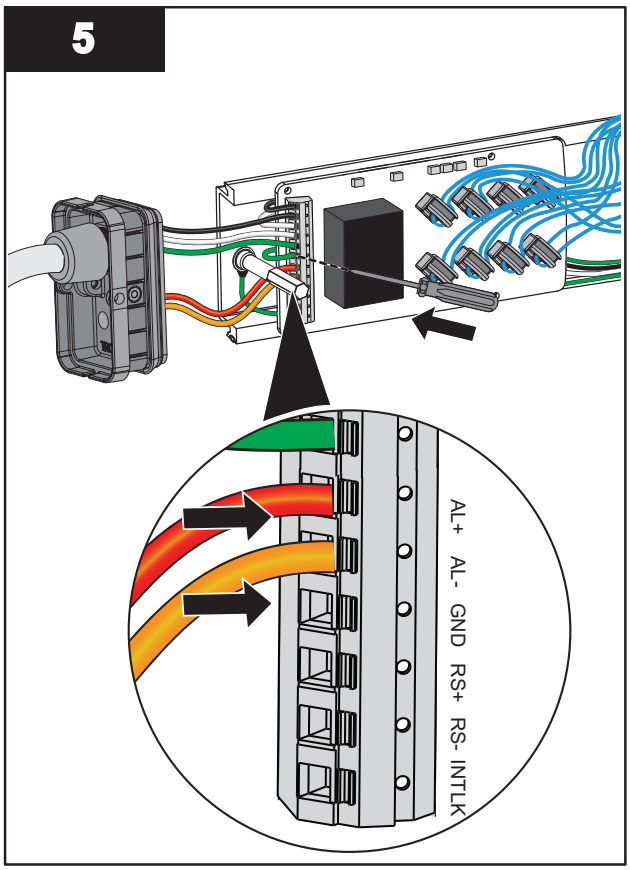


Note: *Connect all blue lamp wires (A) to the terminal block.*

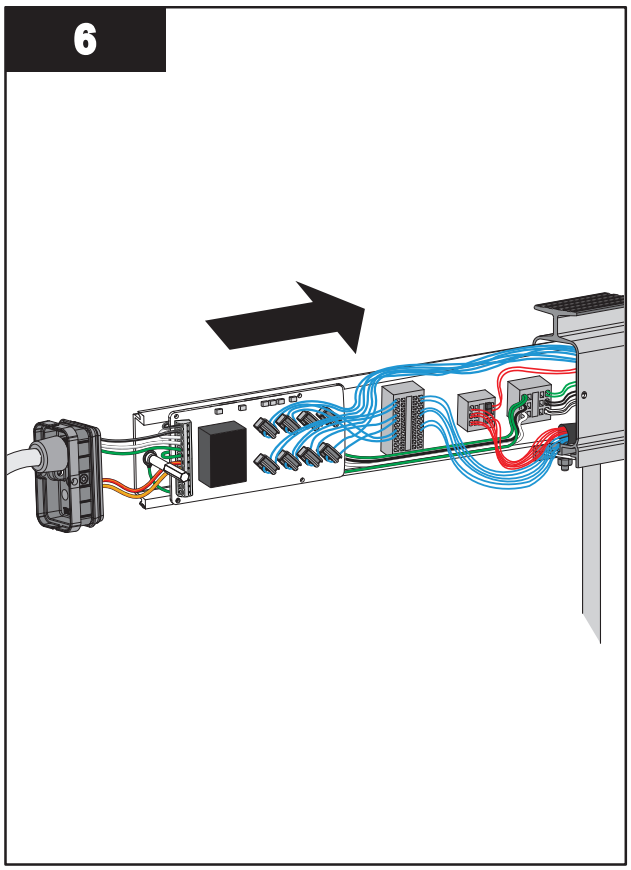


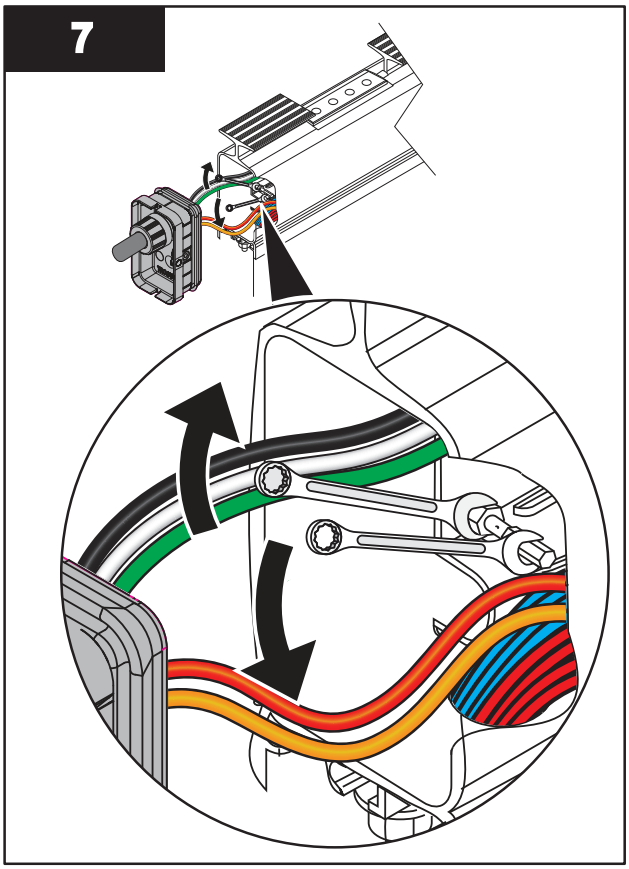
Notes: *1) The power cord strain relief must be installed toward the top of the enclosure.*

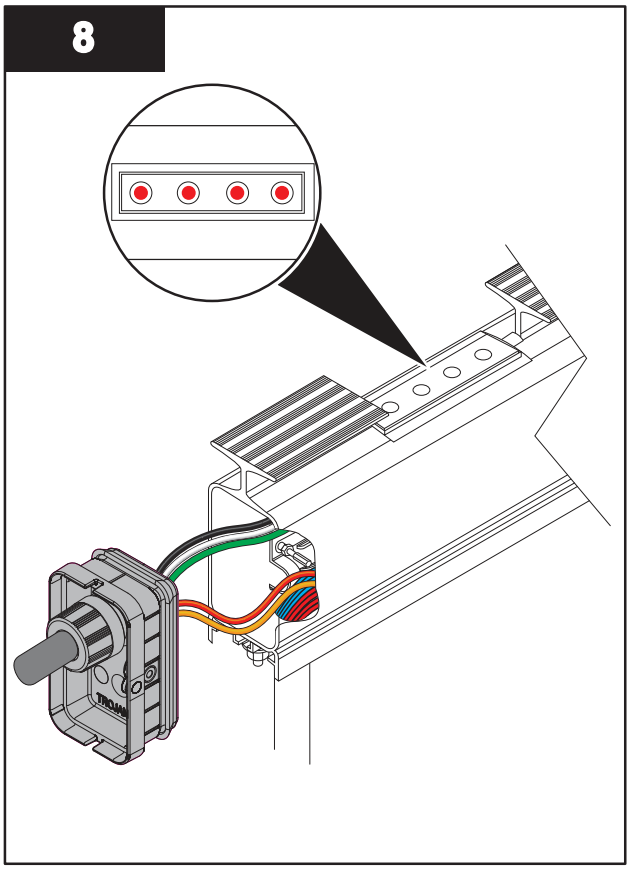
2) Terminate the black wires to Line 1, the white wires to Line 2/Neu and the green wires to EGND.



Note: *Terminate the red wire to AL+ and the orange wire to AL-.*







Note: *Tighten the pressure cone and nut at each end of the enclosure.* ***Note:*** *Verify that the LED's align on the viewing window.*

Post-requisites:

- Install the Service End Cap. Refer to Section 9.3.2.3.

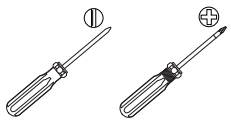
9.3.2.2 Remove and Replace Lamp Driver

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

Prerequisites:

- Remove the Lamp Driver Tray. Refer to Section 9.3.2.2.

Tools:

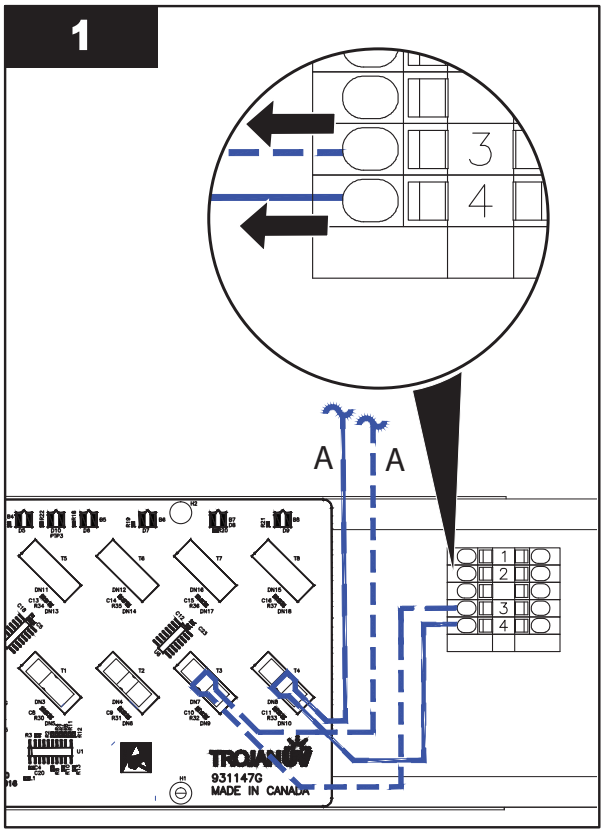


Materials:

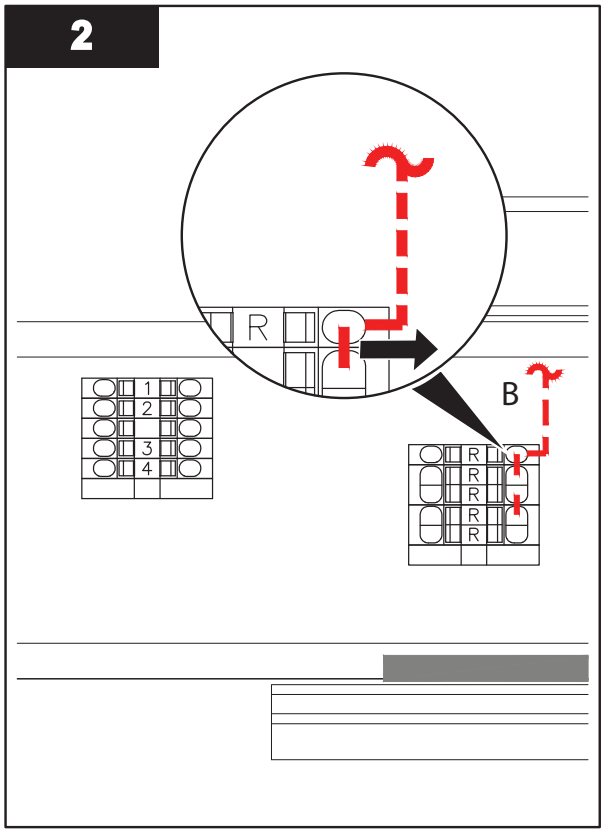
- Lamp Driver

Procedure:

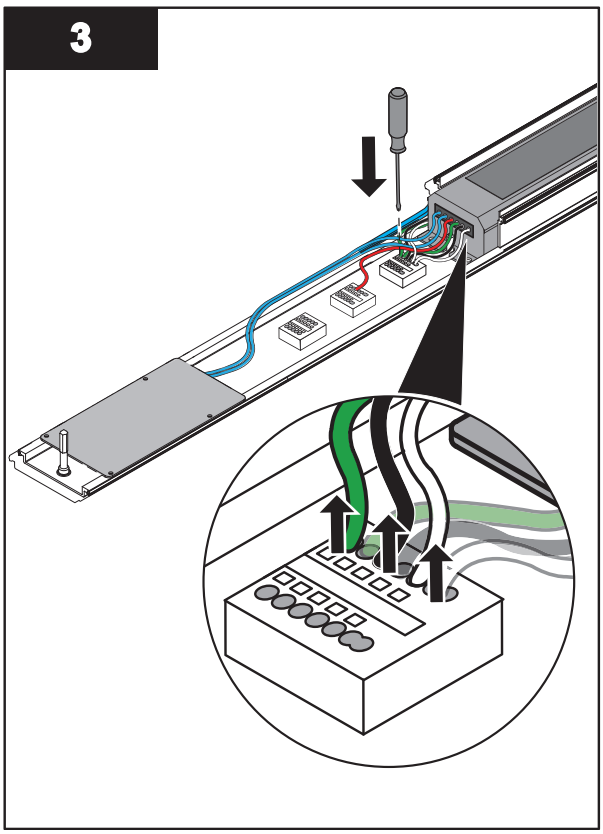
Remove:



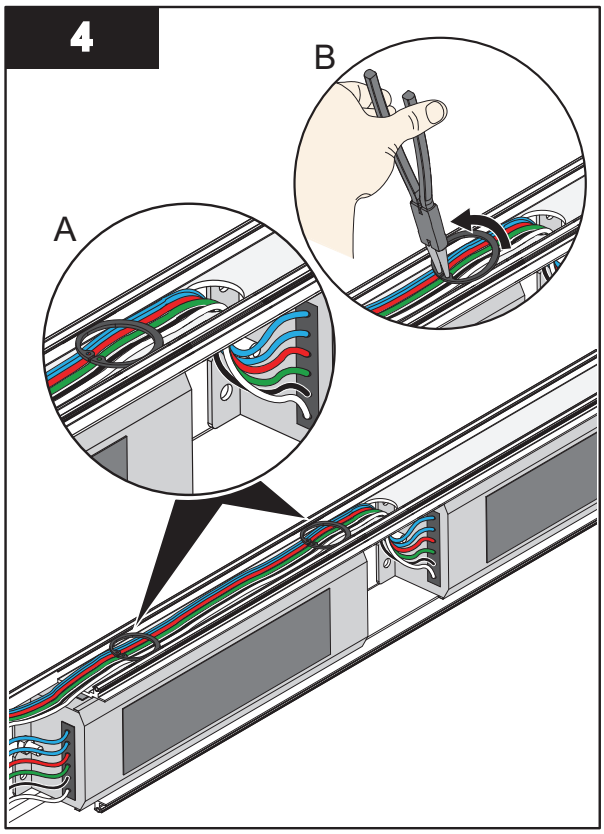
Note: *Disconnect the blue Lamp Driver wires (A) [x2] from the terminal block for the Lamp Driver that needs to be replaced.*

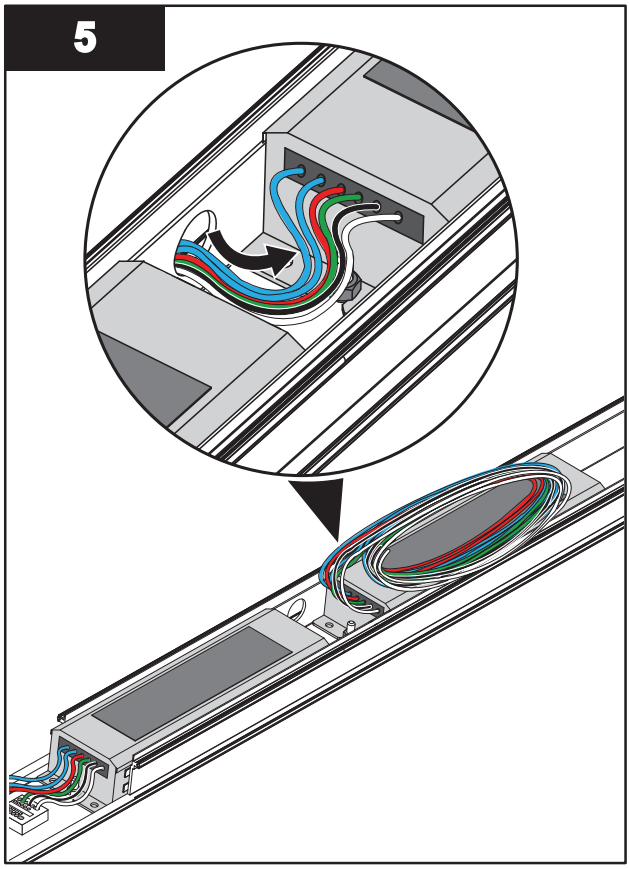


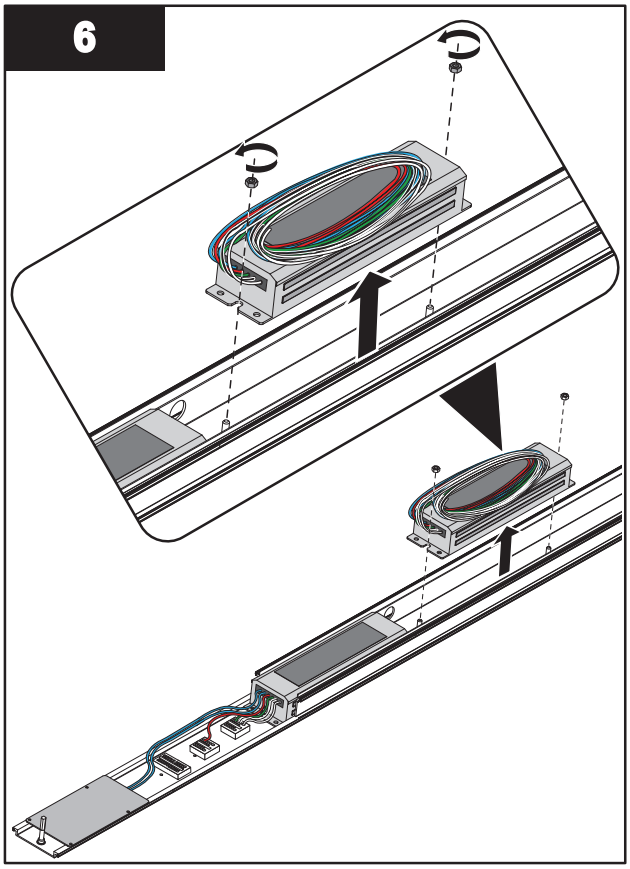
Note: *Disconnect the red Lamp Driver wire (B) from the return block for the Lamp Driver that needs to be replaced. Depending on the quantity of Lamp Drivers, the terminal block may be located in between the Lamp Drivers.*



Note: *Disconnect the power wires for the Lamp Driver that needs to be replaced. Depending on the quantity of Lamp Drivers, the terminal block may be located in between the Lamp Drivers.*

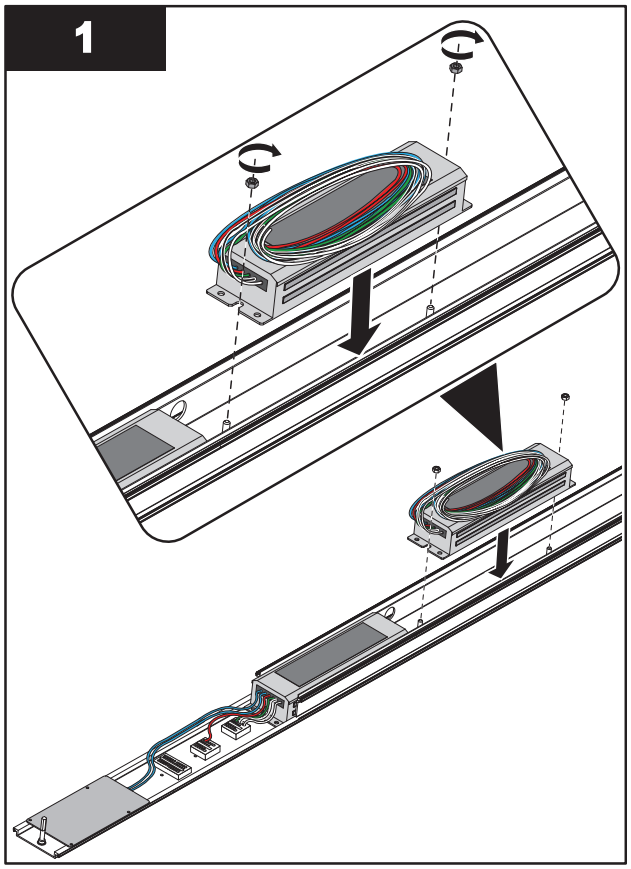


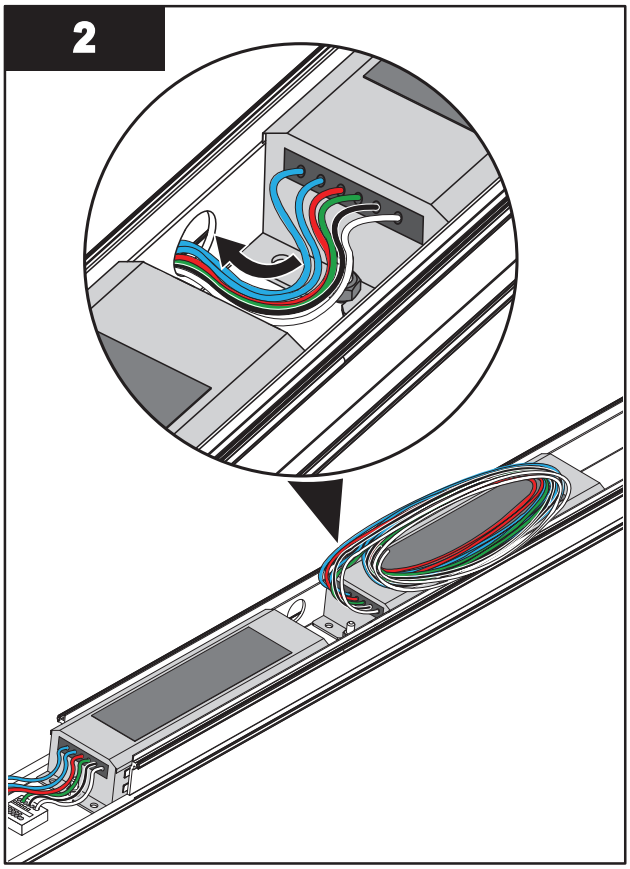


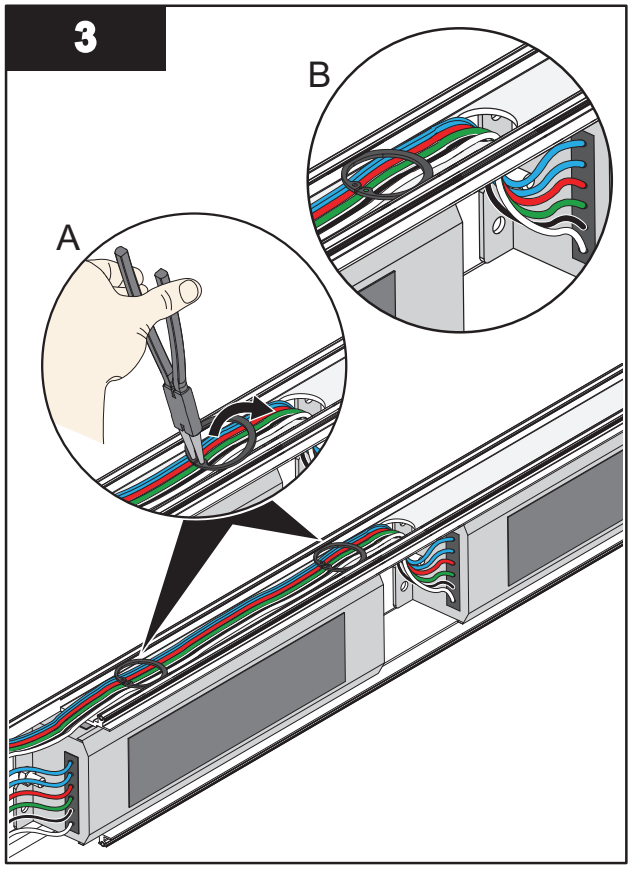


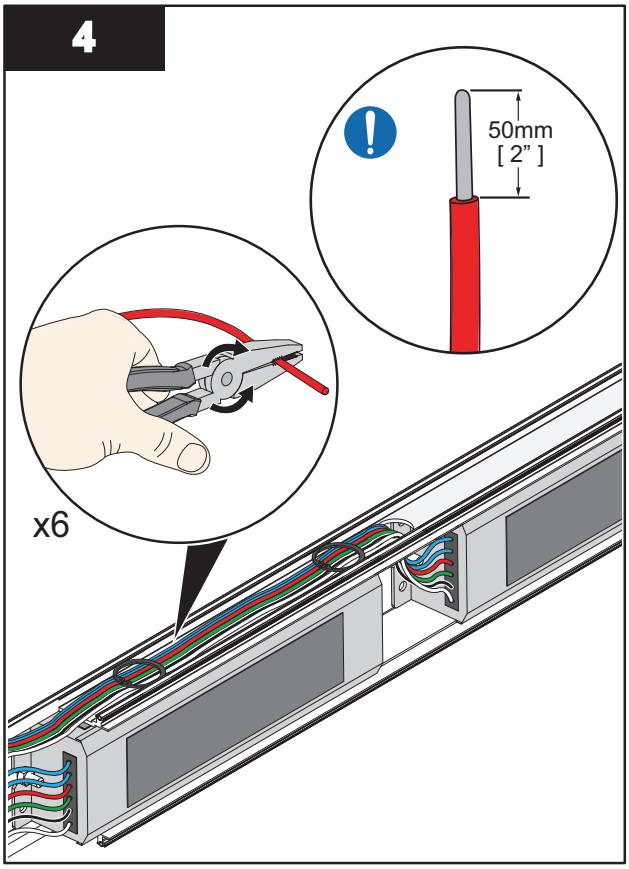
Note: *Loosen and remove Lamp Driver mounting hardware.*

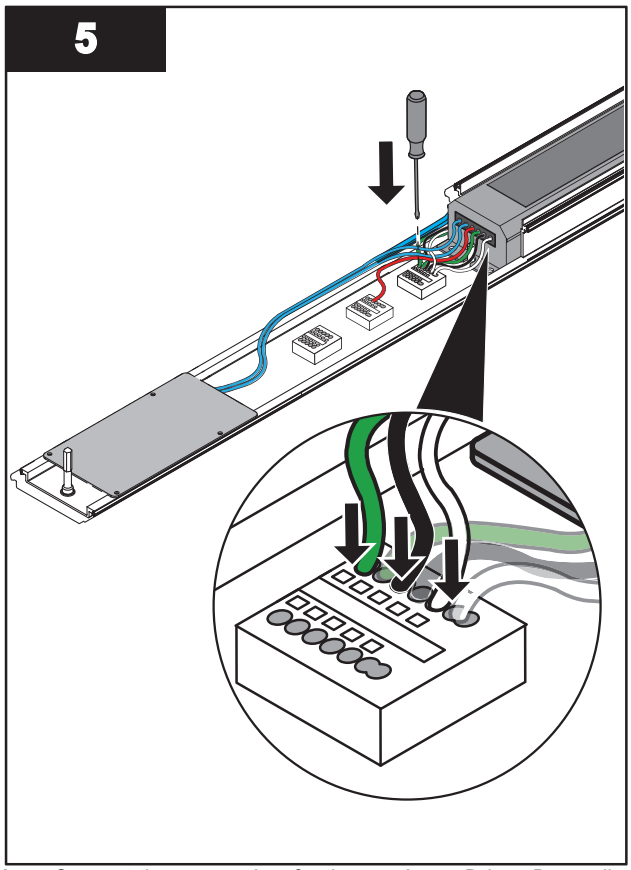
Install:



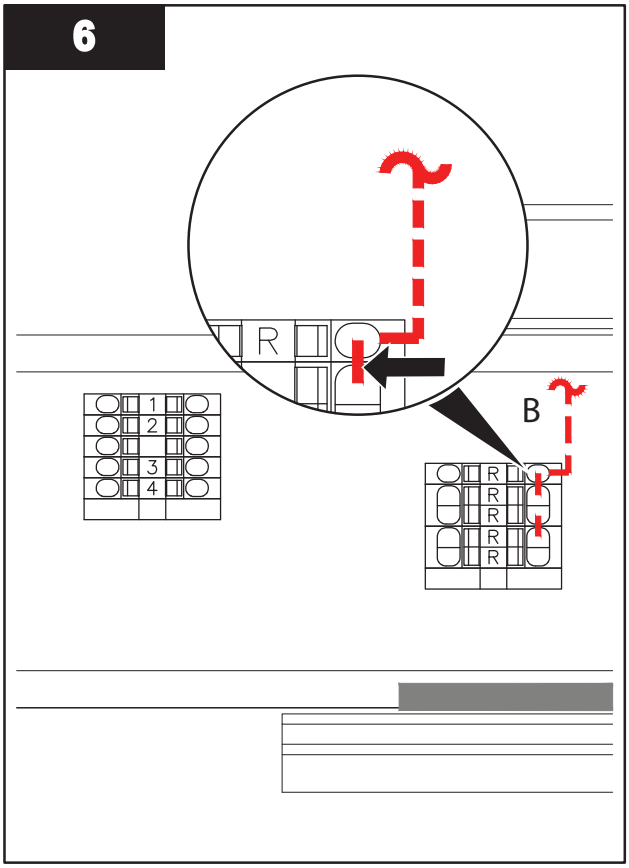




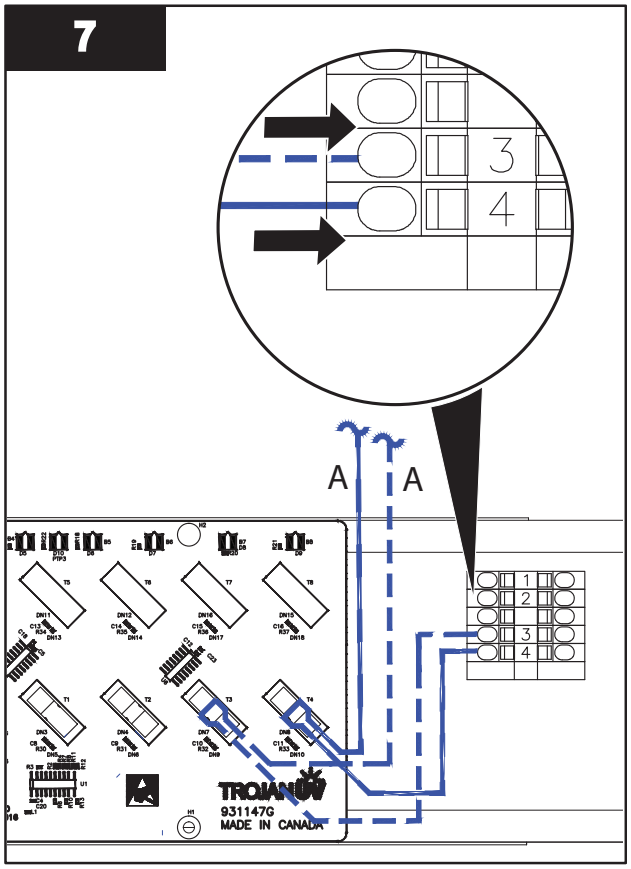




Note: *Connect the power wires for the new Lamp Driver. Depending on the quantity of Lamp Drivers, the power terminal block may be located in between the Lamp Drivers.*



Note: *Connect the red Lamp Driver wire (B) to the terminal block. Depending on the quantity of Lamp Drivers, the terminal block may be located in between the Lamp Drivers.*



Note: *Route the blue Lamp Driver wires (A) [x2] through the toroid core and connect to the terminal block.*

Post-requisites:

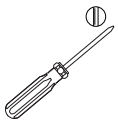
- Install the Lamp Driver Tray. Refer to Section 9.3.2.1.

9.3.2.3 Install the Service End Cap

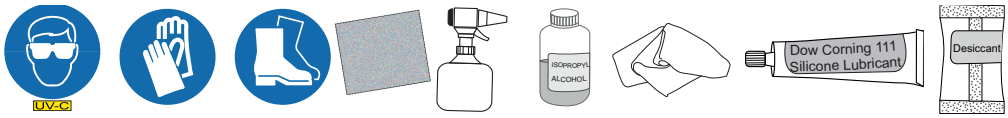
Prerequisites:

- Install the Lamp Driver Tray. Refer to Section 9.3.2.1.

Tools:



Materials:



- Silicone Seal (if needed)
- Service End Cap (if needed)

Procedure:

NOTICE
The enclosure must be securely sealed to keep the Module Control Board dry and free of debris.

1. Remove the silicone seal.
2. Clean sealing groove with household cleaner and cloth.

3. Inspect the sealing groove. If damaged, replace service end cap.
4. Inspect silicone seal for cuts or excessive wear marks along the surface shown in item 2 of Figure 6.
   a. If damaged, replace silicone seal.

      Note: *Remove the service end cap power cord wire leads from the terminal block.*

   b. If not damaged, clean silicone seal with household cleaner and cloth. Make sure the seal is completely dry before installation.

      Note: *The manufacturer recommends replacement of the seal during maintenance or service. Keep new seals in sealed bags until they are needed for installation.*
5. Use all supplied lubricant on the seal.
6. Inspect for deep gouges in the interior wall of the lamp driver enclosure.
   a. Use emery cloth sandpaper to remove gouges and sharp edges around cross-drilled holes.
   b. Use isopropyl alcohol to clean the first 51mm (2 in.) of the interior of the lamp driver enclosure to remove debris.

Note: *If seal was replaced, install wire leads back to terminal block and install Lamp Driver Tray. Insert desiccant packages on each side of the enclosure before putting end caps back on.*

NOTICE

The power cord strain relief must be installed toward the top of the enclosure.

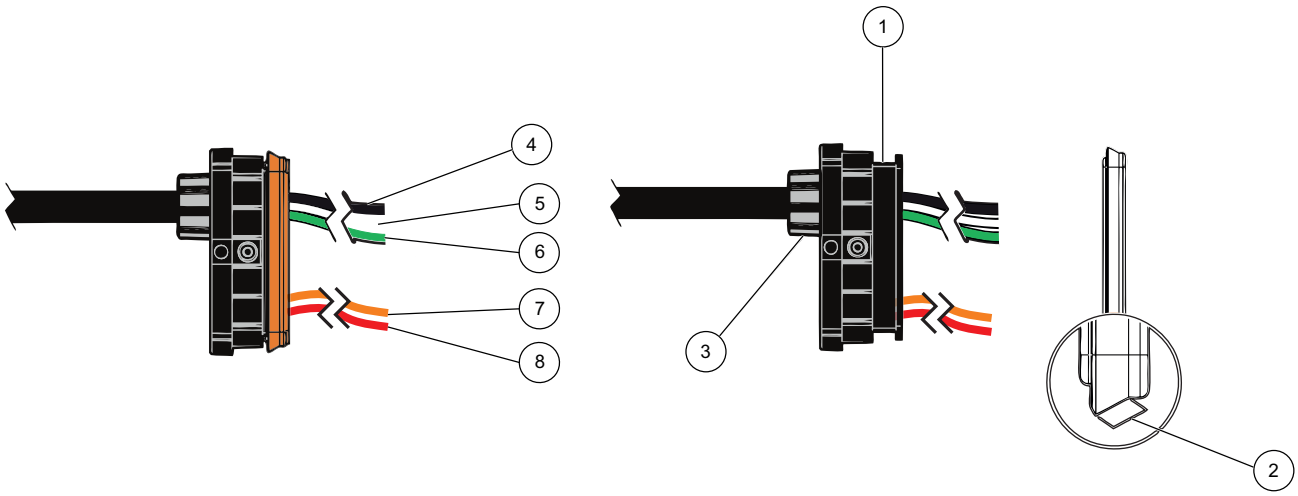
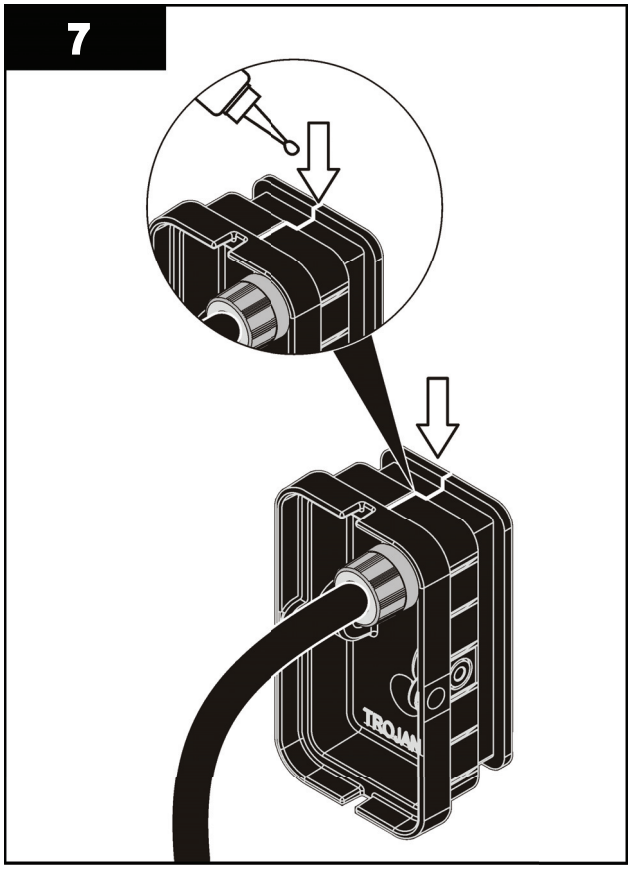


Figure 6 Service End Cap Seal Inspection

1	Service end cap	**5**	White Wire
2	Silicone seal surface	**6**	Ground - Green Wire
3	Strain relief	**7**	Orange Wire
4	Black Wire	**8**	Red Wire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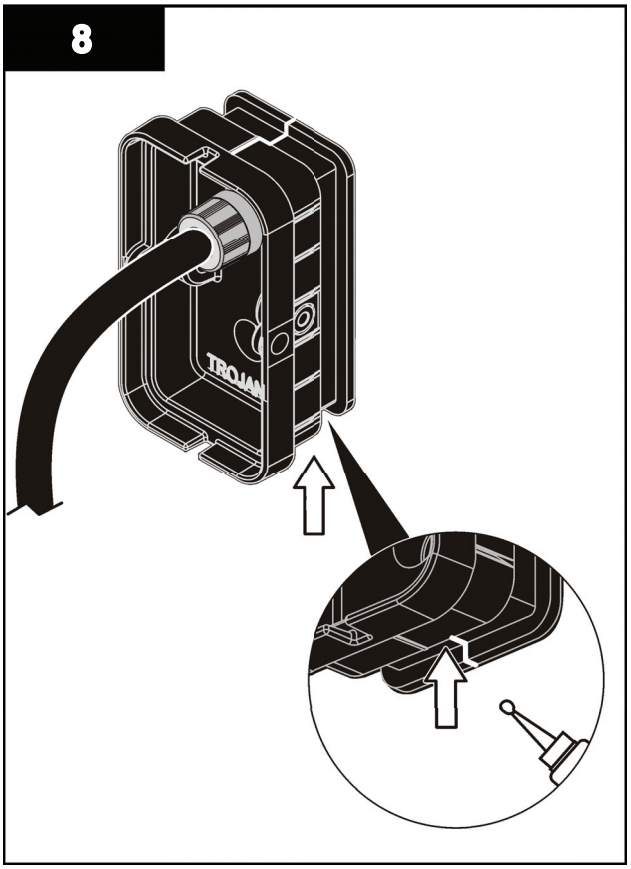
TROJAN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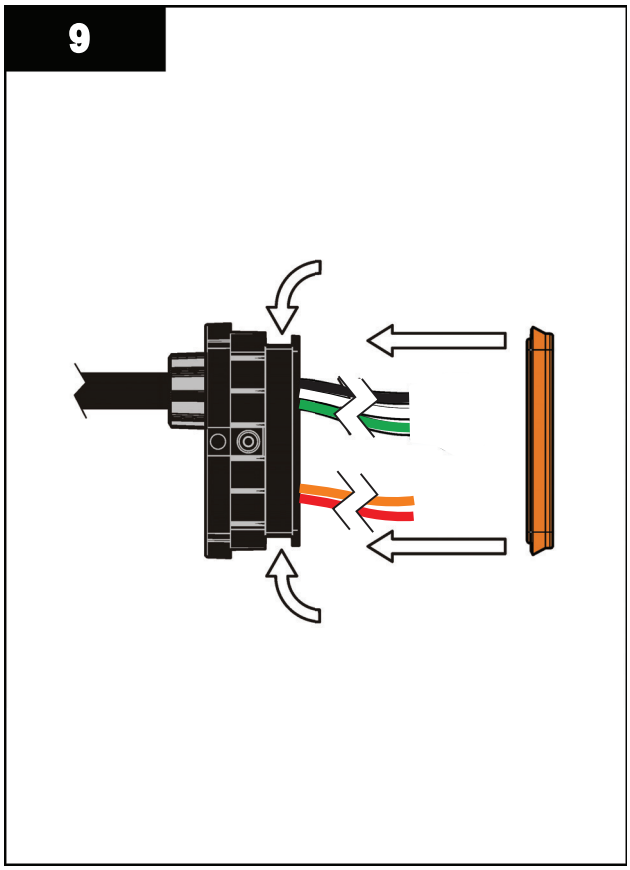
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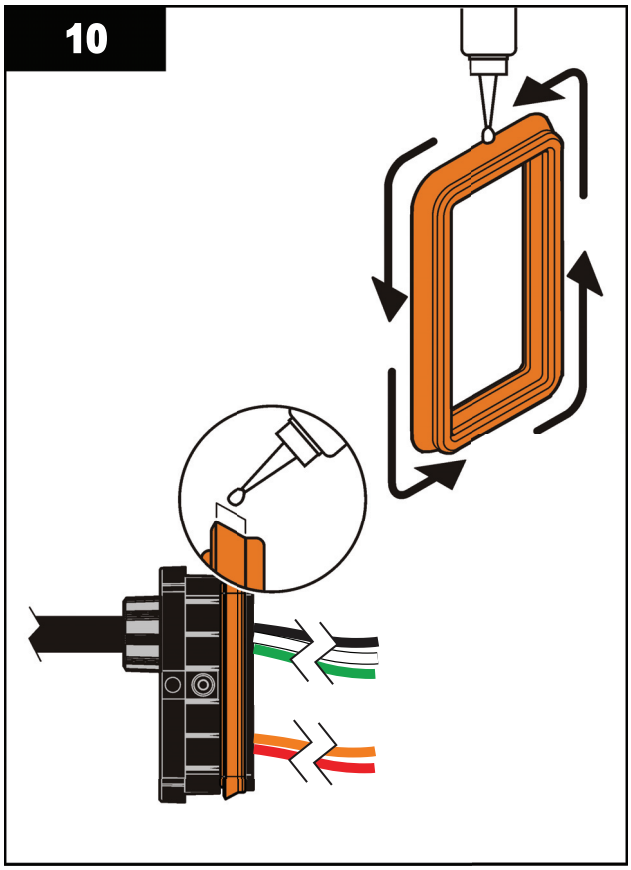
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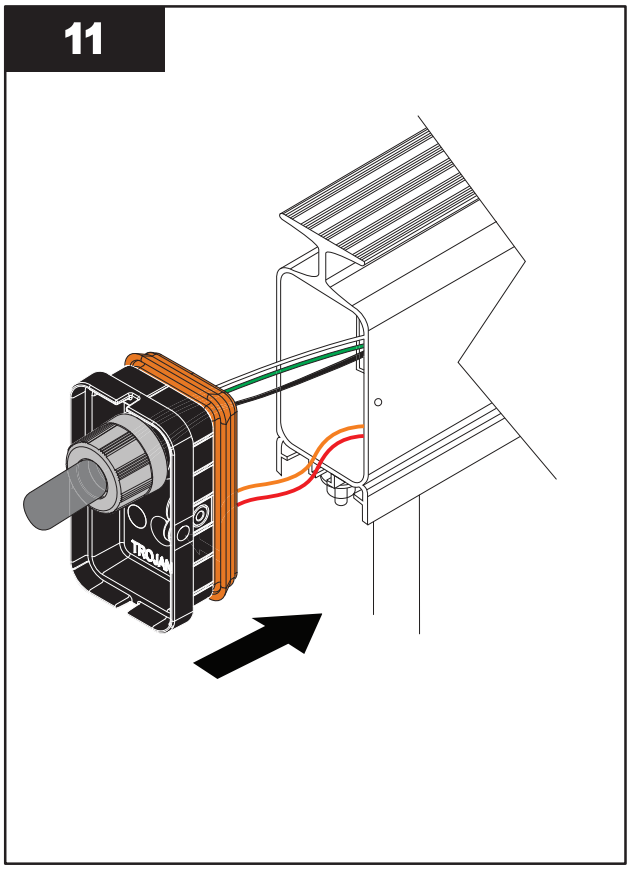
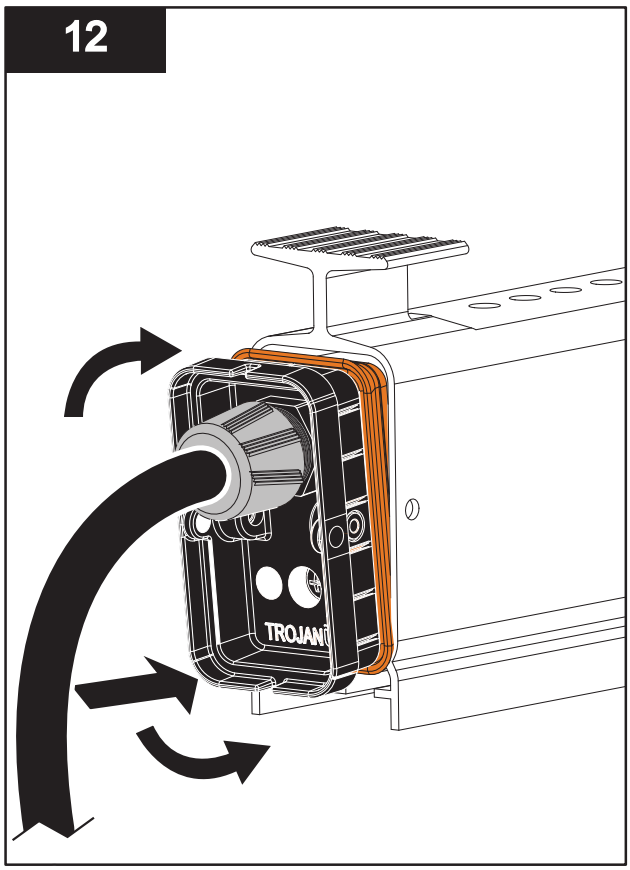


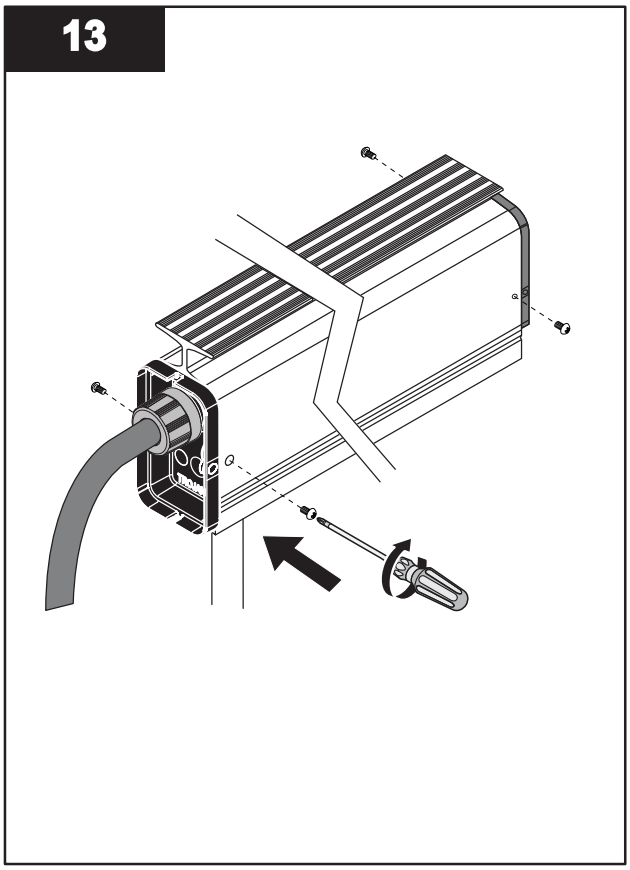
Note: *The power cord strain relief must be installed toward the top of the enclosure.*

12



Note: *Insert the seal slowly to allow enough time for the seal to react with the enclosure. If the seal is inserted too fast, the corner of the seal may be pinched or damaged. Push the service end cap until it is in full contact with the enclosure body.*

13



14. Install screws on the sides of the service end caps, and turn by hand until contact is made with the enclosure.
15. When the service end cap is installed, tighten each screw an additional 1/4 turn.
16. Make sure that the power cord strain relief is tight.
17. Repeat steps for the plain end cap.
18. To do the optional air pressure test, refer to Section 9.3.2.4. Otherwise, return the UV module to service.
19. When the service is complete, assemble the prerequisites in the reverse order of disassembly.

9.3.2.4 Air Pressure Test

Use the air pressure test tool to validate Type 6P rating for the Lamp Driver Enclosure.

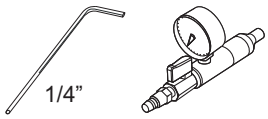
NOTICE

The enclosure must be securely sealed to keep the Module Control Board dry and free of debris.

Prerequisites:

- Shut down the UV system. Refer to Section 7.1.
- Apply lockout tag out devices as necessary. Refer to Section 4.
- Remove the UV module. Refer to Section 9.3.1.

Tools:



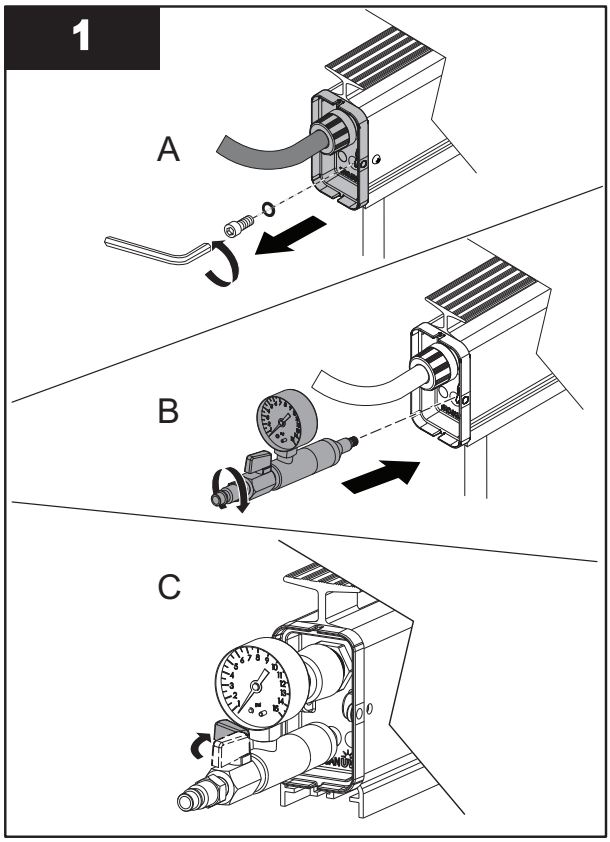
Materials:

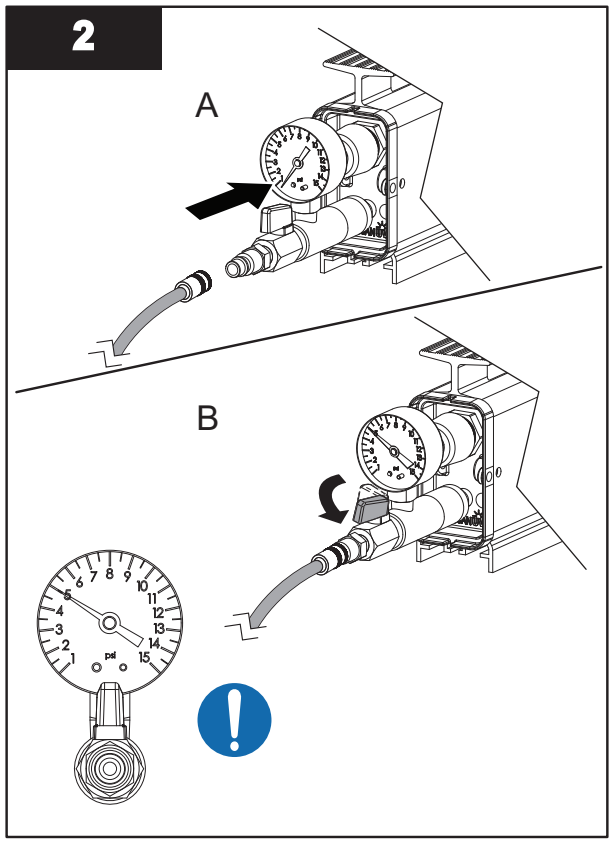
Procedure:

NOTICE

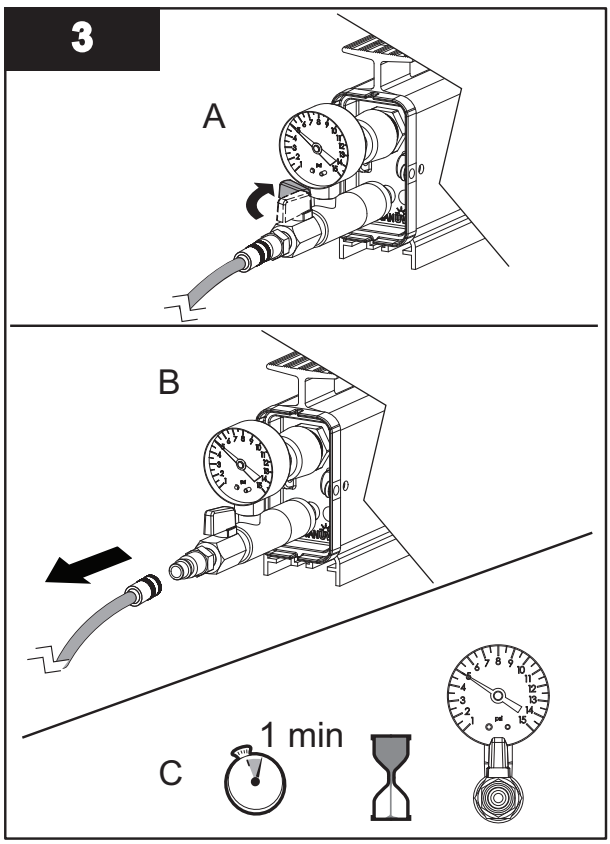
The enclosure must be securely sealed to keep the Module Control Board dry and free of debris.

To prevent damage, pressurize the Lamp Driver Enclosure to 5 PSI, **DO NOT** exceed 10 PSI.

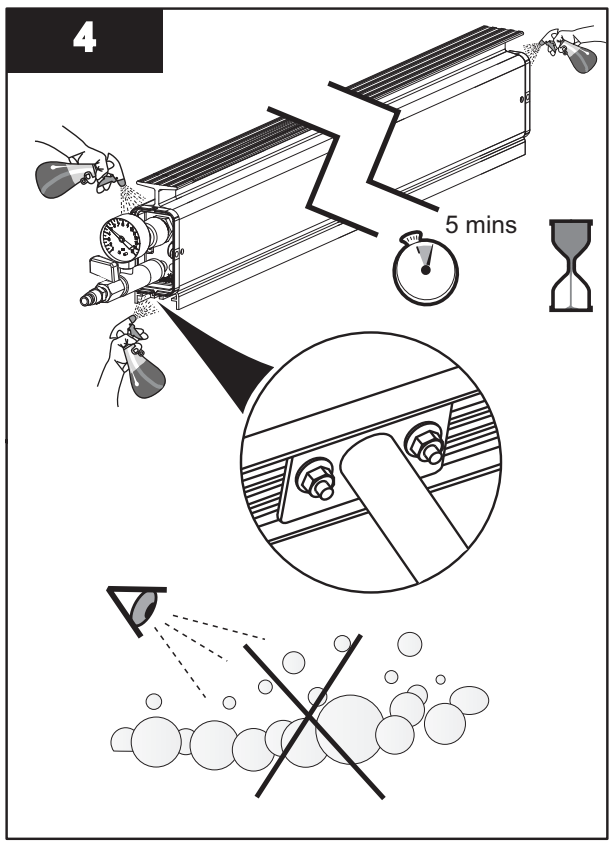




Notes: *1) Slowly open the valve to pressurize to 5 PSI.*
DO NOT *exceed 10 PSI.*
2) Where possible, use a regulator set to 5 psi maximum, to control the maximum air pressure.

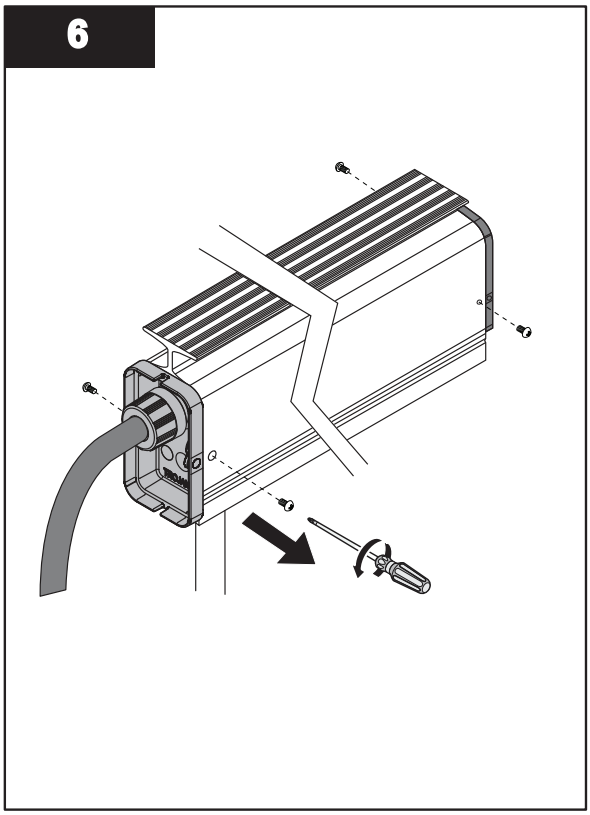


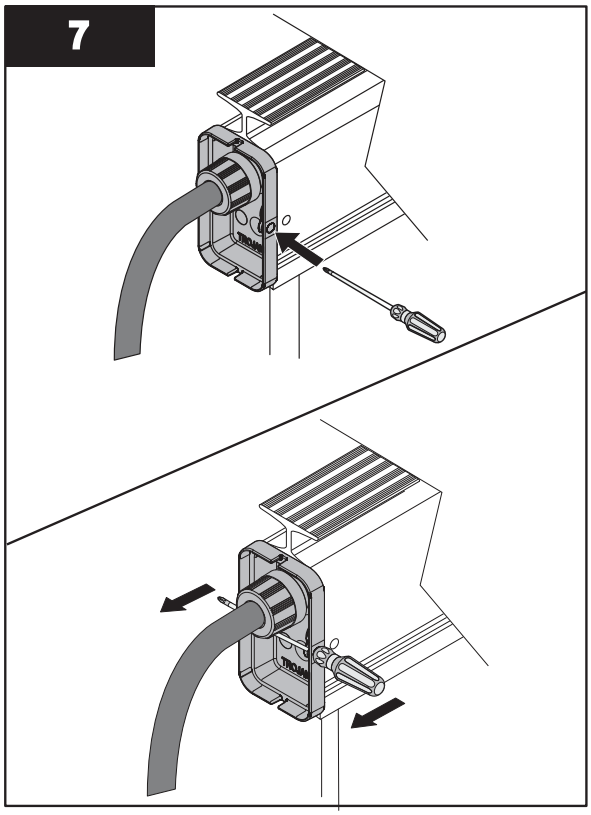
Note: *Verify that the pressure is stable (5 PSI) for 1 minute.*



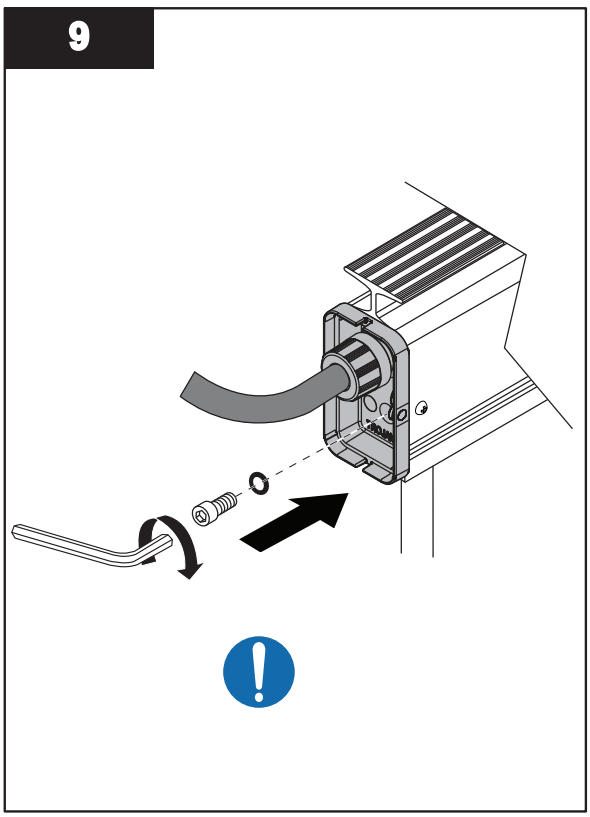
Note: *Spray with soapy water. After 5 minutes, if the air pressure gauge on the air pressure test tool is still at 5 PSI and no air bubbles are present, the end cap is installed correctly and is safe for 6P rating.*

5. Open the air valve on the air pressure test tool to release the air pressure (0 PSI). Remove the Air Pressure Test Tool.
   a. If bubbles were present, go to step 6.
   b. If bubbles were not present, go to step 9.





8. Go to Section 9.3.2.3, perform steps 1 - 13. Repeat Air Pressure Test as required (Section 9.3.2.4).



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

9.3.3 UV Lamps and Lamp Sleeves

UV Lamps contain mercury. (Section 2).

9.3.3.1 Storage Requirements for Used UV Lamps

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

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

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

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

9.3.3.2 Inspect the Lamp Sleeves

UV lamps and lamp sleeves are made of fragile quartz tubing and easily fractured. Do not strike, bend or apply pressure, or it will break. Follow all local regulations. Make sure lamp sleeves are clean internally and externally. Fouling will block UV and compromise treatment. Fouling can also result in higher UV lamp operating temperatures and reduce UV lamp efficiency. Excessive moisture in the lamp sleeve can cause corrosion of the UV lamp shunt and pins, which results in shorter UV lamp life.

9.3.3.3 Clean the Lamp Sleeves

Clean the lamp sleeves when the UV intensity falls below 2.8 mW/cm^2.

NOTICE

Do not use abrasive materials to clean the lamp sleeves. Abrasive materials will scratch and damage the lamp sleeves.

If the cleaning solution comes in contact with the lamp driver enclosure, immediately flush and clean the enclosure with potable water to prevent permanent damage. Damage due to cleaning solution will void the warranty.

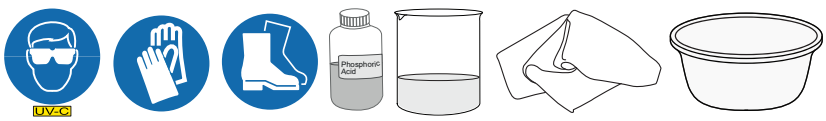
NOTICE

Only use Trojan Technologies approved cleaning solutions on the lamp sleeves. Use of unapproved chemicals may result in damage to the equipment. For a list of approved cleaning solutions refer to Table 4.

Prerequisites:

- Remove the UV module. Refer to Section 9.3.1.

Materials:



Procedure:

1. Refer to Table 4 for dilution ratio's.
   - Mix the solution thoroughly. Use pH indicator strips to make sure that pH is between 1.0-1.5. The solution is effective in cleaning UV modules when the pH is less than 3.0. Above pH 3.0, the cleaning solution should be recharged with acid or replaced.

Table 4 Approved Cleaning Solution and Dilution Ratio's

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

Note: *When mixing the solution, always add the acid to the tank filled with water.*

Clean with a maintenance rack (wash by hand)

1. Remove debris from the UV module with low pressure potable water, such as a garden hose. Secure the UV module on a maintenance rack or flat surface.
2. Apply a manufacturer approved cleaning agent (ActiClean™ Gel or diluted Phosphoric Acid. Refer to Table 4 for dilution ratio's) to a sponge, paper towel or plastic scrub pad. Rub the outside of the lamp sleeve until all deposits are gone.

   Note: *Clean up spills to avoid slipping and dispose of cleaning solution as per site and country protocols.*

   - If heavy internal fouling is present, replace the lamp sleeve.
   - Clean all visible moisture inside of the lamp sleeve with a clean, dry paper towel or Kimwipe®
3. Let the lamps sleeves dry for minimum ten (10) minutes and reinspect, repeat manual cleaning as required.

   Note: *A completely clean lamp sleeve will have the clarity of a new, unused lamp sleeve.*
4. Install the UV Module into the UV Channel.

9.3.3.4 Remove and Replace a UV Lamp and Lamp Sleeve

Prerequisites:

- Remove UV module. Refer to Section 9.3.1.

Materials:

- New Lamp (if required)
- New Lamp Sleeve (if required)
- O-ring

Procedure:

1. Support the UV module on a flat surface.
2. Turn the lamp sleeve nut until it loosens from the lamp sleeve cup. Slide the lamp sleeve nut and O-ring along the lamp sleeve.
3. Apply water to the dome end. Gently rotate the lamp sleeve while pulling it away from the lamp sleeve cup. The lamp sleeve should be extended 18-20 cm (7 to 8 inches) beyond the formed leg of the UV module.

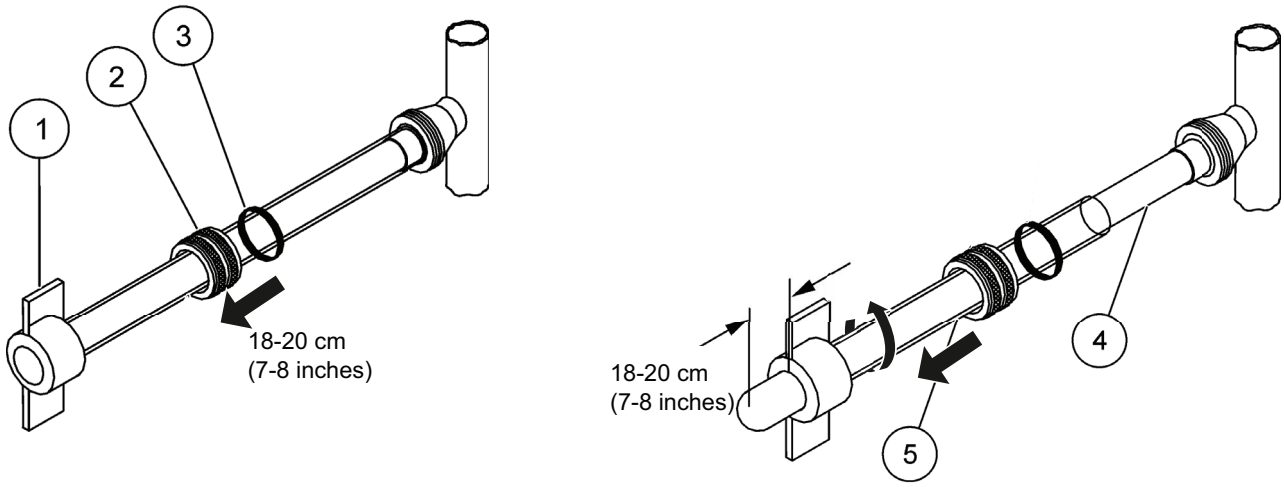


Figure 7 Remove Lamp Sleeve from Sleeve Cup

1	Formed leg	**4**	UV lamp
2	Sleeve nut	**5**	Lamp sleeve
3	O-ring		

4. Pull the UV lamp away from the UV lamp holder to disconnect it. Do not remove the molded UV lamp holder from the steel sleeve cup. Support the lamp sleeve. Refer to Figure 8.

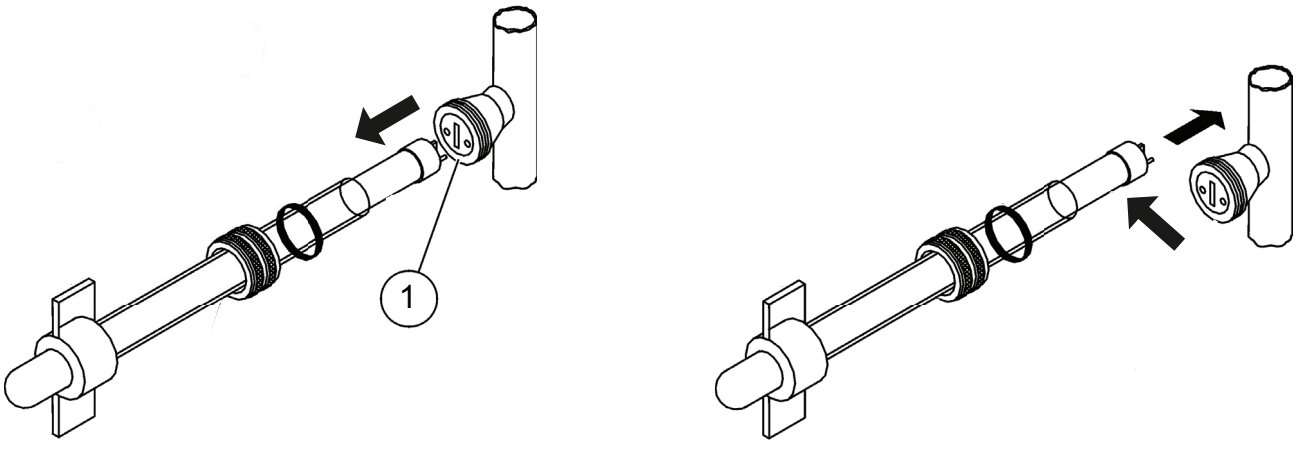


Figure 8 Remove the UV lamp

1	Lamp Holder

5. Remove the UV lamp from the lamp sleeve. To replace the UV lamp only, slide the lamp sleeve only as far as needed to safely remove and replace the UV lamp.

6. Pull the entire lamp sleeve and UV lamp together from the module leg. Remove the lamp sleeve nut and the O-ring from the dome end of the lamp sleeve. Replace lamp sleeve if damaged.

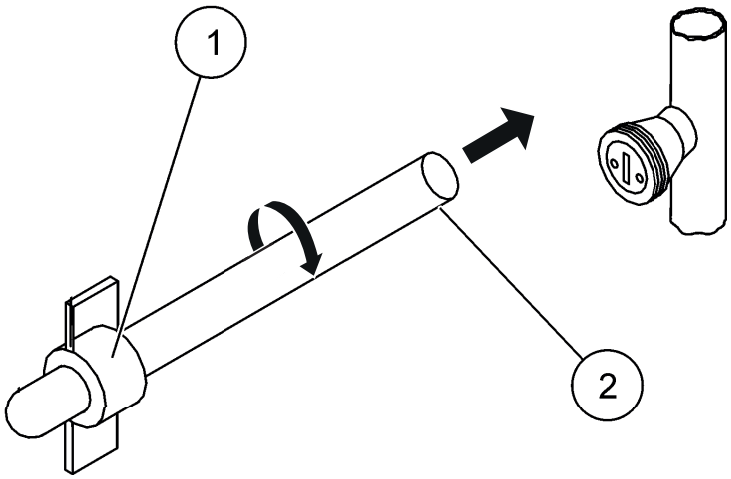


Figure 9 Remove the lamp sleeve

1	Formed leg	**2**	Lamp sleeve

7. Put the new UV lamp into the Lamp Sleeve. Make sure that the lamp connection end is at the open end of the lamp sleeve.
8. Install the sleeve nut and an O-ring onto the lamp sleeve.
9. Put the lamp sleeve through the formed leg.

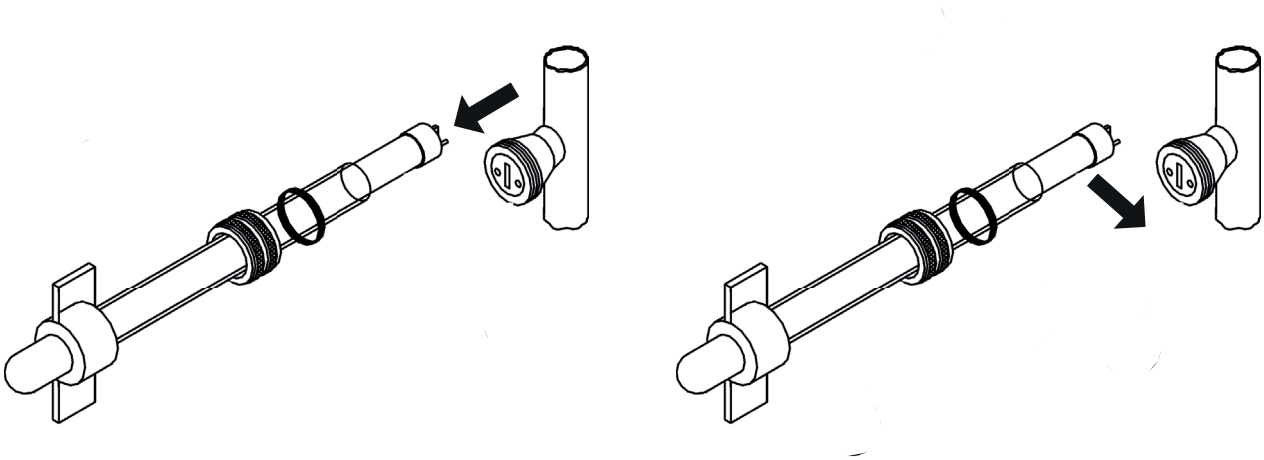


Figure 10 Replace the UV lamp and lamp sleeve

10. Connect the UV lamp to the lamp holder. Move the lamp sleeve nut along the lamp sleeve to the lamp sleeve cup. Hand-tighten the lamp sleeve nut.
11. Make sure the lamp sleeve is in full contact with the rubber sleeve stop and not just in contact with the internal lamp sleeve seal.
12. Push the sleeve until it is past the internal sleeve seal and against the rubber sleeve stop.
13. Reset lamp life hours. Refer to Section 8.4.8.

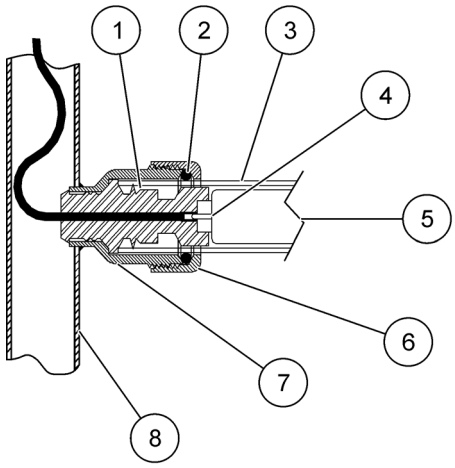


Figure 11 Replace the UV lamp and lamp sleeve

1	Internal lamp sleeve seal	**5**	Lamp end
2	External O-ring lamp sleeve seal	**6**	Sleeve nut
3	Lamp sleeve	**7**	Stainless steel sleeve cup
4	Lamp pin	**8**	Module frame

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

9.4 UV Sensor

The UV sensor system is calibrated in the factory and should not be altered, or its calibration changed, in any way.

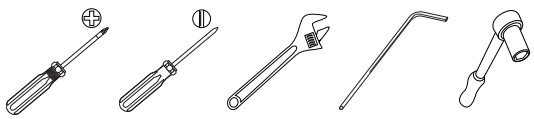
9.4.1 Remove the UV Sensor

Prerequisites:

- Remove the UV module. Refer to Section 9.3.1.

Materials:

Tools:



Procedure:

1. Remove the nylon cable ties and release UV sensor cable from the UV module leg and power cable.
2. Disassemble UV sensor mounting bracket from Teflon sleeves (Teflon sleeves remain in place).
3. Remove setscrew from the U-bracket and remove UV sensor body from the U-bracket.
4. Unsnap bushing from light lock channel.
5. Un-thread UV sensor cable and strain relief from the hole in the light lock channel.

9.4.2 Install a New UV Sensor

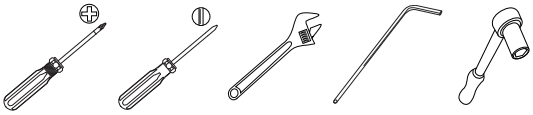
Prerequisites:

- Remove the UV sensor. Refer to Section 9.4.1.

Materials:

- UV sensor

Tools:



Procedure:

1. If necessary, remove UV sensor body from new sensor assembly. Refer to Figure 12.

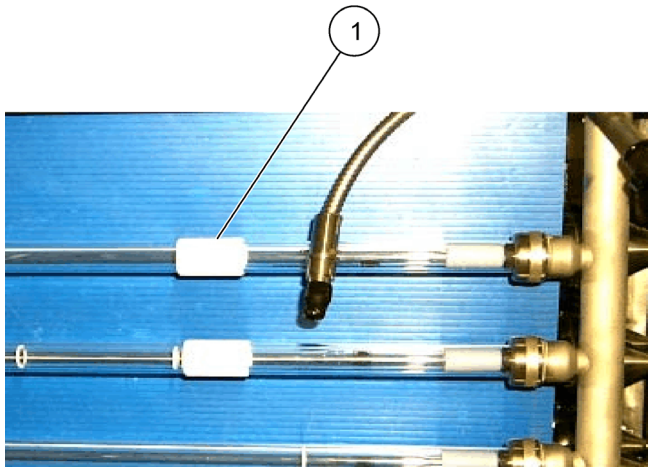


Figure 12 UV Sensor

1	Teflon sleeve

2. Insert the sensor body into the sensor U-bracket until flush with the bracket. Secure in place with #10 set screw. Refer to Figure 13.

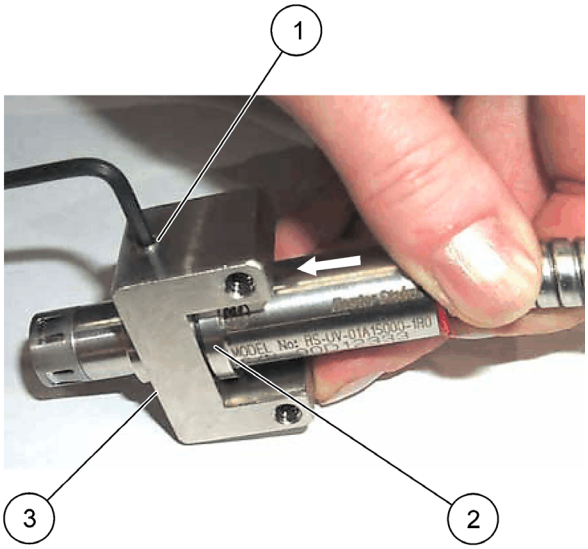


Figure 13 UV Sensor U-Bracket

1	Set screw, #10	**3**	U-bracket
2	UV Sensor		

3. Position one side of mounting bracket on U-shaped sensor bracket and attach loosely with screws and split lock washers. Refer to Figure 14.

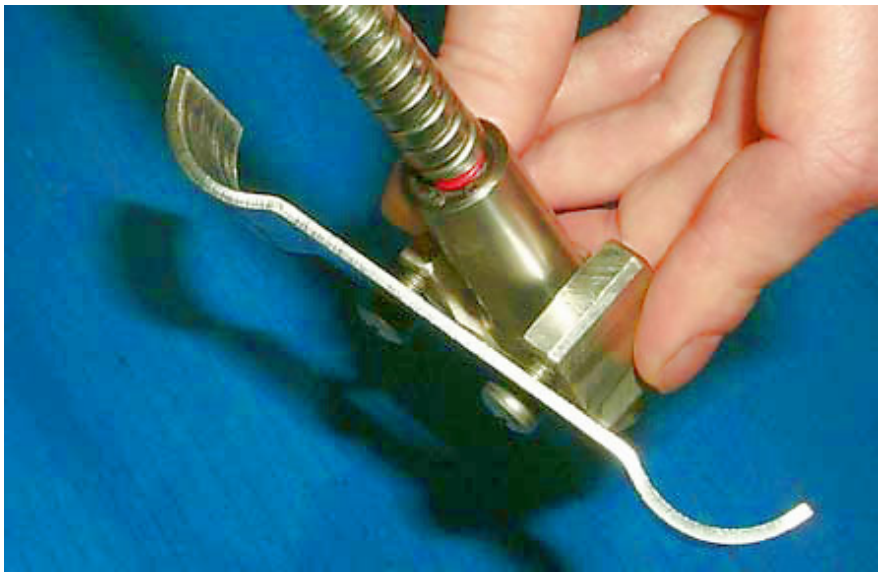


Figure 14 UV Sensor Mounting Bracket

4. Assemble sensor mounting bracket over Teflon®* sleeves, leaving screws loose.

*Teflon is a registered trademark of Dupont Company.

5. While sensor bracket is loosely connected to U-bracket, place pressure on the UV sensor head to position UV sensor as close to the UV lamp as the bracket will allow. Tighten all 4 screws. Refer to Figure 15.

   Note: *UV sensor window is mounted such that it faces away from effluent flow.*

6. Use nylon ties to secure the UV sensor cable to the UV module leg and power cable. Trim excess from cable ties.

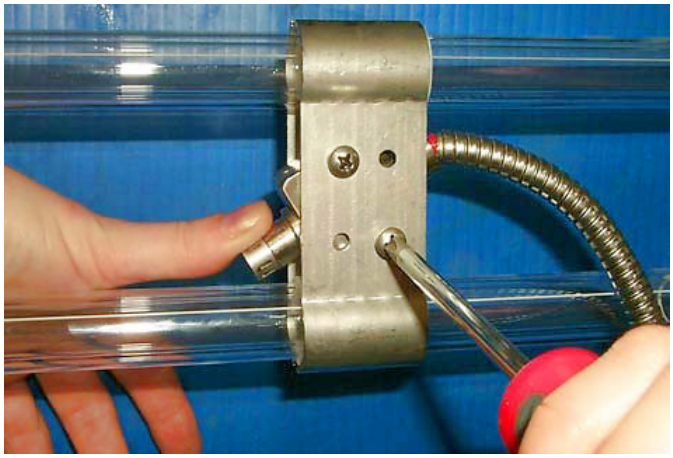


Figure 15 Mount the Sensor

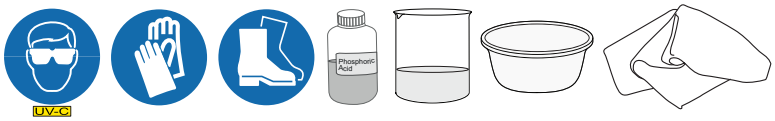
9.4.2.1 Clean the UV Sensor

UV sensor cleaning frequency depends on the effluent quality. Fouling on the UV sensor will lead to lower UV sensor readings. The UV sensor should be checked and cleaned at least as often as the lamp sleeves.

Prerequisites:

- Remove the UV module. Refer to Section 9.3.1.

Materials:



Procedure:

1. Apply a solution of 50% water and 50% manufacturer approved cleaning agent (spray or wipe on, using a cleaning cloth), and then wipe the solution off.
2. Check the UV sensor window and lamp sleeve for cleanliness and repeat step 1, if needed.
3. When service is complete, assemble the prerequisites in the reverse order of disassembly.

9.5 System Control Center

9.5.1 Clean the SCC

Prerequisites:

- Shutdown the system. Refer to Section 7.2.
- Lockout tag out the system components. Refer to Section 4.1.

Materials:

Procedure:

1. Use soft cloth with soap and water to clean the exterior of the panel.
   Note: *Do not use high-pressure hose and corrosive cleansers.*
2. Inspect the panel interior for signs of moisture.
3. Inspect the door seal for signs of wear or damage. Replace, as required.

9.5.2 Remove/replace Monitor Board Fuse

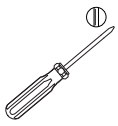
Prerequisites:

- Shutdown the system. Refer to Section 7.2.
- Lockout tag out the system components. Refer to Section 4.1.

Materials:

- Fuse

Tools:



Procedure:

An AC power supply fuse located beside the power termination strip, may require replacement if a power surge or short circuit occurs. To remove or replace the monitor board fuse:

1. Disconnect the AC supply to the monitor board.
2. Remove the fuse with a screwdriver and test.
3. Replace the fuse with an identical spare.

Section 10 Troubleshooting

⚠ DANGER

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

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

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

NOTICE

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

Instructions:

1. Locate the condition in one of the tables below that best matches the condition onsite
2. Review the symptoms and possible causes corresponding to the given condition.
3. Review the corresponding solution(s) provided and obey the correct procedures as outlined in this manual.

   Note: *If at any time you are unsure of the procedure, call a local certified service provider before proceeding. Injury or damage to the equipment due to improper testing, handling, or maintenance will not be covered under the manufacturer's warranty and is the responsibility of the individual performing the troubleshooting.*

10.1 UV Module

Condition	Symptom	Possible cause	Solution
One UV lamp status LED is OFF	Corresponding UV lamp is OFF	UV lamp failure	Replace the UV lamp.
		Lamp holder / wiring	Inspect the lamp holder and wiring and replace as necessary.
		Water intrusion	Inspect and replace the UV lamp, sleeve and O-ring as necessary.
	Corresponding UV lamp is ON	Module Control Board (MCB)	Replace the MCB.
Two UV lamp status LEDs are off (lamps 1 and 2 or lamps 3 and 4)	Corresponding UV lamps are OFF	UV lamp failure	Replace the UV lamps.
		Lamp holder / wiring	Inspect the lamp holder and wiring and replace as necessary.
		Water intrusion	Inspect and replace the UV lamp, sleeve and O-ring as necessary.
		Lamp driver failure	Replace the lamp driver.
	Both LEDs are off in a 2-lamp UV module	No power to the UV module	Inspect the UV module power cable - is it plugged-in or damaged?
	Corresponding UV lamps are ON	Module Control Board (MCB)	Replace the MCB.

10.1 UV Module (continued)

Condition	Symptom	Possible cause	Solution
All the UV lamp status LEDs are OFF	All the UV lamps are OFF	UV lamp failure	Replace the UV lamps.
		Lamp holder / wiring	Inspect the lamp holder and wiring and replace as necessary.
		Water intrusion	Inspect and replace the UV lamp, sleeve and O-ring as necessary.
		Lamp driver failure	Replace the lamp driver.
	All the UV lamps are ON	Module Control Board (MCB)	Replace the MCB.
Note: *If you have checked all possible causes, call a local certified service representative or the manufacturer for technical assistance.*			

10.2 System Control Center (SCC)

Condition	Possible cause	Solution
Elapsed time display flashing	Elapsed time displays 12000 -12,500, 24,000-24,500… hours.	Replace the UV lamps. Display will stop flashing after 12,000, 24,000… hours.
UV intensity display is flashing and displaying 0.0 mW/cm^2	UV sensor cable is not connected to monitoring system.	Reconnect the UV sensor to the monitoring system.
	Fouled lamp sleeve and/or UV sensor.	Clean the lamp sleeve and UV sensor as required with a manufacturer approved cleaning agent.
	Loose or no connection at TB5 terminal in monitoring system enclosure.	Tighten or reconnect the wiring at the terminal.
UV intensity display is flashing and displaying value less than alarm set point (1.6 mW/cm^2)	Fouled lamp sleeve and/or UV sensor.	Clean the lamp sleeve and UV sensor as required with manufacturer approved cleaning agent.
Note: *If you have checked all possible causes, call a local certified service representative or the manufacturer for technical assistance.*		

10.3 UV System Performance

Condition	Symptom	Possible cause	Solution
Indicator Organism limit has exceeded	Indicator organism is greater than the legislated limit.	UV lamps are beyond 12,000 hours of operation.	Replace the UV lamps. Refer to Section 9.3.3.
		UV lamps are out within the UV modules.	Replace the defective UV lamps.
			Replace the defective lamp drivers.
		Lamp sleeves are fouled.	Clean the lamp sleeves with manufacturer approved cleaning agent.
		Debris within the UV modules.	Remove the debris from UV modules.
		Effluent level within the channel is greater than 1 inch above top UV lamp.	Channel flow is within system design parameters.
			Level controller is clean of debris.
			De-water channel and clean.
		Contaminated sample, sample container.	Repeat sample using proper sampling techniques.
		Channel has collected a build up of debris and solids.	De-water channel and clean.
		Effluent percent UV transmittance (%UVT) is below system design parameter.	Review plant process to return % UVT within system design parameters.
		Peak flow is greater than system design limits.	System peak flow is within system design limits.
		Effluent total suspended solids (TSS) is greater than system design parameter.	Review plant process to return TSS within system design parameters.
		Effluent particle size distribution (PSD) is high.	Review plant process to address the size of effluent solids.
		UV absorbent agents have entered plant process.	Review to changes to plant process (e.g., Iron).
Note: *If you have checked all possible causes, call a local certified service representative or the manufacturer for technical assistance.*			

Section 11 Replacement Parts and Accessories

Contact Trojan Technologies with the listed information to order replacement parts. Provide the:

- Product name and model number (refer to the front of this manual)
- Part number and description of the replacement part or accessory
- If a replacement part is not listed, contact Trojan Technologies.

11.1 Optional Equipment

Item	Description	Part number
1	Operator Kit	906015-320
2	Photometer Kit	905107
	• Photometer, UV 100/240 VAC	905253
	• Quartz Cuvette 10 mm	905262
	• Solution, 100%T 1 Gal	905036
	• UV Lamp, 254 NM, Realtech	905260*

* This component contains Mercury (Hg). Dispose according to Local, State, or Federal Laws.

11.2 Service End Cap

Refer to Figure 16 for components.

Item	Description	Part number
1	Strain relief	914478-127
2	End Cap, Power end	316559-001
3	End Cap Seal, Silicone	316558
4	Stainless Steel Screw, Philips Head	013039
5	O-ring, air pressure test access	002226G
6	Screw, socket head plug for pressure test access	303314
7	End Cap, Plain end	316559-002

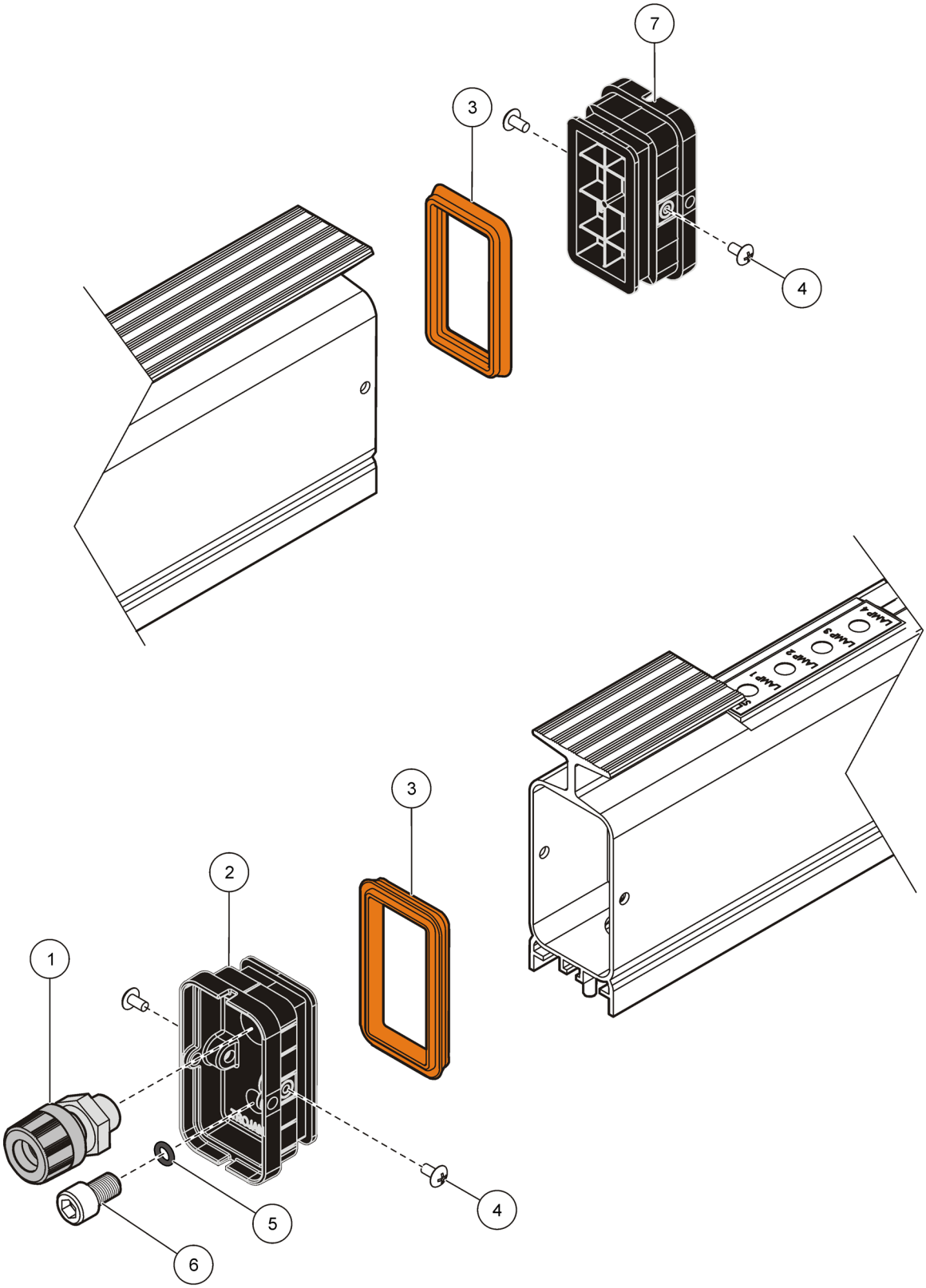


Figure 16 Service End Cap Components

11.3 UV Module

Item	Description	Part number
1	Lamp Driver	917858
2	Module Control Board (MCB)	
	2 or 4 UV Lamp	931147-001
	6 or 8 UV Lamp	931147-002
3	Power Cord	
	6 Feet	915509-06
	10 Feet	915509-10
	12 Feet	915509-12
	15 Feet	915509-15
	20 Feet	915509-20
4	Sleeve Cup Nut	302312
5	O-ring, Sleeve Support	302314
6	O-ring, Sleeve Seal	302300
7	Compression Spring	700105
8	UV Lamp	302418*
9	Lamp Sleeve	302208
10	Lamp Holder, 60 inches	316640-060

* This component contains Mercury (Hg). Dispose according to Local, State, or Federal Laws.

11.4 UV Sensor

Item	Part Description	Part number
1	UV sensor assembly - 10 ft.	015195-010
2	UV sensor bracket kit	015306

11.5 Air Pressure Test Tool

Item	Part Description	Part number
1	Air pressure test tool	907631

11.6 System Control Center (SCC)

Refer to Electrical Drawings Bill of Materials for replacement parts.

11.7 Power Distribution Center (PDC)

Refer to Electrical Drawings Bill of Materials for replacement parts.