MEMORANDUM

To: Mayor McConnell and Members of the Assembly
Jim Dinley, Municipal Administrator

From: Michael Harmon, P.E., Public Works Director MH
Stephen L. Weatherman P.E., Municipal Engineer
Mark Buggins, Environmental Superintendent MB

cc: Jay Sweeney, Finance Director
Mellissa Cervera, Contract Coordinator MC

Date: March 6, 2013

Subject: **UV Disinfection System Equipment Pre-Purchase Recommendation of Award of Procurement Contract to Trojan Technologies**

Background:

The Blue Lake drinking water system is a surface water system, which must comply with the EPA Enhanced Surface Water Treatment Rules (ESWTRs). The subject UV Disinfection Facility will provide the additional microbial and disinfection controls required under the ESWTRs. The project to design and construct the Facility will be operational by 2014.

A Request for Proposals and Statement of Qualifications (RFP&SQ) for supply of UV reactors and control equipment for the UV Disinfection Facility was published in accordance with City and Borough procurement policy. Two Proposals and Statements of Qualifications were received, Trojan Technologies and Xylem Water Solutions.

The RFP&SQs were reviewed by City Staff and CH2MHill our UV Disinfection Consultant. The bid results are as follows:

Bid Form	Trojan Technologies	Xylem Water Solutions
Capital Cost (Bid Form A1)	$192,000.00	$196,500.00
Average Annual Power Cost & Annual Maintenance Cost	$7,248.59	$7,332.91

The apparent low bidder is Trojan Technologies based both on initial capital cost and present average power and maintenance costs. Their bid was further evaluated against the requirements of the Request for Proposal and was found to be in compliance. A summary of this evaluation and results of the reference checks are attached. All three references contacted were favorable.

Therefore, based on compliance with the required technical specifications and reference responses, we recommend awarding the contract to the lowest responsive bidder, Trojan Technologies.

Analysis

Public Works proposes to award a contract to Trojan Technologies in the amount of $192,000 for the UV reactors and control equipment. The reactors will be made available to be installed in the proposed UV Disinfection Facility when it reaches appropriate competition.

Fiscal Note

Funding for this project will come from State loans and grants.

- $4,000,000 FY 2011 State of Alaska Department of Environmental Conservation (ADEC) Loan. Includes $2,500,000 financed with $1,500,000 subsidized.
- $2,550,000 FY 2012 ADEC Loan (pending).
- $3,500,000 FY 2012 ADEC Grant (30% local match requirement)
- $2,061,000 FY 2013 ADEC Grant (pending - 30% local match requirement)

$12,111,000 Total Project Funding

The grants and loans indicated as pending are grants and loans listed on the Alaska Drinking Water Fund intended use plans which CBS has submitted appropriate paper work to have the grant or loan finalized. The current funding available is $7,500,000 which is more than required for the UV reactors.

Recommendation:

Approve a contract for the procurement of the UV reactors and control equipment to Trojan Technologies in the amount of $192,000.00

City and Borough of Sitka

UV Disinfection System

Proposal Evaluation for Low Bidder - Trojan Technologies

Proposal Summary

Criteria	Summary of Requirement	Trojan's Proposal
1	Number of UV reactors (duty + standby)	2 + 1
2	Validated Flow range (1250 to 5000 gpm)	50 to 6072 gpm (w/ 2 units)
3	Validated UVT range (90 to 97.5%)	70 to 98%
4	Maximum headloss at peak flow (36 inches)	28 inches (estimated from curve)

Compliance with Technical Specifications

Section 44 44 73 Paragraph:	Summary of Requirement	Trojan's Proposal
1.3 A.1	Provide list of equipment and instrumentation components (lamps, ballasts, sensors, reactors, switchgear, etc.) provided including quantities, manufacturer address and phone number, and materials of construction.	Submitted
1.3 A.2	Describe external cooling and ventilating requirements of control panels. If cooling water is required, state flow rate and duration.	None required
1.3 A.3	What UVDGM-defined control strategy will be used? Describe how equipment incorporates flow, UVT, and intensity sensor readings into dose calculations. Are dose calculations validated for full operating range as described in the Specification, 44 44 73 UV System, as assembled herein?	EPA-MS2 RED Pacing-TrojanUVSwift
1.3 A.3	Provide the Validation Factor (VF) and Reduction Equivalent Dose (RED) for the equipment provided and all of the design conditions indicated in the RFP as assembled herein. Include summary of applicability of the Validation Testing results for this project including identification of the operating window and the controlling setpoints for operation within that window of validated conditions. Provide supporting documentation showing range of flows, UVT, power settings, piping configuration, and lamp on/off operating scenarios for each reactor that has been validated per the 2006 UVDGM.	Validation documentation submitted. Complies with requirements of the specifications.
1.3 A.8	Provide input power requirements; clearly specify whether 480V, 3-wire or 480/277V, 4-wire is required as well as capacity.	3 phase 4 wire
1.3 A.8	State the maximum time duration of AC power loss that the local control panel (LCP) can tolerate before functional shutdown.	UV equipment does not include or require any cooling of the reactor or CCP
1.3 A.12	Describe automated cleaning procedures and estimated time to clean sleeves and sensors. Describe type/quantity of cleaning chemical and ancillary equipment required. Provide status of NSF certification for cleaning chemicals.	Wiper interval timer, or "wipe now" button

1.3 A.16	Provide submittal for intensity sensors which includes details of sensor calibration and traceability, as well as information on uncertainty from linearity, temperature response, spectral response, angular response, and long-term drift.	One sensor per 10 lamps, submittal data included
1.3 A.16	Describe how sensor calibration is checked at the WTP. Describe the factory calibration requirements for the reference UV intensity sensors and duty UV intensity sensors, and anticipated factory calibration frequency.	If indicated value deviates from measured by more than 5%, adjustment performed by qualified person.
1.3 A 25	Describe how the UV control system monitors the system for lamp breakage and signals the breakage to the Plant PLC.	Same as failed lamp. Contained in quartz sleeve.
1.4	Provide list of spare parts. Include cost of spare parts in Item A.1 of Bid Form.	Provided
2.2 I.4	Provide 3rd-party end of lamp life certification to support values used in Bid Form calculations (if applicable).	Provided
2.2 I.5-6	Provide 3rd-party sleeve fouling factor certification to support values used in Bid Form calculations (if applicable).	Defaulted to 0.9
2.2 J	Provide graph of headloss over full range of operating flowrates (gpm or mgd) per reactor.	Provided in validation section. Headloss meets criteria.
2.2.M.2	Provide recommended methods for lamp intensity checks.	Intenstiy alarm set at factory. Follow reference sensor procedure to verify calibration of duty sensor
2.6 B.4	Describe turndown capacity (in terms of percent of total power) including minimum setting and available increments. To support the turndown capacity, describe the options, demonstrated through Validation Testing, available to modify number of lamps in operation, lamp power setting, and validated operating regime.	Operate with 1 or 2 units on-line depending on flow and UVT. Operate at 60-100% power in 2% incriments. All lamps on/off together and operate at same power level.

Mandatory Criteria

No.	Criteria	Compliance
1	System proposed meets UV disinfection system performance criteria	Proposal meets requirements
2	Experience of supplier (minimum 5 years).	36 years. Many installations
3	References (minimum of 3 references)	See reference summary.
4	Meets design conditions as defined in Part 4 of the RFP.	Completely functional, meets criteria.
5	Compliant with Long Term 2 Enhanced Surface Water Treatment Rule	Fully compliant

Drawing and Layout Requirements

No.	Criteria	Compliance
1	Provide equipment drawings of each reactor.	Proposal meets requirements
2	Provide preliminary layout drawings	Proposal meets requirements
3	References (minimum of 3 references)	See reference summary.
4	Meets design conditions as defined in Part 4 of the RFP.	Completely functional, meets criteria.
5	Compliant with Long Term 2 Enhanced Surface Water Treatment Rule	Fully compliant

City and Borough of Sitka

UV Disinfection System

Proposal Evaluation for Low Bidder - Trojan Technologies

References

Questions	Hall Road, PA	San Gabriel Water District, CA	Joplin Blendville, MO
Project Completion	Late May 2012	2005	Late 2008
Contact	Chad Corey	Tom Schiewe	Rich Kiwala
Contact Time/Details	2/28/2013	2/28/2013	2/28/2013
Disinfection or UV AOP	Disinfection - groundwater source, PA requires all groundwater sources to provide 4-log virus removal. Remote, unmanned facility	AOP - groundwater source with perchlorate, NDMA, other organics. Dose peroxide and high UV dose	Surface water, 4-log disinfection required
Capacity	1.5-1.6 MGD	7,800 gpm	21.5 MGD
Are you happy with your UV system?	So far, very pleased	Yes, has been simplest part of plant to operate (also do air scour, carbon, ion exchange...)	Generally happy
Which reactors were installed and when?	2 Swift D-12's. Both are duty reactors, run at 75% power	Couldn't remember (has a medium pressure UV plant as well)	3 duty, 1 standby 30 lamp reactors. Couldn't remember exact model number
Did Trojan deliver on time?	Yes, though there was an issue with the carrier and one reactor was damaged in transit - not Trojan's fault. Delivered new reactor as quickly as possible.	Yes	Yes. Install went well with the SCADA integrator
Were they helpful during start up?	Yes.	Yes, startup crew was good	Yes. Worked well with others on site
Is the system easy to operate?	Yes, runs remotely on small system. Control panel is intuitive and his technology resistant operators have been able to work with it without problems.	Yes, simplest part of plant.	Yes, very well.
How is the control system interface	Control system integrated very well with existing SCADA	Good	Good

Are they responsive	Yes. There is a very good local sales rep who is able to visit the site very quickly.	Trojan is under contract to provide maintenance and support, so they do lamp changes and regular maintenance, no problems. Have been responsive to operational issues as well.	Yes. They have a local installation and maintenance technician who is able to help with anything that the phone based service team can't.
Are replacement parts easy to get?	Yes. They keep a full set of lamps on site as well as lamp sleeves. Has replaced 4 lamps since running, one was burnt out, and the others were operator error while inspecting	Yes, they keep a good numeber in stock.	Yes, keep lamps on site.
Is the power cost what you expected?	Don't have any information on power consumption.	Yes, but high (due to AOP)	Doesn't have power monitoring equipment
Are they reliable? Do you get a lot of unexplained alarms?	Yes reliable. Some UVT alarms (goes to zero for 1-2 min then comes back). They programmed a delay in their SCADA system to prevent call-outs.	Very reliable	Yes, occasional nuissance alarms. Usually take reactor offline and restart.
Additional Notes	Would shop around before buying again for low cost, but likes the product.	Working on another UV/AOP project with Trojan using carbon to quench the peroxide after UV/AOP.	They had a problem with the seals on the wiper sleeve leaking - they were designed for higher pressure systems, (this system runs at 10 psi). Trojan redesigned the seals and replaced at no cost to owner.

TROJAN UV

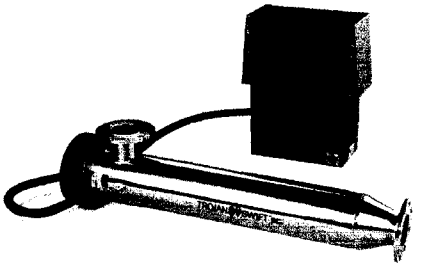
RFP & STATEMENTS OF QUALIFICATIONS UV DISINFECTION SYSTEM:

City and Borough of Sitka
Sitka, Alaska
UV Disinfection System

SUBMITTED BY TROJAN TECHNOLOGIES
Bill Gordon bgordon@trojanuv.com 519.457.3400

AND OUR LOCAL REPRESENTATIVE
BILL REILLY bill@whreilly.com 503-223-6197

February 2013



Cover Letter

TROJANUV
WATER CONFIDENCE™

November 12, 2012

Office of the Municipal Clerk
City and Borough of Sitka
100 Lincoln Street
Sitka, AK
99835

Re: Request for Proposals and Statement of Qualifications – UV System Procurement

Dear Sir/Madam:

Please find enclosed Trojan's proposal in accordance with Request for Proposals and Statement of Qualifications for the Purchase of the UV Disinfection System for the City and Borough of Sitka Alaska. Trojan has been designing, manufacturing and supporting UV disinfection systems for over 35 years and is excited at the opportunity to have City and Borough of Sitka as a valued, long-term customer.

Trojan's proposal is based on two (2) TrojanUVSwift™SC model D12 duty reactors plus one (1) redundant reactor for a total of three (3) UV reactors. Each reactor incorporates twelve (12) lamps and is capable of meeting the disinfection levels of 3-log Cryptosporidium and Giardia inactivation per the EPA UVDGM at the specified flow rates and design UVT values after incorporation of the specified derating factors. The proposed system utilizes low-pressure, high-intensity, lamps to minimize footprint and headloss while also offering extremely high electrical efficiency. The system includes an automatic on-line mechanical cleaning system for regular sleeve cleaning.

Trojan maintains a staff of over 60 factory certified Service Technicians to provide installation support, startup assistance, operator training and regular maintenance when requested. We also have local certified technicians available through our local representative, WM. H. Reilly & Co., located in Portland as well as additional local technicians located in Salt Lake City, Vancouver and Calgary. Trojan provides over-the-phone assistance from our Call Centre through a 1-800 number. This service is available 24 hours a day, seven (7) days a week and is staffed by fully qualified service technicians that have extensive field experience and specialized training.

I would like to note a few of the features and benefits of purchasing a UV system from Trojan.

- Small footprint (use of the low pressure high output lamps)
- High electrical efficiency utilizing LPHO lamp technology
- On-line mechanical wiping system.
- Unmatched service capabilities (local and global certified service technicians)
- Trojan recycles the lamps at no cost to the City and Borough of Sitka when replacement lamps are purchased from Trojan
- Trojan offers an unparalleled Lifetime Performance Guarantee. The spirit of this guarantee is simple: the Trojan equipment, as sized for the project, will meet the disinfection requirements for the life of the system

TROJAN UV
WATER CONFIDENCE™

We would like to thank the City and Borough of Sitka and CH2MHILL Engineers for the invitation to submit our proposal for this project. If you have any questions or require any additional information please do not hesitate to contact our local representative Bill Reilly Jr. at WM. H. Reilly & Co., (503) 223-6197 or myself at (519) 457-3400.

Yours truly,
TROJAN TECHNOLOGIES, INC.

Bill Gordon, PMP
Municipal Applications

UV PROPOSAL

Manufacturer:	Haraeus

UV intensity sensor

Quantity:	3
Type:	Plug-in sensor in measuring window
Material:	316 SST, Viton, Corning 7980
Number of sensors:	EPA 1 per UV reactor
Output:	4-20 mA current loop (2-wire)
Spectral range:	220-290 nm
Supply voltage power:	24 VDC (12-30 VDC) from the PDC
Overall length:	73 mm (2.87 in.)
Diameter Sensor body:	20 mm (0.79 in.)
Max operating temperature:	50 °C (122 °F)
Max upset temperature:	50 °C (122 °F), 24 hours maximum upset duration
Ambient operating temperature:	1 to 40 °C (34 to 104 °F)
Ambient storage temperature:	-20 to 40 °C (-4 to 104 °F)
Ambient relative humidity:	0 to 100%
Pressure:	< 50 psi
Manufacturer:	Trojan Technologies

Power Distribution Center (PDC)

Quantity:	3
Enclosure rating:	Type 12
Enclosure material:	Painted mild steel
Enclosure mounting:	Wall
Ballasts output:	2 x 240 W
PDC supply voltage:	480 V / 277, 3 phase Y, 4 wire + GND, 50 / 60 Hz L-L-L-N.
Ballast power level:	60-100% in 2% increments
Manufacturer:	Trojan Technologies

Automatic Mechanical Wiping System (AMWS)

Quantity:	3
Wiper material:	Food grade EPDM/Viton lamp sleeve wipers
Wiper plate material:	316 SST
Motor type:	1/8 horsepower
Manufacturer:	Trojan Technologies

1. MS2 RED Low Major Alarm
2. MS2 RED 4-20mA output (Optional)
3. UVT and Flow can be selected as the following:
    - "Live 4-20mA" signal
    - "Entered Value" worst case for your water parameters
    - "SCADA 4-20mA Signal (from PLC or other device)
    - "None", Controller calculates MS2 RED for worst case scenario of Maximum Flow and Minimum UVT validated ranges.

All data is available on the controllers Modbus RTU RS485 protocol

Section 44 44 73 Part 1.3.A.3 Provide the Validation Factor (VF) and Reduction Equivalent Dose (RED) for the equipment provided and all of the design conditions indicated in the RFP as assembled herein. Include summary of applicability of the Validation Testing results for this project including identification of the operating window and the controlling setpoints for operation within that window of validated conditions. Provide supporting documentation showing range of flows, UVT, power settings, piping configuration, and lamp on/off operating scenarios for each reactor that has been validated per the 2006 UVDGM.

TROJAN'S RESPONSE: The Validation information has been provided as a separate bound package attached with our bid documentation and should be considered part of our bid submission. The Trojan validation information contains very sensitive and proprietary trade secret information that should not be publicly released. We are confident you will treat this information as confidential and not release this information with this understanding. The validation report is for the express use and review for the City and Borough of Sitka, AK to evaluate the Trojan UV SWIFTSC D12 UV disinfection equipment. If the consulting engineer would like to review the validation documentation, they will need to enter into a non-disclosure agreement with Trojan Technologies.

Section 44 44 73 Part 1.3.A.8 Provide input power requirements; clearly specify whether 480V, 3-wire or 480/277V, 4-wire is required as well as capacity.

TROJAN'S RESPONSE: The main power feed supplied by others to each Control Power Panel shall be 480 V / 277, 3 phase Y, 4 wire + GND, 50 / 60 Hz L-L-L-N.

Section 44 44 73 Part 1.3.A.8 State the maximum time duration of AC power loss that the local control panel (LCP) can tolerate before functional shutdown.

system). On systems with more than one UV Sensor (i.e. D12 and D30) there will be multiple ports on the UVR and multiple UV intensity displays on the control panel, to display the intensity of each sensor.

The UV intensity detected by the UV Sensor is continuously displayed on the operator interface in W/m^2. If the intensity drops below the set-point, the display will flash indicating an alarm condition. The Common Alarm Output Relay will be energized.

Specifications

- Sensor Output: 4-20 mA current loop (2 wire)
- Sensor: Photodiode
- Supply Voltage: ⁼24V DC

Review sensor manual located under tab Additional Information for greater detail regarding the UV Sensor supplied with D12 UV Reactor.

Section 44 44 73 Part 1.3.A.16 Describe how sensor calibration is checked at the WTP. Describe the factory calibration requirements for the reference UV intensity sensors and duty UV intensity sensors, and anticipated factory calibration frequency.

TROJAN'S RESPONSE: If the indicated value deviates from the measured value of the reference radiometer by more than 5%, an adjustment must be performed by a qualified person. This adjustment must be documented with the date and the measured values before and after the adjustment.

After two years at the latest, or when the sum of the deviations of all adjustment procedures exceeds 20% of the measured value, a factory calibration is required. For this purpose, the relevant sensor has to be replaced by a new or recalibrated one with a valid calibration certificate. The replacement must be documented with the sensor's serial number and the date.

Review sensor manual located under tab Additional Information for greater detail regarding the UV Sensor supplied with D12 UV Reactor.

Section 44 44 73 Part 1.3.A.25 Describe how the UV control system monitors the system for lamp breakage and signals the breakage to the Plant PLC.

TROJAN'S RESPONSE: The UV control system will interpret a broken lamp in the same fashion as a failed lamp. The broken lamp is contained in a quartz sleeve and therefore a non-functioning lamp(s)

Reference Sensor Procedure to verify the calibration of the duty sensor using a reference sensor. Please review the complete UV Intensity Reference Sensor Procedure located in the bid tab Additional Information for further details regarding sensor checks.

Section 44 44 73 Part 2.6 B.4 Describe turndown capacity (in terms of percent of total power) including minimum setting and available increments. To support the turndown capacity, describe the options, demonstrated through Validation Testing, available to modify number of lamps in operation, lamp power setting, and validated operating regime.

TROJAN'S RESPONSE: The control circuit board issues a power level signal to the electronic ballasts. Each ballast modulates the power to 2 lamps between 60% and 100% power level in 2% increments. All lamps for the UV reactor will be turned on/off together and will all operate at the same power level.

Current sensing circuits in the ballast detect lamp on/off status. The ballast reports the lamp status to the control circuit board. Faulted lamps are listed as individual alarms on the HMI.

When switched on, lamps are initially energized to 100% power setting for a warm-up period. After the warm-up period has expired, the lamps are automatically switched to the requested power level.

MANDATORY CRITERIA

1. System proposed meets UV Disinfection System performance criteria of the Technical Specifications and all federal and State of Alaska code and regulatory requirements.

TROJAN'S RESPONSE: Trojan's proposal meets the disinfection performance criteria of the Technical Specification and have validated the UV system in to comply with the protocols specified in the US EPA UV Disinfection Guidance Manual (UVDGM, EPA 815-R-06-007 November 2006).

2. Experience of Supplier. The Supplier shall have a minimum of 5 years' experience in the design, fabrication, assembly, and operation of equipment similar to that specified. The Supplier must have a minimum of 5 similar operating public utility drinking water systems in North America. Similar systems shall use the same model equipment (may be a different size) with a minimum of two reactors for UV disinfection of drinking water. Minimum facility treatment capacity to be counted towards experience is 3 mgd. Provide 5-year experience list for similar systems. Include facility location, installation date, treated flow rate, validation approach, and number of reactors provided at each facility

			Cucamonga, CA (60 MGD) Westminster (Beta) – London, ON (20 MGD)
TrojanUVSigna™	2010	3	**Upcoming Installations:** Little Blue Valley, MO (150 MGD) Auburn, AL (34 MGD)

Today, Trojan is recognized around the world as the leader in advanced UV water treatment technology and is committed to protecting public health and delivering sustainable treatment solutions. This is accomplished in a variety of segments including municipal drinking water, municipal wastewater, environmental contaminant treatment and residential applications, as well as the purification of water used in food and beverage manufacturing, pharmaceutical processing, and semi-conductor applications. Trojan's success is evident in more than 7,800 *municipal* UV disinfection facilities operating in over 80 countries – the largest installed base of UV systems in the world.

Trojan is headquartered in London, Ontario, Canada, and also has offices in the U.K., Germany, Netherlands, Spain, Australia, and the United States. Trojan services a growing customer base around the globe through an extensive network of dealers and representatives. This strong distribution network allows us to provide unparalleled levels of service and support to customers regardless of location.

Trojan's advanced manufacturing facilities ensure a high level of quality control at every stage of the process, from initial design to final installation. Since 1998, Trojan has received the ISO 9001 designation – an internationally recognized model for quality assurance in design, development, production, installation and service.

Recognized as being the most experienced and knowledgeable professionals in the industry, Trojan scientists and engineers have introduced many of today's global innovations in UV technology. Our record of accomplishment for innovation has set us apart and with more than 190 Trojan patents granted or pending, we are well positioned to continue leading the way to safer, more efficient water disinfection techniques.

offer Trojan Certified Service, all Trojan service representatives must undergo a comprehensive certification process that involves classroom training at Trojan's head office and extensive field training, led by Trojan's experienced technicians.

24/7 Telephone Support and Remote Troubleshooting

Trojan provides over-the-phone assistance from our Technical Assistance Center (TAC) in London, Ontario. Trojan Service Technicians staff our call center Monday to Friday, 8:00 am to 5:00 pm (EST). After hours emergency support is available 24 hours a day, seven days a week through a toll-free number. All Service Technicians within the Call Center have field experience and are thoroughly trained to provide installation support, start-up assistance, and equipment troubleshooting. The Technical Assistance Team consists of seven (7) Product Specialists and three (3) Control's Specialists. The specialists in this team have over forty (40) years of experience on UV systems.

The Trojan Technical Assistance Center is also equipped with sophisticated capabilities to connect with the PLCs of our installations in order to monitor, upload programs, and troubleshoot systems remotely. This access allows faster response in diagnosing system irregularities, and can expedite service times. It's quick, convenient and, in many instances, can save the expense of a service call.

Manufacturing Staff

Approximately 50 of Trojan's employees are dedicated to production requirements and support staff. Through the support of Danaher, Trojan is continuously improving every manufacturing cell by improving work-flow, increasing throughput and ultimately reducing product ship times. Visual management is a large part of Danaher's business philosophy and practiced by Trojan enabling anyone to track project ship times at a glance.

Joint Water Purification Project (JWPP); Cottonwood, Colorado	CO	9.00	Mike Keefover	303-790-4380	Feb 10

4. System proposed shall be completely functional and operable within specified design conditions, as identified in RFP Part 4 - Specifications.

TROJAN'S RESPONSE: The proposed system is completely functional and operable within specified design conditions, as identified in RFP Part 4 - Specifications.

5. System proposed shall be fully compliant with the requirements of the Long Term 2 Enhanced Surface Water Treatment Rule (LT2) and the guidelines of the 2006 Ultraviolet Disinfection Guidance Manual (UVDGM).

TROJAN'S RESPONSE: The proposed system is fully compliant with the requirements of the Long Term 2 Enhanced Surface Water Treatment Rule (LT2) and the guidelines of the 2006 Ultraviolet Disinfection Guidance Manual (UVDGM). Please refer to the validation letter in the validation section for further details.

The Validation information has been provided as a separate bound package attached with our bid documentation and should be considered part of our bid submission. The Trojan validation information contains very sensitive and proprietary trade secret information that should not be publicly released. We are confident you will treat this information as confidential and not release this information with this understanding.

DRAWING AND LAYOUT REQUIREMENTS

1. Provide equipment drawings showing the dimensions of each reactor including power distribution panels or ballasts.

TROJAN'S RESPONSE: Please review both drawing 203666 showing the dimensions of each reactor including power distribution panels or ballasts. The drawing is located in the bid tab marked Drawings.

a. List the flange diameters for connection to piping by others. Provide recommended spacing between reactors for proper maintenance.

TROJAN'S RESPONSE: The inlet and outlet configuration of the proposed system is fully compliant with the requirements of the 2006 Ultraviolet Disinfection Guidance Manual (UVDGM). Please refer to the validation letter in the validation section for further details.

3) If the inlet and outlet configuration of the UV system in the proposed layout does not meet either of the above guidelines, the UV System Supplier shall provide computational fluid dynamics (CFD) modeling results of the proposed configuration to show that the UV dose delivery of the proposed configuration will be better than that during validation. This modeling should conform to the guidelines provided in Appendix D of the UVDGM.

TROJAN'S RESPONSE: The inlet and outlet configuration of the proposed system is fully compliant with the requirements of the 2006 Ultraviolet Disinfection Guidance Manual (UVDGM). Please refer to the validation letter in the validation section for further details.

c. Maintain minimum recommended clearances (for operations and maintenance activities) around the reactors for lamp, sleeve, power and controls access recommended by the UV System Supplier and as required to meet all OSHA regulations.

TROJAN'S RESPONSE: Please review both drawing 203666 and drawing SW0054 for all applicable dimensions and clearances for the SWIFT SC D12 equipment proposed. The drawing is located in the bid tab marked Drawings.

d. All frequently accessed equipment shall be located at a readily accessible elevation (3-4 ft above finished floor elevation). All parts of the system that are frequently accessed for routine maintenance that are not readily accessible from the floor shall be clearly noted so that other access requirements may be considered.

TROJAN'S RESPONSE: All frequently accessed equipment is located at readily accessible elevations. Please review drawing 203666 located in the bid tab marked Drawings.

e. Maintain minimum of 7'-6" from floor to bottom of inlet or outlet header, as required to provide access between trains.

TROJAN'S RESPONSE: Trojan used the ACAD bid drawings as the basis of the equipment layout in order to establish the location and position of the UV equipment. Please review drawing 203666 located in the bid tab marked Drawings for the minimum distances and access between trains.

NON-COLLUSION AFFIDAVIT

TROJAN'S RESPONSE: Please review signed Non-Collusion Affidavit located in the bid tab marked Bid Bond and Bid Form.

MANUFACTURER'S UV SYSTEM LAYOUT DRAWING(S)

TROJAN'S RESPONSE: Trojan used the ACAD bid drawings as the basis of the equipment layout in order to establish the location and position of the UV equipment. Please review drawing 203666, SW0052 and SW0054 located in the bid tab marked Drawings for additional information.

SUPPORTING INFORMATION

1. **Describe your company's history, corporate structure and ownership, location of your corporate headquarters, and manufacturing facility locations. Provide contact information including the name, phone number and email address of the individual that should be contacted if additional information is required regarding this proposal.**

TROJAN'S RESPONSE:

COMPANY INFORMATION

MEETING CURRENT AND EMERGING NEEDS

All Trojan systems are designed to meet specific regulatory requirements around the world, including the U.S., Canada, Great Britain, New Zealand, Australia and Germany. In addition to meeting and exceeding these requirements, UV disinfection creates minimal by-products and is extremely safe for both UV system operators and the public.

Trojan's advanced manufacturing facilities ensure a high level of quality control at every stage of the process, from initial design to final installation. In 1998, Trojan received the ISO 9001-1994 designation – an internationally recognized model for quality assurance in design, development, production, installation and service.

FIRST IN OUR FIELD

Recognized as being the most experienced and knowledgeable professionals in the industry, Trojan scientists and engineers have introduced many of today's global innovations in UV technology:

- The first application of UV technology to disinfect reclaimed wastewater to stringent limits
- The first incorporation of electronic ballasts into low-pressure UV lamp disinfection technologies
- The first commercially successful medium pressure UV lamp system (TrojanUV4000™) for high volume and lower quality wastewater treatment
- The first integrated chemical and mechanical cleaning system for both low and medium pressure UV lamp systems
- The first electronic ballast with extended control capacity for medium pressure UV lamps in any application
- The first underwater UV lamp testing facility in the industry
- The first large scale, monochromatic lamp-based UV system for the treatment of *N-nitrosodimethylamine* (NDMA)
- The first installation of UV-oxidation for the control of taste and odor-causing compounds and disinfection in municipal drinking water (Cornwall, Ontario, Canada)

Our track record for innovation has set us apart and with more than 180 Trojan patents granted or pending, we are well positioned to continue leading the way to safer, more efficient water disinfection techniques.

MUNICIPAL WASTEWATER

Recognized as a safer, more cost-effective, and environmentally responsible alternative to chlorination, UV has become the preferred choice for wastewater disinfection.

Disinfection Facility to treat source water from the Catskill & Delaware reservoirs, located more than 100 miles from the city. The UV system will ensure that bacteria and microorganisms in the water are rendered harmless, so they cannot cause disease. The treated water will be supplied to a population of over 9 million people in the city and surrounding area. Trojan was selected after a rigorous validation process which included Trojan building one full-size UV system designed for the project, which underwent performance tests at an independent test facility. The New York City DEP also conducted an evaluation of the total life cycle costs of each proposed system, and found the Trojan system to be the most economical.

Trojan has also been selected to supply UV equipment for the largest UV installations in Canada (Victoria, Canada) and Europe (Rotterdam, Netherlands).

Not only are Trojan's Municipal Drinking Water contracts growing in scope and size, there is increasing diversity in how the innovative UV systems are being integrated with existing chemical and non-UV disinfection treatments. A key reason is that government legislation is changing the way communities look at safeguarding their drinking water supplies. Municipalities are responding by supplementing their systems with other forms of disinfection in a strategy known as "multi-barrier protection." Based on efficacy and environmental-safety, Trojan UV technology is extremely well positioned to continue capturing significant market share.

Another key consideration is cost. Trojan UV costs are about $^1/_5$ that of ozone disinfection and $^1/_{10}$ the cost of membrane filtration – the two key technologies competing with UV in the multi-barrier treatment market.

Trojan**UV**SWIFT™

The TrojanUVSwift™ Municipal Drinking Water system provides a flexible platform that allows for upgrades to meet new or more stringent requirements, such as changes in flow rate, regulatory requirements, disinfection redundancy demands, or changes in intake water quality. With one of the smallest reactor dimensions in the industry, the TrojanUVSwift™ offers important cost advantages over other larger UV systems for retrofit applications in existing drinking water treatment plants as well as new plant construction.

Trojan**UV**SWIFT™SC

Originally designed for smaller communities (SC), the TrojanUVSwift™SC allows regions with flow volumes of less than 10 million gallons per day to safeguard their drinking water supply against *Cryptosporidium* and *Giardia* and other harmful microorganisms. Although the TrojanUVSwift™SC system itself is small, the market is significant – in North America, Europe and abroad. The advanced,

- Industrial discharge and process water treatment

Trojan offers the revolutionary **TrojanUVPhox™** and the **TrojanUVSwift™ECT** for the treatment of environmental contaminants.

Trojan**UV**PHOX™

The patent-pending TrojanUVPhox™ (UV-Photolysis and Oxidation) is a groundbreaking, pressurized reactor that utilizes Trojan's low energy, high output UV lamps. Through the extensive use of computational fluid dynamics modellling and other computer simulation tools, Trojan has optically and hydraulically optimized the reactor to provide extremely efficient and cost-effective UV treatment. Its unique design allows for the use of multiple reactors in series, giving it an extremely compact footprint. As an added benefit, the TrojanUVPhox™ provides disinfection as well, leading to further cost savings.

One of the premier indirect potable water reuse facilities in the world, operated by the Orange County Water District (OCWD) of Orange County, California, has installed the TrojanUVPhox™ as the UV solution for the treatment of NDMA in wastewater destined for aquifer recharge. When completed, the Groundwater Replenishment System will employ the largest quantity of UV treatment equipment ever assembled for one project to treat up to 100 million gallons per day of wastewater to a quality that exceeds drinking water standards.

Trojan**UV**SWIFT™ECT

The TrojanUVSwift™ECT employs sophisticated controls to optimize the treatment of environmental contaminants. The broad light spectrum of light emitted in the TrojanUVSwift™ECT makes it extremely well suited for the treatment of certain contaminants, particularly some pesticides and taste and odor-causing compounds found in surface waters. It's ultra-compact footprint and large flow capacity makes it an excellent reactor for use as part of a multi-barrier system in large municipal applications (hundreds of millions of gallons per day). In such an application, the TrojanUVSwift™ECT destroys contaminants such as pharmaceuticals and taste and odor-causing compounds while providing disinfection of microorganisms such as *Cryptosporidium* and *Giardia*.

The PWN Water Supply Company in North Holland installed the TrojanUVSwift™ECT to provide a barrier to contaminants while providing disinfection. Completed in 2004, the 25 million gallon per day system is the largest UV oxidation drinking water facility in the world treating contaminants with UV light.

Compact in size and easy to install, the TrojanUVMax™ series of high-performance disinfection systems is designed for homes, cottages, schools, restaurants, and nursing homes. Unlike virtually all other private water supply treatment technologies, Trojan UV systems provide effective elimination of harmful microorganisms such as *Cryptosporidium*, *Giardia*, and *E. coli*.

2. **Provide contact information including the name, phone number and email address of the individual that should be contacted if additional information is required regarding this proposal.**

TROJAN'S RESPONSE:

SALES SUPPORT	
Primary Sales Contact	Tim Proctor – Regional Sales Manager
Contact Phone Number	519-457-3400 x 2275
Contact Email Address	tproctor@trojanuv.com
Secondary Sales Contact	Bill Gordon – Municipal Applications
Contact Phone Number	519-457-3400 x 2315
Contact Email Address	bgordon@trojanuv.com
PROJECT MANAGEMENT	
Primary Project Manager	Kevin Wylie – Project Manager
Contact Phone Number	519-457-3400 x 2117
Contact Email Address	kwylie@trojanuv.com

BID SECURITY

BID BOND

Any singular reference to Bidder, Surety, Owner, or other party shall be considered plural where applicable.

BIDDER (Name and Address):
Trojan Technologies
3020 Gore Road
London, ON N5V 4T7

SURETY (Name and Address of Principal Place of Business):
Travelers Casualty and Surety Company of America
One Tower Square
Hartford, CT 06183

OWNER (Name and Address):

City and Borough of Sitka
100 Lincoln Street
Sitka, Alaska 99835

BID

Bid Due Date: January 30, 2013
Project (Brief Description Including Location): City and Borough of Sitka, AK UV Disinfection System

BOND

Bond Number: N/A
Date (Not later than Bid due date): January 22, 3013

Penal sum (Ten percent of initial system cost shown on Bid Form)	Five percent of amount bid (Words)	5% of amount bid (Figures)

Surety and Bidder, intending to be legally bound hereby, subject to the terms printed on the reverse side hereof, do each cause this Bid Bond to be duly executed on its behalf by its authorized officer, agent, or representative.

BIDDER

Trojan Technologies (Seal)
Bidder's Name and Corporate Seal

By: _____
Signature and Title Secretary

Attest: K. Lain VP Corporate Secretary
Signature and Title

SURETY
Travelers Casualty and Surety Company of America (Seal)
Surety's Name and Corporate Seal

By: Adanna Brathwaite
Signature and Title Adanna Brathwaite, Attorney-in-Fact
(Attach Power of Attorney)

Attest: Erin M. Margelis
Signature and Title Erin M. Margelis, Witness

Note: Above addresses are to be used for giving required notice.

1. Bidder and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to pay to Owner upon default of Bidder the penal sum set forth on the face of this Bond. Payment of the penal sum is the extent of Surety's liability.

2. Default of Bidder shall occur upon the failure of Bidder to deliver within the time required by the Request for Proposals and Statement of Qualifications (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Request for Proposals and Statement of Qualifications and any performance and payment bonds required by the Request for Proposals and Statement of Qualifications.

3. This obligation shall be null and void if:

3.1. Owner accepts Bidder's Bid and Bidder delivers within the time required by the Request for Proposals and Statement of Qualifications (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Request for Proposals and Statement of Qualifications and any performance and payment bonds required by the Request for Proposals and Statement of Qualifications, or

3.2. All Bids are rejected by Owner, or

3.3. Owner fails to issue a Notice of Award to Bidder within the time specified in the Request for Proposals and Statement of Qualifications (or any extension thereof agreed to in writing by Bidder and, if applicable, consented to by Surety when required by Paragraph 5 hereof).

4. Payment under this Bond will be due and payable upon default by Bidder and within 30 calendar days after receipt by Bidder and Surety of written notice of default from Owner, which notice will be given with reasonable promptness, identifying this Bond and the Project and including a statement of the amount due.

5. Surety waives notice of any and all defenses based on or arising out of any time extension to issue Notice of Award agreed to in writing by Owner and Bidder, provided that the total time for issuing Notice of Award including extensions shall not in the aggregate exceed 120 days from Bid due date without Surety's written consent.

6. No suit or action shall be commenced under this Bond prior to 30 calendar days after the notice of default required in Paragraph 4 above is received by Bidder and Surety and in no case later than one year after Bid due date.

7. Any suit or action under this Bond shall be commenced only in a court of competent jurisdiction located in the state in which the Project is located.

8. Notices required hereunder shall be in writing and sent to Bidder and Surety at their respective addresses shown on the face of this Bond. Such notices may be sent by personal delivery, commercial courier, or by United States Registered or Certified Mail, return receipt requested, postage pre-paid, and shall be deemed to be effective upon receipt by the party concerned.

9. Surety shall cause to be attached to this Bond a current and effective Power of Attorney evidencing the authority of the officer, agent, or representative who executed this Bond on behalf of Surety to execute, seal, and deliver such Bond and bind the Surety thereby.

10. This Bond is intended to conform to all applicable statutory requirements. Any applicable requirement of any applicable statute that has been omitted from this Bond shall be deemed to be included herein as if set forth at length. If any provision of this Bond conflicts with any applicable statute, then the provision of said statute shall govern and the remainder of this Bond that is not in conflict therewith shall continue in full force and effect.

11. The term "Bid" as used herein includes a Bid, offer, or proposal as applicable.

END OF SECTION

WARNING: THIS POWER OF ATTORNEY IS INVALID WITHOUT THE RED BORDER

TRAVELERS

POWER OF ATTORNEY

Farmington Casualty Company
Fidelity and Guaranty Insurance Company
Fidelity and Guaranty Insurance Underwriters, Inc.
St. Paul Fire and Marine Insurance Company
St. Paul Guardian Insurance Company
St. Paul Mercury Insurance Company
Travelers Casualty and Surety Company
Travelers Casualty and Surety Company of America
United States Fidelity and Guaranty Company

Attorney-In Fact No. 225340 **Certificate No.** 005282301

KNOW ALL MEN BY THESE PRESENTS: That Farmington Casualty Company, St. Paul Fire and Marine Insurance Company, St. Paul Guardian Insurance Company, St. Paul Mercury Insurance Company, Travelers Casualty and Surety Company, Travelers Casualty and Surety Company of America, and United States Fidelity and Guaranty Company are corporations duly organized under the laws of the State of Connecticut, that Fidelity and Guaranty Insurance Company is a corporation duly organized under the laws of the State of Iowa, and that Fidelity and Guaranty Insurance Underwriters, Inc., is a corporation duly organized under the laws of the State of Wisconsin (herein collectively called the "Companies"), and that the Companies do hereby make, constitute and appoint

David C. Moylan, Julia B. Taylor, Adanna Brathwaite, David Saul, and Erin M. Margelis

of the City of Washington, State of DC, their true and lawful Attorney(s)-in-Fact, each in their separate capacity if more than one is named above, to sign, execute, seal and acknowledge any and all bonds, recognizances, conditional undertakings and other writings obligatory in the nature thereof on behalf of the Companies in their business of guaranteeing the fidelity of persons, guaranteeing the performance of contracts and executing or guaranteeing bonds and undertakings required or permitted in any actions or proceedings allowed by law.

IN WITNESS WHEREOF, the Companies have caused this instrument to be signed and their corporate seals to be hereto affixed, this 21st day of November, 2012.

Farmington Casualty Company
Fidelity and Guaranty Insurance Company
Fidelity and Guaranty Insurance Underwriters, Inc.
St. Paul Fire and Marine Insurance Company
St. Paul Guardian Insurance Company
St. Paul Mercury Insurance Company
Travelers Casualty and Surety Company
Travelers Casualty and Surety Company of America
United States Fidelity and Guaranty Company

State of Connecticut
City of Hartford ss.

By: _____
Robert L. Raney, Senior Vice President

On this the 21st day of November, 2012, before me personally appeared Robert L. Raney, who acknowledged himself to be the Senior Vice President of Farmington Casualty Company, Fidelity and Guaranty Insurance Company, Fidelity and Guaranty Insurance Underwriters, Inc., St. Paul Fire and Marine Insurance Company, St. Paul Guardian Insurance Company, St. Paul Mercury Insurance Company, Travelers Casualty and Surety Company, Travelers Casualty and Surety Company of America, and United States Fidelity and Guaranty Company, and that he, as such, being authorized so to do, executed the foregoing instrument for the purposes therein contained by signing on behalf of the corporations by himself as a duly authorized officer.

In Witness Whereof, I hereunto set my hand and official seal.
My Commission expires the 30th day of June, 2016.

MARIE C. TETREAULT NOTARY PUBLIC CONNECTICUT

Marie C. Tetreault
Marie C. Tetreault, Notary Public

58440-8-12 Printed in U.S.A.

WARNING: THIS POWER OF ATTORNEY IS INVALID WITHOUT THE RED BORDER

This Power of Attorney is granted under and by the authority of the following resolutions adopted by the Boards of Directors of Farmington Casualty Company, Fidelity and Guaranty Insurance Company, Fidelity and Guaranty Insurance Underwriters, Inc., St. Paul Fire and Marine Insurance Company, St. Paul Guardian Insurance Company, St. Paul Mercury Insurance Company, Travelers Casualty and Surety Company, Travelers Casualty and Surety Company of America, and United States Fidelity and Guaranty Company, which resolutions are now in full force and effect, reading as follows:

RESOLVED, that the Chairman, the President, any Vice Chairman, any Executive Vice President, any Senior Vice President, any Vice President, any Second Vice President, the Treasurer, any Assistant Treasurer, the Corporate Secretary or any Assistant Secretary may appoint Attorneys-in-Fact and Agents to act for and on behalf of the Company and may give such appointee such authority as his or her certificate of authority may prescribe to sign with the Company's name and seal with the Company's seal bonds, recognizances, contracts of indemnity, and other writings obligatory in the nature of a bond, recognizance, or conditional undertaking, and any of said officers or the Board of Directors at any time may remove any such appointee and revoke the power given him or her; and it is

FURTHER RESOLVED, that the Chairman, the President, any Vice Chairman, any Executive Vice President, any Senior Vice President or any Vice President may delegate all or any part of the foregoing authority to one or more officers or employees of this Company, provided that each such delegation is in writing and a copy thereof is filed in the office of the Secretary; and it is

FURTHER RESOLVED, that any bond, recognizance, contract of indemnity, or writing obligatory in the nature of a bond, recognizance, or conditional undertaking shall be valid and binding upon the Company when (a) signed by the President, any Vice Chairman, any Executive Vice President, any Senior Vice President or any Vice President, any Second Vice President, the Treasurer, any Assistant Treasurer, the Corporate Secretary or any Assistant Secretary and duly attested and sealed with the Company's seal by a Secretary or Assistant Secretary; or (b) duly executed (under seal, if required) by one or more Attorneys-in-Fact and Agents pursuant to the power prescribed in his or her certificate or their certificates of authority or by one or more Company officers pursuant to a written delegation of authority; and it is

FURTHER RESOLVED, that the signature of each of the following officers: President, any Executive Vice President, any Senior Vice President, any Vice President, any Assistant Vice President, any Secretary, any Assistant Secretary, and the seal of the Company may be affixed by facsimile to any Power of Attorney or to any certificate relating thereto appointing Resident Vice Presidents, Resident Assistant Secretaries or Attorneys-in-Fact for purposes only of executing and attesting bonds and undertakings and other writings obligatory in the nature thereof, and any such Power of Attorney or certificate bearing such facsimile signature or facsimile seal shall be valid and binding upon the Company and any such power so executed and certified by such facsimile signature and facsimile seal shall be valid and binding on the Company in the future with respect to any bond or understanding to which it is attached.

I, Kevin E. Hughes, the undersigned, Assistant Secretary, of Farmington Casualty Company, Fidelity and Guaranty Insurance Company, Fidelity and Guaranty Insurance Underwriters, Inc., St. Paul Fire and Marine Insurance Company, St. Paul Guardian Insurance Company, St. Paul Mercury Insurance Company, Travelers Casualty and Surety Company, Travelers Casualty and Surety Company of America, and United States Fidelity and Guaranty Company do hereby certify that the above and foregoing is a true and correct copy of the Power of Attorney executed by said Companies, which is in full force and effect and has not been revoked.

IN TESTIMONY WHEREOF, I have hereunto set my hand and affixed the seals of said Companies this 22 day of JANUARY, 20 13.

Kevin E. Hughes, Assistant Secretary

To verify the authenticity of this Power of Attorney, call 1-800-421-3880 or contact us at www.travelersbond.com. Please refer to the Attorney-In-Fact number, the above-named individuals and the details of the bond to which the power is attached.

WARNING: THIS POWER OF ATTORNEY IS INVALID WITHOUT THE RED BORDER

BID FORM

NOTE TO BIDDER: Use typewriter or BLACK ink for completing this Bid Form.

BID FORM

To:	City and Borough of Sitka (CBS)
Mailing Address:	Municipal Clerk City and Borough of Sitka 100 Lincoln Street Sitka, AK 99835
Project Identification:	UV Disinfection System

BIDDER'S DECLARATION AND UNDERSTANDING

1.1. This Bid is genuine and not made in the interest of or on behalf of any undisclosed person, firm, or corporation and is not submitted in conformity with any agreement or rules of any group, association, organization, or corporation; Bidder has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid; Bidder has not solicited or induced any person, firm, or corporation to refrain from bidding; and Bidder has not sought by collusion to obtain for itself any advantage over any other Bidder or over CBS.

1.2. In submitting this Bid, Bidder certifies Bidder is qualified to do business in the State of Alaska as required by laws, rules, and regulations at the time the Bid Form is submitted to CBS.

1.3. In this section, the Bidder shall provide values for specific performance parameters for the Ultraviolet Disinfection System (UV System). The Bidder understands and agrees that the values stated in this section for the associated performance parameters will be compared to the performance standards required in the Technical Specifications. Bidders understand and agree to guarantee the performance values stated herein for the UV System in accordance with the guidelines specified in the Technical Specifications. The definition of each performance parameter used in the life-cycle cost comparison is as defined herein.

1.4. The undersigned Bidder understands and agrees that this Proposal shall form the basis for a contract with CBS. Therefore, the undersigned agrees to enter into an agreement to perform and furnish all Work as specified or indicated in these Specifications for the amount indicated in this Bid Form and in accordance with the other terms and conditions of this Request for Proposal (RFP).

1.5. The undersigned accepts all of the terms and conditions of this RFP including, without limitation, those dealing with the disposition of Bid security, and the penalties that may be imposed based on results from the Performance Testing.

BIDDER'S NAME Trojan Technologies

1.6. This Proposal shall remain subject to acceptance for a period of 120 days after the day of Bid opening.

2. CONTRACT EXECUTION

2.1. The undersigned Bidder agrees, if this Bid is accepted, to enter into an Agreement with CBS to perform and furnish Work as specified or indicated in the Bidding Documents for the Contract Price derived from the Bid, and in accordance with the other terms and conditions of the Bidding Documents.

2.2. Bidder accepts the terms and conditions of the Bidding Documents.

3. INSURANCE

3.1. Bidder further agrees that the Bid amount(s) stated herein includes specific consideration for the specified insurance coverages.

4. ADDENDA

4.1. Bidder hereby acknowledges that it has received Addenda

Nos. One (1), Two (2), Three (3), _____,

(Bidder shall insert number of each Addendum received) and agrees that Addenda issued are hereby made part of the Bidding Documents, and Bidder further agrees that this Bid includes impacts resulting from said Addenda.

5. STATE AND LOCAL SALES AND USE TAXES

5.1. State and local sales taxes shall not be included in this Bid Form.

5.2. All other applicable taxes shall be included in all costs provided by supplier.

BIDDER'S NAME Trojan Technologies

6. BID SCHEDULE

6.1. Bidder shall provide required information by filling in all blanks following the Bid Schedule (begins next page).

6.1.1. The life cycle period for the purposes of the cost evaluation of the UV System is defined as 20 years.

6.1.2. The interest rate for purposes of the cost evaluation of the UV System is defined as 5 percent (based on an 8 percent rate of return and 3 percent inflation rate).

6.1.3. The present worth of recurring annual costs over a 20 year life cycle is defined as the annual cost multiplied by 12.46.

6.1.4. The guarantees for component lifetimes shall be in terms of calendar time based on the average usage conditions identified herein.

BIDDER'S NAME Trojan Technologies

BID SCHEDULE
1. Manufacturer: Trojan Technologies
2. UV Reactor Model: Trojan UVSwiftSC D12
3. Total Number of UV Reactors (duty plus one standby): 2 duty, 1 standby

Report all costs in terms of US Dollars.	
A1. Cost of the UV System in Whole Dollar Amount Cost of the UV System including type and quantity of UV reactors provided in lines 1 through 3 above designed to meet all requirements of the RFP to provide UV disinfection under the specified design conditions with one unit out of service. Cost shall include time for required manufacturer support services as stated in RFP documents herein (e.g., design support, performance testing, training, etc.) and spare parts as required in Specification 44 44 73, 1.08.	$ 192,000

BIDDER'S NAME Trojan Technologies

A2. Annual Electric Power Cost in Whole Dollar Amount

The Average Power Consumption calculation shall assume that the system will operate at a validated dose (Dval) greater than 12 mJ/cm^2 to achieve a minimum of 3.0 log Cryptosporidium inactivation. Power requirements of all equipment supplied under this RFP, including the UV disinfection system and all associated equipment will be included in the electric power cost calculation. The operating conditions identified in A2.1 shall serve as the basis for calculation of the Average Power Consumption on an annual basis. The calculated Average Power Consumption will be validated based on readings taken during the Performance Testing. **Assume an average unit power cost of $0.15/kWh.**

A2.1 Average Power Consumption

A2.1.a Design Factors

Indicate values for the items requested in the following table that should be used to calculate the reactor power setting and power consumption:

Item	Description	Value
End of Lamp Life Aging factor (ELAF)	Bidder to provide third-party certified ELAF for the proposed UV System, Max=0.90.If no 3rd-party certification is submitted, assume 0.80. If data supports a value less than 0.80, substitute with the more conservative value.	0.90
Quartz Sleeve Fouling Factor (QSFF)	Bidder to provide third-party certified QSFF for the proposed UV System. For systems with automatic cleaning mechanism assume 0.90. For systems with manual cleaning, assume 0.80.	0.90
Design Fouling-Aging Factor (DFAF)	This factor is used to determine design UV dose. Multiply ELAF x QSFF.	0.81
Average Fouling-Aging Factor (AFAF)	This factor is used to determine average power consumption. Average of 1.0 and DFAF	0.905
Operating Safety Factor (OSF)	This safety factor is applied to adjust the operating target of the UV system to reflect actual operating conditions. Min OSF = 5%. Multiply 1.05 x 3.0 log Cryptosporidium inactivation to determine the operating setpoint.	12.9

BIDDER'S NAME Trojan Technologies

A2.1.b. The proposed system will operate at a validated dose (Dval) greater than 12 mJ/cm2 to achieve a minimum of 3.0 log Cryptosporidium inactivation times the Operating Safety Factor (OSF) as listed in A2.1.a.

For each of the following conditions, indicate how many reactors and lamps will be used, and at what power setting. The Average Fouling-Aging Factor (AFAF) calculated in A2.1.a should be used to calculate the power setting.

	UVT	Flow (gpm)	Time [1] (%)	No. of Reactors	No. of Lamps	Power Setting (kW)	Power Consumption (kWh/day)
(1)	94.5	1800	35%	1	12	1.8	43.2
(2)	96.0	2800	15%	1	12	1.86	44.64
(3)	93.0	2500	10%	1	12	2.22	53.28
(4)	94.5	2250	40%	1	12	1.92	46.08

1. The water quality and flow conditions (1) through (4) are expected to be encountered in the proportions listed here over the course of a typical year.

A2.1.c. Calculate Average Power Consumption by multiplying the power consumption for each condition shown in the table above by its expected condition.

[Power Consumption (1) x 35%] + [Power Consumption (2) x 15%] + [Power Consumption (3) x 10%] + [Power Consumption (4) x 40%]

A2.1.c Calculated Average Power Consumption (kWh/day)
45.576

A2. Average Annual Power Cost [A2.1.c x ($0.15/kWh) x (365 days per year)]	$ 2,495.29

BIDDER'S NAME Trojan Technologies

A3.2 Annual Ballast/Transformer Replacement Cost Determine cost by [BRC x BRY] from Items A3.2.a and A3.2.b, below.	$ 1,287

A3.2.a. Ballast/transformer information.

Item	Description	Value
Ballasts/transformers in Service (BS)	Total number of ballasts/transformers (BS) in all reactor(s) (including redundant)	18
Guaranteed Ballast/transformer Life (GBL)	Guaranteed Ballast/Transformer Life (GBL), expressed in years.	10
Ballast/transformer replacement cost (BRC)	Guaranteed not-to-exceed replacement cost per ballast/transformer expressed in dollars (BRC).	$ 650

A3.2.b Ballast/transformer replacement calculations

The number of ballast/transformer replacements is annualized by dividing the total number of ballasts/transformers in all reactor(s) (including redundant) by the guaranteed ballast/transformer life. It is assumed that 10% of ballasts in service will fail prematurely during their life.

[1.1 x BS / GBL]

Calculated Ballast/Transformer Replacements per Year (BRY)
1.98

BIDDER'S NAME Trojan Technologies

A3. Annual Maintenance Costs

Annual maintenance costs will be calculated based on guaranteed life and cost data provided by the supplier for lamps, ballasts/transformers, quartz sleeves, UV intensity sensors and cleaning method. UV equipment operating conditions shall be based on design UV dose for minimum of 3.0 log Cryptosporidium inactivation times the operating safety factor at average flow rate of 2200 gpm, average UVT of 94.5 percent, and average fouling-aging factor.

A3.1 Annual Lamp Cost Determine cost by [LMC x LPY] from Item A3.1.a, below.	$ 1,708.20

A3.1.a. Lamp information.

Item	Description	Value
Number of Lamps in Service (LS)	Number of Lamps in Service (LS) in operating reactor(s).	12
Guaranteed Lamp Life (GLL)	Expressed in hours, for the given conditions and reactor in service.	12,000
Lamp Material Cost (LMC):	Guaranteed not-to-exceed replacement cost for one UV lamp including return of spent lamp, expressed in dollars.	$ 195.00
Number of Lamps Replaced Per Year (LPY):	Number of Lamps in Service divided by Guaranteed Lamp Life multiplied by 24 hours per day multiplied by 365 days per year. [(LS / GLL) x 24 x 365]	8.76

BIDDER'S NAME _____

A3.3 Annual Quartz Sleeve Replacement Cost Determine cost by [QRC x QRY] from Items A3.3.a and A3.3.b, below.	$ 336.60

A3.3.a Quartz sleeve information.

Item	Description	Value
Total number of quartz sleeves (QS)	Total number of quartz sleeves (QS) in all reactor(s) (including redundant)	36
Guaranteed Quartz sleeve Life (GQL)	Guaranteed Quartz Sleeve Life (GQL), expressed in years.	10
Quartz sleeve replacement cost (QRC)	Guaranteed not-to-exceed replacement cost per quartz sleeve expressed in dollars (QRC).	$ 85

A3.3.b Quartz sleeve replacement calculations.

The number of quartz sleeve replacements is annualized by dividing the total number of quartz sleeves in all reactor(s) (including redundant) by the guaranteed quartz sleeve life. It is assumed that 10% of quartz sleeves in service will be replaced prematurely during their life.

[1.1 x QS / GQL]

Calculated Sleeve Replacements per Year (QRY)
3.96

BIDDER'S NAME Trojan Technologies

A3.4 Annual Duty Sensor Replacement Cost Determine cost by [SRC x SRY] from Items A3.4.a and A3.4.b, below.	$ 313.50

A3.4.a Duty UV intensity sensor information.

Item	Description	Value
Total number of duty UV intensity sensors (SS)	Total number of duty UV intensity sensors (SS) in the all reactor(s) (including redundant)	3
Guaranteed duty UV intensity Sensor Life (GSL)	Guaranteed Sensor Life (GSL), expressed in years.	10
Guaranteed duty UV intensity Sensor calibration frequency (GSC)	Guaranteed duty UV intensity Sensor calibration frequency (GSC), expressed in weeks.	4.3
Duty UV intensity Sensor replacement cost (SRC)	Guaranteed replacement cost per UV intensity sensor expressed in dollars (SRC).	$ 950

A3.4.b Duty UV intensity sensor replacement calculations.

The number of duty UV intensity sensor replacements is annualized by dividing the total number of duty UV intensity sensors in all reactor(s) (including redundant) by the guaranteed sensor life. It is assumed that 10% of duty UV intensity sensors in service will be replaced prematurely during their life.

[1.1 x SS / GSL]

Calculated Sensor Replacements per Year (SRY)
0.33

BIDDER'S NAME Trojan Technologies

A3.5 Annual Reference UV Sensor Calibration Cost Annual cost for reference UV sensor calibration. Assume re-calibration of all reference sensors each year.	$ 750
A3.6 Annual UVT Analyzer Maintenance Cost Annual cost for UVT analyzer (2) replaceable components. Annualize replaceable components with replacement frequencies less than once per year.	$ 750
A3.7 Annual Automatic Cleaning System Replacement Cost Annual cost for automatic cleaning system replaceable components. Annualize replaceable components with replacement frequencies less than once per year.	$ 108
A3. Total Operating Cost of the UV System [A3.1 + A3.2 + A3.3 + A3.4 + A3.5 + A3.6 + A3.7]	$ 4,753.30

BIDDER'S NAME Trojan Technologies

A4. Present Value of Initial and Annual Costs in Whole Dollar Amounts

The present value of initial and annual costs is calculated based on a 20-year design life and a 5 percent interest rate.

A4.1 Total Initial Costs: [A1]	$ 192,500
A4.2 CBS Component of Initial Costs (non grant-funded portion): [A1 * 0.30]	$ 57,750
A4.3 Total Annual Costs (TAC): [A2 + A3]	$ 7,248.59
A4.4 Present Value of Total Annual Costs: [A4.3 x 12.46]	$ 90,317.38
A4. Present Value System Cost: [A4.2 + A4.4]	$ 148,067.38

A5. Guaranteed Daily Billing Rate (For Reference Only; Do not include in cost calculations)

Supplier shall guarantee that they will provide up to 60 hours of additional technical services, including additional programming, training, or regulatory assistance. This billing rate shall be guaranteed for a minimum of 2 years following Final Payment of the UV Disinfection System Contract.

A5. Guaranteed Daily Billing Rate (US dollars per 8-hr Workday)	$ 1,250

BIDDER'S NAME Trojan Technologies

A6. Lead Time for Submittal of Shop Drawings and Work Delivery:	
Supplier shall provide the lead time required for submittal of shop drawings and work delivery as described in CONTRACT TIMES in AGREEMENT FORM (00 52 63).	
A6.1. Lead time for Submittal of Shop Drawings:	Within 25 business days after the date of Execution of Contract
A6.2. Lead time for Equipment Delivery: Note: Actual equipment delivery may be later if requested by CBS to accommodate the construction schedule.	100 days after the Date for Delivery is established or after final approval of Shop Drawings

BIDDER'S NAME Trojan Technologies

7. GUARANTEES

7.1. Performance: Supplier shall guarantee that the system will perform, providing the design dose to the design flowrate as stated in Section 44 44 73, UV System. After installation, the Supplier will conduct Performance Testing to confirm performance as described in Section 44 44 73, UV System.

7.2. Power Consumption: Supplier shall guarantee that the system's power utilization and total connected load will not exceed the amounts specified in the Bid Schedule as guaranteed by Supplier. After installation and Performance Testing, the total connected load and system power consumption will be measured under a number of conditions. If either or both of these quantities exceed the guaranteed amounts for any of the tested conditions, Supplier shall pay CBS a Power Penalty. The amount of the Power Penalty shall be equal to the present worth value of the calculated difference in actual and guaranteed electricity costs for the 20-year design life (based on a 5 percent discount rate, flow frequency, and the power costs listed in the Bid Form).

7.3. UV System Inlet and Outlet Configuration: If the proposed system layout does not meet the inlet and outlet configuration requirement of 2006 UVDGM, Supplier shall perform computational fluid dynamics (CFD) modeling (at no additional cost) to confirm that the UV dose delivery at the proposed configuration will be better than that during validation. This CFD modeling shall be included with the UV system shop drawing submittal, but may be required earlier in order to gain approval of the proposed layout from the Alaska Department of Environmental Conservation.

7.4. The costs of replacements for all system components shall be guaranteed by the Supplier for a period of 5 years from system acceptance date. The guaranteed replacement costs shall be the lower of either the costs listed in the Bid Schedule or future market prices. After 5 years, the cost of the replacement parts identified in this paragraph may be adjusted on an annual basis to account for inflation based upon the U.S. Department of Labor's Producer Price Index (PPI) as follows:

$$\text{Component Unit Replacement Cost (year 20XX)} = \text{Base Unit Price} \times \frac{\text{PPI (year 20XX)}}{\text{PPI (year 2010)}}$$

7.5. Lamps, Ballasts, Quartz Sleeves and UV Intensity Sensors: Supplier shall guarantee average life as listed in the Bid Schedule. If these Replacement Parts do not last for the guaranteed life, Supplier shall pay CBS for the cost of replacement, adjusted proportional to the actual life. In addition, UV lamps shall be guaranteed at their full replacement cost up to a minimum of 1,000 hours of operation and prorated henceforth. For example, if the lamps last 4,000 hours but are guaranteed for 5,000 hours (or their intensity declines below the

BIDDER'S NAME Trojan Technologies

guaranteed end of lamp life output), one penalty shall be (5,000 – 4,000)/(5,000-1,000) times the initial cost. The guaranteed life shall apply to all original and replacement parts provided by the Supplier within a 20-year period and terminate only when the part has reached its guaranteed life, whichever is later. Supplier's not-to-exceed cost shall include receiving and disposing of spent lamps. The proposer-nominated guaranteed life and replacement cost for each replaceable component will be used to estimate life-cycle costs for the system.

7.6. Billing Rate for Allowance for Additional Technical Services: Supplier shall guarantee that they will provide up to 60 hours of additional technical services, including additional programming, training, or regulatory assistance, as listed in Bid Schedule. This billing rate shall be guaranteed for a minimum of 2 years following Final Payment of the UV Disinfection System Contract.

8. SURETY

8.1. If Bidder is awarded the Work from this Bid, the surety providing the Performance Bond is:

Travelers Casualty and Surety Company of America			whose address is
One Tower Square	Hartford	CT	06183
Street	City	State	Zip

9. BIDDER

SUBMITTED on February 9, 2013

State Contractor License No. _____. (If applicable)

If Bidder is:

An Individual

Name *(typed or printed)*: _____

By *(signature)*: _____

Doing business as: _____

Business address: _____

_____

Phone No.: _____ FAX No.: _____

BIDDER'S NAME Trojan Technologies

A Partnership

Partnership Name: Trojan Technologies (SEAL)

By: _____
(Signature of general partner – attach evidence of authority to sign)

Name *(typed or printed)*: TREVOR NOYE, CFO.

Business address: 3020 Gore Road, London, Ontario, Canada N5V 4T7

Phone No.: 519-457-3400 FAX No.: 519-457-3030

A Corporation

Corporation Name: _____(SEAL)

State of Incorporation: _____

Type (General Business, Professional, Service, Limited Liability):_____

By: _____
(Signature – attach evidence of authority to sign)

Name *(typed or printed)*: _____

Title:_____ (CORPORATE SEAL)

Attest: _____
(Signature of Corporate Secretary)

Business address: _____

Phone No.:_____ FAX No.:_____

Date of Qualification to do business is: _____

A Joint Venture

Joint Venturer Name: _____(SEAL)

By: _____

BIDDER'S NAME Trojan Technologies

(Signature of joint venture partner – attach evidence of authority to sign)

Name *(typed or printed)*: _____

Title:_____

Business address: _____

_____

Phone No.:_____ FAX No.:_____

(Each joint venturer must sign. The manner of signing for each individual, partnership, and corporation that is a party to the joint venture should be in the manner indicated above.)

Phone and FAX Number, and Address for receipt of official communications:

Trojan Technologies, 3020 Gore Road, London, Ontario, Canada N5V 4T7

Phone: 519-457-3400 Fax: 519-457-3030

END OF SECTION

BIDDER'S NAME Trojan Technologies

NON-COLLUSION AFFIDAVIT

CITY AND BOROUGH OF SITKA
SITKA, ALASKA

TROJAN TECHNOLOGIES (Bidder), first being duly sworn, on his oath says that the bid above submitted is a genuine and not a sham or collusive bid, or made in the interest or behalf of any person not herein named, and he further says that the said bidder has not directly or indirectly induced or solicited any bidder on the above work or supplies to put in a sham bid, or any other person or corporation to refrain from bidding; and that said bidder has not in any manner sought by collusion to secure to HIS self an advantage over any other bidder or bidders.

(TREVOR NOTE)
CFO
BIDDER TROJAN TECHNOLOGIES

Subscribed and sworn to before me this 4th day of February, 2013

NOTARY PUBLIC
My Commission Expires: Not Applicable

CERTIFICATE

Execution of Routine Documentation

The undersigned, being the Secretary of Trojan Technologies (the "Partnership") hereby certifies that Trevor Noye is the Chief Financial Officer of the Partnership and as such is authorized to execute on this date the Bid Form with respect to the City and Borough of Sitka UV Disinfection System in accordance with the applicable Trojan Technologies policies in force as of the date hereof.

DATED the 4th day of February, 2013

Jeffrey S. Kafka
Secretary,
Trojan Technologies

SCOPE OF SUPPLY

TROJANUV
WATER CONFIDENCE™

SCOPE OF SUPPLY FOR ULTRAVIOLET DISINFECTION EQUIPMENT – TROJAN UV SWIFT™SC

Project Name:	Sitka, AK
Consulting Engineer:	CH2M Hill
Specification Section:	44 44 73
Addendum #:	Addendum # 3
Trojan Quote:	203666
Trojan Reactor Model:	TrojanUVSwift™SC model D12

Design Criteria:			
	Peak Flow:	5000	gpm(US)
	UV Transmission:	93	% @ 5000 gpm(US)
		90	% @ 4000 GPM(US)
	Target Organism:	3.0	LOG Inactivation)Cryptosporidium and Giardia)

We are pleased to submit the following scope of equipment based on the above criteria. The equipment described herein is named as the basis for the design.

The purchaser is responsible for reading all information contained in this Supply Contract. Trojan will not be held accountable for the supply of equipment not specifically detailed in this document. Supplemental Terms and Conditions are attached to this document. Detailed installation instructions are provided with the shop drawings and are available upon request. Changes to the attached Scope of Supply that affect selling price will be handled through a change order.

Please refer all inquiries to Trojan's Manufacturer's Representative:

Wm. H& Reilly & Co.
Bill Reilly
503-223-6197

This proposal has been respectfully submitted by,

Trojan Technologies

Bill Gordon, PMP
Municipal Applications

1. 240V, 60 Hz, 1-phase, 2 wire + ground 4kw electrical supply.
2. Wiring of UV Reactor to it's associated Control Power Panel (LV and HV cable and conduit supplied by Trojan). Maximum permissible Reactor to Panel separation distance (as measured along the wire route) is 75 feet.
3. 4-20 mA DC Analog Output from the flowmeter to the CPP (if applicable)
4. Discrete hard wired Output Signals or AB Ethernet connection to Plant PLC/SCADA

- **All conductors, conduit and local disconnects are the responsibility of the CONTRACTOR unless explicitly stated otherwise.**
- **The Trojan CPP does not provide power or control to any valves (if present).**

POWER PACK (Transformers)

Trojan's Responsibility:
A power pack (transformer) will be supplied for each unit since the required 240 Volt, 1 phase, 2 wire plus ground is not available.

Size: 5 kVA
Enclosure Rating: NEMA 3R, STD ANSI 61 Grey, wall mounted

Installation Contractor's Responsibility:
Contractor will be required to mount the transformer, wire the secondary and primary taps, provide all wiring and conduit and all necessary overcurrent protection/disconnects to meet local electrical codes.

ON-LINE UV TRANSMISSION UNIT MONITOR – Trojan Optiview™

Trojan's Responsibility:
Trojan Technologies will supply a UVT sensor/sampler to monitor influent transmission

Quantity:	2 UVT monitors will be supplied
Materials of Construction:	Stainless Steel
Enclosure Rating:	Type 4X
Approximate Weight:	65 lb / 29.5 kg

Installation Contractor's Responsibility:
The Installation Contractor to be responsible for setting in place and wall mounting the enclosure indoors as per the layout drawings. The Installation Contractor shall also be responsible for the supply, installation and connection of the following:

1. One 120 Volt, 1 phase, 2 wire + ground, 15 amp power supply, 250 VA.
2. One (1) 4-20 mA DC Analog Output from the UVT Monitor to the CPP.
3. All tubing/piping to connect the Optiview to the process water stream (3/8" male NPT fittings on Optiview), maximum tubing/piping diameter of ¼". UVT Monitor requires a pressurized source and the appropriate flow regulators/pressure reducers to maintain flow rates of 0.1 gpm (0.4 l/min) to 0.4 gpm (1.6 l/min) at a maximum inlet pressure of 30 psi (210 kPa).
4. Shut off valve located within three (3) ft (1 meter) of cabinet.

START-UP, TESTING AND INSTRUCTION

Trojan's Responsibility:
As per Section 3.0 – Execution.

WARRANTY

Trojan's Responsibility:
As per Section 44 44 73 Part 3.10

PAYMENT TERMS

As per Section 00 72 10
Freight paid to jobsite.
Selling price does not include any duties or taxes, which may be applicable.

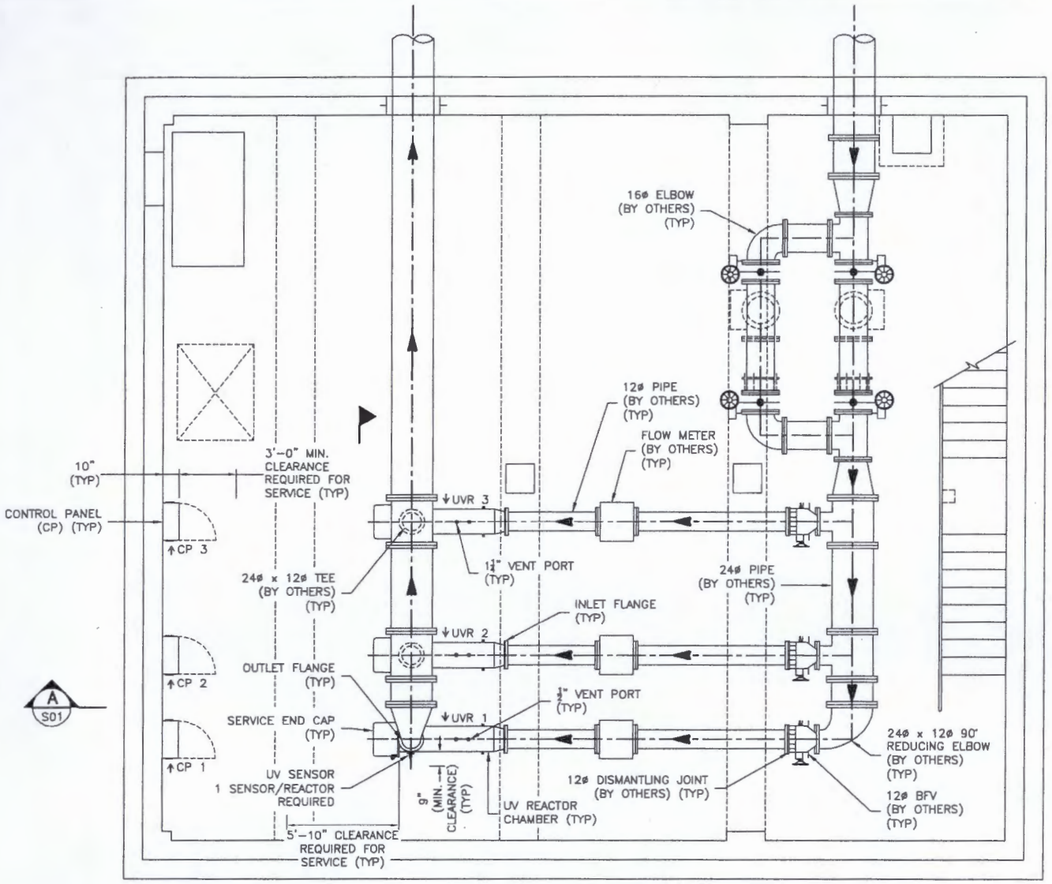
EQUIPMENT DELIVERY

Equipment delivery to site: As per A6.2 of the Bid Form.

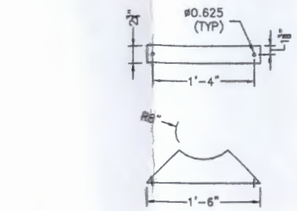
DRAWINGS

PRELIMINARY, NOT FOR CONSTRUCTION.
SUBJECT TO CHANGE.

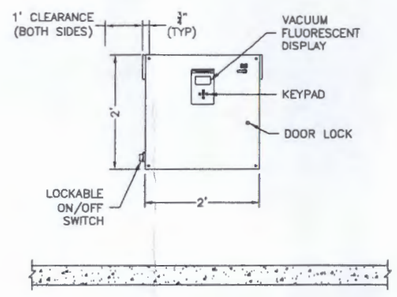
NOTES:
: CONNECTION SEALS AND HARDWARE TO BE SUPPLIED BY CUSTOMER.
: INTERCONNECTING CABLE LENGTH TO BE 15ft.
: MAXIMUM OPERATING PRESSURE TO BE 150 psi.
: MOUNTING AND SAMPLING PORTS ARE TO BE SUPPLIED BY THE CUSTOMER.
: CLEARANCES FOR WIPING SYSTEMS FALL WITHIN CLEARANCES REQUIRED FOR SLEEVE REMOVAL.
: LAMP TYPES AVAILABLE: A – DISINFECTION
V – VALIDATED DISINFECTION
: AMWS – AUTOMATIC MECHANICAL WIPING SYSTEM OPTIONAL
: ANSI FLANGE: ASME/ANSI B16.5 SLIP-ON WELDING CLASS 150
DIN FLANGE: BOLT PATTERN AND DIMENSIONS COMPLY WITH THE SPECIFICATION OF "DIN 2576: FLAT FLANGE, PN 10".
: PANEL RATING: MILD STEEL PAINTED = UL TYPE 12 (IP54)
SST W/COVER = UL TYPE 3R (IP55)



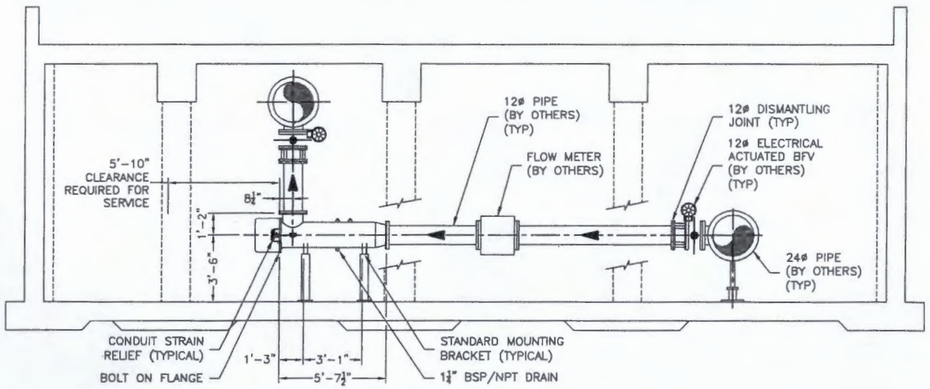
PLAN VIEW
SCALE:AS SHOWN
B S01



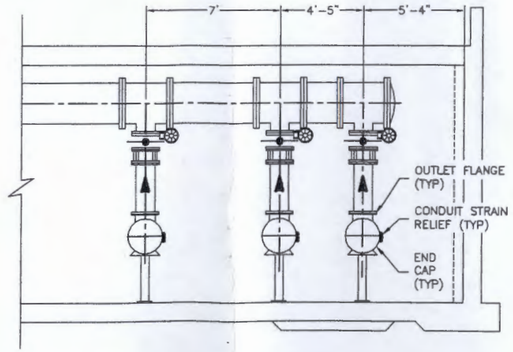
BRACKET DETAIL
SCALE:NOT TO SCALE



FRONT VIEW OF CP
SCALE:AS SHOWN



A SECTION
S01 SCALE:AS SHOWN
NOTE: STAIRS (BY OTHERS), AND PIPE SUPPORTS (BY OTHERS) NOT SHOWN FOR CLARITY.



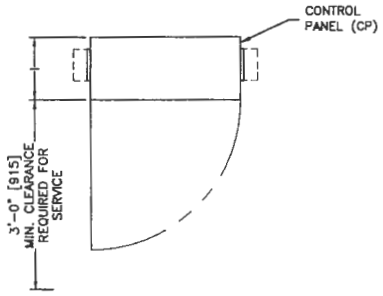
B SECTION
S01 SCALE:AS SHOWN

DESIGN CRITERIA		
	PEAK FLOW	5000.00 GPM
	U.V TRANSMITTANCE	93 %
	DISINFECTION LIMIT	3 LOG CRYPTO / GIARDIA

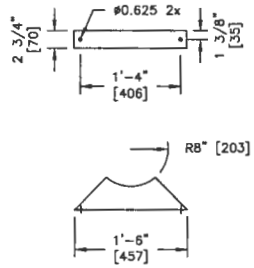
TROJANUV

DESCRIPTION: LAYOUT, TROJANUVSWIFTSC D12 SITKA AK

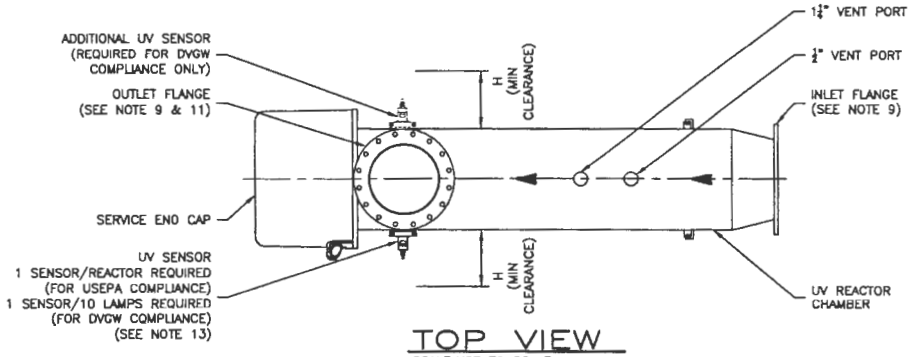
DRAWN BY : SPM	DATE : 13JA16	QUOTE NO.	203666
CHECKED BY :	DATE : 13JA17	PROJECT NO.	N/A
APPROVED BY :	DATE : 13JA17	DWG NO.	S01
SCALE (11x17) : 1/8" = 1'-0"	LOG NUMBER : N/A	REV.	A



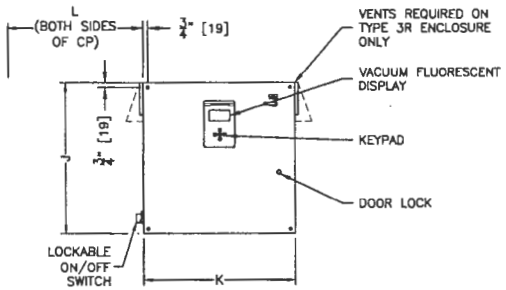
TOP VIEW OF CP
SCALE:NOT TO SCALE



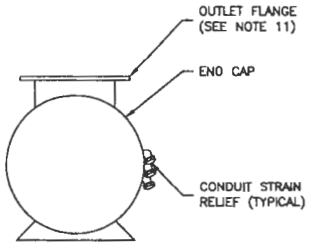
BRACKET DETAIL
SCALE:NOT TO SCALE



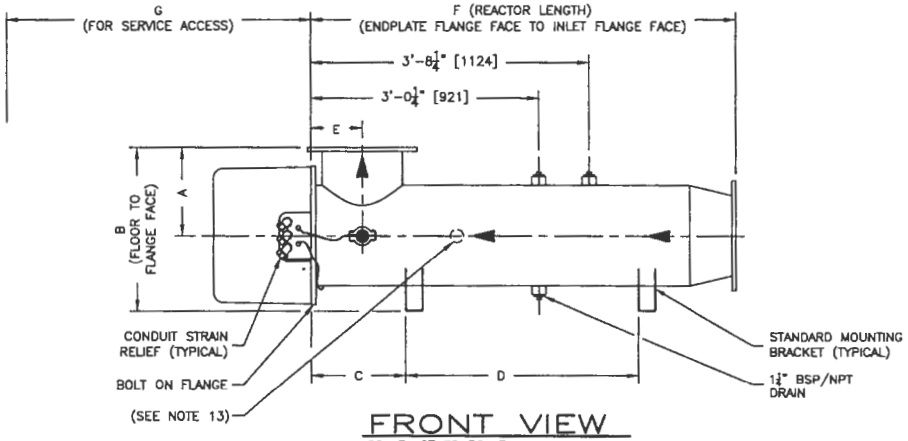
TOP VIEW
SCALE:NOT TO SCALE



FRONT VIEW OF CP
SCALE:NOT TO SCALE



END VIEW
SCALE:NOT TO SCALE



FRONT VIEW
SCALE:NOT TO SCALE

NOTES:

1. [ ] INDICATES MILLIMETERS UNLESS OTHERWISE SPECIFIED.
2. CONNECTION SEALS AND HARDWARE TO BE SUPPLIED BY CUSTOMER.
3. INTERCONNECTING CABLE LENGTH TO BE 15ft [4.5m].
4. MAXIMUM OPERATING PRESSURE TO BE 150 psi [10 BAR].
5. MOUNTING AND SAMPLING PORTS ARE TO BE SUPPLIED BY THE CUSTOMER.
6. CLEARANCES FOR WIPING SYSTEMS FALL WITHIN CLEARANCES REQUIRED FOR SLEEVE REMOVAL.
7. LAMP TYPES AVAILABLE: A – DISINFECTION
   V – VALIDATED DISINFECTION
8. AMWS – AUTOMATIC MECHANICAL WIPING SYSTEM OPTIONAL
9. ANSI FLANGE: ASME/ANSI B16.5 SLIP-ON WELDING CLASS 150
   DIN FLANGE: BOLT PATTERN AND DIMENSIONS COMPLY WITH THE SPECIFICATION OF "DIN 2576: FLAT FLANGE, PN 10".
10. PANEL RATING: MILD STEEL PAINTED = UL TYPE 12 (IP54)
    SST W/COVER = UL TYPE 3R (IP55)
11. OUTLET LOCATION OPTION: 12,3,6,9 O'CLOCK (VIEWED FROM SERVICE END)
12. WHEN OUTLET LOCATION IS NOT 12 O'CLOCK AIR VENT IS PROVIDED
13. SENSOR LOCATION (ON THIS SIDE) WHEN OUTLET ROTATED 90° CW FROM END VIEW SHOWN, SENSOR LOCATION (ON REVERSE SIDE) WHEN OUTLET IS ROTATED 90° CCW

MODEL	LAMP LENGTH	UV REACTOR ASSEMBLY DIAMETER	# LAMPS AVAILABLE	FLANGE TYPE	FLANGE SIZE	DIM. 'A'	DIM. 'B'	DIM. 'C'	DIM. 'D'	DIM. 'E'	DIM. 'F'	DIM. 'G'	DIM. 'H'	OPTIONAL WIPING SYSTEM AVAILABLE	PANEL RATING	DIM. 'I'	DIM. 'J'	DIM. 'K'	DIM. 'L'
012	LONG	16.00" [400]	12	ANSI/ DIN	12" [300]	1'-2" [356]	2'-2" [660]	1'-3" [381]	3'-1" [940]	8¼" [210]	5'-7⅞" [1715]	5'-10" [1778]	9" [229]	AMWS	TYPE 12	10" [254]	2'-0" [610]	2'-0" [610]	1'-0" [305]
															TYPE 3R	10" [254]	2'-0" [610]	2'-0" [610]	3'-0" [915]

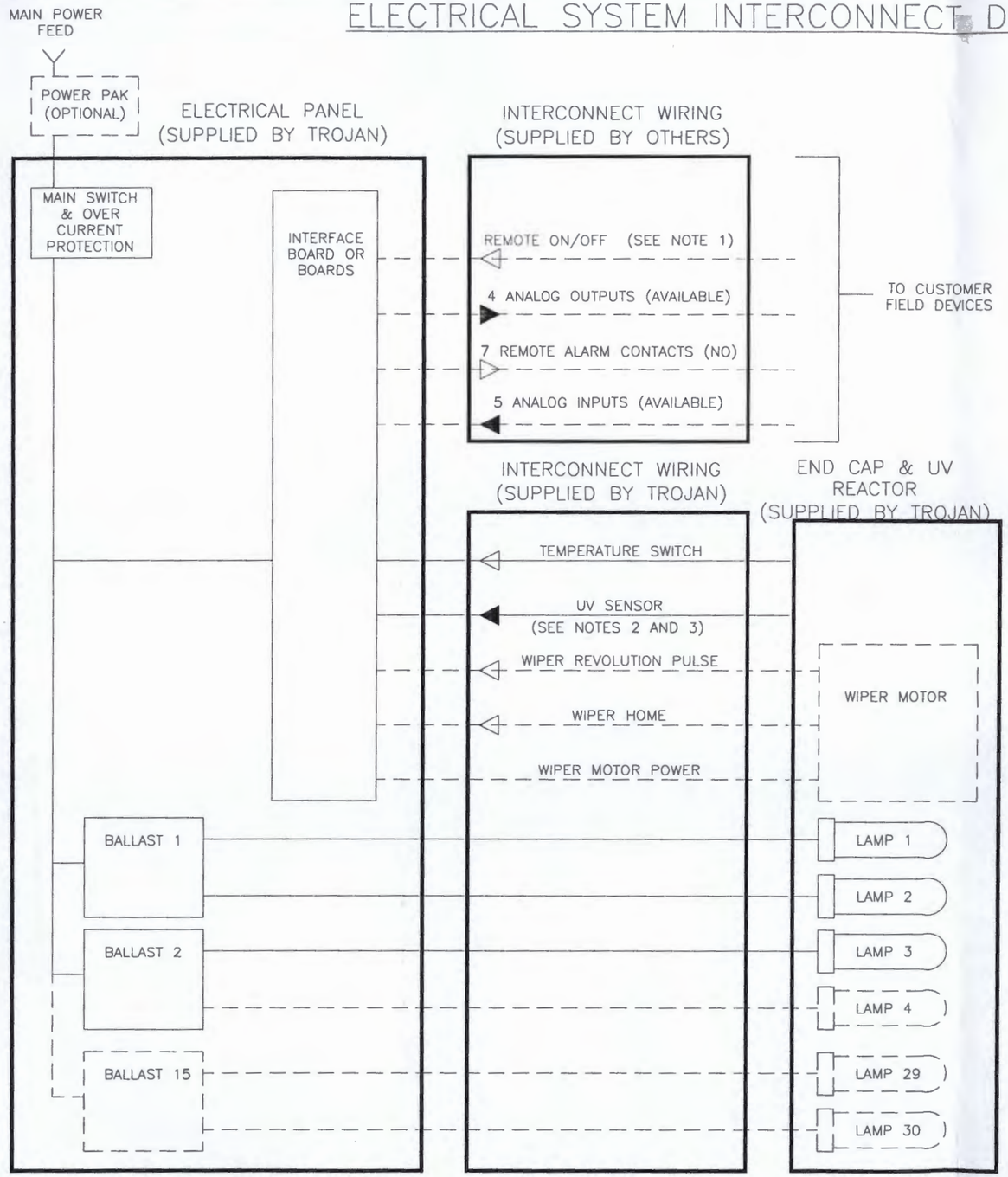
TROJANUV

DESCRIPTION: STD, UVSWIFTSC D12

DRAWN BY :	DAF/JMM/SPM	DATE : 12AP16
CHECKED BY :	DTR	DATE : 12AP16
APPROVED BY :	SAH	DATE : 12AP16
SCALE (8½x11) :	NOT TO SCALE	LOG NUMBER : N/A

STANDARD DRAWING NO. SW0054
REFERENCE # 794679
DWG NO. D01
REV. 1

ELECTRICAL SYSTEM INTERCONNECT DRAWING FOR UVSWIFTSC D MODELS



NOTE:
1. CUSTOMER TO SUPPLY REMOTE INPUT VOLTAGE.
2. FOR THE D12 MODEL, 2 UV SENSOR INPUTS AND 2 ANALOG OUTPUTS ARE REQUIRED (DVGW ONLY).
3. FOR THE D18 MODEL, 2 UV SENSOR INPUTS AND 2 ANALOG OUTPUTS ARE REQUIRED (DVGW ONLY).
4. FOR THE D30 MODEL, 3 UV SENSOR INPUTS AND 3 ANALOG OUTPUTS ARE REQUIRED (DVGW ONLY).
5. FOR THE D12 MODEL, 1 UV SENSOR INPUT AND 1 ANALOG OUTPUT IS REQUIRED (EPA ONLY).
6. FOR THE D18 MODEL, 1 UV SENSOR INPUT AND 1 ANALOG OUTPUT IS REQUIRED (EPA ONLY).
7. FOR THE D30 MODEL, 1 UV SENSOR INPUT AND 1 ANALOG OUTPUT IS REQUIRED (EPA ONLY).

STANDARD CHECKLIST

D03 3 LAMP PANEL 1070VA	D06 6 LAMP PANEL 1840VA	D12 12 LAMP PANEL 3390VA	D18 18 LAMP PANEL 4930VA	D30 30 LAMP PANEL 8030VA

STANDARD VOLTAGES

MAIN POWER FEED (SUPPLIED BY OTHERS)			REQUIRED INPUT PANEL VOLTAGE
240/120VAC	1PH ED, 3W + GND	(L-L-N)	240VAC 1PH 2W + GND (L-L)
208/120VAC	3PH Y, 4W + GND	(L-L-L-N)	208VAC 1PH 2W + GND (L-L)
240VAC	3PH D, 3W + GND	(L-L-L)	240VAC 1PH 2W + GND (L-L)
380/220VAC	3PH Y, 4W + GND	(L-L-L-N)	220VAC 1PH 2W + GND (L-L)
400/230VAC	3PH Y, 4W + GND	(L-L-L-N)	230VAC 1PH 2W + GND (L-L)
415/240VAC	3PH Y, 4W + GND	(L-L-L-N)	240VAC 1PH 2W + GND (L-L)

OPTIONS CHECKLIST

OPTIONAL VOLTAGES POWER TRANSFORMER REQUIRED

110VAC	1PH 2W + GND	(L-N)	480VAC	3PH D, 3W + GND	(L-L-L)
120VAC	1PH 2W + GND	(L-N)	600/347VAC	3PH Y, 4W + GND	(L-L-L-N)
480/277VAC	3PH Y, 4W + GND	(L-L-L-N)	460/265VAC	3PH Y, 4W + GND	(L-L-L-N)

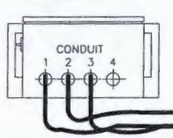
AVAILABLE OPTIONS	ITEMS SUPPLIED BY TROJAN	ITEMS SUPPLIED BY OTHERS	OPTIONS SELECTED
REMOTE ON/OFF FEATURE	REMOTE ON/OFF CONTROL	REMOTE ON/OFF SIGNAL + WIRING (SHIELDED CABLE 2 WIRES + GND)	
AUTOMATIC WIPER	WIPER MOTOR AND CONTROLS	N/A	
ANALOG OUTPUT	ANALOG OUTPUT SIGNAL(S) (SEE NOTE 1)	WIRING (SHIELDED CABLE 2 WIRES + GND)	
REMOTE ALARM RELAY	DISCRETE DRY CONTACTS (NO)	POWERED LOOP + WIRING (SHIELDED CABLE 2 WIRES + GND)	

LEGEND

- ▷ DIGITAL SIGNAL
- ▶ ANALOG SIGNAL
- —— INTER CONNECT WIRING AND CABLES
- – – OPTIONAL WIRING CONNECTIONS
- ⌐ ¬ OPTIONAL ELECTRICAL DEVICE
- □ ELECTRICAL DEVICE

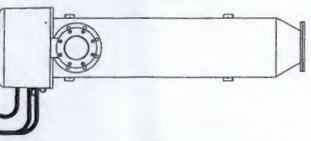
MAJOR SYSTEM COMPONENTS

ELECTRICAL PANEL (SUPPLIED BY TROJAN) (BOTTOM VIEW)



FLEXIBLE CONDUIT AND INTERCONNECT WIRES (SUPPLIED BY TROJAN)

END CAP AND UV REACTOR (SUPPLIED BY TROJAN) (TOP VIEW)



SYSTEM	CONDUIT 1	CONDUIT 2	CONDUIT 3	CONDUIT 4
D03 – 3 LAMPS	(1.25" CONDUIT) GROUND WIRE + LAMP 01–03 WIRES + OPT. WIPER MOTOR WIRES	(0.75" CONDUIT) GROUND WIRE + UV SENSOR(S) + TEMP SWITCH + END CAP ATTACHED + OPTIONAL WIPER PROXES	NOT USED	NOT USED
D06 – 6 LAMPS	(1.25" CONDUIT) GROUND WIRE + LAMP 01–06 WIRES + OPT. WIPER MOTOR WIRES	(0.75" CONDUIT) GROUND WIRE + UV SENSOR(S) + TEMP SWITCH + END CAP ATTACHED + OPTIONAL WIPER PROXES	NOT USED	NOT USED
D12 – 12 LAMPS	(1.25" CONDUIT) GROUND WIRE + LAMP 01–06 WIRES	(1.25" CONDUIT) GROUND WIRE + LAMP 07–12 WIRES + OPTIONAL WIPER MOTOR WIRES	(0.75" CONDUIT) GROUND WIRE + UV SENSOR(S) + TEMP SWITCH + END CAP ATTACHED +OPTIONAL WIPER PROXES	NOT USED
D18 – 18 LAMPS	(1.25" CONDUIT) GROUND WIRE + LAMP 01–10 WIRES	(1.25" CONDUIT) GROUND WIRE + LAMP 11–18 WIRES + OPTIONAL WIPER MOTOR WIRES	(0.75" CONDUIT) GROUND WIRE + UV SENSOR(S) + TEMP SWITCH + END CAP ATTACHED + OPTIONAL WIPER PROXES	NOT USED
D30 – 30 LAMPS	(1.25" CONDUIT) GROUND WIRE + LAMP 01–10 WIRES	(1.25" CONDUIT) GROUND WIRE + LAMP 11–20 WIRES	(1.25" CONDUIT) GROUND WIRE + LAMP 21–30 WIRES + OPTIONAL WIPER MOTOR WIRES	(1.25" CONDUIT) GROUND WIRE + UV SENSOR(S) + TEMP SWITCH + END CAP ATTACHED +OPTIONAL WIPER PROXES

TROJANUV

DESCRIPTION: STD, UVSWIFTSC SINGLE LINE DIAGRAM D MODEL

DRAWN BY : RH/CJB	DATE : 12JL17	STANDARD DRAWING NO. SW0052
CHECKED BY : MVW	DATE : 12JL17	REFERENCE # N/A
APPROVED BY : SAH	DATE : 12JL17	DWG NO. D01 / REV. G
SCALE (11X17) : NOT TO SCALE	LOG NUMBER : N/A	

VALIDATION INFORMATION

BID PROPOSAL REQUIREMENT– VALIDATION INFORMATION

The Validation information has been provided as a separate bound package attached with our bid documentation and should be considered part of our bid submission. The Trojan validation information contains very sensitive and proprietary trade secret information that should not be publicly released. We are confident you will treat this information as confidential and not release this information with this understanding. This information is for use by the City and Borough of Sitka only for evaluating the UV equipment proposed; all other who would like to review this information must first enter into a non-disclosure agreement with Trojan Technologies. A second separately bound copy of the validation report has been included in the bid submission for submission to the State of Alaska if Trojan is awarded the project. If Trojan is *not awarded* the UV project, we respectfully request the two validation reports be returned to Trojan without delay.

HDR | HydroQual

May 24, 2011

TRJN.012

Re: Trojan Technologies TrojanUVSwift™SC D12 UV Disinfection System Validated Performance

HDR|HydroQual Inc. provides this letter to confirm that validation testing has been satisfactorily completed for the TrojanUVSwift™SC D12 UV disinfection system, developed and manufactured by Trojan Technologies, 3020 Gore Road, London, Ontario, Canada. The Validation Test matrix was developed to comply with the protocols specified by the United States Environmental Protection Agency UV Disinfection Guidance Manual (UVDGM, EPA 815-R-06-007 November 2006). Validation testing was conducted for the TrojanUVSwift™SC D12 in conformance with United States Regulations 40 CFR 141.720, and the Long Term 2 Enhanced Surface Water Treatment Rule, effective January 5, 2006, which require dose-delivery performance validation of UV reactors that are used for the disinfection of drinking waters.

HDR|HydroQual, Inc. conducted all testing, sampling and analysis, data analysis and documentation, and will prepare the final validation report. The full-scale reactor testing was conducted at the UV Validation and Research Center of New York, Johnstown, NY. We certify that the TrojanUVSwift™SC D12 system was validated over a range of flow rates, feed water UV transmittances, and power levels to encompass a range of reduction equivalent doses (RED) of MS2, T1, T7 coliphage and *Aspergillus niger* conidia (now known as *Aspergillus brasiliensis)*, in accordance with UV dose requirements that meet US Drinking Water Standards. The validated operational envelope covered an RED range of approximately 3.0 mJ/cm^2 (T7) and 269.6 mJ/cm^2 (*Aspergillus niger* conidia). The operational envelope was defined by a flow range between 49 and 3,037 US gallons per minute (11.1 and 689.8 m^3/hour), a UVT range between 68.7% and 97.4%, and input power levels at 60% and 100% of nominal.

The system has been validated for 4-log adenovirus inactivation. The 4-log adenovirus inactivation operating envelope was defined (prior to the application of end-of-lamp-life and fouling factors) by a flow range between 131 and 775 US gallons per minute (29.8 and 176.1 m^3/hour), a UVT range between 86.1% and 97.1%, and at a suitable power level defined by the reactor controller.

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HDR | HydroQual
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Checklist 5.1 UV Reactor Documentation (Page 1 of 2)

Does UV reactor documentation contain the following elements?

Yes No

General

☑ ☐ Technical description of the reactor's UV dose-monitoring strategy, including the use of sensors, signal processing, and calculations (if applicable).

☑ ☐ Dimensions and placement of all wetted components (e.g., lamps, sleeves, UV sensors, baffles, and cleaning mechanisms) within the UV reactor.

☑ ☐ A technical description of lamp placement within the sleeve.

☑ ☐ Specifications for the UV sensor port indicating all dimensions and tolerances that impact the positioning of the sensor relative to the lamps. If the UV sensor port contains a monitoring window separate from the sensor, specifications giving the window material, thickness, and UV transmittance should be provided.

Lamp specifications

☑ ☐ Technical description
☑ ☐ Lamp manufacturer and product number
☑ ☐ Electrical power rating
☑ ☐ Electrode-to-electrode length
☑ ☐ Spectral output of new and aged lamps (specified for 5 nm intervals or less over a wavelength range that includes the germicidal range of 250 – 280 nm and the response range of the UV sensors)
☑ ☐ Mercury content
☑ ☐ Envelope diameter

Lamp sleeve specifications

☑ ☐ Technical description including sleeve dimensions
☑ ☐ Material
☑ ☐ UV transmittance (at 254 nm for LP and LPHO lamps, and at 200 – 300 nm for MP lamps with germicidal sensors)

Specifications for the reference and the duty UV sensors

☑ ☐ Manufacturer and product number
☑ ☐ Technical description including external dimensions
☑ ☐ Data and calculations showing how the total measurement uncertainty of the UV sensor is derived from the individual sensor properties. (See Table D.1 for an example of the calculation of UV sensor measurement uncertainty from the uncertainty that arises due to each UV sensor property.)

Checklist 5.1 UV Reactor Documentation (Page 2 of 2)

Does UV reactor documentation contain the following elements?

Yes	No	
		Sensor measurement properties
☑	☐	Working range
☑	☐	Spectral and angular response
☑	☐	Linearity
☑	☐	Calibration factor
☑	☐	Temperature stability
☑	☐	Long-term stability
		Installation and operation documentation:
☑	☐	Flow rate, head loss, and pressure rating of the reactor
☑	☐	Assembly and installation instructions
☑	☐	Electrical requirements, including required line frequency, voltage, amperage, and power
☑	☐	Operation and maintenance manuals that include cleaning procedures, required spare parts, and safety requirements. Safety requirements should include information on electrical lockouts, eye and skin protection from UV light, safe handling of lamps, and mercury cleanup recommendations in the event of lamp breakage.

5.11.2 Validation Test Plan

A validation test plan should document the key components of UV reactor testing. Recommended components of a validation test plan are provided in Checklist 5.2. This list is not meant to be all-inclusive; engineers should document any factors they believe are important for validation testing in their Validation Test Plan.

Checklist 5.2 Key Elements of the Validation Test Plan (Page 1 of 1)

Does the validation test plan contain the following elements?

Yes	No	
☑	☐	Purpose of Validation Testing. General description of why the tests are being done and how the data will be used.
☑	☐	Roles and Responsibilities. Key personnel overseeing and performing the full-scale reactor testing and collimated beam testing, including their qualifications. This section should include contact names and telephone numbers.
☑	☐	Locations and Schedule. Location for conducting full-scale reactor testing and collimated beam testing. Planned schedule for conducting the tests and performing the data analyses.
☑	☐	Challenge Microorganism Specifications. Specifications for the challenge microorganism to be used during validation that include the protocols required for growth and enumeration, the expected UV dose-response, and suitability for use in validation testing.
☐	☐ N/A	Plan for state review (if applicable).

Design of the Biodosimetry Test Stand/On-site Testing Facilities

☑	☐	Inlet/outlet piping design, including backflow prevention
☑	☐	Mixing
☑	☐	Sample ports
☑	☐	Pumps
☑	☐	Additives (Material Safety Data Sheets for UV-adsorbing chemical, quenching agent)

Collimated Beam Testing Apparatus

☑	☐	Lamp type
☑	☐	Collimating tube aperture
☑	☐	Distance from light source to sample surface
☑	☐	Radiometer make and model

Monitoring Equipment Specifications and Verification of Equipment Accuracy for the following:

☑	☐	Flow meters
☐	☐ N/A	UVT analyzers (if used)
☑	☐	UV Spectrophotometers
☑	☐	Power measurement
☑	☐	UV sensors
☑	☐	Radiometer make, model, and calibration certificates

Experimental Test Conditions including, but not limited to:

☑	☐	Number of tests, UVT, flow rate, lamp power, and lamp status for each test condition
☐	☑	Lamp fouling factor, use of new or aged lamps. No Fouling Factor used in Validation
☑	☐	Influent concentration of challenge microorganisms for each test condition
☑	☐	QA/QC Plan

5.11.3 Validation Report

The validation report should provide detailed documentation of all validation testing results. The report should also include all elements of the Validation Test Plan and a summary of the field-verified UV reactor properties.

EPA recommends that the report begin with an executive summary with key information that can be used by states and water systems to assess inactivation credit for the target pathogen(s). The executive summary should include, at a minimum,

- The validated dose or range of validated doses,
- The log credit achieved for the potential target pathogens by the UV reactor, and
- Validated operating conditions (i.e., flow rate, UVT if the Calculated Dose approach is used).

If the UV Intensity Setpoint approach is used, the executive summary should provide the UV intensity setpoint (or setpoints) for the validated dose. If the reactor uses the Calculated Dose Approach as its dose monitoring strategy, the dose-monitoring equation should be provided.

In addition to the items listed above, the executive summary should include the following:

- A brief description of the validated reactor,
- The assumed fouling/aging factors for the reactor and indication if new or aged lamps were used during validation testing,
- A summary of the validation test conditions, including but not limited to the flow rate, UVT, and lamp power for each test condition,
- Key validation test results used to derive the dose, including but not limited to the RED values for each test condition, the UV dose-monitoring equation from collimated beam testing, and the VF,
- A summary of QA/QC checks and results, including UV sensor and radiometer reference checks,
- A description of the validation facilities,
- The organizations conducting the validation test, and
- Names and credentials of the individuals/organizations providing third party oversight.

Recommended contents for the detailed validation report are listed in Checklist 5.3. Note that these recommendations are not intended to be all-inclusive. Engineers should document any test characteristics or outcomes they believe are important in the Validation Report.

Checklist 5.3 Key Elements of the Validation Report (Page 1 of 1)

Does your validation report contain the following elements?

Yes No

General

☑ ☐ Detailed reactor documentation (see Checklist 5.1), including drawings and serial numbers, and procedures used to verify reactor properties.

☑ ☐ Validation test plan (either a summary of key elements, or the test plan can be attached to the validation report along with documentation of any deviations to the original test plan)

Full-scale reactor testing results, with detailed results for each test condition evaluated. Data should include, but are not limited to:

☑ ☐ Flow rate

☑ ☐ Measured UV intensity

☑ ☐ UVT

☑ ☐ Lamp power

☑ ☐ Lamp statuses

☑ ☐ Inlet and outlet concentrations of the challenge microorganism

Collimated beam testing results, including detailed results for each collimated beam test used to create the UV dose-response equation:

☑ ☐ Volume and depth of microbial suspension

☑ ☐ UV Absorption of the microbial suspension

☑ ☐ Irradiance measurement before and after each irradiation

☑ ☐ Petri factor calculations and results

☑ ☐ Calculations for UV dose

☑ ☐ Derivation of the UV dose-response equation, including statistical methods and confidence intervals (i.e., calculation of U_{DR})

QA/QC Checks:

☑ ☐ Challenge microorganism QA/QC, including blanks, controls, and stability analyses

☑ ☐ Measurement uncertainty of the radiometer, date of most recent calibration, results of reference checks

☑ ☐ Measurement uncertainty of UV sensors and results of reference checks

☑ ☐ Measurement uncertainty of the flow meter, UV spectrophotometer, and any other measurement equipment used during full-scale testing

Calculation of the validated dose, log inactivation credit, and validated operating conditions:

☑ ☐ RED for each test condition

☑ ☐ Calculation of the VF

☐ ☐ N/A Setpoints if the reactor uses the UV Intensity Setpoint Approach

☑ ☐ Dose-monitoring equation if the reactor uses the Calculated Dose Approach

☑ ☐ Log inactivation credit for target pathogens (e.g., *Cryptosporidium*, *Giardia*, and viruses)

☑ ☐ Validated operating conditions (e.g., flow rate, lamp status, UVT)

5.12 Guidelines for Reviewing Validation Reports

State engineers and water systems purchasing pre-validated reactors should review the validation report to confirm the following:

- Validation testing meets the minimum regulatory requirements as summarized in Table 5.1.
- EPA's recommended validation protocol was followed and any deviations from the protocol are adequately justified.
- Validated doses achieved by the UV equipment meet or exceed the target pathogen log inactivation desired.
- QA/QC criteria were met during validation testing.

Checklist 5.4 summarizes the QA/QC recommendations presented throughout this chapter and in Appendix C. If a QA/QC plan was prepared prior to validation, reviewers should request a copy of the plan and make sure it is consistent with industry standards.

Checklist 5.5 contains key elements that should be verified by state or water system personnel when reviewing validation reports. States and systems should keep documentation that these key validation criteria were met.

Checklist 5.4 Review for Quality Assurance/Quality Control (Page 1 of 1)

Yes No

Uncertainty in Measurement Equipment (See Section 5.5 and C.2.2 for more information)

☑ ☐ **Flow Meter:** Is the measurement uncertainty < 5 percent?

☑ ☐ **UV Spectrophotometer:** Is the measurement uncertainty ≤ 10 percent?

☑ ☐ **UV Sensors:** Did duty sensors operate within 10 percent of the average of two or more reference sensors? If not, was uncertainty in sensor measurement incorporated into the VF?

☑ ☐ **Radiometer:** (for collimated beam testing only). Do lamp output measurements vary by no more than 5 percent over exposure time? Was the accuracy of the radiometer verified with another radiometer?

QA/QC of Microbial Samples (See Section 5.6.4 for more information)

☑ ☐ **Reactor controls:** For influent/effluent samples taken with the UV reactor lamps turned off, does the change in log concentration correspond to a change in RED that is within the measurement error of the minimum RED measured during validation (typically ≤ 3 %)?

☑ ☐ **Reactor blanks:** For DAILY influent/effluent samples taken with NO challenge microorganisms injected, are the measured concentrations of the challenge microorganism negligible?

☑ ☐ **Trip Controls:** For an UNTESTED sample bottle of challenge microorganism stock solution that travels with tested samples between the laboratory and the reactor, is the change in the log concentration of the challenge microorganism within the measurement error. (I.e., the change in concentration over the test run should be negligible. This is typically on the order of 3 to 5%.)

☑ ☐ **Method Blanks:** For sterilized reagent grade put through the challenge microorganism assay procedure, is the challenge microorganism concentration non-detectable?

☑ ☐ **Stability Samples**: For influent/effluent samples at low and high UVT, are the challenge microorganism concentrations within 5 percent of each other?

Uncertainty in Collimated Beam Testing Data (See Appendix C for more information)

☑ ☐ Do the uncertainties in the terms in the UV dose calculation meet the following criteria:

- Depth of suspension (d) ≤ 10 percent
- Incidence irradiance (E_s) ≤ 8 percent
- Petri factor (P_f) ≤ 5 percent
- L/(d + L) ≤ 1 percent
- Time (t) ≤ 5 percent
- $(1 - 10^{-ad})/ad$ ≤ 5 percent

☑ ☐ Is the **uncertainty in dose-response** (U_{DR}), as calculated using equation C.6, less than or equal to 30 percent? If not, was U_{DR} incorporated into the VF?

Checklist 5.5 Review for Key Validation Report Elements (Page 1 of 2)

Yes	No	
☑	☐	Does the validation testing meet QA/QC criteria (see Checklist 5.4)?
☑	☐	For full-scale testing, does the mixing and location of sample ports follow recommendations provided in Sections 5.4.3 and 5.4.4, respectively?
☑	☐	If the reactor was validated off-site, do inlet/outlet piping conditions at the water treatment plant result in a UV dose-delivery that is **the same or greater than** the UV dose delivery at the off-site testing facility? (See Section 3.6 for recommended inlet/outlet piping configurations and Section D.6 for considerations for CFD modeling.)
☑	☐	Were collimated beam tests and full-scale reactor tests performed on the same day for a given test condition and using the same stock solution of challenge microorganisms? (See Section 5.7 for experimental testing guidelines.)
☑	☐	Is the UV sensitivity of the challenge microorganism and the overall shape of the UV dose-response curve consistent with the expected inactivation behavior for that challenge microorganism? See Appendix A of this manual for published UV dose-response curves for MS2 and *B. subtilis*.
☐	☑	Does the validation test design account for lamp fouling and aging, minimum UVT, and maximum flow rate expected to occur at the water treatment plant? (See Section 5.6 for recommended test design.)

For UV Reactors Using MP Lamps

☐	☐ N/A	Is the UV reactor equipped with a germicidal sensor? New UV reactors should have germicidal sensors. If an installed reactor uses an MP lamp and a non-germicidal sensor, is a polychromatic bias factor incorporated into the derivation of the VF? (See Section D.4.3 for guidance on the polychromatic bias factor.)
☐	☐ N/A	Was validation testing conducted using a challenge microorganism other than MS2 or *B. Subtilis*? If yes, was the need for a correction factor assessed and was that factor applied based on the outcome? (See Sections 5.3 and D.4.1 for more information)

For UV Reactors Using the UV Intensity Setpoint Approach

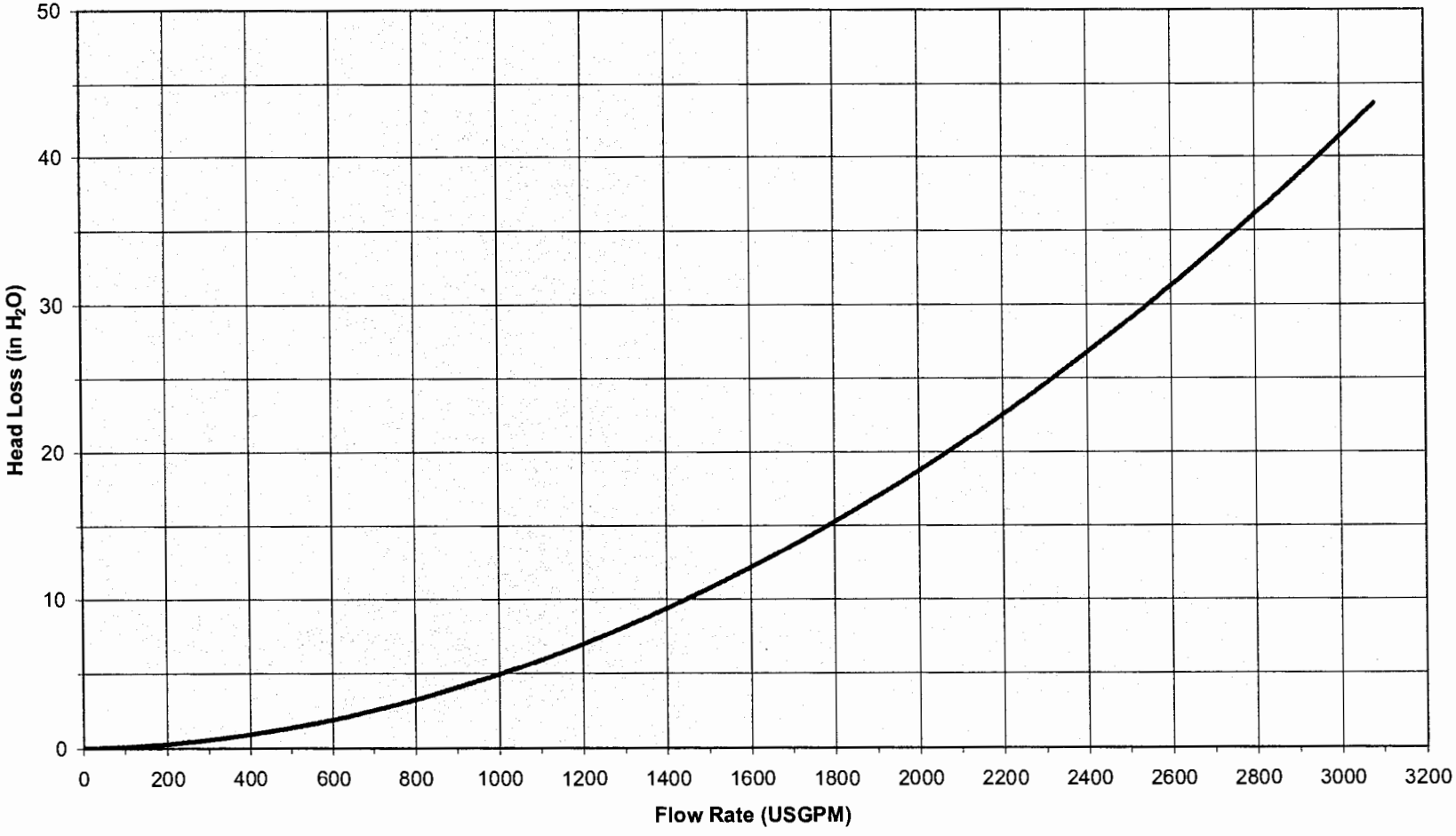
☐	☐ N/A	Were the minimum test conditions performed as specified in Section 5.6.1?
☐	☐ N/A	Is the UV intensity setpoint low enough to account for combined conditions of minimum UVT and maximum lamp fouling/aging at the water treatment plant (See Section 5.6.1 for guidance)
☐	☐ N/A	Was the **minimum RED** selected for calculating the validated dose? (See Section 5.8.1 for additional guidance.)
☐	☐ N/A	Does the VF calculation include both the B_{RED} and U_{SP}? (See Section 5.9 for additional guidance.)

Checklist 5.5 Review for Key Validation Report Elements (Page 2 of 2)

Yes	No	
		For UV Reactors Using the UV Intensity Setpoint Approach (continued)
☐	☐ N/A	If U_S and/or U_{DR} did not meet the QA/QC criteria, were they also included in the VF calculation?
☐	☐ N/A	Is the validated dose greater than or equal to the required dose for the water system's target pathogen and log inactivation level?
		For UV Reactors Using the Calculated Dose Approach
☑	☐	Was the minimum number of test conditions evaluated as specified in Section 5.6.2?
☑	☐	Was the empirical equation developed using standard statistical methods (e.g., multivariate linear regression)? (See Section 5.8.2 for additional guidance.)
☑	☐	Does the validation report include an analysis of goodness of fit and bias for the dose-monitoring equation? (See 5.8.2 for additional guidance.)
☑	☐	Does the VF calculation include both the B_{RED} and U_{IN}? (See 5.9.)
☐	☐ N/A	If U_S and/or U_{DR} did not meet the QA/QC criteria, were they also included in the VF calculation? (THESE CRITERIA WERE MET)
☐	☐ N/A	For the range of UVT values and flow rates expected to occur at the water system, is the validated dose greater than or equal to the required dose for the system's target pathogen and log inactivation? GENERAL VALIDATION REPORT

TROJAN UV SWIFT™ SC

D12 Headloss Curve



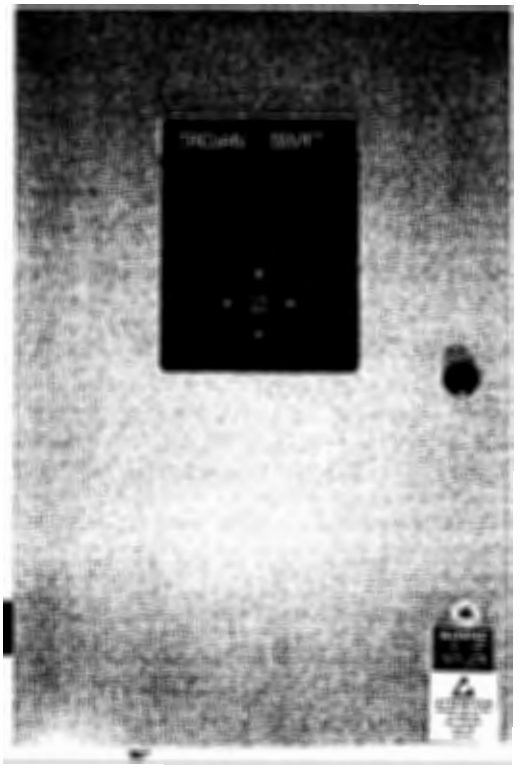
TROJAN UV
WATER CONFIDENCE

Rev. B
August 1, 2006

ADDITIONAL INFORMATION

Chapter 5

CONTROL PANEL (CP)



5 Control Panel (CP) 5-1

5 CONTROL PANEL (CP)

5.1 Operational Details

Controls Philosophy

Control System Overview

The Control Panel (CP) provides control and monitoring of the UV Reactor (UVR). The basis for system control is a Microcontroller located in the CP and fully capable of allowing Lamps to be operated to maintain sufficient fixed power. The Operator Interface is located on the CP door and provides complete control and monitoring of the UVR accomplished through the P40 Operator Interface local display.

Power supply mains provide power to the ballasts contained in the CP.

In the event of a disruption of power to the controller, the system shall retain the control program in memory.

UV Reactor Control

Each UVR has a Selector Switch for "OFF / ON" located on the side of each CP enclosure.

When "OFF" is selected, that UVR is not in operation (i.e. the Lamps are not powered).

When the system is ON there are 3 modes of operation. The system can be controlled:

- **Local** - at the CP.
- **Remote** - through a digital input on P40.
- **SCADA** - through a Modbus communication module.

In both Remote and SCADA modes, the P40 and UVR are in the "Standby Mode" and waiting for the "Start-up" sequence and operational control from the Plant PLC. In any mode all Lamps are turned on/off together and operate at the same power level.

Note:	*Loss of flow signal forces the system to jump to 100% power and initiates the No Flow Signal Critical Alarm until the flow signal is restored.*

When power is restored after an electrical service interruption, any UVR required for operation will immediately go into a Warm-up mode (refer to the Normal Operation Start-up heading) before the UV System returns to the previous operational mode.

Normal Operation Start-up

The UVR will be placed into an 3 minute Warm-up mode until the UV Intensity has stabilized. During the first 18 seconds of the 3 minute Warm-up mode, all alarms are temporarily suspended except for Reactor HiTemp Critical (Reactor High Temperature Critical and all Wiper Alarms (if AMWS is provided).

Flow for disinfection must not be allowed to pass prior to the expiration of the 3-minute warm up mode. However, if a customer wishes not to wait the full 3 minutes, process water may be allowed to pass through the chamber after 18 seconds of the warm-up mode has expired and the adjustable Alarm delay time has passed (see Normal Operation for example). In addition the Low UV Minor set point must not be in alarm.

While in Warm-up mode the UV Lamps will reach 100% output. Once the Warm-up mode timer expires, the UVR will be placed into the "System On" mode at which time the controller will adjust the power to an appropriate level.

Normal Operation (Basic Dose 40)

This UV system will operate at a power level of 100%

Normal Operation (Intensity Pacing Option)

Normal operation begins once the Warm-up Mode time expires (refer to Normal Operation – Start-Up) and the controller adjusts the power level to an appropriate level to meet disinfection while minimizing power consumption.

There is fixed alarm delay of 10 seconds and when starting up the UVR the first 18 seconds of Warm-up mode time is added to the Alarm Delay time. i.e. (standard 18 second Warm-up mode Alarm suspension) + (the 10 second Alarm Delay) = 28 seconds before alarms can activated after start-up. In warm-up "Low UV intensity alarm major" is blocked from going into alarm and the main screen message displays "Dose Below 40mJ/cm².

Pacing

DVGW - Intensity Pacing

The system utilizes operational feedback and pacing control to continuously ensure a minimum validated dose of 40 mJ/cm² is maintained.

Third-party DVGW certification testing of the TrojanUVSwift™sc product line has confirmed the minimum UV intensity that corresponds to a 40 mJ/cm² dose at any flow rate within the validation range for each model. Pacing software uses closed-loop control of the electronic ballast power to ensure the intensity target (and thus 40 mJ/cm² dose) is efficiently met.

Note:	*Intensity Pacing mainly responds to changes in flow rate and UV Intensity value from the UV Sensor. Reference Troubleshooting Guide under Low UV Intensity for all possible causes of Low UV Intensity.*

In general, if there is a change in UV Intensity reading from the UV Sensor and or change in the rate of flow then the Control Board will adjust Lamp power levels accordingly to achieve a dose equal to or above 40 mJ/cm².

EPA – MS2 RED Pacing - D30 only

The system utilizes operational feedback and pacing control to continuously ensure a validated MS2 RED set point between 8.52 and 99.67 mJ/cm² is maintained.

Third-party USEPA certification testing of the TrojanUVSwift™ SC D30 product has confirmed the UV intensity that corresponds to a MS2 RED value at a given flow rate and UV transmittance (per 1.0 cm water layer) within the validation range. Pacing software uses closed-loop control of the electronic ballast power to ensure the required UV intensity (and thus the MS2 RED target) is efficiently achieved.

In general, if there is a change in UV intensity reading, UVT value or flow rate the Control Board adjusts output power level accordingly to achieve MS2 RED equal to or above the set point MS2 RED value in mJ/cm².

If any of these signal are not available the control algorithm will pace base on entered values. If all analogs are "OFF" then the control board will use maximum flow and minimum UVT for pacing calculations.

EPA – Dose Pacing D03, D06, D12, D18

Note:	*Dose Pacing mainly responds to changes in UVT, flow rate and UV Intensity value from the UV Sensor. Reference Troubleshooting Guide under Low UV Intensity for all possible causes of Low UV Intensity.*

The system utilizes operational feedback and pacing control to continuously ensure a validated RED set point is maintained.

Third-party USEPA testing of the TrojanUVSwift™ SC D03, D06, D12 and D18 product line has certified the units over a range of flow rates, feed water UV transmittance, and power levels to encompass a range of reduction equivalent doses (RED). Pacing software uses closed-loop control of the electronic ballast power to ensure the RED target is efficiently achieved.

In general, if there is a change in UV intensity reading, UVT value or flow rate the Control Board adjusts output power level accordingly to

achieve RED equal to or above the set point RED value in mJ/cm^2.

If any of these signal are not available the control algorithm will pace base on entered values. If all analogs are "OFF" then the control board will use maximum flow and minimum UVT for pacing calculations.

Shutdown

If the system is being controlled by a Plant PLC and if the Remote On signal is removed, the system will turn off and remain in Standby mode. In Standby mode the UVR Lamps are de-energized.

The UV System will also initiate a shutdown sequence for the UVR in response to only one Critical fault condition – "Reactor HiTemp" (Reactor High Temperature). When a UVR Critical alarm is active, the P40 will shut off the lamps. Refer to table of Critical alarm details at the end of this chapter.

Lamp Control and Monitoring

The UVR P40 is set to a fixed power level. Each Lamp is controlled directly from the Lamp ballast. All Lamps for the UVR will be turned on/off together if commanded by the P40 and all operate at the same power level.

Specially designed current sensing circuits detect Lamp on/off status. The status of each individual Lamp whether it's faulted or okay is displayed by the CP Operator Interface on the panel door.

When switched on, Lamps are initially energized for a Warm-up period regardless of Local or Remote control. After the warm-up period has expired, the Lamps are automatically switched to the operational power level. The power level of the lamps is controlled by Intensity Pacing. Refer to Intensity Pacing heading in this Chapter for more detail.

Wiping System (Optional)

When an automatic and integral mechanical cleaning system is provided, the cleaning system uses a mechanical wiping action to de-scale the Lamp Sleeves. The cleaning system is fully operational without requiring the UVR to be placed out of service. A UVR cleaning sequence may be initiated automatically as scheduled by the P40 CP controller.

In Automatic mode, the interval between cleaning sequences is determined by the "cleaning sequence" timer, which is normally pre-set at 8 hours and adjustable to 0, 0.5, 1, 2, 3, 4, 6, 8, 12, 24, 48, or 96 hours.

The Home Limit Switch is used to find the *Home* position which is the zero revolution position. At the start of a wiping sequence the Wiper travels towards the inlet (extended position). After reaching the extended position, the motor de-energizes as the Wiper pauses for 3 seconds, it then travels in the opposite direction back to the *Home* position. During this reset cycle the Revolution Sensor continues counting past Zero until Wiper compresses the

Limit Switch Home rod and the Revolution Sensor detects a reduction in revolution speed. The motor is then de-energized, and the Wiper is now in the *Home* position. After a 3 second delay, the Wiper travels towards the inlet for 10 revolutions, placing the Wiper in the *Park* position.

The P40 uses a "Wiper Revolution" timer during the wiping sequence for fault logic.

If there is a power failure, the Wiper travels to the *Home* position and back to *Park* when the power is restored.

UV Sensor

A UV Sensor is provided for each UVR to measure UV intensity. The signal is converted to 4-20mA and is available from the P40 in the Analog Output.

The UV Sensor (Intensity) alarm will be pre-set at the factory, based on customer supplied data.

External Interfaces

There are 2 modes available for connecting to an external interface:

- The standard "Remote (Remote On)" mode allows connection to the customer Plant PLC by powering a voltage loop into the P40's voltage sensing circuit.
- The optional "SCADA (SCADA Remote)" mode allows connection to the customer Plant PLC through SCADA communications.

SCADA Communication (Optional - 931080)

The Modbus RTU RS485 communication protocol is an optional feature that enables the Control Panel to communicate with and be controlled by the Plant PLC by remote means.

Communication can be received from the Plant PLC to the Control Panel as well as transmitted from the Control Panel to the Plant PLC. The following are a general list of communication commands that can be exchanged:

Receive from Plant PLC: (examples)

- Turn ON/OFF (Remote ON/OFF)
- External Interface and System Operation Modes
- Initiate Wiper Sequence (if provided)
- Lamp and Wiper (if provided) ON/OFF Resets
- 4-20 mA Flow Signals
- Etc.

Transmit to Plant PLC: (examples)

- All Lamp/Ballast Alarms
- All timers and counters
- All values (i.e. Wiper Cycles, etc.)

Connect the Modbus communication using a appropriate SCADA cable like a twisted pair shielded cable in a Daisy-chain or Star topology configuration.

Daisy-Chain Connection:

If you connect the Modbus with **Daisy-Chain** method you must move the EOL resistor on the last board at the end of the wire line. Also, you must address each P40 controller board with a different P40 node address in System Settings on page 6, line 2.

Star Connection:

If you connect the Modbus with **Star** method you must not move the EOL resistor because each P40 Controller board is already at the end of the wire line. Also, you do not need to address each P40 controller board with a different P40 node address in System Settings on page 6, line 2. They can be the same or different based on your set-up, but can work both ways and it is recommended to keep them all at the same address.

Note:	*Refer to the SCADA Communication Module Appendix for a detailed list of communication commands and states.*

Alarms

All alarms generated by the P40 will be displayed on the Operator Interface. The last alarm to occur will be displayed on line 7 of the Main Screen and line 1 of the Active Alarm and Alarm History Screens. All alarms will be displayed in order of occurrence - position 1 always indicates the most recent alarm which will then move to position 2 upon the next occurring alarm etc. A maximum of 18 alarms can be displayed before the oldest alarm drops off the list.

Auto Home Position Reset (if Wiper is provided)

Any time the CP is turned ON; the Wiper resets itself by travelling to the *Home* position, it then pauses and travels back to the *Park* position to wait for the signal to cycle. Whenever the Wiper is in operation the controller will change to the Wiper Screen.

If there is a power failure, again the Wiper travels to the *Home* position and back to *Park* when the power is restored.

The operator can also reset the wiper faults and send the wiper to *Home* position from the System Setting screens.

If a problem occurs during a wipe cycle, the display will generate a Wiper Fault Alarm. The four types of Wiper Fault Alarms include the *Wiper Revolution Alarm, Wiper Home Alarm*, and the *Wiper Limit Switch Alarm.* The fourth alarm is the *Wiper General Alarm,* which includes one of or any combination of the first 3 Wiper Alarms. Simply turning the CP off for 10 seconds and on again should remedy the problem. This procedure may have to be repeated once or twice. If this fails to resolve the issue, refer to Chapter 8 for troubleshooting.

Should the Wiper Fault continue to appear, the Wiper system should be disassembled and the problem diagnosed.

Wiper Revolution Counter (Proximity Sensor) Input (if Wiper is provided)

The Revolution Counter is used to count the number of revolutions that the Motor makes to extend the Wiper Plate to the inlet end of the chamber. When the Revolution Counter counts out to the set limit, the Motor is shut off, the Wiper Plate pauses and then the return sequence is initiated.

Alarm Output Relays

The 7 Programmable Digital Outputs are 24VDC operated dry contacts. All are Normally Open (NO) contacts. When 24VDC power is supplied to the P40, the contacts will be individually held closed. In the event of an alarm, the closed contact will return to its normal open state that indicates an alarm.

Refer to section 5.7 for a typical wiring application.

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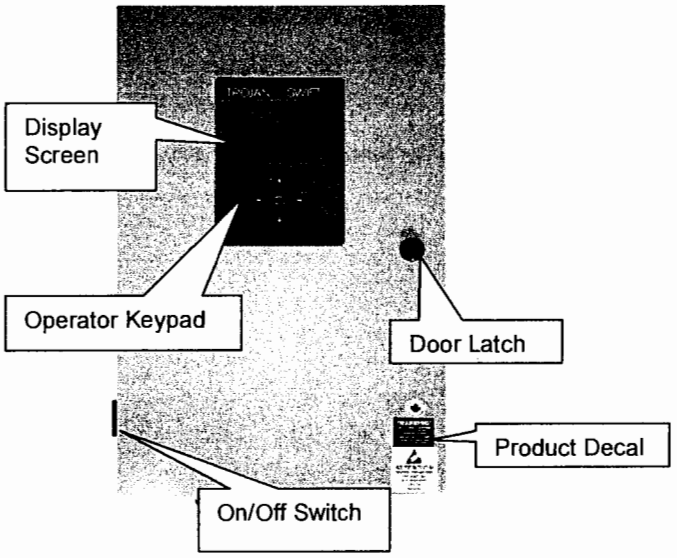
5.2 Control Panel (CP) Hardware

Control Panel (CP) Enclosure

Description

The Control Panel (CP) enclosure houses the main Interface to the UV system and a microprocessor based controller with input and output connection points. The CP also houses the power supplies and provides power distribution to the UV Reactor (UVR) and associated equipment (i.e. Automatic Cleaning System, UV Sensors).



The CP will directly accept an input power from between 208 and 240 VAC split phase power. If the power supply is other than that previously indicated the system will be supplied with a Power Pack. This device is used to convert the plant power supply into the required 240VAC as needed.

The Operator Interface to the UV system is located on the door of the CP enclosure. The CP is a metal enclosure that houses the control electronics and power supplies. The CP may be fan cooled depending on Model requirements and is suitable for indoor installation. Refer to the System Label located at the front of this manual for the specifications for your system.

Specifications

Installation: indoors, wall mounted

Rating: Type 12 or optional 3R

Material of Construction:

- Type 12 is epoxy painted carbon steel
- Optional Type 3R is 304 SST

Size: Dependent on system Type:

- D03 & D06 Model 24"High x 16"Wide x 10"Deep
- D12 Model 24"High x 24"Wide x 10"Deep
- D18 & D30 Model 48"High x 36"Wide x 10"Deep

Input Power to CP:

- Models 208-240VAC Input Power Only

Maximum Cable Length (UVR to CP):

- 4.5 m, 7.5 m, 15 m, 23 m (From Reactor to Panel)

Maintenance

Similar to steel products exposed to the outdoor environment, the exterior of an enclosure installed indoors needs to be washed monthly with a mild soap and water solution.

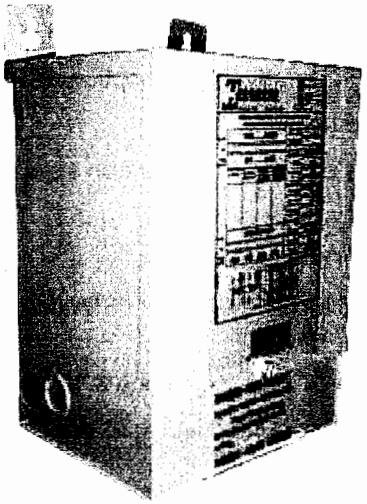
A damp sponge or soft cloth should be used for regular cleaning. Do not use any corrosive cleansers on the CP cabinet or Operator Interface.

The TrojanUVSwift™SC controller may have a venting filter depending on the Model requirement. If equipped, remove the filter and blow clean on a monthly basis or as determined by site conditions.

Power Pack

Description

The Power Pack will provide step-up or step-down power. When incoming supply voltage is not the standard 208- 240 VAC, a Power Pack will be required. The Power Pack is essentially



an independent transformer that is housed in its own Type 3R enclosure. The enclosure may reside wherever needed; however it should preferably be installed in a Plant's Distribution Panel/ Electrical Room.

Based on your system size and the power being provided by the plant, an appropriate Power Pack will be provided when necessary.

Specifications

Installation:	indoor
Rating:	Type 3R
Material of Construction:	Painted Steel

Electronic Ballasts

Description

The TrojanUVSwift™SC Ballasts are located within the CP. The system utilizes an electronic Ballast to energize the germicidal Lamps. Each of the Ballasts drives two UV Lamps.

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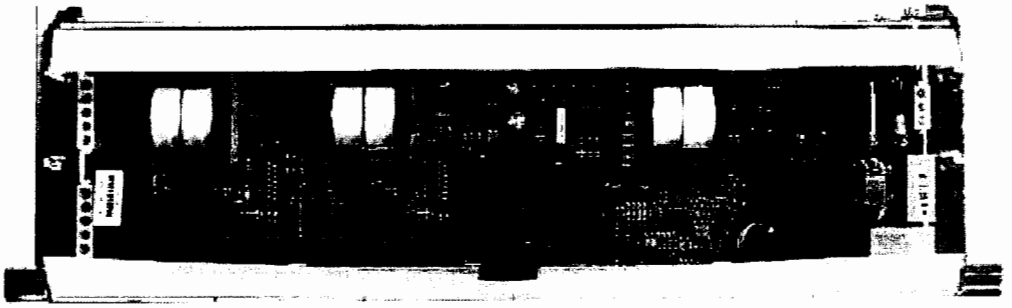
Each pair of lamps is powered by electronic ballast located in the CP.



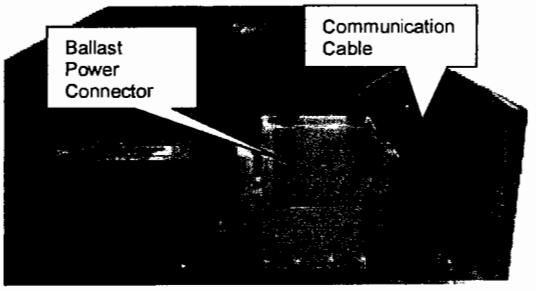
Maintenance

D Model –Ballast Removal & Replacement

Hot Surface!
Allow electronic ballast and lamps to cool before handling.

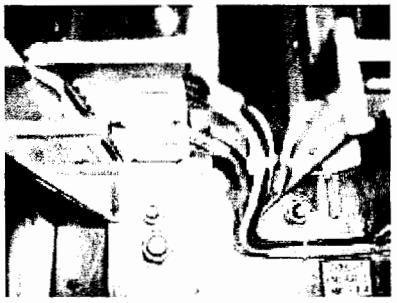
Electrical Hazard!
Because of the potential hazard from this power source it is prudent to use LOCK OUT procedures and TAG all sources of power before performing any maintenance, cleaning or repairs on any piece of equipment. The power sources may include electrical or stored energy. Refer to the general lock out and tag procedures in this manual.

1. Disconnect all power to the CP and follow *Lockout and Tag procedures* which are found in the *Preface*.
2. Disconnect the power to the Ballast, as shown below.

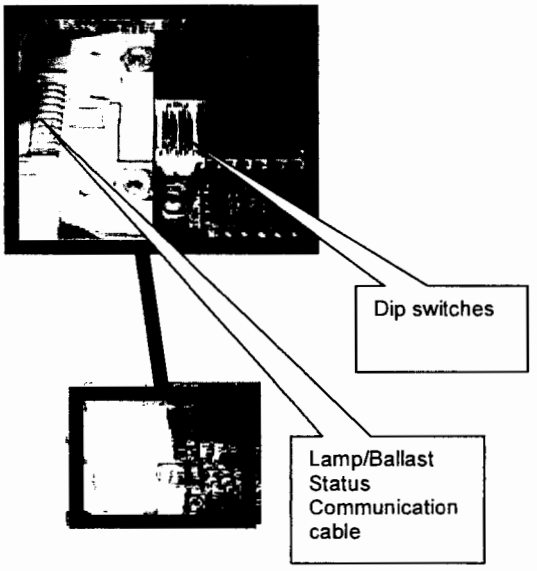


3. Disconnect the Communication Cables for Lamp/Ballast Status, as shown above.
4. Remove the Connector that distributes power from the Ballast to the Lamps.
5. Remove the 2 hex Mounting Screws on either side of the Ballast and lift it out.

6. Take note of the Dip Switch settings for Switch 0 and 1 (found right below Communication Cable Connector).



7. Set the Dip Switches on the new ballast to match the old Ballast or consult *the Electrical Drawings provided in Appendix D.*
8. Place the new Ballast onto the Back Plate and align onto the Mounting Screw holes. Fasten the Ballast into place.
9. Reinstall the Connectors that provide power to the Lamps on the new Board.
10. Reconnect the Lamp/Ballast status Communication Cable to the correct locations as shown on previous page.



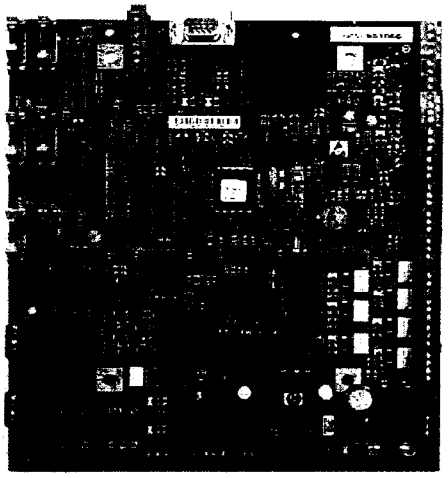
Note:	*Incorrect alignment of the Lamp/Ballast status Communication Cable will damage the pins and ruin the Ballast.*

11. Reinstall the Power Plug to the Ballast.
12. The system is now ready to power up.

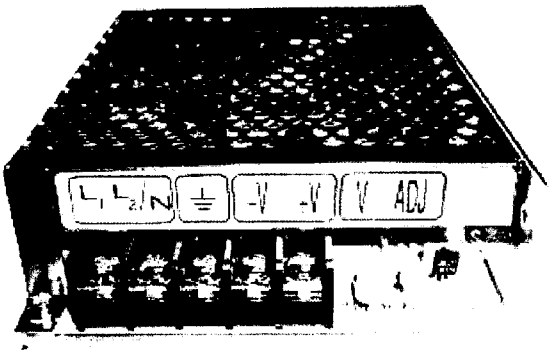
System Controller – The Control Board

Description

The heart of the control system is a microprocessor-based controller, which continuously monitors and controls the UV system's functions. Custom electronics provide the CP with the necessary indications of system parameters.



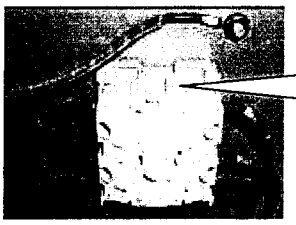
The Control Board is powered by a 24Vac power supply which is located in the control panel and is similar to the one shown below.



The Board is configured by a user-friendly Operator Interface Menu System and Keypad. The Board allows the Operator to recall its original factory settings. If for some reason someone accidentally changes parameters and is uncertain what they have done, these factory settings are stored right on the Board, and can be retrieved at any time.

P40 Board Power supply requirements

The D Models require 1 Input power connection to the P40 Board:



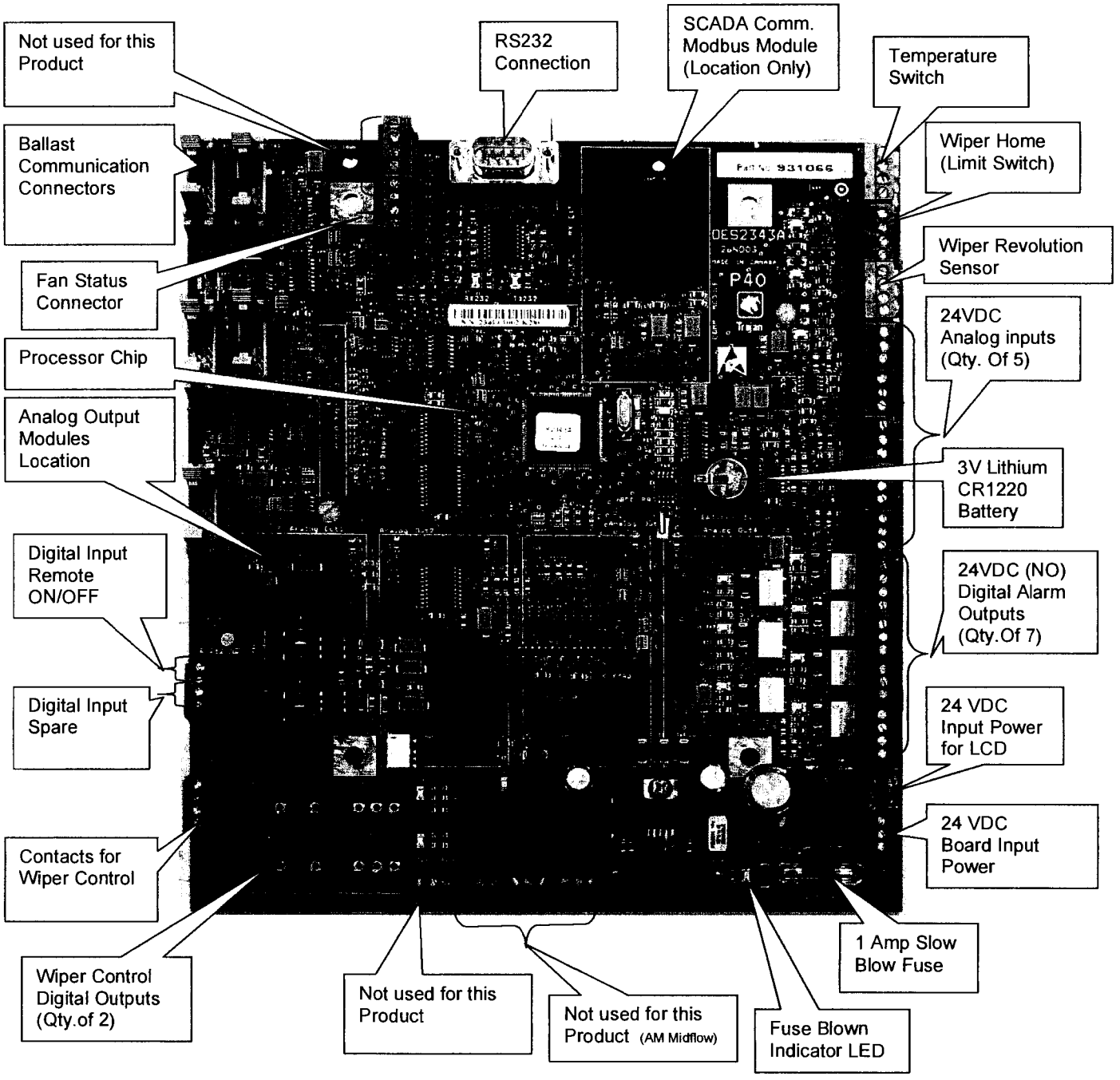
- 24VDC for VF Display and Board Power.

Board Diagram

See the following page.

Note:	*The Contractor's primary responsibility is to terminate the following:* *The Main Power to the Disconnect Switch as shown in the Previous figure.* *The Alarm terminations* *Optional Digital Inputs if applicable. (Remote ON/OFF).*

CONTROLLER BOARD



RS232 Com Port

The RS232 communications port can accommodate a laptop connection.

Ballast Communication Ports

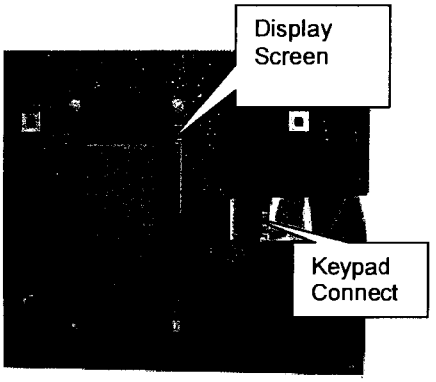
The Ballast Communication Ports are used for Lamp and Ballast Status information, to determine Runtime and Alarm Faults. These 10 Pin ports connect directly by a ribbon cable to the Com Ports on the Ballasts.

Board Fuse

The Control Board houses a 1 amp Slow Blow Fuse for the Board power supply. In the event of a blown fuse, the LED beside the fuse will be lit, signifying that the fuse needs to be replaced.

Keypad Connector

Located on the solder side of the Board is the Keypad Connector, which simply provides the connection of the keypad to the Board for navigation and control.



VFD Communication Port

The VFD (Vacuum Florescent Display) Communication Port is on the solder side of the Board as well. The function of this connection is to provide power and communication from the Board to the Display Screen.

Battery Replacement

The time and date will be lost when the battery is replaced. The Lithium 3V battery #CR1220 should not require replacement.

Input / Output Features

The Board has many built-in and add-on features. Some of the features are as follows:

- 7 Programmable Digital Output Relays
- 2 Digital Output Relays (wiper only)
- 2 Digital Inputs
- 5 Analog Inputs
- 4 Analog Outputs
- Communications Module

Programmable *Output Relays*

These Output Relays can be custom programmed to alarm on up to 7 different items. The standard configuration is set up with the following list of alarms:

1. Common Alarm
2. Low UV Intensity (Major)
3. Reactor High Temperature (Critical)
4. System On-Line
5. Spare (blank)
6. Spare (blank)
7. Spare (blank)

For a full list alarm possibilities refer to the "Alarms Overview" s*ection* within this chapter.

Note:	*For typical operator connections, refer to the Digital Output Wiring Diagrams at the end of this chapter.*

Digital Output Relays (if Wiper is provided)

These two plug-able Relay Modules are provided on systems with an Automatic Mechanical Wiping System (AMWS). The relays provide control of the Wiper Motor for extend and retract sequences.

Digital Inputs

Inputs are provided with input voltage detection circuitry and, once enabled, will accept 24-240 VAC or VDC.

The two standard Inputs are Wiper Limit SW (Wiper Limit Switch) and Reactor Hi Temp (Reactor High Temperature).

There are two optional Inputs. One D/I 1 is for Remote ON/OFF Control and D/I 2 is a spare.

- **Remote ON/OFF Power Control (Optional)**

The Remote ON/OFF Power Control option enables the user to switch the TrojanUVSwift™SC ON/OFF from a remote location. To make use of this option, power must be supplied to the terminals.

- **Wiper Limit SW Input (Limit Switch) (if Wiper is provided)**

The Wiper Limit Switch acts as a digital signal to send a message to shut the Motor OFF. In normal operation the Wiper Plate sits in the Park position until a wipe sequence is initiated. For details on the operation of the wiping system, refer to the *Controls Philosophy* section at the beginning of this chapter.

- **Reactor Hi Temp Input (Reactor High Temperature)**

The Reactor High temperature Input connection has a low current signal loop. This loop is continuous. In the event the UVR exceeds the limit of the High Temperature Switch, the Switch will break the Circuit, causing an alarm condition and consequently turn the UVR off.

Analog Inputs

The TrojanUVSwift™SC is provided with the 5 Analog Inputs available for use. Refer to your *System Description* in this manual to see what they are being used for.

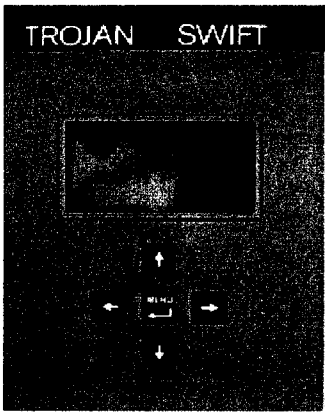
Analog Outputs

Up to 4 Analog Outputs are available for use with the TrojanUVSwift™SC. Refer to your *System Description* in this manual to see how many Analog Boards where requested. As an example, if the UV Intensity Sensor reading was requested for remote monitoring, then an additional Analog Output module Board would be provided. The module Board is located on the Control Board in one of the 4 available slots, as shown on the Board Drawing. This output module provides a 4-20 mA, 24 VDC signal.

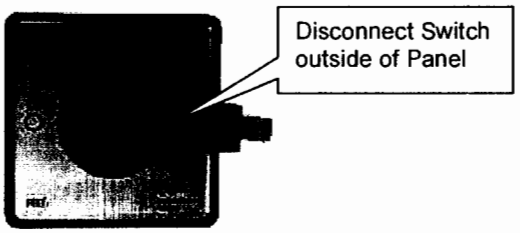
Operator Interface

The Operator Interface is a Florescent Display that is programmed with custom screens. The Operator may navigate though the different screens using the 5-button Keypad, as shown below.

The system is controlled by the main On/Off Power Switch located on the side of the CP. The Ballasts / Lamps are turned ON and OFF in accordance with the position of the switch.



Operation



The TrojanUVSwift™SC is designed to operate with very little intervention. The system will monitor UV Intensity and Dose when required to ensure that proper disinfection is being met. The system will also monitor the UVR Temperature, Lamp and Ballast Status, and when provided - Wiper Status. In the event of an alarm, the Operator Interface will display an alarm on the screen and will keep track of them in an Alarm History. With AMWS, the controller will monitor wiping sequences, the frequency of wiping, as well as the status. The variables on cleaning frequency can be adjusted to suit varying site conditions.

Specifications

Display: 128 x 64 Dot Matrix VFD

Control: Keypad with Five Button Integrated Decal

Maintenance

5.3 Control Panel (CP) Software

Boot Screen

This screen is displayed from main power on is about 7 seconds and then you see the above for 4 seconds when the power to the unit is initially turned on. After the 4-second timer has expired, the Main Display screen will appear.

Main Display Screen DVGW version:

One UV Sensor main screen

Main Display Screen EPA version

The Main Display screens consist of the UV Intensity Sensor 1 and optional Flow Rate and UVT screens. To navigate through all the main screens press the *Menu* ↵button. To access the Main Menu, press the *Menu* ↵button through each of the Main Display screens until the Main Menu screen appears.

UV Sensor

This screen provides a general system overview of all key operations including:

UVI1: Displays the UV Intensity of the UV Sensor in W/m^2, and horizontal bar graph that depicts the live UV Intensity reading with the "Low UV Intensity Major" marked as "ı".

XX.XX Hrs: Displays the total Lamp Runtime to date in Hours and Minutes.

XX Lamps: Displays the # of Lamps in the

Note:	*Operator Interfaces vary depending on the system configuration. The screens described in this chapter may not be the exact screens provided on your system.*

system.

Power & Mode: The Power is displayed as a percentage. The mode will be displayed as either local or Remote.

Local: Control override by Operator at the CP.

Remote: Control by the UV System CP

Final Line "Status Line": This line will display one of the following status lines:

1- During start-up
   - *Ballast Ignition*
   - *Lamps Preheat*
   - *Lamps On*
   - *Warm-up 3:00m (count down)*
2- During Wiper Cycle (if Wiper is provided)
   - *Wiper Find Home*
3- During Remote Standby
   - *Remote Host Standby*
4- During Shutdown
   - *Lamps Turned Off*
5- Upon any Active Alarm
   - *Most Current Alarm* – From the list in the controls Philosophy, Section 7-18.

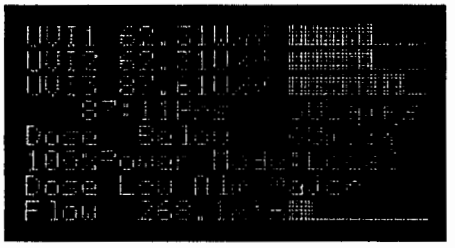
Two UV Sensor Option: DVGW

On systems with two UV Sensors the screen will be the same as the previous. If you have more analog signals than can fit on the screen then a second main page will be displayed. To see the second main screen you must hit the *Enter* or *Menu* button.

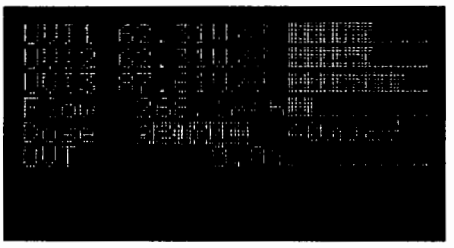
Three UV Sensor Option: DVGW

On systems with three UV Sensors the screen will be the same as the previous. If you have more analog signals than can fit on the screen then a second main page will be displayed. To see the second main screen you must hit the *Enter* or *Menu* button.

Main Screen – DVGW Version Only



The second main screen is display if you have multiple Analog inputs that cannot fit on the first main screen. Some people may prefer to leave this screen displayed all the time.



Optional Analogs Inputs:

This data will only appear if any other analog inputs are configured. Flow Rate, Valve Position, UVT Pass-Thru and Reactor Temperature options are configured.

Bar Graph: Each bar graph depicts live readings. The Flow Rate graph indicates the

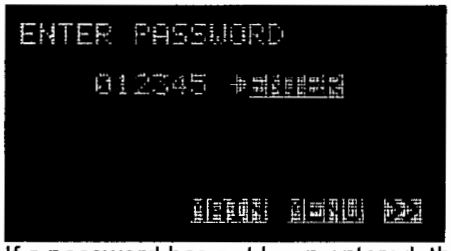
flow rate in relation to the Low Flow Major marked as "▮".

The Reactor Temp graph works in a similar fashion. It indicates both the High Temperature Major and High Temperature Critical respectively from left to right as "▮".

Menu Screen

To enter the Main Menu the Operator must Press the *Enter*↵or *Menu* button, located in the center of the keypad. This will bring up the following menu. From here the Operator can choose to navigate through any of the listed menus by placing the cursor, beside the desired screen, using the arrow keypad and then hitting the *Enter*↵key.

Login Screen



If a password has not been entered, the system will automatically allow Operator level access only. Technician level access requires a password entered on the Login Screen.

When you enter the Login Screen, you will be prompted to enter your password. If you are a Technician you will enter your password using the keypad arrows to select each character.

Note:	*The Login screen will automatically log the user out after 10 minutes.*

Once, the password is entered select Enter using the *Enter*↵or *Menu* button.

If the password was incorrect, "INVALID" Password text will appear. Correct incorrect password numbers and select enter

If the password was correct it will take you back to the Main Menu Screen. You will notice that along the bottom of the screen it will now say TECH. This stands for Technician Level access.

Active Alarms Screen

HIST – Alarm History Screen

ACTI – Active Alarm Screen

MAIN – Main Screen

LOGIN – Login Screen

 – Next page within this screen series.

 – Previous page within this screen

Access this screen by selecting Alarms Lists from the Main Menu. This screen provides the Operator with a list of alarm faults for use in troubleshooting. The screen is capable of storing up to 18 alarms. If the list exceeds 18 entries, the oldest alarm entry will drop off the list. The buttons at the bottom of the following screens take the Operator to the respective screens.

Alarms List Screen Series

For a full list of alarms and their descriptions see the Alarm Overview Section in this chapter.

Note:	*The entire Alarm History can be cleared by selecting "Clear" found at the top right of the screen. The Clear button is only visible and active when logged in as a Technician.*

Alarm History Screen

The Alarm History Screen can be accessed from the Active Alarm Screen by pressing the *HIST* button. This screen provides the Operator with a history of all active and all resolved alarms, including the time of their occurrence. The screen is capable of storing up to 18 alarms. If the list exceeds 18 entries, the oldest alarm entry will drop off the list.

Note:	*Alarms also flash on each of the display screens. See the Three UV Sensor Option screen for an example.*

Alarm History Details Screen

By scrolling down the list of Alarms in the Alarm History Screen the Operator can highlight individual Alarms. Hit *enter* while the cursor is beside a specific Alarm and the Alarm History Detail Screen appears. This screen (like the one shown above) provides additional information about individual Alarms.

Digital Input-Output Screen Series

These screens are accessible through the Main Menu by selecting the Digital Input-Output Screens.

Access to screens is limited to the level of password entered into the login screen.

Operator Access Level Screens

Note:	*The alarm settings are pre-adjusted at the factory or with specific instructions from Trojan Technologies* *Devices for UV Disinfection systems are delivered with fixed programmed threshold values for the main alarm that are suited for the specific application.*

The Operator has viewing access of the following screens. The first screen shows what the Current Digital Alarm Relays are set to (i.e. 1R refers to Relay #1). The second screen depicts which Digital Inputs are designated and how they are assigned.

Note:	*For typical operator connections, refer to the Digital Output Wiring Diagrams at the end of this chapter.*

Technician Level Access Screens

To access these screens you must have entered the Technician's Password. Then, from each of the previous Digital Input/Output Screens select the *Change* button. The text will reverse (dark text with light background) indicating that change mode has been entered.

These screens enable the Technician to select which Digital Inputs and Outputs they wish to be present at the Operator Level. To designate Inputs and Outputs move the cursor to the line of choice, and press enter to scroll through the list of items that could be connected to that particular input or output on the board. Once the corresponding item is displayed, arrow up or down to another line. Continue until all lines are configured as required. Move the cursor to *Save* and the press *enter* ↵to accept and keep all changes.

A blank line indicates that the Input or Output has not been configured.

For the following screen, the Reactor High Temp is an additional Digital Input/Output that is mandatory. As a standard it is set to Critical.

Note:	*The Digital Input and Output screens are factory set alarm choices. Personnel with Technician level access are able to change these options.* *When an alarm occurs the corresponding Digit Input/Output name will flash.*

Analog Input-Output Screen Series

Note:	*Digital input 1 and 2 are optional and will only appear if you have opted to have each or both of these inputs configured with your UV system.*

These screens can be accessed through the Main Menu by selecting the Analog Input-Output Screens.

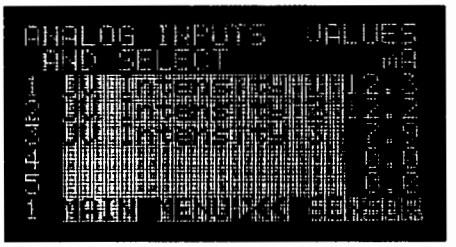
Access to screens is limited to the level of access entered into the login screen.

Operator Access Level Screens:

The Operator has viewing access of these screens. The first screen shows the Current Analog Inputs that are in use. Each input number shows the real time analog value being received.

The second screen allows the Operator to view the Analog Output usage, including the real time analog values being transferred. In addition to this, the Operator can configure the location of the UV Sensor (UV Intensity 1 – 3), Dose Achieved, and optional Flow Rate, Reactor Hi Temp, Pass-Thru UVT and Valve Position.

This is what the analog input values screen looks like when in the "change mode". The Change mode selection for the 5 analog inputs is active when the text is reversed.



UV Intensity Sensor Adjustments

This screen is displayed when you enter the Sensor button. The screen allows UV sensors of a DVGW system to offset the intensity reading by +/- 10 % from the live value. The reversed text values are values that are displayed and used for calculations on the main screen. If the percentage is 0% then no compensation is being used. This function can also normalize multiple sensors readings to have their displayed values closer together.

Technician Level Access Screens

To access these screens you must have entered the Technician's Password. Then, from each of the previous Analog Input-Output Screens select the *Change* button. The text will reverse (dark text with light background) indicating that change mode has been entered.

Within these screens the Technician is able to select which Analog Inputs and Outputs they wish to utilize. The UV Intensity Input is mandatory and is designated in the Operator Level Access Screens. As options, Flow Rate and Reactor Hi Temp (Reactor High Temperature) are also available.

Note:	*The UV Intensity can be displayed for each UV Sensor or as an average of multiple sensors. Displaying both individual intensities and an average of all UV Sensors simultaneously is also an option.*

To designate Inputs and Outputs move the cursor to the line of choice, and press enter to scroll through the list of items that could be connected to that particular input or output on the board. Once the corresponding item is displayed, arrow up or down to another line. Continue until all lines are configured as required. Move the cursor to *Save* and then press *enter* ↵to accept and keep all changes.

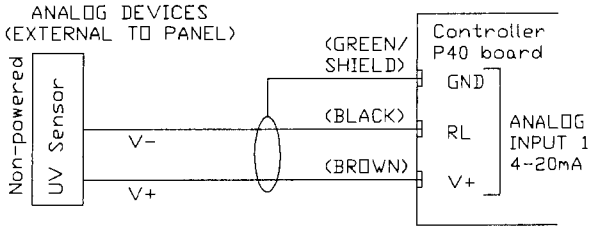
A blank line indicates that the Input or Output has not been configured.

Other Analog inputs devices:

UVT (opti-view), Flow, Valve and Reactor High Temperature

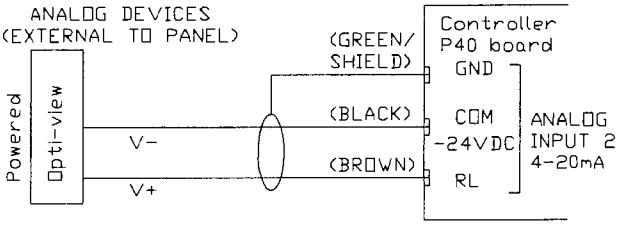
The Controller board can accept a 4-20mA signal from 24VDC loop powered and non-powered devices.

4-20mA Non-Powered Devices:



4-20mA Powered Devices:

Opti-view UVT or Flow meter or other



System Settings Screens

These screens can be accessed through the Main Menu by selecting the *System Settings*.

The access to screens is limited to the level of access entered into the login screen.

Operator Access Level Screens

The first three screens are available for the Operator to adjust, however changes should

not be made unless you are familiar with the consequences of doing so.

This screen allows the Operator to adjust the following:

Note:	*During startup, the UV Sensor Alarm Delay + an 18 second alarm suspension will occur before an alarm appears. Refer to the Normal Operation heading in this chapter for more details.*

Wiper Timer Adj:(For systems with a Wiper). This feature sets the cleaning cycle frequency.

Operation Mode: This mode selector can be changed to:

- **Local** – control at the CP by the controller.
- **Remote** – control by an external device by powering a voltage loop into the P40's voltage sensing circuit.
- **SCADA** - Remote control by an external device through SCADA communications

On/Off Power: This is a counter that keeps track of the number of times the power to the system (i.e. Board) is cycled ON/OFF.

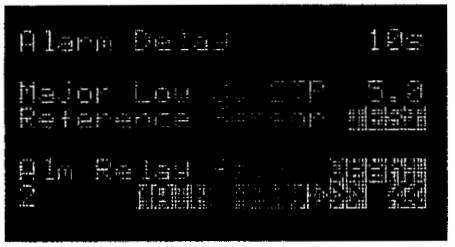
On/Off Lamps: This is a counter that keeps track of the number of times the power to the Lamps (i.e. UVR) is cycled ON/OFF.

Wiper Cycle: Systems with Wipers use a counter that keeps track of the number wiping cycles.

Run 100% Power: By changing this field to "ON" the Operator can force the system ON to override Critical Alarms that would shut the UVR down. The system can only be forced ON for a maximum of 4 hours. "R" indicates Reset.

Wiper Reset and Home: (For systems with a Wiper). Clears the wiper fault alarm(s) and sends the wiper to the home position.

This screen allows the Operator to adjust the following:



Alarm Delay: range 10- 999 seconds.

Major Low UV STP: This is a preconfigured, nonadjustable field that indicates at which value a Major Low UV Alarm will be triggered.

Reference Sensor Test:: This field allows the Operator to turn on a 2 minute delay for all UV Sensors alarms. This allows the operator time to remove UV Sensor(s) and temporally insert a reference UV Sensor to verify the sensor is still within calibration.

Open: Fail-Safe Logic (default),

Normal operation, Remote Standby, "System On-line", "System Warming" and "Common Major Siren": 24VDC Relay contacts closed and LED is on.

Alarm active or UV System is off: 24VDC Relay contacts open and LED is off.

	**CAUTION**
	The Run 100% Power option is available as a temporary solution. This option is not intended for extended use.

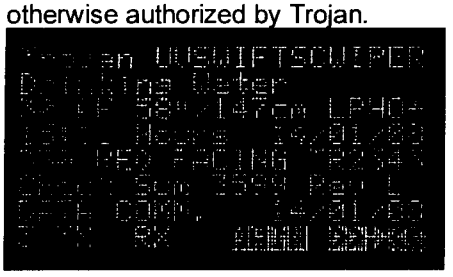
Closed: Non Fail-Safe Logic, Relay contacts close and LED is ON for active alarms **Normal operation and Remote Standby:** 24VDC Relay contacts open and LED is off.

Alarm active, UV System is off, "System On-line", "System Warming" and "Common Major Siren": 24VDC Relay contacts closed and LED is on.

Note:	*In order to use all the available Analog Outputs, additional Analog Boards must be purchased. See your System Verification Label located at the front of the manual for the number of Analog Boards provided with your system.*

Once you press enter for the reference sensor test, the display changes to the main screen with a 2 minute count down timer shown

The following system settings screen information should not be reconfigured unless otherwise authorized by Trojan.



The information presented on this screen includes the System Type, With or Without Automatic Wiping, Equipment Usage (I.e. Drinking Water), Number of Lamps, Lamp Length (ie. 36 for 36 inch), Current Time and Date, Firmware Name, and Version & Date.

Technician Level Access Screens

To access these screens you must have entered the Technician's Password at the Login Screen. Then from the previous System Settings screen select the "*Next*" button.

This screen allows the Technician to change the following

Reset Lamp Hours: This field allows the Technician to reset the Lamp run time hours to zero. This should occur on every 12,000 hours when the all the UV lamps are changed at the same time.

Language Selection: This field allows for language selection. Options are: French, Dutch, German, Spanish and Norwegian.

ON/OFF Cycles Reset : This field allows the Technician to reset the System ON/OFF Main Power Cycles to zero.

ON/OFF Lamps Reset : This field allows the Technician to reset the Lamp ON/OFF Cycles to zero

Factory Config Reset : This field allows the Technician to reset the System Controller back to the factory settings.

Wiper Cycles Reset : (For systems with a Wiper only). This field allows the Technician to reset the Wiper Cycle counter to zero.

Wipe Lamps ON or OFF : This field allows the Technician to have the controller wipe the Lamps regardless if the Lamps are powered or alternatively only wipe when the Lamps are on.

DVGW Screen Shot (below):

EPA Screen Shot (below):

This screen allows the Technician to adjust the following:

Set Clock: This field allows the Technician to adjust the system Time.

Set Date: This field allows the Technician to adjust the system Date.

Change Technician Password: This field allows the Technician, who would have correctly entered their password, the ability to change it.

Trend Time: This Field allows the Technician to change the duration of the Trending feature to either 12 minutes or 1 hour (for testing) or 24 Hours or 1 week (for normal operation).

Hi Temp Off Delay: This field allows the High Temperature Off delay to be set anywhere between 0 - 15 minutes. If '0" is selected, lamps will turn off immediately.

SCADA Command: This field allows the SCADA Command to be set to Enable (E) for normally operation or Disable (D) to block SCADA commands and perform Local operation and/or or testing.

Trend Screens

The Trend Screens provide live graphical displays based on the Analog Input readings from any of the analog devices connected to the Board. Trending can be shown over a period of 12 minutes, 1 hour, 24 hours or 1 week.

Wiper Screen (AMWS) (For systems with a Wiper).

This screen can be accessed through the Main Menu Screen by selecting Wiper Status. Alternatively, if you are in the Main Screens this screen will automatically pop up upon the start of a wipe sequence. Once the sequence is complete it will return to the Main Screen.

The Wiper screen provides the Operator with the following information:

- Next Wipe In – Displays the time remaining until the next wipe cycle is to occur, indicated in hours.
- Wiper Cycle – Indicates how often the Wiper will cycle.
- Rev – Number of revolutions the Wiper has turned during extend or retract sequence.
- L: Represents the Limit Switch. The L will blink and "fault" will appear on the screen if a fault associated with the switch occurs.
- C: Represents Revolution Switch Count. The "*C*"will blink and "fault" will appear on the screen if a fault associated with the counter occurs.
- M: Represents the motor.
- Wipe Now: When selected will initiate a wipe sequence.

Note:	*The Rev number is useful for determining the location of the Wiper if it repeatedly stops at a location and is faulted. The Rev number divided by 10 equals the approximate location in inches from the start position of the wipe sequence.*

The screen also graphically displays the UVR wiping as it is in progress.

Wiper Sequence Timer (AMWS) (For systems with a Wiper)

The system is delivered from the factory with a frequency setting of one wiping cycle occurring every 8 hour period. The wiping cycle duration is approximately 65 seconds.

This setting is a starting point for initial system set-up. The wiping frequency can be increased or decreased based on water quality and system performance (UV Intensity). A good understanding of your water quality will enable the Operator to adjust the Wiper cycle frequency to maximum efficiency.

One of the imbedded features of the Board is the Auto Power off.

Note:	*While the Wiper system is in the Auto Power Off mode, the UV system remains operating not compromising the disinfection of the water, however, attention to the Wiper system should be addressed as soon as possible.*

Wiper Auto Power Off (For systems with a Wiper)

If the Wiper encounters significant resistance while operating, the Gear Motor will automatically turn off, protecting both Wiper Assembly and Quartz Sleeves. The display will flash "Fault" which indicates the Wiper is not functioning properly.

⚠	**CAUTION**
	If you hear or suspect Sleeve breakage, do not wipe by resetting the power. You will break more Sleeves or Lamps.

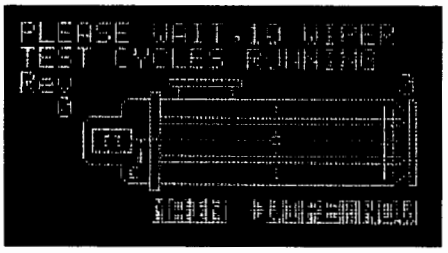
The Operator can reset the Wiper system by turning the CP off, waiting 10 seconds and turning the power on again. Alternately, the Operator can remove the Wiper Assembly from the chamber to diagnose the problem.

The other button labelled *WIPE NOW* allows the Operator to do a manual wipe sequence at any time.

Automatic 10 test wiper cycles:

This automatically tests 10 wiper cycles to confirm wiper is functioning correctly. This saves some time if you want to know if the wiper system is okay without standing and waiting to push the "Wipe Now" button 10 ten times.

Turn the main panel power off to the controller P40 board, press and hold the UP arrow on the keypad and turn main power back ON. Keep holding the UP arrow until you see the wiper screen. This will take about 17 seconds to see the following screen. This test mode will run 10 wiper cycles with 10 seconds between each wipe. The wiper cycles are counted on the screen just below and to the right of the word "Running". The screen will return to normal after 10 wiper cycles. If you don't want to run all 10 cycle then just turn main power off and then on again to cancel this test.



Analog Menu Screen

Technician Password required to display this screen.

Please see Table 1.2 for Analog option availability for the all the different UV System Types.

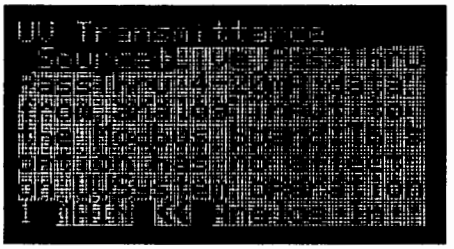
You will only see this screen if your UV system has the ability to have the option. To access this screen, select *Analog Menu* from the Main Menu screen. From the Analog Menu screen, the operator can select *Flow Rate* to access the following Flow Rate configure screen.

UV Transmittance

UVT data "Source" selected to "OFF"

UVT Pass-Thru:

Move arrow cursor to "Source" and press the enter button on the keypad. This display shows a signal connection caution message for 5 seconds.



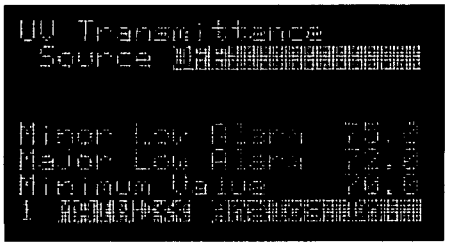
Then you will see the following screen.

This option allows any system to display and Pass-Thru UVT data to an analog output or send to SCADA. The customer can set Minor and major alarm set-points for alarms. The UVT alarms no effect on the UV system operation, but can be seen on the display and configured to any of the 7 digital alarm relays. The UVT data is not used for and system performance or Dose calculations in anyway. The minimum UVT is 70% and the maximum is 100%. The horizontal bar graph on the main screen shows the UVT scale from 70 -100%.

UVT Entered, Live or SCADA:

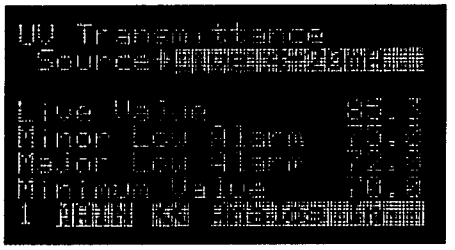
This is only available for EPA system approved MS2 RED Pacing UV systems

Entered UVT:



If you don't a live UVT signal you can entered in the worst case value of your water quality for Pacing calculations. If you change the Source to "Off", the calculations use 70% UVT to calculate Dose.

Live 4-20mA UVT:



SCADA 4-20mA UVT:

This signal is transmitted from the PLC using the Modbus communications and received by the Controller board.

Flow Rate Configure Screen (Optional)

This screen allows the Operator to adjust the following:

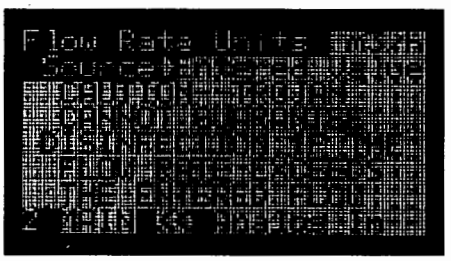
Flow Rate Units: Selections include USGPM, USMGD, m3/h, m3/d, and L/s. Flow Rate must initially be entered as m3/h.

Note:	*If a Flow Rate Unit is selected that sets the Full Scale to a value with 4 digits and 1 decimal or greater a "Too Hi" indicator will appear instead of the Full Scale value. This indicates that the selected Flow Rate Unit cannot be used. Select another Flow Rate Unit to continue.*

Source: The operator can select if the Flow Rate will be drawn from an Entered Value or from a Live Value. Depending on the source selected one of the following will appear:

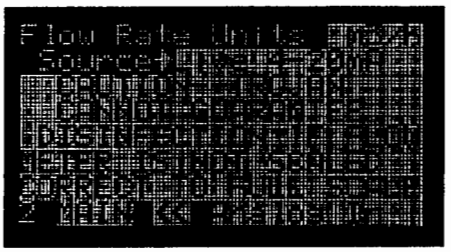
Entered Value: Values can be set between 0 and 6553.5 as determined by the operator

Move arrow cursor to "Source" and press the enter button on the keypad. This display shows a signal connection caution message for 5 seconds.

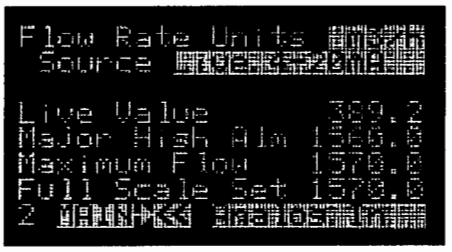


	CAUTION
⚠	*Entered Flow:* *If process flow exceeds the Entered Value,* ***disinfection cannot be guaranteed by the Trojan UV System.*** *Trojan recommends that the Operator set the Entered Value no higher than the anticipated process flow to ensure safe dose delivery. In addition, ensure that an appropriate safety factor is included in the Entered Value to allow for fluctuation.*

Live Value:



The measured live 4-20mA analog signal value.



Note:	*Flow rate values cannot exceed the maximum flow rates as described in the Maximum Flow Rate Table 1.1.*

	CAUTION
⚠	*Live Flow:* *Due to the customer supplied Flow Meter type,* ***Full Scale*** *settings must be adjusted to the maximum flow rate or less as described in the Maximum Flow Rate Table 1.1. The default settings are 4mA (equivalent to zero flow) and 20mA (equivalent to 300 m3/hr). The default numbers are valid for D06 models only. The defaults must change for use with D12 and D30 models.* ***Disinfection cannot be guaranteed by the Trojan UV System if scaling is incorrect.***

Major

Alarm: This Major High Flow Alarm set point will automatically match the value entered for the Full scale setting and can be used to trigger valve close or start-up a standby UV reactor.

Full Scale: Values can be set up to the Maximum Flow Rate for each model. Refer to Table 1.1 for each model's maximum flow rates. The default value of 300m3/hr is set for a D06 model. For any other model, this default needs to change accordingly.

SCADA Selection for Flow:

Full scale setting warning screen is displayed for 5 seconds.

Then you seen this screen

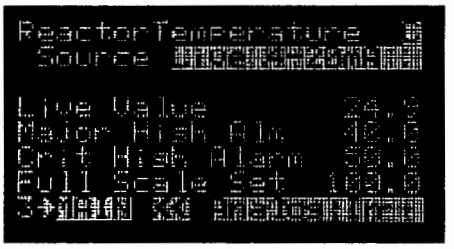
Reactor Hi Temp (Reactor High Temperature) Configure Screen (Optional)

This screen allows the Operator to adjust the following:

Reactor Temperature °C / °F: Temperature can be set to either Celsius or Fahrenheit from the Systems Setting screen page 2 if the analog Reactor Temperature option is enabled.

Note: This option replace of the digital end plate temperature sensor, the controller cannot operate using both analog and digital temperature sensors.

Source: This field is a pre-configured live, measured 4-20mA analog signal reading.

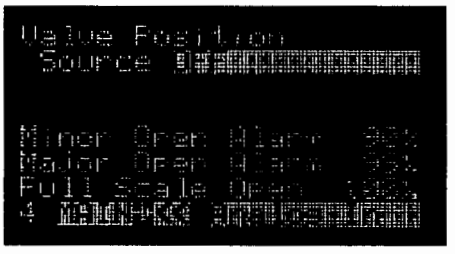


Major High Alarm: This Major High Temperature alarm set-point acts as a warning. This field is adjustable between 0 – 60 °C (32 - 140 °F). Default is 45 °C (113 °F).

Critical High Alarm: This Critical Temperature Alarm set point is adjustable between (0) and 60 °C (32 and 140 °F). The default setting is 50 °C (122 °F). This Analog Reactor Temperature option works in a similar fashion to the Reactor Hi Temp (Reactor High Temperature) Digital Input. If the timed delay setting is set to between 1 and 15 minutes, a delay will occur before the alarm occurs and the lamp de-energize. Setting a delay of (0) minutes causes the alarm to occur and the lamps to de-energized immediately.

Full Scale: This value is preconfigured at 100°C or 212 °F depending on the Reactor Units set. It cannot be adjusted.

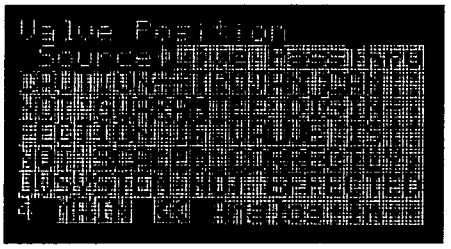
Valve Position



Live Pass–Thru:

Move arrow cursor to "Source" and press the enter button on the keypad. This display shows

a signal connection caution message for 5 seconds.



This option allows any system to display and Pass-Thru position data to an analog output or send to SCADA. The customer can set minor and major alarm set-points for alarms. The valve alarms have no effect on the UV system operation, but can be seen on the display and configured to any of the 7 digital alarm relays. The valve data is not used for and system performance or Interlocked in anyway. The Valve position range is 0-100% on this screen. The horizontal bar graph on the main screen shows the Valve position UVT scale from 0 - 100%.

This area intentionally left blank.

Valve Control

This can be done by using some of the 7 alarm relays and 24VDC signals to trigger other circuits to open or close valves.

Examples:

"System On-line" status can be configured to an alarm relay to close a 24VDC voltage loop to send to another circuit to "Open Outlet valve".

"Dose Low Major" or "High Flow Alarm" status can be configured to an alarm relay to open a 24VDC voltage loop to send to another circuit to "Close outlet valve".

5.4 System Status and Common Alarm List

	CAUTION
⚠	*This system uses ultraviolet light to reduce the concentration of pathogens to a non-infectious level. Non-observance of the maintenance instructions or the alarm messages will diminish the effectiveness of this system. Required disinfection effectiveness is no longer guaranteed and the requirements of the water supply regulations are no longer being met. A health risk exists.*

These status items indicate that an alarm or alarms in the group are active.

Alarm	Availability	Active when	Delay	Action
System In-Operation	All Products	Active after Warm Up	None	Digital output SCADA output
System On-Line		Active after Warm Up && No Major Alarms present		
System Warming		Active during Warm Up		
Common Alarm		Any Minor, Major or Critical Alarm present		
Common Minor Alarm		Any Minor Alarm present		
Common Major Alarm		Any Major or Critical Alarm present		
Common Major Siren		Any Major or Critical Alarm present		

5.5 Alarm Overview

Minor Alarms

On a minor fault the UVR will remain On-Line. Minor alarms will display on the CP and alarm relays will be deactivated. On a Minor alarm, action should be taken to correct the problem soon after the alarm but disinfection may or may not be okay.

Wiper Alarms only valid if your UV System has the Wiper option.

Alarm	Availability	Active when	Delay	Action
Low UV Intensity 1 Minor	All systems except EPA && After warming up && Not Ref. Sensor Test	Measured value < Minor UV Intensity Alarm Setpoint	Alarm Delay (10s default)	Alarm message display Digital output SCADA output Common Low UV Minor Alarm Common Alarm Common Minor Alarm
Low UV Intensity 2 Minor				
Low UV Intensity 3 Minor				
Low UV Common Minor		Any Low UV Intensity Minor Alarm		
UV Sensor 1 Alarm	EPA only && After warming up && Not Ref. Sensor Test	No UV Intensity signal		

UV Sensor 2 Alarm	EPA only && No. of Sensors > 1 && After warming up && Not Ref. Sensor Test			
UV Sensor 3 Alarm	EPA only && No. of Sensors > 2 && After warming up && Not Ref. Sensor Test			
Lamp XX Alarm Minor	Any product && After lamps are ON	Lamp Fault Ballast Fault Loss of Lamp Fault Signal		Alarm message display Digital output SCADA output Common Alarm Common Minor Alarm Flash Number of Lamps
Low UVT Minor Alarm	After warming up && UVT analog signal enabled	UVT < Minor UVT Alarm Setpoint		Alarm message display Digital output SCADA output Common Alarm Common Minor Alarm
Valve Open Minor	Valve Position analog signal enabled	Valve Position > Minor Valve Position Alarm Setpoint		
End Of Lamp Life Hours	Any product && After lamps are ON	EOLL < Elapsed Hours < EOLL + 250	None	
Wiper Home Alarm	Wiping System enabled && Homing not completed	Revolution speed < 1rps OR Revolution count > 300		Wiper stops if moving Alarm message display Wiper fault display
Wiper Revolution Alarm	Wiping System enabled && Limit / Spring wiper && Homing completed	Revolution speed < 1rps OR Revolution count > 300		Digital output SCADA output Wiper General Alarm Common alarm Common Minor alarm
Wiper High Pressure Alarm	Wiping System enabled && Hydraulic wiper	Forward / Reverse time out OR High pressure signal OR No high pressure input		
Wiper Limit Switch Alarm	Wiping System enabled && Homing process complete	Home limit switch signal is not right when wiper stops, extending or retracting	20 Seconds	

Wiper General Alarm	Wiping System enabled && Without End Cap Alarm	Wiper Home alarm OR Wiper Limit SW Alarm OR Wiper Revolution Alarm	None	Wiper stops if moving Alarm message display Wiper fault display Digital output SCADA output Common alarm Common Minor alarm

Refer to section 8-1 for alarm indicators and troubleshooting.

Major Alarms

On a Major alarm immediate action is required by the Operator to ensure that disinfection is not compromised. Alarm relays will be deactivated.

Alarm	Availability	Active when	Delay	Action
Low UV Intensity 1 Major	After Warming up && Not Ref Sensor Test	Measured value < Major UV Intensity Alarm setpoint	Alarm Delay 10s default for measured < setpoint - 10% 2m for measured > setpoint - 10%	Alarm message display Digital output SCADA output Low Dose Major output Low UV Common Major Alarm Common Alarm Common Major Alarm Common Major Siren Alarm System On-Line deactivates Achieved Dose An. Output (DVGW) Dose trend value (DVGW) Flash dose display Latch 100% BPL
Low UV Intensity 2 Major				
Low UV Intensity 3 Major				
Low UV Common Major		Any Low UV Intensity Major Alarm		Alarm message display Digital output SCADA output Common Alarm System On-Line deactivates Common Major Alarm Common Major Siren
Ballast XX Alarm Major	Any Product && After lamps are On	Ballast Fault Loss og Ballast Fault Signal	Alarm Delay (10s default)	Alarm message display Digital output SCADA output Common Alarm Common Major Alarm Common Major Siren Alarm Dose Major Alarm MS2 RED Dose Alarm B.s RED Dose Alarm System On-Line deactivates Achieved Dose An. Output (DVGW) Dose trend value (DVGW) Flash dose display Hold 100% BPL while present

Multiple Lamp Alarms		No. of Faulted Lamps > Multiple Lamp Alarm Setpoint	Alarm Delay (10s default)	Alarm message display Digital output SCADA output Common Alarm Common Major Alarm Common Major Siren System On-Line deactivates Hold 100% BPL while present
Low UVT Major Alarm	After warming up && UVT analog signal enabled	UVT < UVT Major Alarm Setpoint		
High Flow Alarm Major	After warming up && Flow analog signal enabled	Flow > Flow High Alarm Setpoint		
Valve Open Major Alarm	Valve Position analog signal enabled	Valve Position > Valve Position Major Alarm Setpoint		
No Flow Alarm Major	After warming up && Flow analog signal enabled	Analog Signal < 2 mA (Live) Or Flow Value == 0 (Entered, SCADA)		
No Valve Signal Alarm Major	Valve Position analog signal enabled	Analog Signal < 2 mA (Live)		
No UVT Signal Alarm Major	After warming up && UVT analog signal enabled	Analog Signal < 2 mA (Live) Or UVT Value == 0 (Entered, SCADA)		Alarm message display Digital output Common Alarm Common Major Alarm Hold 100% BPL while present
Low Dose Major	UVSwiftSC DVGW B, C or D reactor UVFit Theoretical Dose reactors UVLogicDP reactors	Lamp Fault Ballast Fault UV Intensity Major Alarm Lamps NOT ON Lamps Warming Dose Target not met	Lamp or Ballast alarm delay OR Dose Alarm Delay OR None	Alarm message display Digital output SCADA output System On-Line deactivates Flash Dose Display Dose Trend value Latch 100% BPL
B.s RED Low Major	UVSwiftSC EPA D06 or D12 reactor	Lamp Fault Ballast Fault Lamps NOT ON Lamps Warming Dose Target not met		Alarm message display Digital output SCADA output System On-Line deactivates Latch 100% BPL
MS2 RED Low Major	UVSwiftSC EPA D30 reactor UVFit NWRI Reuse reactors			
VIR RED Low Major	UVSwiftSC EPA D06 or D12 Adenovirus Reactor			
Slave Communication Alarm	Any Master/Slave configuration	No valid communications received from Slave within 1 minute	None	Alarm message display Digital output SCADA output System On-Line deactivates Common Alarm Common Major Alarm Common Major Siren Alarm Hold 100% BPL while present
SCADA Communication Alarm	SCADA Operation Mode	No valid communications received from SCADA within 15 seconds		

5.6 Input and Output Overview

Refer to section 8-1 for alarm indicators and troubleshooting.

Table 1.1

The corresponding chart displays the maximum flow rates that trigger a "High Flow Major Alarm" in the SwiftSC D Series.

UVSwiftSC Model	Maximum Flow Rate				
	m3/h	m3/d	USGPM	USMGD	L/s
D03	222.6	5,342.4	980.08	1.41	61.83
D06	382.2	9,172.8	1,682.7	2.42	106.17
D12	845.5	20,292	3,722.62	5.36	234.86
D18	1343.9	32,253.6	5,917	8.52	373.31
D30	2094.4	50,265.6	9,221.37	13.28	581.78

Table 1.2

This table dipicts how the Analog inputs are used or not used for pacing of the different systems.

UV Systems P40 Controller Analog Input - Maximum 5 Inputs															Analog - Max 4 Outputs		
				FLOW				UVT					Reactor	Valve	Dose	Intensity	
			UV Sensor (s)	OFF	Entered	Live	SCADA	OFF	Entered	Live	SCADA	Pass Thru	Hi-Temp	Position	Achieved	Regular	Averaging
system		Model				4-20mA				4-20mA			Live 4-20mA	Pass Thru	4-20mA	4-20mA	4-20mA
UVSwiftSC	DVGW	D03	1	Yes, It uses MAX value	Yes	Yes	Yes	Yes, It uses Min value	No	No	No	Yes	Yes	Yes	Pacing Or Basic Dose	Yes	No
		D06			Yes	Yes	Yes		No	No	No	Yes	Yes	Yes	Pacing Or Basic Dose	Yes	No
		D12	2		Yes	Yes	Yes		No	No	No	Yes	Yes	Yes	Pacing Or Basic Dose	Yes	Yes
		D18			Yes	Yes	Yes		No	No	No	Yes	Yes	Yes	Pacing Or Basic Dose	Yes	Yes
		D30	3		Yes	Yes	Yes		No	No	No	Yes	Yes	Yes	Pacing Or Basic Dose	Yes	Yes
	EPA	D03	1		Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Pacing Or Basic Dose	Yes	No
		D06															
		D12															
		D18															
		D30															

Critical Alarms

On a critical fault the UVR will be placed into Shutdown. On a Critical alarm the system CP will take immediate action to prevent damage to the equipment and immediate action is also required by the Operator and ensures that disinfection is not compromised.

*** For the Reactor High Temperature Alarm, a timed critical response can be set to allow for plant personnel to correct the problem or bring other equipment on-line.

Alarm	Availability	Active when	Delay	Action
Reactor High Temperature Critical	Digital Reactor High Temp signal enabled	End plate temperature switch is above 50° Celsius	Alarm Delay (10s default) + Hi Temperature Off Delay	Turn Lamps Off Alarm message display Digital output SCADA output System On-Line deactivates Common Alarm Common Major Alarm Common Major Siren
End Cap Off Alarm Critical	End Cap LimitSW digital input enabled	Loss of digital signal	20 seconds	

Refer to section 8-1 for alarm indicators and troubleshooting.

5.7 Input and Output Overview

Item	Inputs / Outputs	Type	Mode	Source
Standard Inputs and Outputs				
UV Sensor (1- 3)	Input	Analog	4-20mA	System I/O
Alarms (1- 7)	Output	Digital	Normally Open (NO)	Customer I/O
Optional Inputs and Outputs Optional Inputs and Outputs cannot typically override standard provided Inputs and Outputs.				
Analog (4)	Output	Analog	4-20mA	System I/O
Remote ON/OFF	Input	Digital	Voltage Sensing Input	Customer I/O
Wiper Option – Revolution Sensor	Input	Digital	9.4Hz Pulse	System I/O
Wiper Option – Limit Switch	Input	Digital	Normally Closed (NC)	System I/O
Wiper Option – Extend (forward)	Output	Digital	Normally Open (NO)	System I/O
Wiper Option – Retract (reverse)	Output	Digital	Normally Open (NO)	System I/O
Max Power Response Loop (jumps to 100% power)- Only for Pacing systems	Input	Digital	Voltage Sensing Input	Customer I/O

Additional Inputs and Outputs

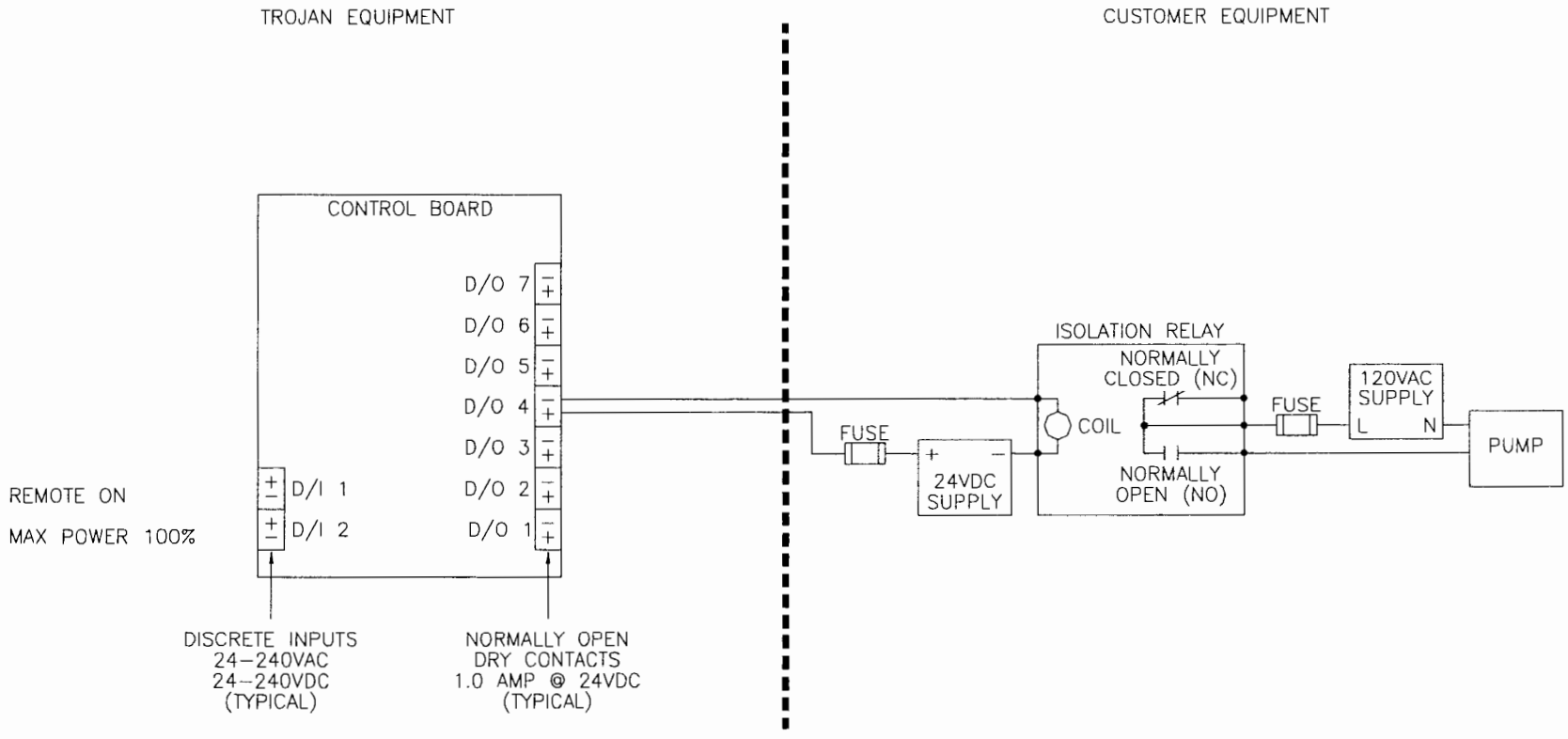
The following are available for custom applications. This list is not intended to cover all options. It is a representative list of options that sites **may** wish to exercise. Custom applications, like the ones that follow will allow a site to wire device information into our system by these analog inputs. The controller will provide a **graphical display of the information only**. Also, if a signal is brought in, it can then be wired out of our system to another if required. If you have a specific request, please contact your representative. Additional Inputs and Outputs cannot typically override standard provided Inputs and Outputs.

*****It is possible to have up to 5 Analog Inputs and 4 Analog Outputs in total.**

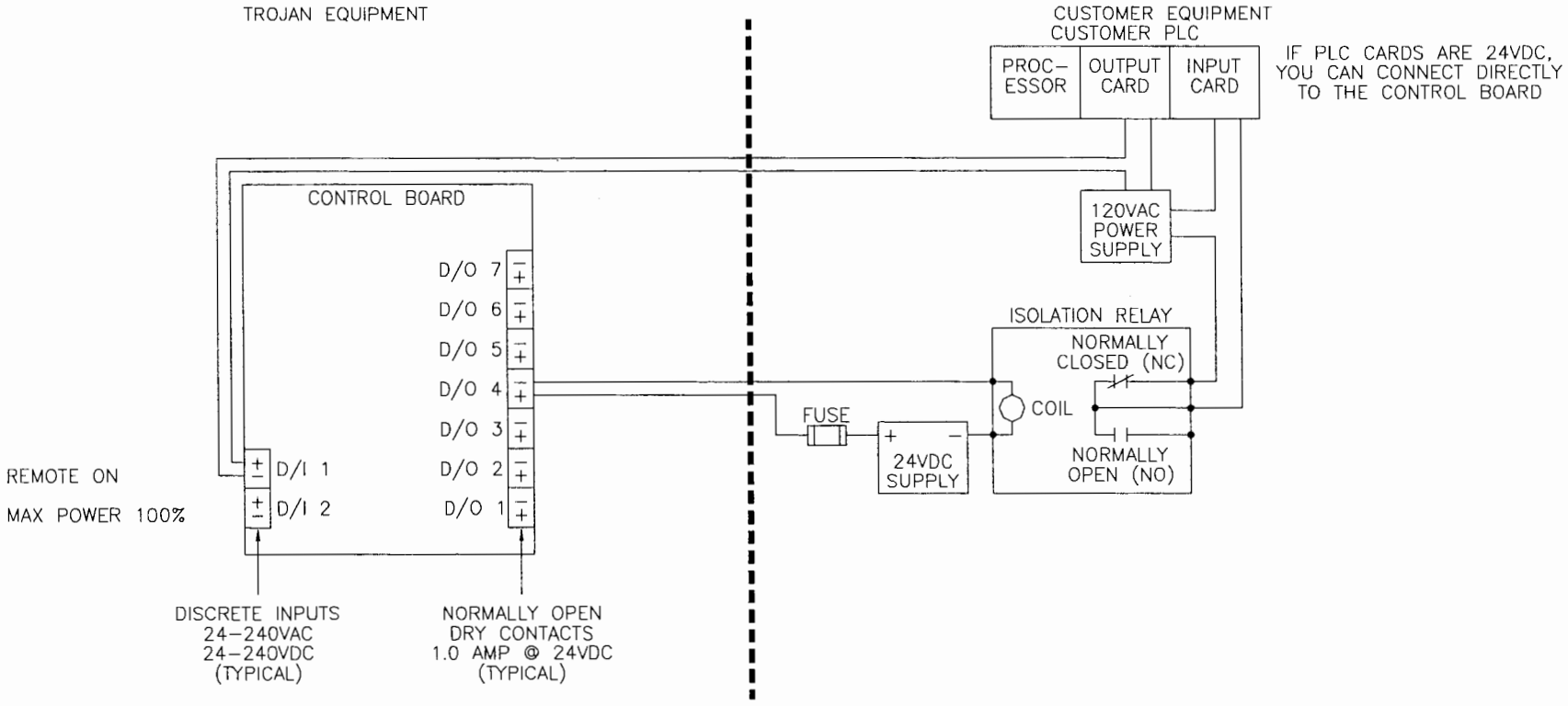
Reactor High Temperature	Input / Output (See note above)	Analog	4-20mA	System and or Customer I/O
UVT Pass-Thru or Live	Input / Output	Analog	4-20mA	System and or Customer I/O
Flow Rate D series only	Input / Output	Analog	4-20mA	System and or Customer I/O
Valve Position Pass-Thru only	Input / Output	Analog	4-20mA	System and or Customer I/O

5.8 Digital Output Wiring Diagrams

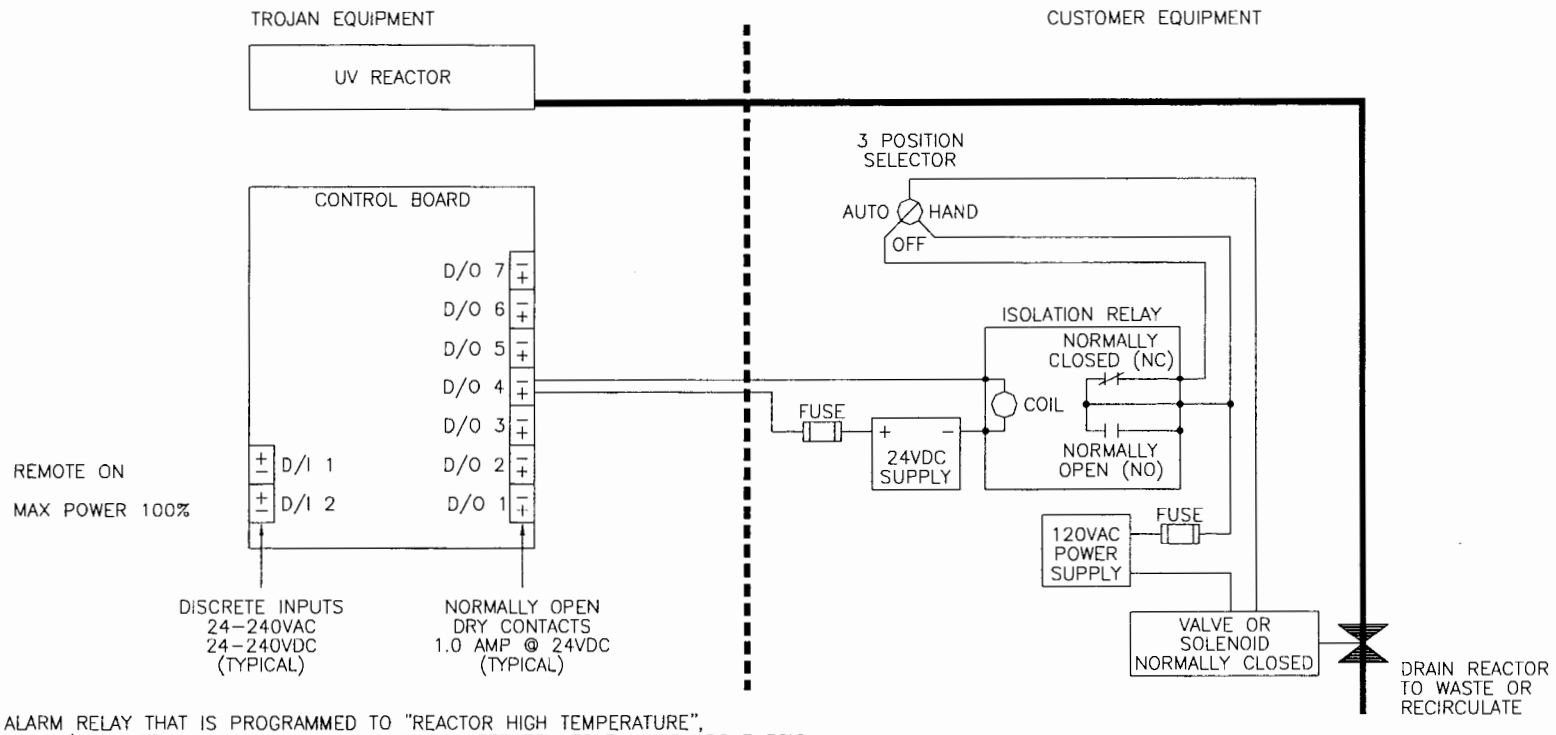
DIGITAL OUTPUT WIRING



PLC OUTPUT WIRING



REACTOR HIGH TEMPERATURE DRAIN WATER DIGITAL OUTPUT WIRING



WHEN ALARM RELAY THAT IS PROGRAMMED TO "REACTOR HIGH TEMPERATURE", NORMALLY D/O 4 GOES OPEN WHEN THE REACTOR WATER TEMPERATURE IS ABOVE 50°C

THE CUSTOMER 24VDC WILL BE LOST AT THE ISOLATION RELAY.

IF THE SELECTOR IS IN "AUTO", THE REACTOR WILL DRAIN IT'S WATER UNTIL THE REACTOR TEMPERATURE HAS COOLED BELOW 50°C AND THE CIRCUIT RESET. THIS WILL TURN OFF THE VALVE AND CLOSE THE DRAIN.

THE SELECTOR SWITCH ALSO ALLOWS THE OPERATOR TO TEST OR MANUALLY DRAIN THE REACTOR.

IT MAY BE DESIRABLE TO TURN THE SELECTOR TO "OFF" DURING WARM UP TO PREVENT THE VALVE FROM UNNECESSARY OPEN/CLOSING.

TrojanUVSwift™SC

UV Intensity Reference Sensor Procedure – Gen 2 Control Panel

Part Number: 794802
Revision: A
Date: 2008-11-07

Application

This procedure is to be followed for reactors operating under US EPA based regulatory requirements for Municipal Drinking Water.

Description

The purpose of the reference sensor procedure is to verify the calibration of the duty sensor using a reference sensor. The duty sensor is an on-line sensor installed in the reactor that monitors UV intensity during operation of the reactor. The reference sensor is an off-line sensor of the same type as the duty sensor, and is used to monitor the calibration of the duty sensor. During the procedure, the reference sensor is mounted in the same sensor port as the duty sensor so that a comparative UV Intensity value (W/m^2) can be provided.

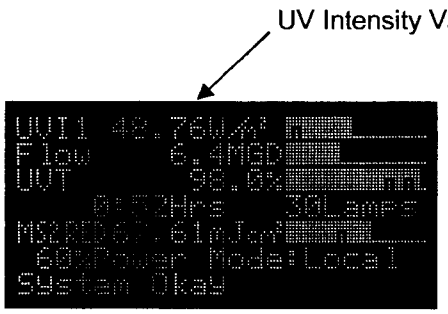
Storage

The Reference Sensor is provided with its' own protective case and is to be kept in a warm, dry, and clean environment.

	**CAUTION** The lamps in this system emit ultraviolet light. Exposure to ultraviolet light can cause serious burns to unprotected eyes and skin. Never view ultraviolet light directly with the naked eye. **Never look through the removable UV sensor window into the reactor when the system is running.** Always view ultraviolet light through properly rated protective eyewear. Always wear protective clothing when exposed to ultraviolet light.
	**CAUTION** Wear Protective Gloves! Always wear protective gloves when working on equipment.

Procedure Instructions

1. Verify that the reactor is operating normally, lamps are operational and sleeves are clean. Perform cleaning maintenance as required. Clean the sensor monitoring window if required, following the "UV Sensor Removal and Cleaning" section in the O&M UV Sensor Chapter.
2. Allow the lamps to run for at least 10 minutes before performing the reference sensor procedure. Power level should be set at what is typically used during normal operation of the system. **Note: Do not remove power to the system while performing the procedure (except in the case of emergency).**
3. Measure and record the UV intensity value (W/m^2) of the duty sensor in the table provided. The intensity value is displayed in the screen on the door of the Control Panel.



Main Screen

Main Screen (2 Sensor System)

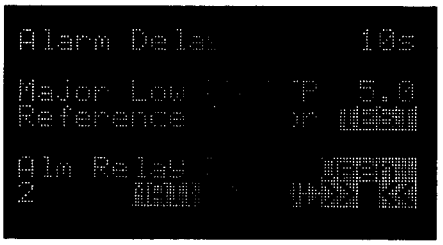
4. To initiate a delay for all UV Sensor alarms for a 2 minute period (*available only for firmware versions 'K' and above*) follow these steps:

   4.1. Press the Menu button (↵) to enter the Main Menu Screen.

Main Menu Screen

   4.2. Move the cursor to 'System Settings' line and press enter (↵).

   4.3. Go to page 2 by pressing the ■ button (The page number is displayed in the bottom left corner of the screen).



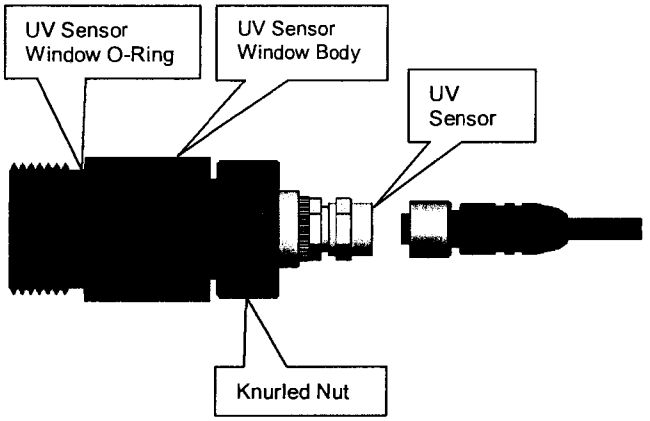
System Settings Screen – Page 2

4.4. Move the cursor to the 'Test' field and press enter (↵).

4.5. The following screen showing the 2 minute countdown will appear and you can proceed to the next step. After the 2 minute period, the system will return to normal operation.

System Settings Screen – Page 2 showing the 2 minute countdown

5. Remove the duty sensor from the reactor by first removing the knurled nut (rotate counter-clockwise).
6. Remove the duty sensor by pulling it straight out of the UV Sensor Window Body.



6. Record the duty sensor serial number in the table provided. Refer to Figure 1 below for location of the serial number on the body of the sensor.

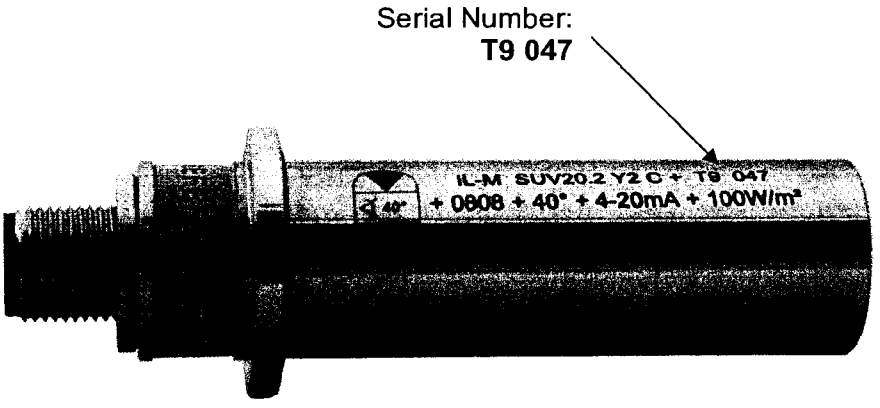


Figure 1

7. Record the reference sensor serial number in the table provided.
8. Insert the Reference Sensor into the UV Sensor Window Body.
9. Reapply the knurled nut by hand until it is snug (rotate clockwise).
10. Remove the cable from the duty sensor and attach it to the reference sensor connector. **Note: Some systems may come equipped with the Sensor Cable permanently attached to the Sensor. If this is true, use the 3ft. extension provided in your Reference Sensor Kit.**
11. Install the reference sensor into the same port as the duty sensor and measure and record the UV Intensity value (W/m^2) of the reference sensor in the table provided. **Note: it is recommended to wait 2 minutes for the value to settle.**
12. Remove the reference sensor from the UV Sensor Window Body and reinstall the duty sensor.
13. Reapply the knurled nut by hand until it is snug (rotate clockwise). Reconnect the sensor cable to the duty sensor.
14. Calculate the calibration ratio and record the result in the table provided. (Note: the duty sensor intensity value is always divided by the reference sensor intensity value)
15. Determine if the duty sensor meets the calibration ratio criteria. The ratio must be greater than or equal to 0.8 and less than or equal to 1.2.
16. If the duty sensor does not meet the calibration ratio criteria then:

    16.1. Verify the operation of the reference sensor by installing a second reference sensor and repeating the reference sensor procedure. If a second reference sensor is not available, two duty sensors may be used by using the average intensity reading of these duty sensors as the comparitive value.

    16.2. Apply a duty sensor intensity value adjustment as detailed on page 5 in the "**UV Duty Sensor Adjustment Procedure (Available only for firmware versions 'L' and above)** section.

    16.3. If the duty sensor still does not meet the calibration ratio criteria, then the duty sensor must be replaced prior to resuming normal operation. **Please refer to the 'UV Sensor Removal and Cleaning' section found in the UV Sensor Chapter in the O&M.**
17. Repeat the procedure for each remaining duty sensor.

UV Duty Sensor Adjustment Procedure (Available only for firmware versions 'L' and above)

UV Sensor Adjustment Screen
(Example image shows a 3 sensor system)

The UV Sensor Adjustment Screen allows the duty sensor(s) displayed intensity reading to be adjusted by ± 10 % from the live value. The reversed text values are values that are displayed and used for calculations on the main screen. In the example screen above, a -10% adjustment has been applied to the live values for UVI 1, UVI 2 and UVI 3 duty sensors, resulting in adjusted intensity values of 47.15, 46.41, and 22.46 W/m² respectively. If the adjustment percentage is 0% then no compensation is being used. This function can also be used to normalize multiple sensors readings to have their displayed values closer together. To get to the UV Sensor Adjustment screen, complete the following:

1. Go to the Main Menu.
2. Move the cursor to the 'Analog In-Outputs' option and press enter (↵).
3. Move the cursor to the 'Change' button and press enter (↵).
4. Move the cursor to the 'Sensor' button and press enter (↵).

If, on application of a 10% maximum adjustment to the live intensity reading of a duty sensor, it still does not meet the calibration ratio criteria, then the duty sensor must be replaced.

Note:

1. This 10% value is added and subtracted from the raw UV intensity value displayed by the duty sensor(s). There is no accumulated percentage over time or for every time you add or subtract some percentage to the duty sensor intensity value.
2. When the Customer resets the lamp Hours at the end of the 12000 hours, the ± 10 % will reset to zero for all duty sensors. This way it is not forgotten that there is an adjustment factor in use on some or all duty sensors.

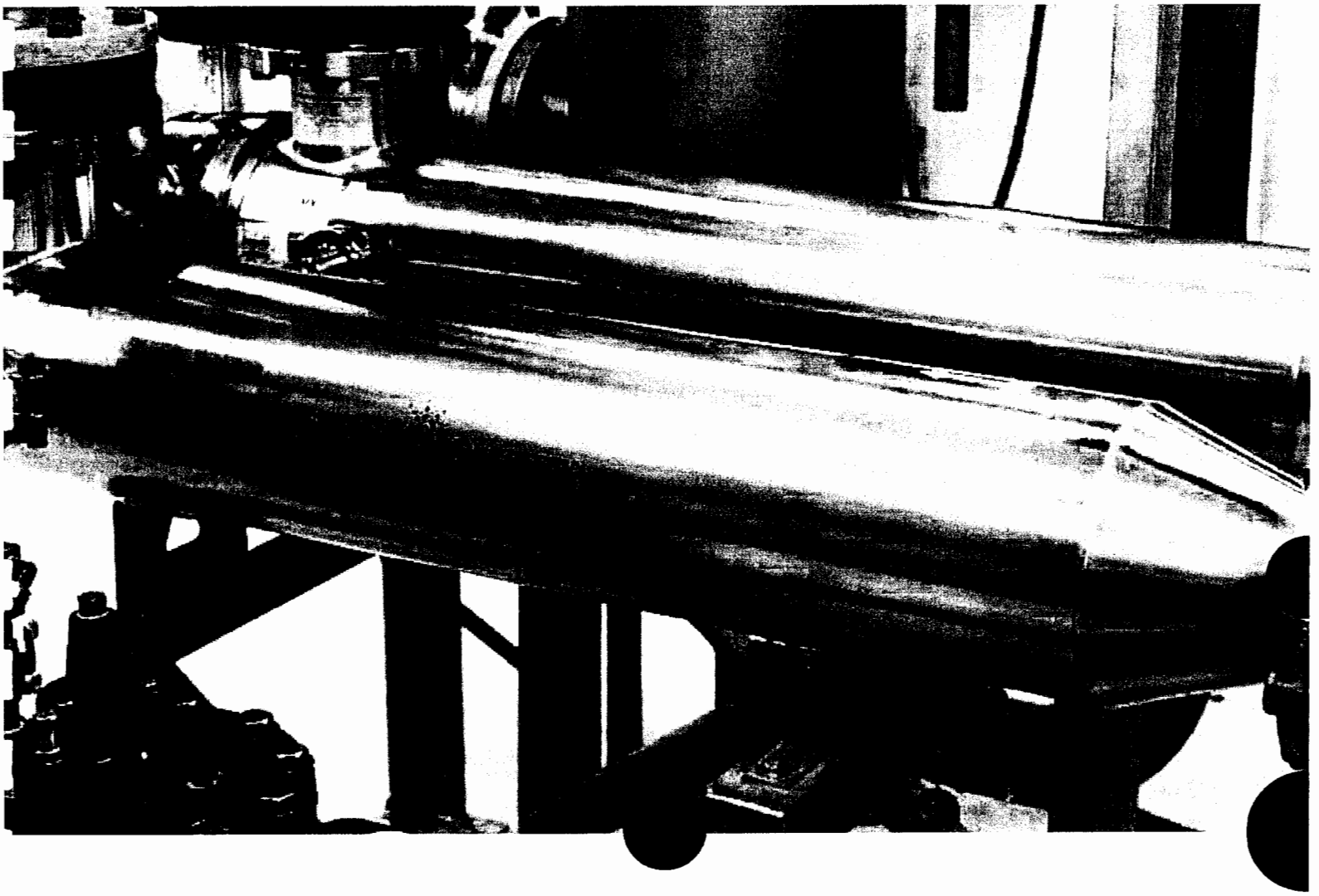
TrojanUVSwift™SC UV Intensity Sensor Data Sheet

Site: _____ **Operator:** _____
Date: _____ **%UVT:** _____

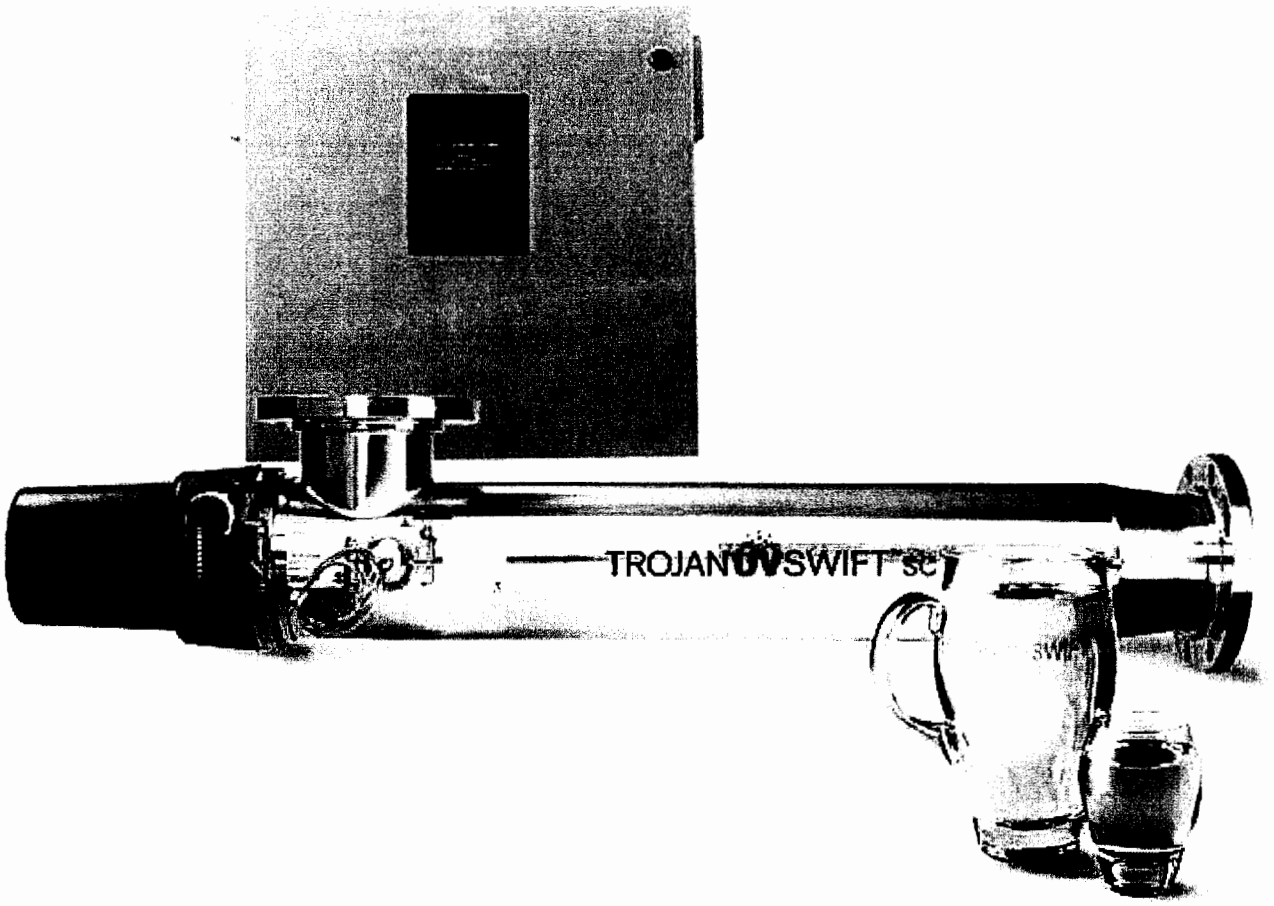
Duty Sensor Serial No.	Reference Sensor Serial No.	Duty Sensor Reading [A] (W/m^2)	Reference Sensor Reading [B] (W/m^2)	Calibration Ratio ([A] / [B])	Calibration Ratio ≥0.8 and ≤ 1.2 (Y/N)

TROJANUVSWIFT™SC

DRINKING WATER TREATMENT



TROJAN UVSWIFT™SC



Water Confidence for Communities Large & Small

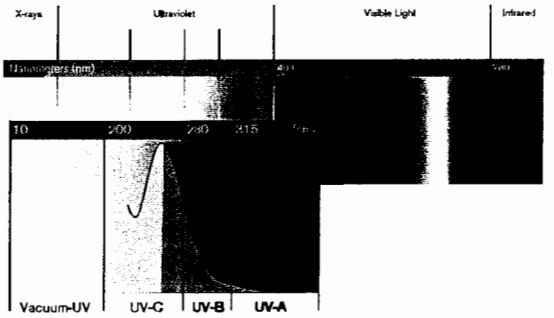
Trojan's proven UV solutions provide validated, cost-effective disinfection

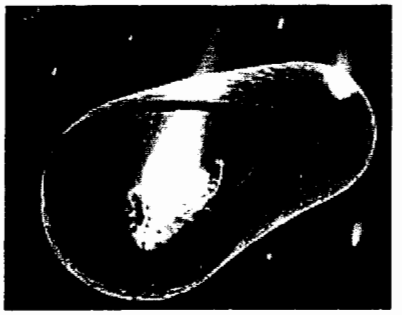
Trojan Technologies is an ISO 9001: 2000 registered company and for more than 30 years has set the standard for proven UV technology and ongoing innovation. With unmatched scientific and technical expertise, and a global network of specialists, representatives and technicians, Trojan is trusted more than any other firm as the best choice for municipal UV solutions – worldwide. The TrojanUVSwift™SC is one of the reasons why. With units designed to treat flow rates of 2 gallons per minute (GPM) to 16 million gallons per day (MGD) 0.5 to 2,523 m^3/hr, these compact, robust UV systems offer communities an efficient, economical solution for drinking water disinfection. Like all Trojan drinking water products, the TrojanUVSwift™SC is bioassay validated, having undergone rigorous DVGW and USEPA certification to ensure verified dose delivery, maximum public safety and peace of mind. It's engineered and built to provide reliable performance, simplified maintenance, and reduced operating costs with innovative features like a hydraulically optimized, "L-shaped" reactor, high-intensity amalgam lamps and optional automatic or manual sleeve wiping.

The Benefits of UV

Broad-spectrum, cost-effective protection that offers unparalleled safety

- UV light is an environmentally-friendly, chemical-free way to safeguard water against harmful pathogens
- Proven in thousands of installations, UV is widely accepted and endorsed worldwide for disinfection of drinking water
- UV offers broad-spectrum protection against a wide range of pathogens, including bacteria, viruses, and chlorine-resistant protozoa
- UV treatment provides *Cryptosporidium*, *Giardia* and virus inactivation of up to 4-log
- UV is a reliable, cost-effective part of a multi-disinfectant treatment strategy
- UV does not create disinfection by-products (DBPs) and does not affect taste
- At approximately 1/5 the cost of ozone disinfection and 1/10 the cost of membrane filtration, UV is the most cost-effective approach for multi-barrier treatment strategies

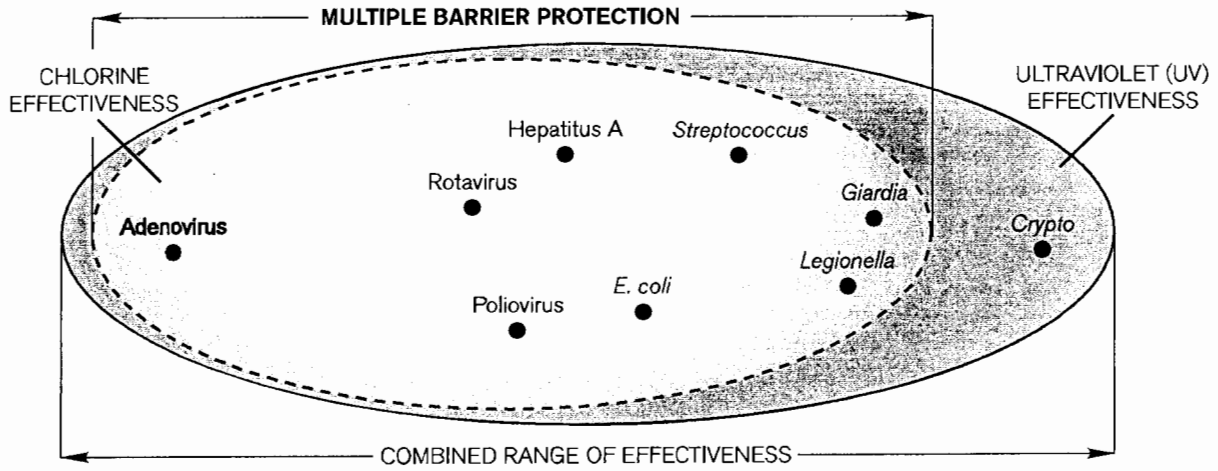




Ultraviolet light is invisible to the human eye, but a highly effective, chemical-free way of inactivating microorganisms in water. UV light penetrates the cell wall of the microorganism and alters its DNA so it can no longer reproduce or cause infection.

Trojan's New Virus Validation Redefines Multi Barrier

UV offers a cost-effective, secondary barrier of protection to safeguard drinking water against virtually all microorganisms treated by chlorine – including adenovirus – as well as proven inactivation of chlorine-resistant protozoa, including *Cryptosporidium* and *Giardia*. Dual barrier treatment using UV provides significantly greater community safety and reduced liability risk for municipalities.

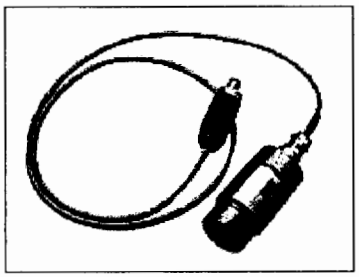


TROJAN UVSWIFT™SC

Designed for efficient performance

Amalgam Lamps

Utilizes high-output amalgam lamps. Each is located within its own protective quartz sleeve and supported by a removable, sleeve holder assembly. Designed for easy lamp replacement.



UV Sensor

Highly accurate, DVGW-approved, photodiode sensor monitors UV output within the reactor. Mounted within the sensor port on the side wall of the reactor for easy access.

Sleeve Wiping System

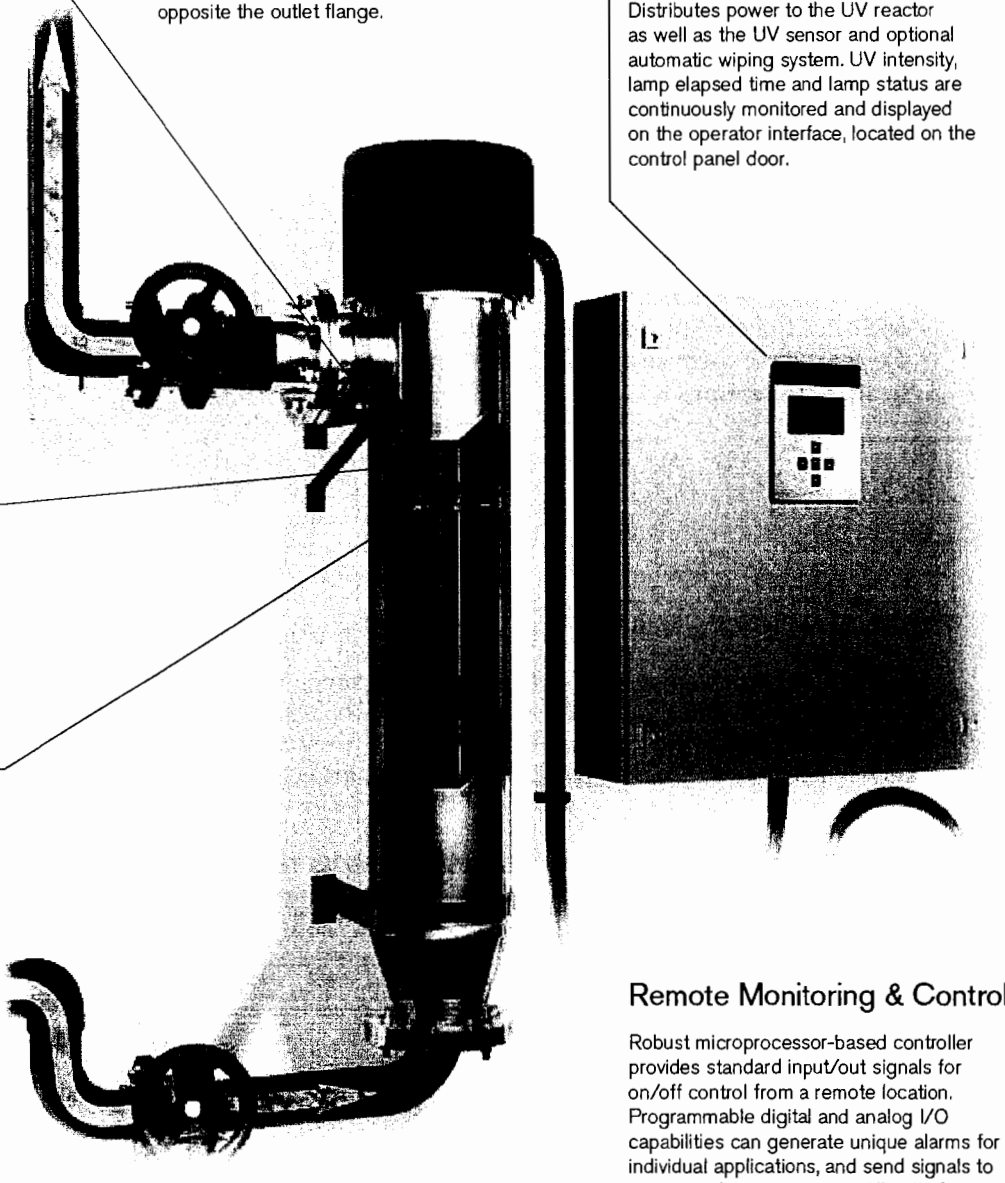
Optional manual or automatic systems available; both operate online, without interrupting disinfection. Fluorocarbon wipers are mounted in stainless steel yoke around the quartz sleeve of each lamp. The manual system is driven by hand using an external handle. The automatic system allows cleaning at preset intervals using a motor-driven wiper assembly.

UV Reactor

Type 316L stainless steel. Reactor configurations are available with multiple inlet/outlet diameters. Rated to 150 PSI (10 BAR) with an optional rating of 232 psi (16 BAR). A drain port is located opposite the outlet flange.

Control Panel (CP)

Epoxy-painted, carbon steel cabinet is designed for indoor, wall-mount installation. Houses a microprocessor-based controller with I/O connection points, and electronic power supplies. Distributes power to the UV reactor as well as the UV sensor and optional automatic wiping system. UV intensity, lamp elapsed time and lamp status are continuously monitored and displayed on the operator interface, located on the control panel door.



Remote Monitoring & Control

Robust microprocessor-based controller provides standard input/out signals for on/off control from a remote location. Programmable digital and analog I/O capabilities can generate unique alarms for individual applications, and send signals to operate valves and pumps. All units feature optional SCADA communication via ModBus for remote monitoring and control, and D-Series systems offer dose pacing.

Key Benefits
TrojanUVSwift™SC

Proven performance – full bioassay validation. TrojanUVSwift™SC systems meet the stringent, internationally-recognized standards of DVGW, ÖNORM, and USEPA – having undergone comprehensive validation at a wide range of flow rates and UV transmittance levels.

Assurance of NSF 61 compliance. TrojanUVSwift™SC systems meet the stringent standards of NSF International.

Compact footprint for installation flexibility. The TrojanUVSwift™SC can handle maximum flow capacity in minimal space. Its compact design allows it to be installed vertically or horizontally in restrictive spaces, thereby lowering installation costs. Where approved by local regulators, the system can even be installed immediately after a 90° elbow and other upstream piping configurations.

Fewer lamps required to treat a given flow. Trojan's use of efficient, high-intensity amalgam lamps minimizes the lamps, seals, and maintenance to meet dose delivery requirements.

Sleeve wiping system reduces maintenance costs. The TrojanUVSwift™SC can be equipped with a highly effective manual or fully automated sleeve wiping system to minimize the frequency and costs of cleaning. Both options work while the UV unit is online and disinfecting.

Designed for maximum operating efficiency. High-efficiency, electronic ballasts ensure cost-effective operation. Trojan's high-capacity D-Series models can be equipped with optional dose pacing that adjusts lamp output to match dose to actual disinfection requirements – minimizing operating costs and extending lamp life.

Local service. Global support. Trojan's comprehensive network of certified service providers offers ongoing maintenance programs and fast response for service and spare parts.

Guaranteed performance and comprehensive warranty. Trojan systems include a Performance Guarantee and comprehensive protection for your investment. Ask for details.

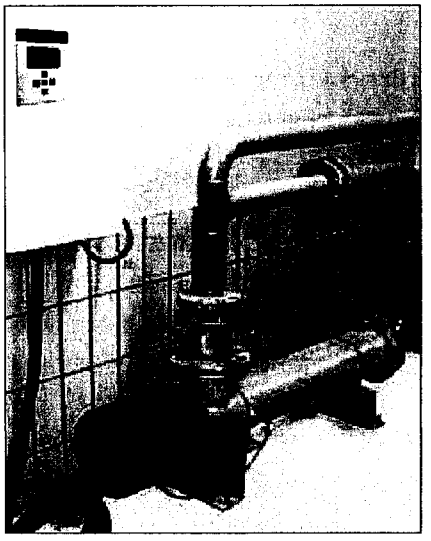
Compact Reactor for Installation Flexibility

Efficient, cost-saving design can be installed vertically or horizontally

Benefits:

- Compact footprint simplifies installation and minimizes related capital costs – making it ideal for retrofit applications into existing water treatment plants
- Engineered to fit into restrictive pipe galleries
- Lamps and sleeves are fully serviceable from one side – allowing the system to be installed tight to walls, other equipment or piping
- Validated with a 90° elbow installed immediately before the reactor to ensure consistent dose delivery – even under challenging hydraulic conditions created by upstream piping
- "L-shaped" reactor design is 40% more efficient than "U-shaped" systems
- Low head-loss design simplifies integration into existing processes, and minimizes the need for additional pumps and their associated capital and operating costs
- Compact wall-mounted control panel can be located up to 82' (25 m) from the reactor

The highly efficient "L-shaped" design and LPHO amalgam lamps result in an extremely compact footprint.



Developed using advanced Computational Fluid Dynamic (CFD) modeling, and incorporating high-output amalgam lamps, the TrojanUVSwift™SC is extremely space efficient. Its compact footprint allows the system to be integrated into restrictive pipe galleries of water treatment facilities reducing installation costs and eliminating the need for additions to buildings.

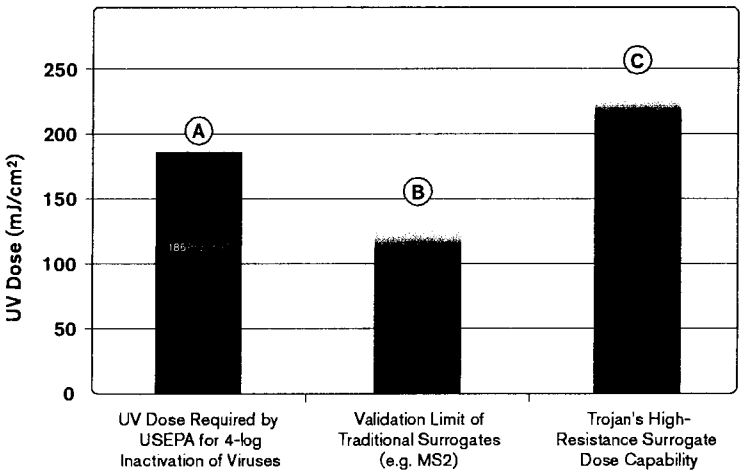
Industry-Leading Bioassay Validations

Validation testing to world standards ensures regulatory compliance regardless of location

Benefits:

- D-Series Units validated in accordance with USEPA 2006 Guidance
  - Use of multiple surrogate organisms (T1, T7 and MS2) allows tailoring of UV dose to that of the target organism (e.g. *Cryptosporidium*)
  - Intensity Setpoint or Calculated Dose control options
  - Validations performed under worst-case hydraulics – with a 90° elbow at the inlet
- UV for Virus Treatment
  - Cutting-edge validation for TrojanUVSwift™ D-Series reactors demonstrates doses sufficient for 4-log inactivation of viruses, including adenovirus, with a single unit
  - Fully EPA compliant, third-party witnessed
- All TrojanUVSwift™SC units are bioassay tested according to German DVGW standards
- Selected D-series models validated in accordance with Austrian ÖNORM protocols
- Bioassay validations eliminate the use of theoretical calculations which can significantly overstate dose, jeopardizing community safety (see Figure 2)
- Trojan systems meet stringent standards of NSF International (NSF 61)

Figure 1. A UV dose of 186 mJ/cm² is required by the USEPA for 4-log treatment of viruses (column A). Traditional surrogates, such as MS2, aren't resistant enough for UV to demonstrate inactivation of 4-log virus (column B). To overcome this challenge, a high-resistance surrogate was used to validate to the doses required for 4-log virus inactivation (column C).



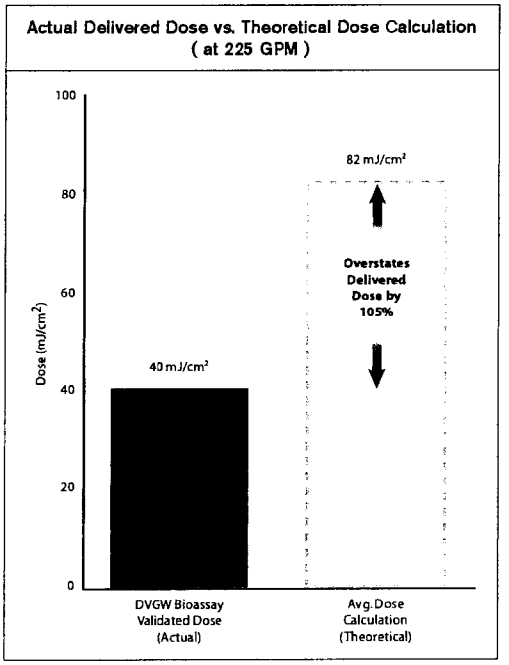


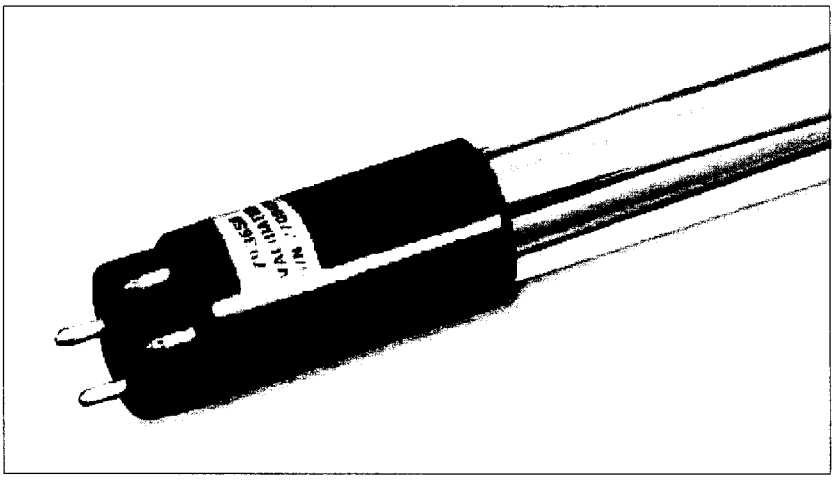
Figure 2. The graph to the left highlights an actual comparison of DVGW bioassay validation results with theoretical dose calculations using commercially available software for a TrojanUVSwift™SC at a flow rate of 225 GPM. The theoretical calculation overstates the delivered dose by 105%. Had a drinking water system been selected based on the results of the calculated dose, public safety could be compromised.

DVGW

NSF International

Energy Efficient, High-Output Amalgam Lamps

Need for fewer lamps reduces capital and O&M costs



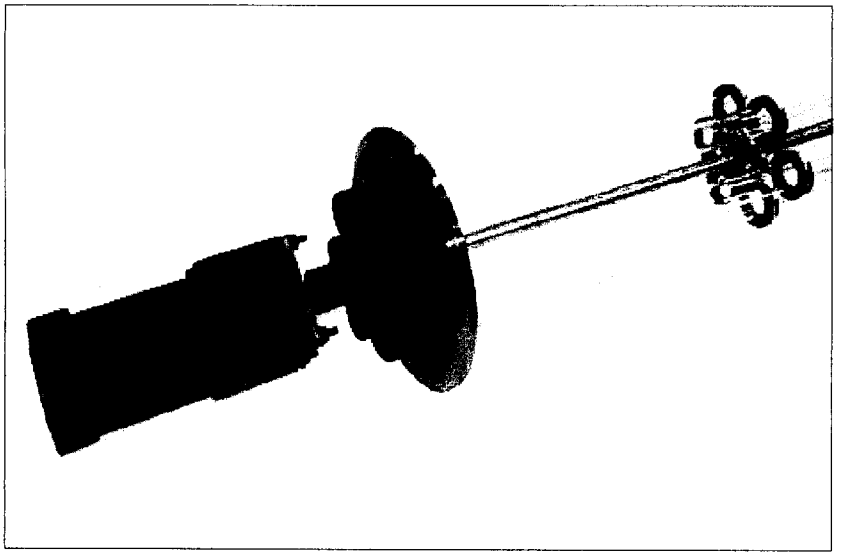
Efficient, low-pressure, high-output amalgam lamps allow TrojanUVSwift™SC systems to deliver the required UV dose with fewer lamps and lower operating costs.

Benefits:

- The TrojanUVSwift™SC requires 1/2 to 1/3 fewer lamps to deliver the required dose compared to traditional UV systems using low-pressure lamps
- With fewer lamps, the TrojanUVSwift™SC is very compact and can be located in small spaces, reducing installation costs
- Trojan high-efficiency, amalgam lamps draw less energy than competitive high-output systems – minimizing operating costs
- Fewer lamps means reduced annual maintenance costs for lamp change-outs

Robust Sleeve Wiping Systems

Optional manual or automatic wiping ensures consistent dose delivery



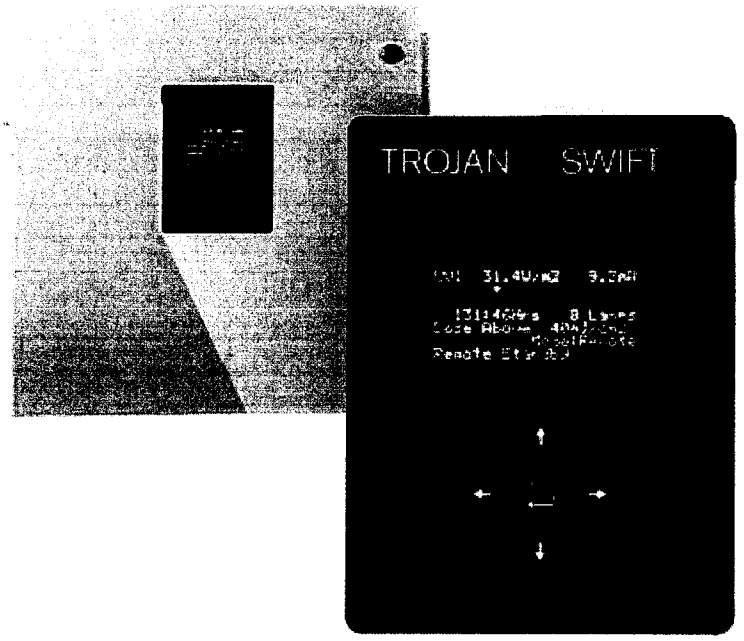
The optional wiping systems reduce maintenance costs. Operators have a choice of the manual system that is operated by hand, or motorized system (shown above) which can be programmed to wipe automatically at preset intervals.

Benefits:

- Wiping systems minimize fouling of the quartz sleeves
- Ensure consistent UV dose delivery for maximum public safety
- Systems operate online while the lamps are disinfecting, reducing downtime
- Automatic wiping system can be programmed to wipe lamp sleeves at preset intervals

User-Friendly Digital Controller

Intuitive system provides at-a-glance system status and allows remote operation



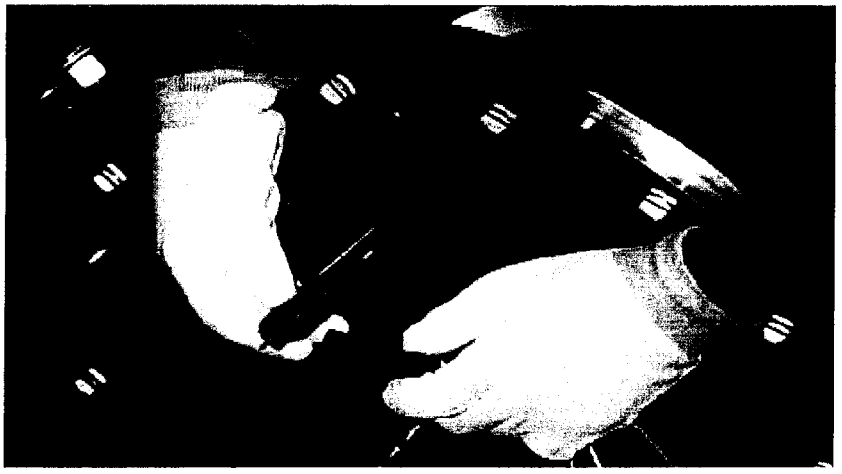
The TrojanUVSwift™SC controller and high efficiency electronic ballasts have been proven in thousands of installations. The Control Panel features a user-friendly digital interface, and can be mounted up to 82 ft (25 m) from the reactor.

Benefits:

- Robust, microprocessor-based controller combines extensive functionality with an operator-friendly, digital interface
- Display provides at-a-glance, real-time system status information
- Programmable digital and analog I/O capabilities allow remote on/off control and alarm code differentiation for fast identification of changes in system status
- Optional dose pacing on high capacity D-Series systems minimizes energy use while maintaining required dose
- Optional ModBus protocol communicates with plant SCADA system for centralized monitoring of UV performance, lamp status, power levels and other parameters

Designed for Easy Maintenance

Operator-friendly design for easy routine maintenance



The TrojanUVSwift™SC design simplifies maintenance procedures. For example, lamp changeovers require no tools and take less than five minutes per lamp.

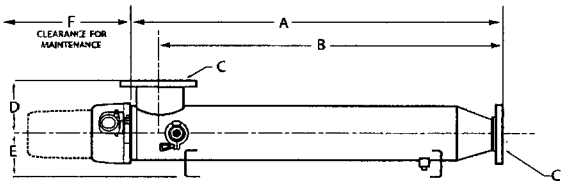
Benefits:

- Single-ended UV lamps simplify annual replacement
- Lamps require less than 5 minutes each to change – without tools
- Externally mounted sensor allows easy access
- Optional automatic or manual sleeve wiping system reduces the frequency, inconvenience and cost of manual cleaning

TROJANUVSWIFT™SC

System Specifications

Model #	A02	B03	B04	B06	B08	D03	D06	D12	D18	D30
Validated Dose Range DVGW (mJ/cm²)	40									
EPA (mJ/cm²)	N/A					186				100
Önorm (mJ/cm²)	N/A					40	N/A		40	N/A
UVT Range	Nominal range of 80% to 98%					70% to 98%				
Water Temperature	1°C to 40°C (34°F to 104°F)									
UV Reactor										
Number of Lamps	2	3	4	6	8	3	6	12	18	30
Reactor Material	Type 316L stainless steel									
Mounting Feet (Brackets)	Optional					Standard				
Max Operating Pressure PSI (BAR) *Additional Pressures Available	150 (10)									
Reactor Weight (Dry) lbs (kg)	34 (15)	72 (33)	75 (34)	81 (37)	85 (39)	115 (52)	275 (125)	430 (195)	665 (301)	1,200 (545)
Reactor Weight (Wet) lbs (kg)	65 (29)	149 (68)	150 (68)	160 (73)	162 (85)	230 (104)	530 (240)	860 (390)	1400 (635)	2250 (1,150)
Wiping System Available	Manual	Manual/Automatic				Automatic				
Control Panel (CP)										
Ballast Power Level	Electronic Constant Output (100%)					Electronic Variable Output (60% - 100%)				
Electrical - Voltages	120 V 230V (Europe)	208 or 240 V, single phase , 2 wire + gnd, 50/60 Hz L-L								
Control Panel Rating	Type 12 (IP54), Type 3R (IP24)			Type 12 (IP54), Type 3R (IP24), Type 4X (IP66)						
Material	Painted Mild steel (Type 12) SS304 (1.4301 in Europe) (Type 3R & Type 4X)									
Inputs/Outputs	5 Analog In, 2 Discrete In, 4 Analog Out, 7 Discrete Out									
Instrumentation										
UV Sensors Per Reactor (DVGW/EPA) 1 per 10 lamps as per DVGW & Onorm 1 per reactor as per EPA	1					1	1	2/1	2/1	3/1
Other										
Languages	Standard: English, French, Dutch, German, Spanish, Norwegian, Swedish, Italian									
Dimensions – Inches (cm)										
without auto wiper A:	33 (84)	47 (119)	47 (119)	47 (119)	47 (119)	68 (173)	66 (170)	68 (173)	68 (173)	70 (178)
B:	30 (75)	43 (109)	43 (109)	43 (109)	43 (109)	62 (157)	60 (152)	59 (150)	56 (142)	56 (142)
Flange Size C:	3 (80DN)	4 (100DN)	4 (100DN)	6 (150DN)	6 (150DN)	6 (150DN)	8 (200DN)	12 (300DN)	16 (400DN)	20 (500DN)
D:	6 (15)	8 (20)	8 (20)	8 (20)	8 (20)	8 (20)	11 (27)	14 (35)	17 (42)	21 (53)
E:	6 (15)	7 (18)	7 (18)	7 (18)	7 (18)	7 (18)	9 (23)	12 (30)	15 (38)	18 (45)
F:	50 (127)	60 (152)	60 (152)	60 (152)	60 (152)	70 (178)	70 (178)	70 (178)	70 (178)	70 (178)



Find out how your drinking water treatment plant can benefit from the TrojanUVSwift™SC – call us today.

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