IQALUIT WATER TREATMENT PLANT-
UV REACTOR REPLACEMENT

CITY OF IQALUIT DEPARTMENT OF
PUBLIC WORKS AND ENGINEERING

OPERATIONS AND MAINTENANCE MANUAL

VOLUME 2

Natik Projects 2007 Inc.
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October 19, 2023

Natik
12525 – 125 Street
Edmonton, Alberta
T5l 0t4

Attention: Vince Bruno, vince@natikprojects.com

Phone: 1-877-453-3257 Ext. 1

RE: O&M for Iqaluit, NU – UV Equipment

Dear Vince Bruno

Enclosed please find an electronic copy of the O&M submittal for Iqaluit, NU WWTP – UVSwift 4L12.

Please confirm if any hard copies will be required.

Best regards,

Gus Karahalios

TROJAN TECHNOLOGIES Group ULC
Gus Karahalios
Project Manager
E-mail: gkarahalios@trojanuv.com
Phone: (519) 457-3400 ext. 2616

TROJAN UVSWIFT™

OWNER'S MANUAL
IQALUIT REPLACEMENT
TROJAN PROJECT NO: 161100016

IMPORTANT CONTACTS

HEAD OFFICE - CANADA

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London, Ontario,
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TOLL FREE NUMBER:
1-800-291-0213

TOLL FREE FAX NUMBER:
1-800-290-6193

To schedule SERVICE or ORDER PARTS,
contact your LOCAL REPRESENTATIVE

eda Environmental Ltd.
180 Wyatt Road,
Winnipeg, MB
Canada, R2X 2X6
Tel.: +204-632-9154
Fax: +204-632-8419
http://www.edaenv.ca

If you are unable to reach your Local Representative and have a TECHNICAL EMERGENCY, contact TROJAN TECHNOLOGIES' TECHNICAL ASSISTANCE CENTER:
Toll Free Phone: 1-866-388-0488
Email: TAC@Trojanuv.com

Document #: OM161100016	Completed By: MJU	Date: 23OC16
Customer Revision: A	Checked By: LG	Date: 23OC18
	Approved By: GK	Date: 23OC19

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PART

A

PROJECT & SYSTEM DESCRIPTION

PROJECT DESCRIPTION

Project Name	Iqaluit Replacement, NU
Trojan Project Number	161100016
Specification Section	Construction Services: Part V - Scope of Services
Total Peak Flow	8 MLD
Peak Flow / Chamber	4 MLD at Design UVT 75%
	8 MLD at Average Operating UVT 83%
Minimum Flow	1 MLD
Design Dose	3 Log Inactivation of Giardia and 3 Log Inactivation of Cryptosporidium
Percent Transmittance	Design UVT 83% Minimum at 253.7nm
Headloss	$\leq$ 23 mm for 4 MLD / per Chamber at Design UVT 75%
	$\leq$ 78 mm for 8 MLD / per Chamber at Average Operating UVT 83%

SYSTEM DESCRIPTION

Descriptions & Requirements

Control Power Panel (CPP)		Quantity: 2	Weight:	300lbs / 136kg
PLC Controller:	Allen Bradley CompactLogix L33ER			
Operator Interface:	Allen Bradley PanelView Plus 7 700, ENET and Touch Screen			
Lan Protocol:	Modbus TCP/IP			
Control Power Panel Material:	Mild Steel Grey			
Enclosure Rating:	Type 12			
Panel Mounting:	Wall			
Refer to CPP Drawings for Electrical and Component Details				

TrojanUVSwift™ UV Chamber		Quantity: 2	Dry Weight:	300lbs / 136kg
Number of UV Lamps per UV Chamber:	Four (4)		Wet Weight:	430lbs / 195kg
ActiClean™ Cleaning System (ACS):	Included			
UV Chamber Material:	316SSTL, Pickled and Passivated			
Enclosure Rating:	Type 6P			
Hydraulic Fitting Material:	316SST			
Inlet/Outlet Flange Size:	12" / 300Ø ANSI 150lbs			
Vent/Drain Size:	1½" / 38mm 3A Sanitary Fitting with ¾" / 19mm FNPT Adapter			
Number of Level Sensors:	One (1) per UV Chamber			
CPP to Chamber Cable Running Length:	6.1m (20 ft)			

AccUVSensor™ Double		Quantity: 4	Weight:	----
Number Required per UV Chamber:	Two (2)			
Sensor Sleeve Type:	Synthetic			

UV Reference Sensor Double		Quantity: 1	Weight:	----

UV Photometer		Quantity: 1	Weight:	----
Monitor Type:	Real Tech UV254 P200			
Refer to Manufacturer Information				

Operator Kit (Gloves, Face Shield, Warning Labels)		Quantity: 1	Weight:	----
Start-Up Provisions are Provided in Addition to the Operator Kit Quantities				

Spare Equipment

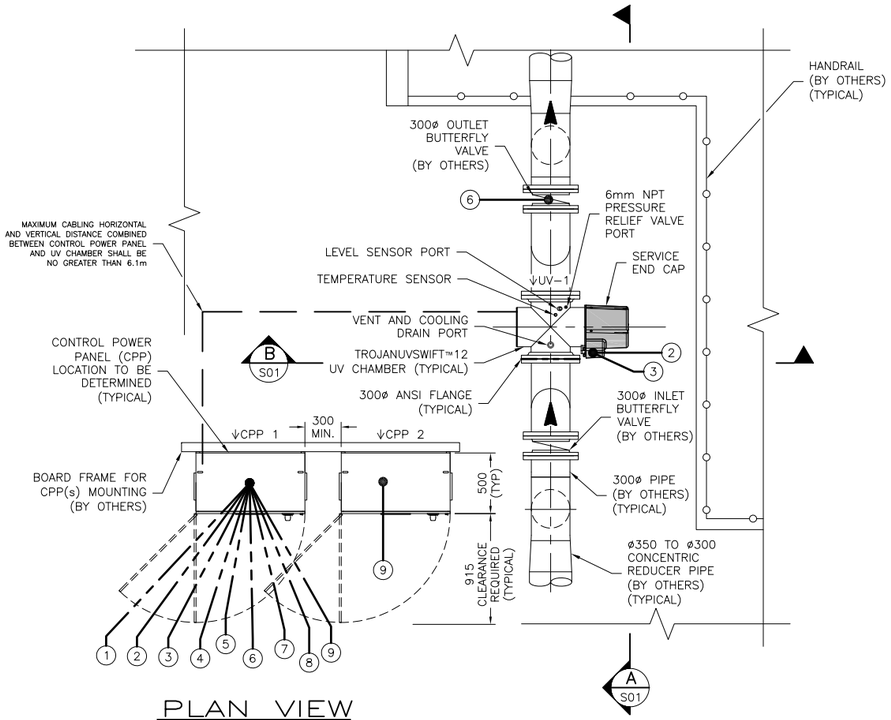
Spare UV Lamps	Quantity: 4
Spare UV Lamp / AccUVSensor Sleeves	Quantity: 6
Spare UV Sensor Double	Quantity: 2
Spare Lamp Mounting Gland Plate O-Ring (Lamp Gland Seals)	Quantity: 8
Spare Sensor Mounting Gland Plate O-Ring (Sensor Gland Seals)	Quantity: 8
Spare AccUVSensor™ Sleeve O-Ring (Sleeve Seals)	Quantity: 12
Spare Wiper Seals	Quantity: 20
ActiClean™ Gel (1 litre)	Quantity: 4
Face Shield	Quantity: 1

NSF 61 certification notes can be found at www.NSF.org under Product and Services listings for Trojan Technologies, Standard 060 and 061.

PART

B

LAYOUT DRAWINGS



PLAN VIEW

SCALE:AS SHOWN

NOTE: INTERCONNECTS SHOWN FOR ONE (1) UV TRAIN ARE TYPICAL FOR BOTH.

NOTES:

: ANCHOR BOLTS ARE NOT SUPPLIED BY TROJAN TECHNOLOGIES.
: SYSTEM CONDUIT, WIRING, DISTRIBUTION PANELS INTERCONNECTIONS BY OTHERS.
: ELECTRICAL REQUIREMENTS SHOWN ARE TO SUPPLY TROJAN UV EQUIPMENT ONLY. ELECTRICAL INRUSH FACTOR TO BE ADDED AS PER LOCAL CODE.
: CONTRACTOR TO REVIEW ALL TROJAN TECHNOLOGIES INSTALLATION INSTRUCTIONS PRIOR TO EQUIPMENT INSTALLATION.

UV CHAMBER NOTES:

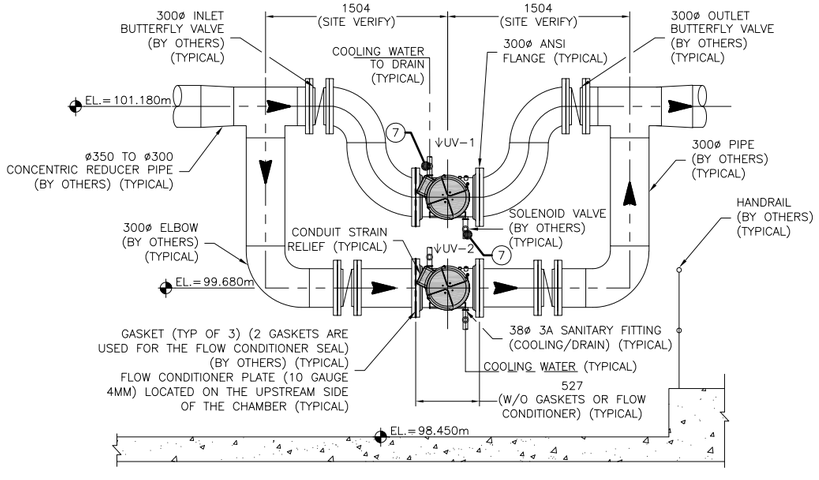
1. CHAMBER MATERIAL TO BE TYPE 316L STAINLESS STEEL.
2. MAXIMUM OPERATING PRESSURE TO BE 150 PSI (10 BAR).
3. TROJAN RECOMMENDS THAT VALVES ARE USED TO ISOLATE THE UV CHAMBER FROM PLANT FLOW FOR SERVICING. ALL VALVES ARE TO BE SUPPLIED BY OTHERS.
4. UV CHAMBER WEIGHT: DRY 136kg; WET 195 kg.

CONTROL POWER PANEL (CPP) NOTES:

1. CONTROL POWER PANEL TO BE E–COAT POWDER COATED RAL7035 (LIGHT GREY) OR SIMILAR. MATERIAL IS TO BE MILD STEEL, NEMA 12, VENTILATED.
2. PANEL IS TO BE WALL MOUNTED.
3. MAXIMUM CABLING DISTANCE BETWEEN CONTROL POWER PANEL AND UV CHAMBER SHALL BE NO GREATER THAN 6.1m AND WILL BE SUPPLIED WITH THE SYSTEM.
4. PANEL WEIGHT 136kg.

TROJAN UV SWIFT™
EQUIPMENT INTERCONNECTIONS

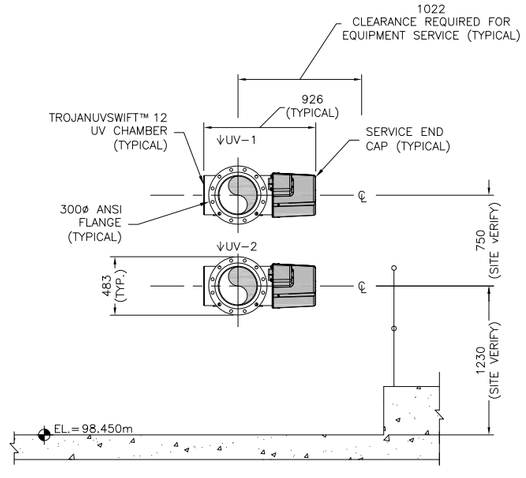
No.	DESCRIPTION	FROM	TO
1	CONTROL POWER PANEL (CPP) POWER SUPPLY 240Y/120V, 60Hz, 1 PHASE, 3 WIRE + GROUND 13.8 kVA UNBALANCED LOAD 60 AMPS MAXIMUM CURRENT / PHASE	DISTRIBUTION PANEL (DP) (BY OTHERS) (NOT SHOWN)	CPP OF PANEL (TOP)
2	UV CHAMBER POWER SUPPLY (CONTAINED WITHIN CONDUIT) (CONDUIT AND CABLING PROVIDED BY TROJAN)	CPP (UNDERSIDE OF PANEL)	UV CHAMBER
3	UV CHAMBER CONTROLS (CONTAINED WITHIN CONDUIT) (CONDUIT AND CABLING PROVIDED BY TROJAN)	CPP (UNDERSIDE OF PANEL)	UV CHAMBER
4	DISCRETE UV SYSTEM STATUS INFORMATION SYSTEM ON/OFF STATUS – 2 CONDUCTORS SYSTEM READY STATUS – 2 CONDUCTORS COMMON CRITICAL ALARM – 2 CONDUCTORS COMMON MAJOR ALARM – 2 CONDUCTORS COMMON MINOR ALARM – 2 CONDUCTORS REMOTE ON/OFF CONTROL – 2 CONDUCTORS	CPP	PLANT PLC (BY OTHERS) (NOT SHOWN)
5	FLOW METER 4–20mA DC ANALOG INPUT (BY OTHERS)	FLOW METER (BY OTHERS) (NOT SHOWN)	CPP
6	DISCRETE OUTLET VALVE OPEN CONTROL OUTPUT – 2 CONDUCTORS DISCRETE OUTLET VALVE CLOSE CONTROL OUTPUT – 2 CONDUCTORS DISCRETE OUTLET VALVE OPEN STATUS INPUT – 2 CONDUCTORS DISCRETE OUTLET VALVE CLOSE STATUS INPUT – 2 CONDUCTORS DISCRETE OUTLET VALVE LOCAL/REMOTE MODE INPUT – 2 CONDUCTORS	CPP CPP OUTLET VALVE (BY OTHERS) OUTLET VALVE (BY OTHERS) OUTLET VALVE (BY OTHERS)	OUTLET VALVE (BY OTHERS) OUTLET VALVE (BY OTHERS) CPP CPP CPP
7	DISCRETE COOLING WATER VALVE OPEN CONTROL OUTPUT – 2 CONDUCTORS	SCC	COOLING VALVE (BY OTHERS)
8	MODBUS TCP/IP COMMUNICATION	CPP 1	PLANT SCADA (BY OTHERS) (NOT SHOWN)
9	MODBUS TCP/IP COMMUNICATION	CPP 1	CPP 2



A SECTION

S01 SCALE:AS SHOWN

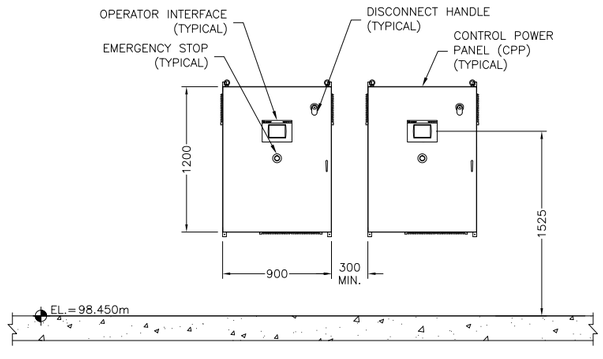
NOTE: CPP(s) AND PIPE SUPPORT (BY OTHERS) NOT SHOWN FOR CLARITY.



B SECTION

S01 SCALE:AS SHOWN

NOTE: PIPE BEYOND (BY OTHERS) AND PIPE SUPPORT (BY OTHERS) NOT SHOWN FOR CLARITY.



FRONT VIEW OF CPP(s)

SCALE:AS SHOWN

DESIGN CRITERIA		
	PEAK FLOW	8 MLD
	DOSE	3 LOG INACTIVATION OF CRYPTOSPORIDIUM 3 LOG INACTIVATION OF GIARDIA
	HEADLOSS	23mm AT 4 MLD / CHAMBER 78mm AT 8 MLD / CHAMBER
	U.V TRANSMITTANCE	75% DESIGN UVT 83 % AVERAGE OPERATING UVT

(1 DUTY, 1 REDUNDANT TRAIN AT AVERAGE OPERATING UVT 83%)
(2 DUTY TRAIN AT DESIGN UVT 75%)

TROJANUV™ A TROJAN TECHNOLOGIES BUSINESS

DESCRIPTION: LAYOUT, TROJANUVSWIFT 4L12 IQALUIT REPLACEMENT, NU

DRAWN BY : MC	DATE : 23MR07	QUOTE NO. 235603
CHECKED BY : SPM	DATE : 23MR09	PROJECT NO. 161100016
APPROVED BY : GK	DATE : 23MR09	DWG NO. S01 / REV. A
SCALE (11x17) : 1:50	LOG NUMBER : N/A	

PART

C

ELECTRICAL DRAWINGS

CONTROL POWER PANEL (CPP)

REV	REVISION DESCRIPTION	LOG NO.	REV'D BY	CHK'D BY	APPRV'D BY	DATE YYYY-MM-DD
A	RELEASE TO PRODUCTION	23-0324	CB	JK	AL	2023-04-04

MAIN SUPPLY SERVICE
240/120VAC 1ø 60Hz, 3WIRE+GND
13.8kVA, 60A MAX CURRENT PER ø
SCCR = 10kA @ 480VAC

N
L1
L2
GND

0102CB 80A SUPPLY LIMIT

WIRE COLOUR LEGEND			
SOURCE	COLOUR		
	L1	L2	N
AC POWER	BLACK	BLACK	WHITE
AC CONTROL	RED	RED	WHITE
24VDC	BLUE		
0VDC	WHITE/BLUE STRIPE		
GROUND	GREEN/YELLOW		
JUMPER	ORANGE		
INTERCONNECT	YELLOW		

01040 01041 01042

BALLAST POWER DISTRIBUTION BLOCKS

01041 6AWG BLK → (1) (L1) 0254CON (2) (T1) → 01070 6AWG BLK → 0136
01042 6AWG BLK → (3) (L2) (4) (T2) → 01080 6AWG BLK → 0136
(5) (L3) (6) (T3)

JUMPER
01042 14AWG BLK → 01142 14AWG BLK → 0200

JUMPER
01040 14AWG WHT → 01161 14AWG WHT → 0200

240VAC
0107 0108
01070 01080

0141CB 20A
01070 12AWG BLK → 01410 12AWG BLK
01080 12AWG BLK → 01420 12AWG BLK
0141BLST BALLAST #1
CABLE CAB_B1
OES#703x PORT B1
BLACK / WHITE
CABLE 0141A
NC
TR8
01411
01421
GND
CABLE 0141B
NC
LAMP#1 2.925kW

LOCATED AT REACTOR (INSTALLED BY TROJAN)

0149CB 20A
01070 12AWG BLK → 01490 12AWG BLK
01080 12AWG BLK → 01500 12AWG BLK
0149BLST BALLAST #2
CABLE CAB_B2
OES#703x PORT B2
BLACK / WHITE
CABLE 0149A
NC
01491
01501
GND
CABLE 0149B
NC
LAMP#2 2.925kW

0157CB 20A
01070 12AWG BLK → 01570 12AWG BLK
01080 12AWG BLK → 01580 12AWG BLK
0157BLST BALLAST #3
CABLE CAB_B3
OES#703x PORT B3
BLACK / WHITE
CABLE 0157A
NC
01571
01581
GND
CABLE 0157B
NC
LAMP#3 2.925kW

0165CB 20A
01070 12AWG BLK → 01650 12AWG BLK
01080 12AWG BLK → 01660 12AWG BLK
0165BLST BALLAST #4
CABLE CAB_B4
OES#703x PORT B4
BLACK / WHITE
CABLE 0165A
NC
01651
01661
GND
CABLE 0165B
NC
LAMP#4 2.925kW

NOTES:
1. ELECTRICAL ASSEMBLY TO BE ASSEMBLED UNDER UL508A AND THE MINIMUM REQUIREMENTS OUTLINED IN ES0127. WHERE THERE IS A CONFLICT BETWEEN THIS DOCUMENT AND THE REQUIREMENTS OF ES0127, THE INFORMATION PRESENTED IN THIS DOCUMENT WILL BE USED.
2. ENCLOSURE ENVIRONMENTAL RATING – UL TYPE 12

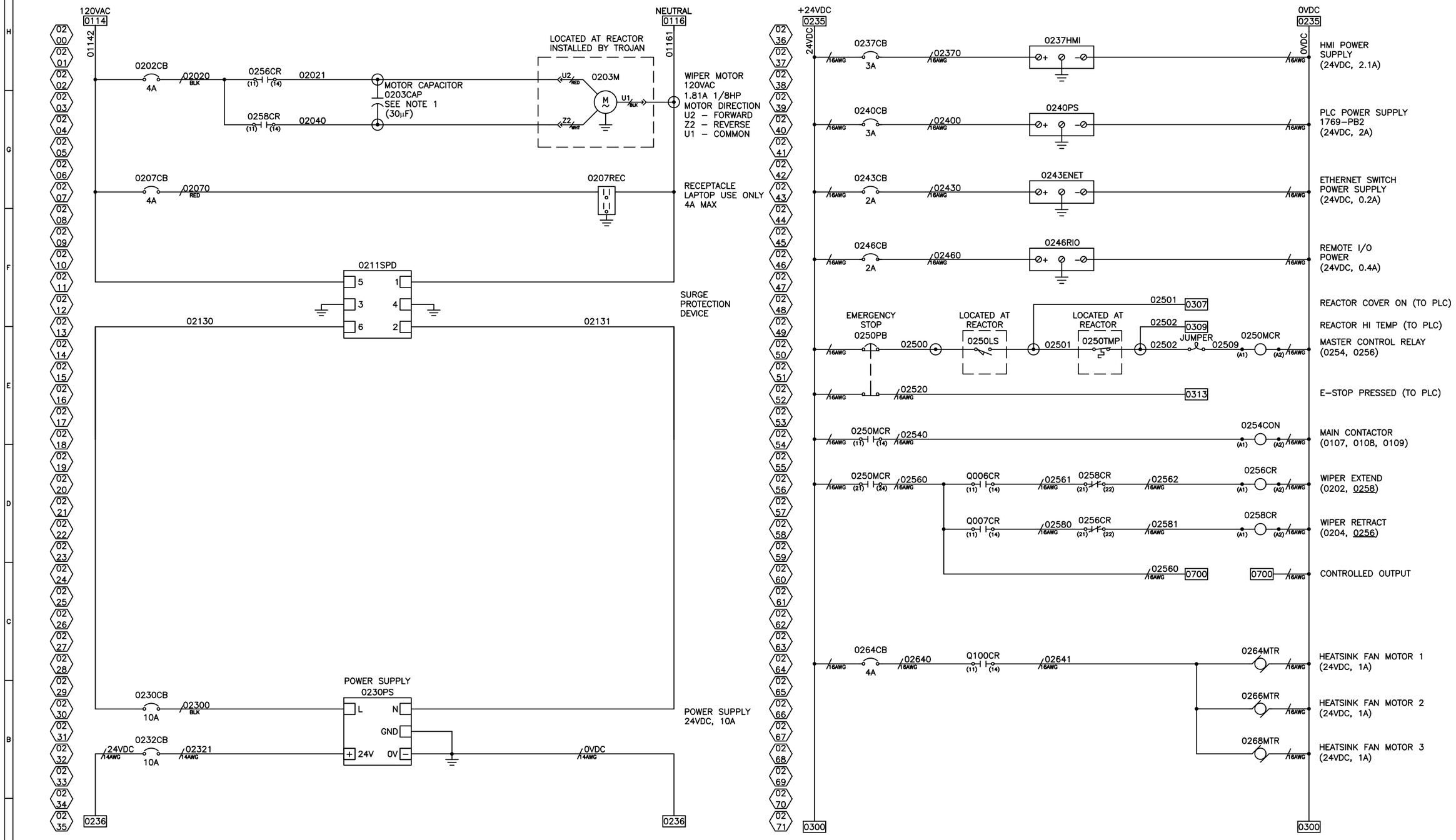
UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
TOLERANCES: 2 PL DEC ± N/A
3 PL DEC ± N/A
ANGLE DEG ± N/A
REMOVE ALL BURRS, ALL CORNERS
R 0.010 OR BREAK EDGE
▷ – CRITICAL CHARACTERISTIC

TROJANUV
3020 GORE ROAD, LONDON, ONTARIO, CANADA, N5V 4T7

DESCRIPTION
CPP ASSY, UVSW12 IQALUIT NU
POWER AND HARDWIRE SCHEMATIC

THIRD ANGLE PROJECTION
0 0.5 1.0
1.0" ON ORIGINAL DWG
SCALE: NTS

DWG NO. 829827
REV A
SHEET 01 OF 15
SIZE D



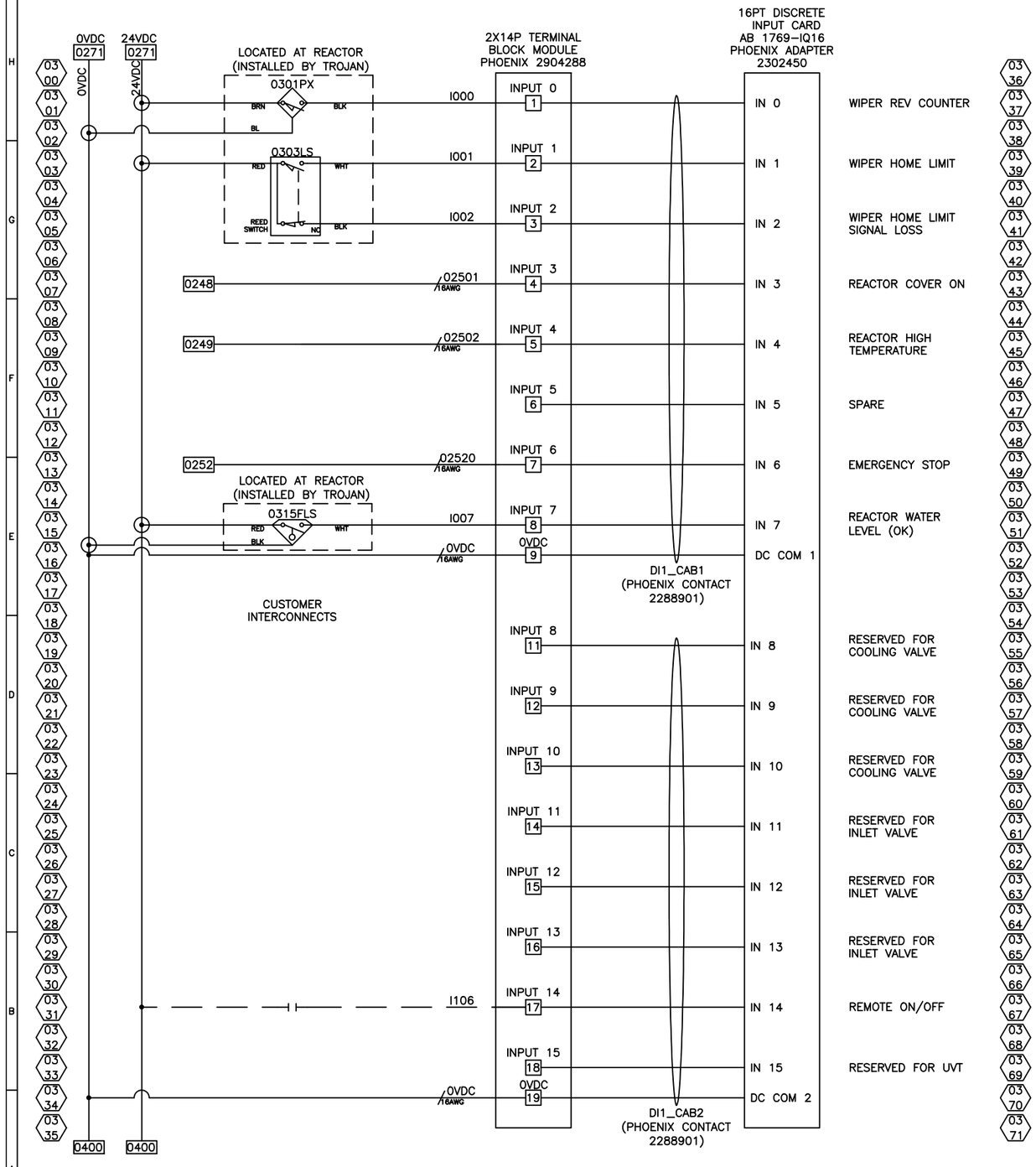
NOTES:
1) MOTOR CAPACITOR TO BE INSTALLED AT TROJAN.

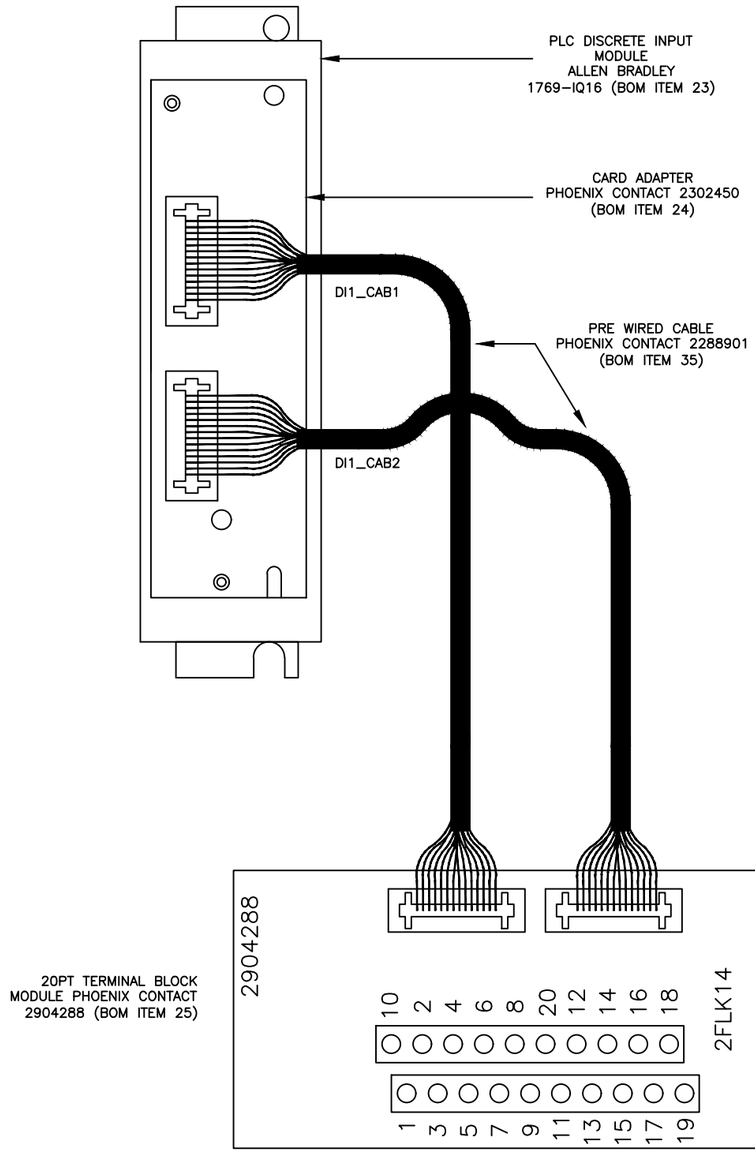
TROJANUV
3020 GORE ROAD, LONDON, ONTARIO, CANADA, N5V 4T7

DESCRIPTION: CPP ASSY, UVSW12 IQALUIT NU
POWER AND CONTROLS SCHEMATIC

REVISED BY	CB	DWG NO.	REV
CHECKED BY	JK	829827	A
APPROVED BY	AL		
APPROVAL DATE YYYY-MM-DD	2023-04-04	SHEET 02 OF 15	SIZE D

0 0.5 1.0
1.0" ON ORIGINAL DWG
SCALE: NTS





20PT TERMINAL BLOCK
MODULE PHOENIX CONTACT
2904288 (BOM ITEM 25)

TROJANUV
3020 GORE ROAD, LONDON, ONTARIO, CANADA, N5V 4T7

DESCRIPTION: CPP ASSY, UVSW12 IQALUIT NU
PLC 16 POINT DISCRETE INPUT CARD 1

REVISED BY	CR
CHECKED BY	JK
APPROVED BY	AL
APPROVAL DATE YYYY-MM-DD	2023-04-04
DWG NO.	829827
REV	A
SHEET	03 OF 15
SIZE	D
SCALE:	NTS

0 0.5 1.0
1.0" ON ORIGINAL DWG

0VDC 0335
24VDC 0335
0VDC
24VDC
0500
0500

2X14P BLOCK MODULE PHOENIX 2904288

16PT DISCRETE INPUT CARD AB 1769-IQ16 PHOENIX ADAPTER 2302450

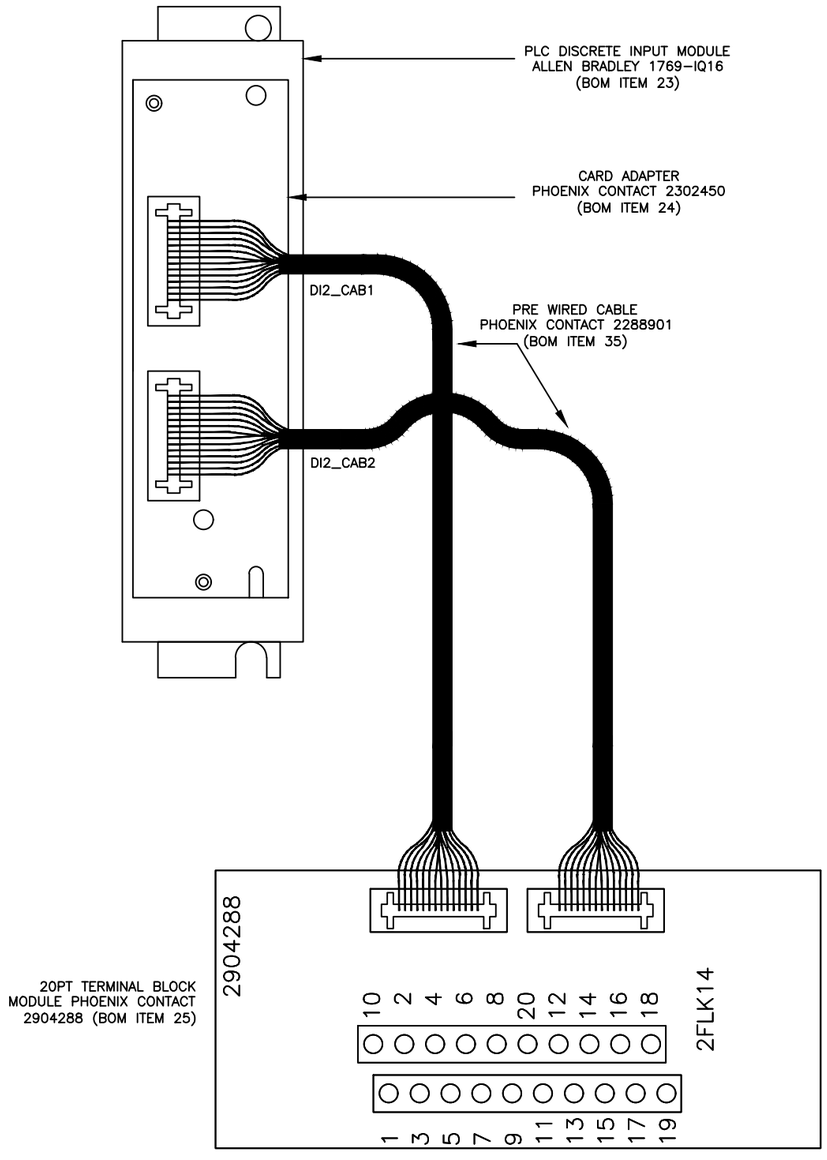
CUSTOMER INTERCONNECTS

I203	INPUT 3 [4]	IN 3	OUTLET VALVE OPEN	04 43
I204	INPUT 4 [5]	IN 4	OUTLET VALVE CLOSED	04 45
I205	INPUT 5 [6]	IN 5	OUTLET VALVE READY	04 47
	INPUT 0 [1]	IN 0	SPARE	04 36
	INPUT 1 [2]	IN 1	SPARE	04 37
	INPUT 2 [3]	IN 2	SPARE	04 38
	INPUT 6 [7]	IN 6	RESERVED	04 49
	INPUT 7 [8]	IN 7	RESERVED	04 51
	0VDC [9]	DC COM 1		04 52
	INPUT 8 [11]	IN 8	SPARE	04 55
	INPUT 9 [12]	IN 9	SPARE	04 57
	INPUT 10 [13]	IN 10	SPARE	04 59
	INPUT 11 [14]	IN 11	SPARE	04 61
	INPUT 12 [15]	IN 12	SPARE	04 63
	INPUT 13 [16]	IN 13	SPARE	04 65
	INPUT 14 [17]	IN 14	SPARE	04 67
	INPUT 15 [18]	IN 15	SPARE	04 69
	0VDC [19]	DC COM 2		04 70

16AWG

DI2_CAB1 (PHOENIX CONTACT 2288901)

DI2_CAB2 (PHOENIX CONTACT 2288901)



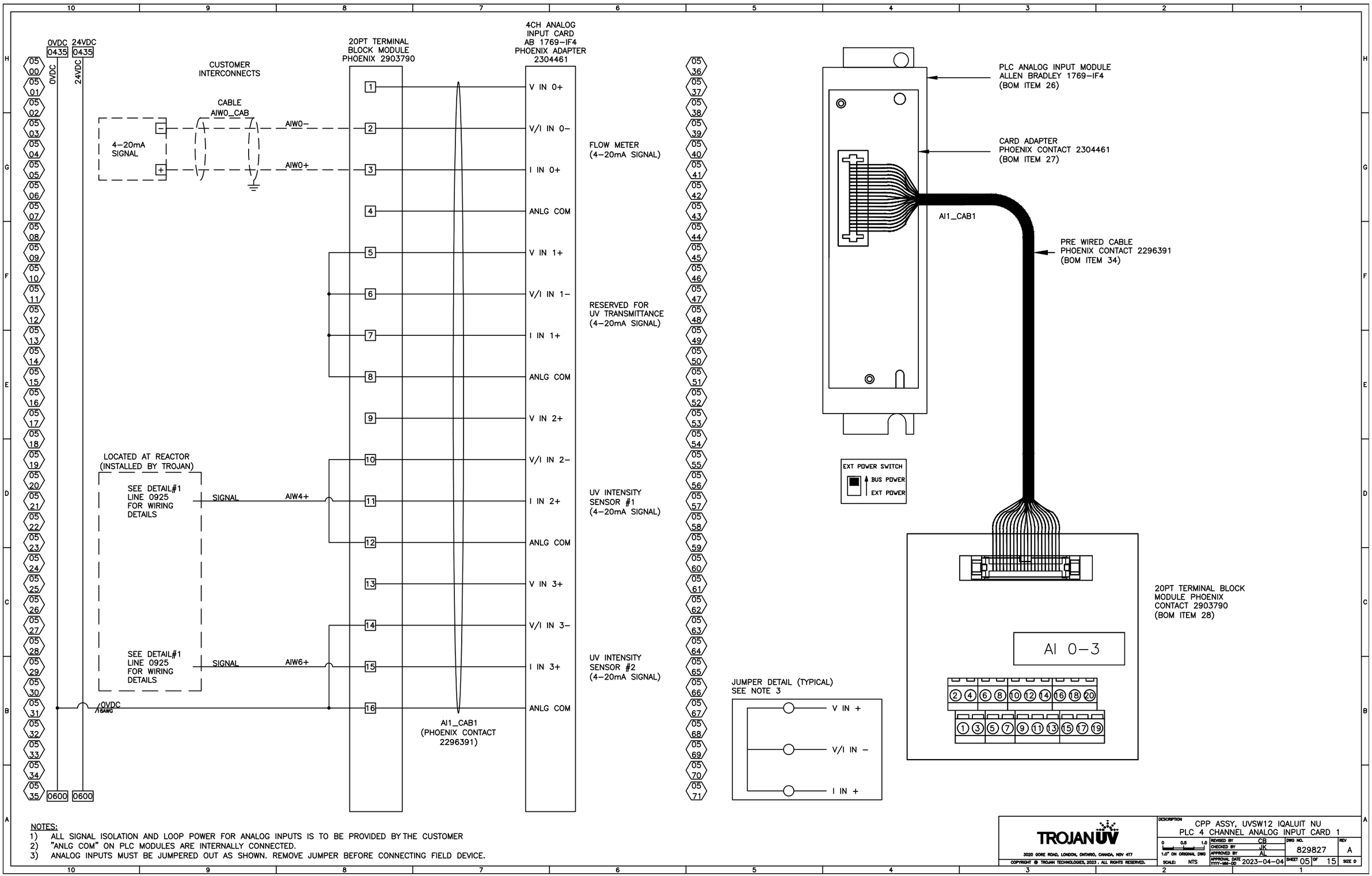
20PT TERMINAL BLOCK MODULE PHOENIX CONTACT 2904288 (BOM ITEM 25)

TROJANUV
3020 GORE ROAD, LONDON, ONTARIO, CANADA, N5V 4T7

DESCRIPTION: CPP ASSY, UVSW12 IQALUIT NU
PLC 16 POINT DISCRETE INPUT CARD 2

REVISED BY	CB
CHECKED BY	JK
APPROVED BY	AL
APPROVAL DATE YYYY-MM-DD	2023-04-04
DWG NO.	829827
REV	A
SHEET	04 OF 15
SIZE	D
SCALE:	NTS

1.0" ON ORIGINAL DWG (0 0.5 1.0)



NOTES:
1) ALL SIGNAL ISOLATION AND LOOP POWER FOR ANALOG INPUTS IS TO BE PROVIDED BY THE CUSTOMER
2) "ANLG COM" ON PLC MODULES ARE INTERNALLY CONNECTED.
3) ANALOG INPUTS MUST BE JUMPERED OUT AS SHOWN. REMOVE JUMPER BEFORE CONNECTING FIELD DEVICE.

TROJAN UV
3020 GORE ROAD, LONDON, ONTARIO, CANADA, N5V 4T7

DESCRIPTION: CPP ASSY, UVSW12 IQALUIT NU
PLC 4 CHANNEL ANALOG INPUT CARD 1

REVISED BY	CB	DWG NO.	REV
CHECKED BY	JK	829827	A
APPROVED BY	AL		
APPROVAL DATE YYYY-MM-DD	2023-04-04	SHEET 05 OF 15	SIZE D

SCALE: NTS
1.0" ON ORIGINAL DWG

0VDC 0535
24VDC 0535

20PT TERMINAL BLOCK MODULE PHOENIX 2903790

4CH ANALOG INPUT CARD AB 1769-IF4 PHOENIX ADAPTER 2304461

LOCATED AT REACTOR (INSTALLED BY TROJAN)

SEE DETAIL#1 LINE 0925 FOR WIRING DETAILS — SIGNAL — AIW8+

SEE DETAIL#1 LINE 0925 FOR WIRING DETAILS — SIGNAL — AIW10+

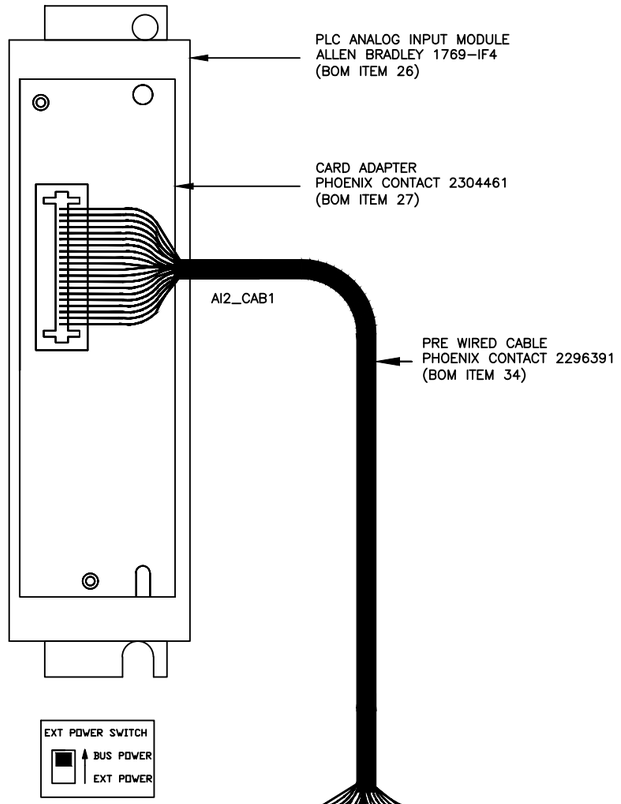
1	V IN 0+	
2	V/I IN 0−	
3	I IN 0+	UV INTENSITY SENSOR #3 (4−20mA SIGNAL)
4	ANLG COM	
5	V IN 1+	
6	V/I IN 1−	
7	I IN 1+	UV INTENSITY SENSOR #4 (4−20mA SIGNAL)
8	ANLG COM	
9	V IN 2+	
10	V/I IN 2−	SPARE (4−20mA SIGNAL)
11	I IN 2+	
12	ANLG COM	
13	V IN 3+	
14	V/I IN 3−	SPARE (4−20mA SIGNAL)
15	I IN 3+	
16	ANLG COM	

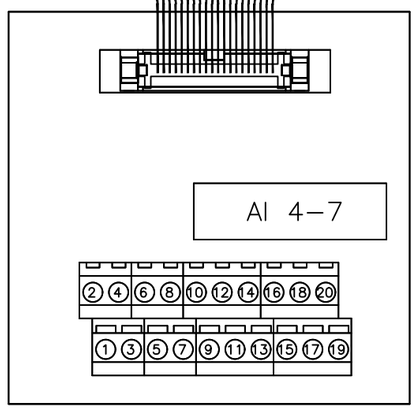
0VDC /16AWG

AI2_CAB1 (PHOENIX CONTACT 2296391)

JUMPER DETAIL (TYPICAL) SEE NOTE 3

V IN +
V/I IN −
I IN +





20PT TERMINAL BLOCK MODULE PHOENIX CONTACT 2903790 (BOM ITEM 28)

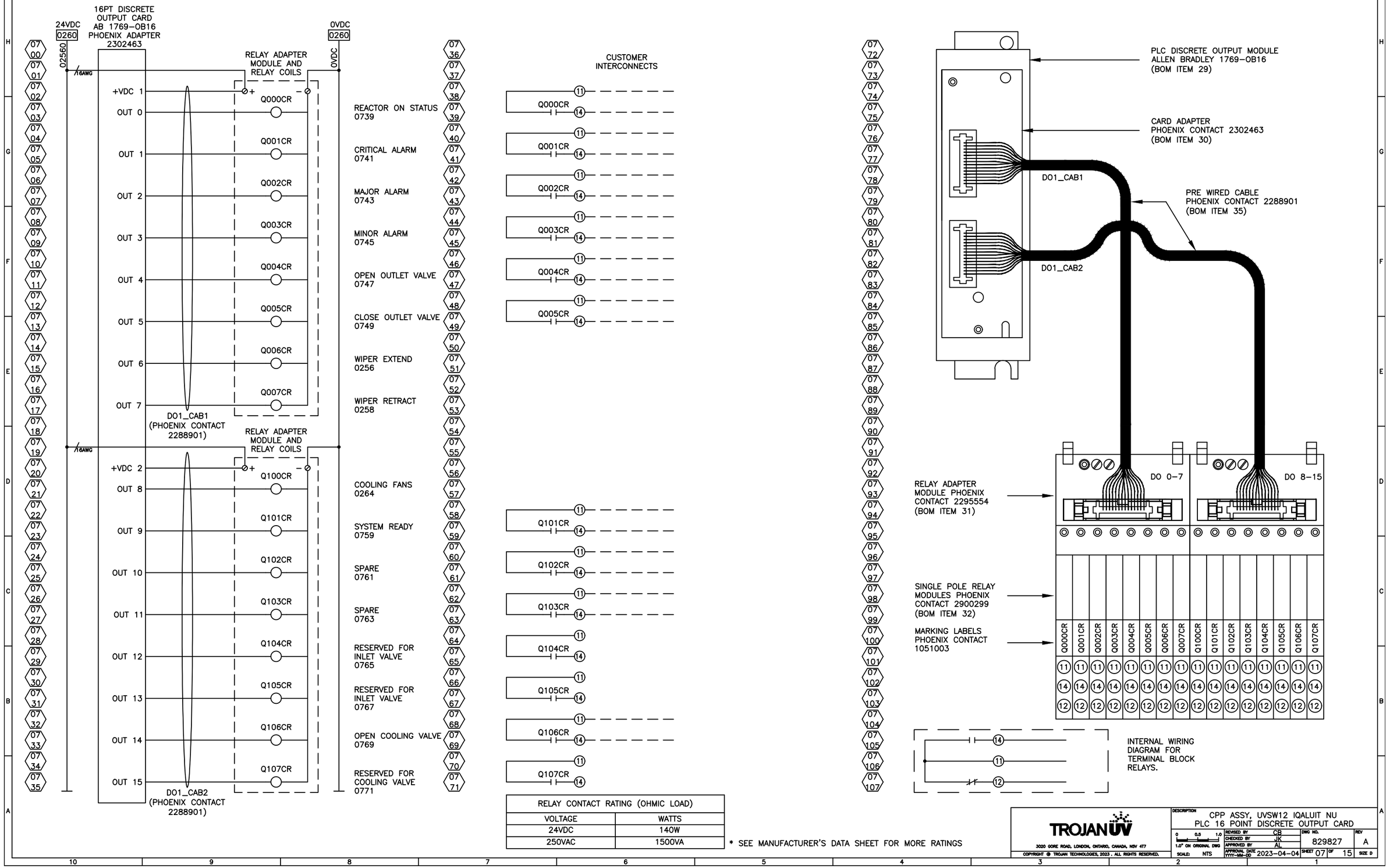
NOTES:
1) ALL SIGNAL ISOLATION AND LOOP POWER FOR ANALOG INPUTS IS TO BE PROVIDED BY THE CUSTOMER
2) "ANLG COM" ON PLC MODULES ARE INTERNALLY CONNECTED.
3) ANALOG INPUTS MUST BE JUMPERED OUT AS SHOWN. REMOVE JUMPER BEFORE CONNECTING FIELD DEVICE.

TROJAN UV
3020 GORE ROAD, LONDON, ONTARIO, CANADA, N5V 4T7

DESCRIPTION: CPP ASSY, UVSW12 IQALUIT NU
PLC 4 CHANNEL ANALOG INPUT CARD 2

REVISED BY	CB	DWG NO.	REV
CHECKED BY	JK	829827	A
APPROVED BY	AL		
APPROVAL DATE (YYYY-MM-DD)	2023-04-04	SHEET 06 OF 15	SIZE D

0 0.5 1.0
1.0" ON ORIGINAL DWG
SCALE: NTS



RELAY CONTACT RATING (OHMIC LOAD)	
VOLTAGE	WATTS
24VDC	140W
250VAC	1500VA

* SEE MANUFACTURER'S DATA SHEET FOR MORE RATINGS

TROJANUV
3020 GORE ROAD, LONDON, ONTARIO, CANADA, N5V 4T7

DESCRIPTION: CPP ASSY, UVSW12 IQALUIT NU
PLC 16 POINT DISCRETE OUTPUT CARD

REVISED BY	CB
CHECKED BY	JK
APPROVED BY	AL
APPROVAL DATE YYYY-MM-DD	2023-04-04
DWG NO.	829827
REV	A
SHEET	07 OF 15
SIZE	D
SCALE:	NTS

0 0.5 1.0
1.0" ON ORIGINAL DWG

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RESERVED FOR FUTURE DEVELOPMENT OR EXPANSION

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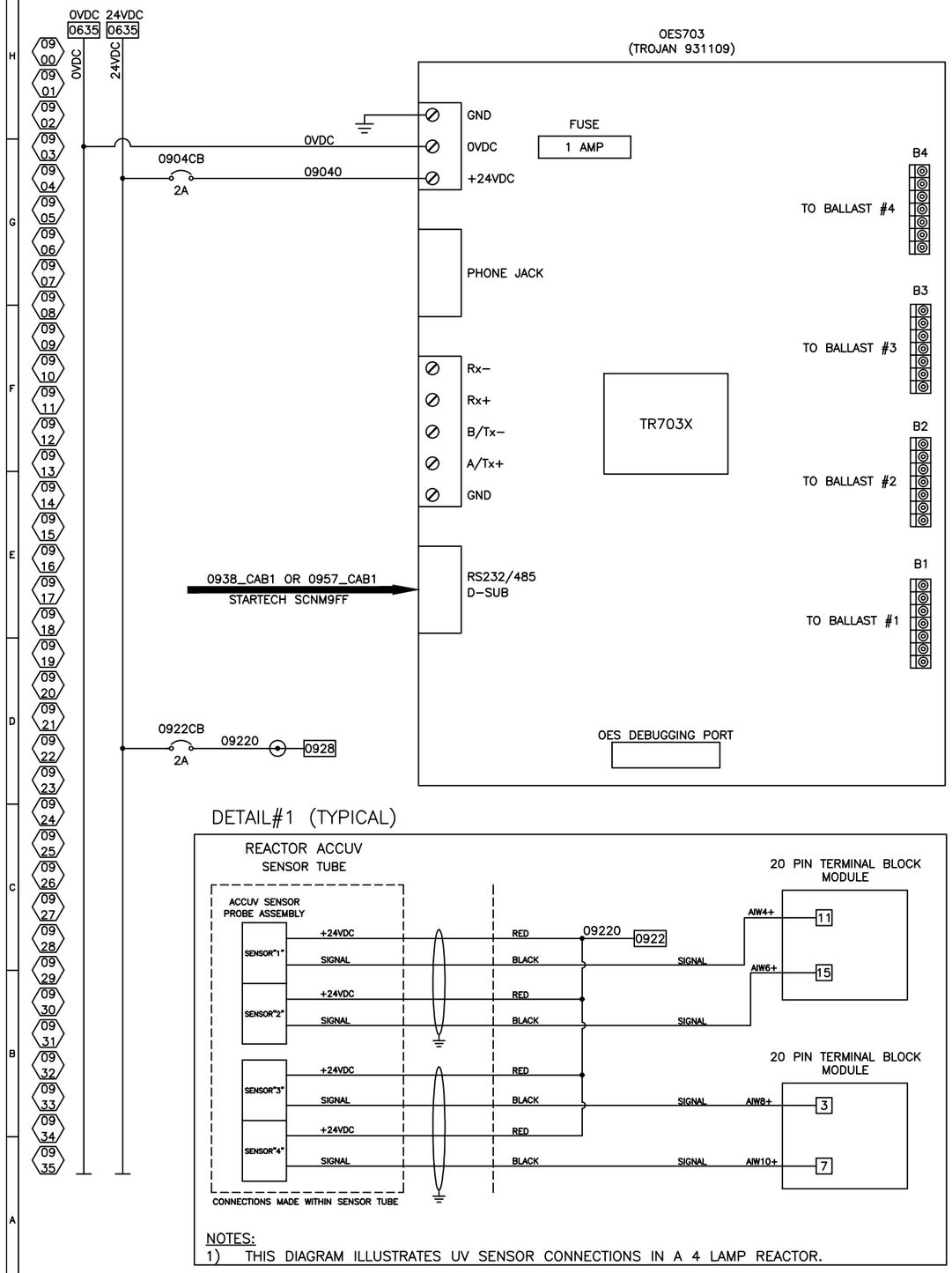
TROJAN UV
3020 GORE ROAD, LONDON, ONTARIO, CANADA, N5V 4T7

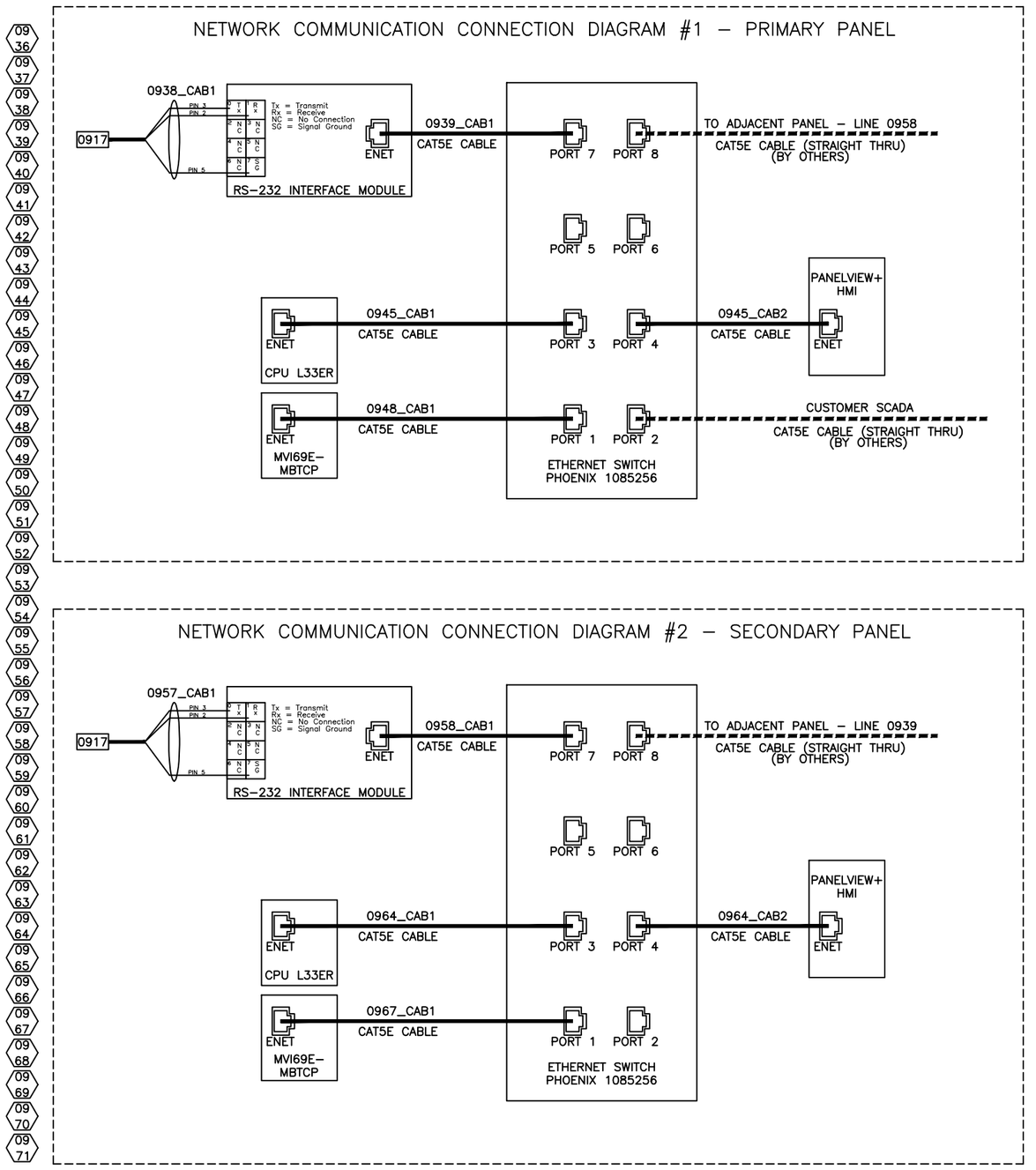
DESCRIPTION: CPP ASSY, UVSW12 IQALUIT NU FUTURE EXPANSION
0 0.5 1.0
1.0" ON ORIGINAL DWG
SCALE: NTS
REVISED BY: CB
CHECKED BY: JK
APPROVED BY: AL
APPROVAL DATE YYYY-MM-DD: 2023-04-04
DWG NO.: 829827
REV: A
SHEET 08 OF 15
SIZE D



DETAIL#1 (TYPICAL)

NOTES:

1) THIS DIAGRAM ILLUSTRATES UV SENSOR CONNECTIONS IN A 4 LAMP REACTOR.



TROJANUV

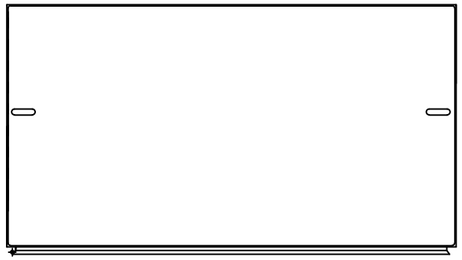
3020 GORE ROAD, LONDON, ONTARIO, CANADA, N5V 4T7

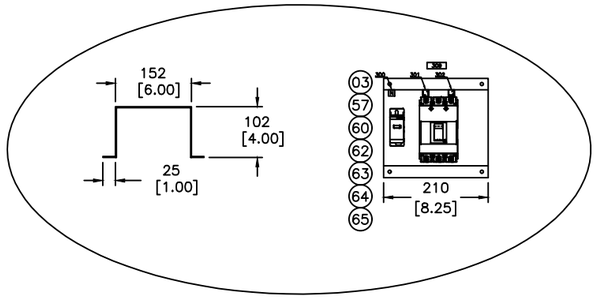
DESCRIPTION: CPP ASSY, UVSW12 IQALUIT NU
SENSOR AND COMMUNICATIONS SCHEMATIC

REVISED BY	CR	DWG NO.	REV
CHECKED BY	JK	829827	A
APPROVED BY	AL		
APPROVAL DATE (YYYY–MM–DD)	2023–04–04	SHEET 09 OF 15	SIZE D

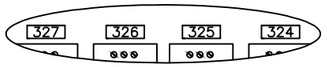
0 0.5 1.0
1.0" ON ORIGINAL DWG
SCALE: NTS

TOP VIEW



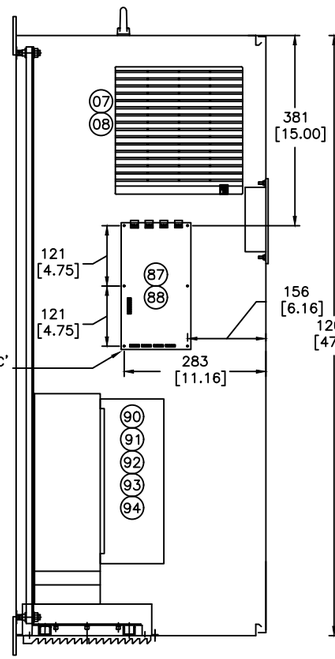


DETAIL 'A'
TOP HAT BRACKET

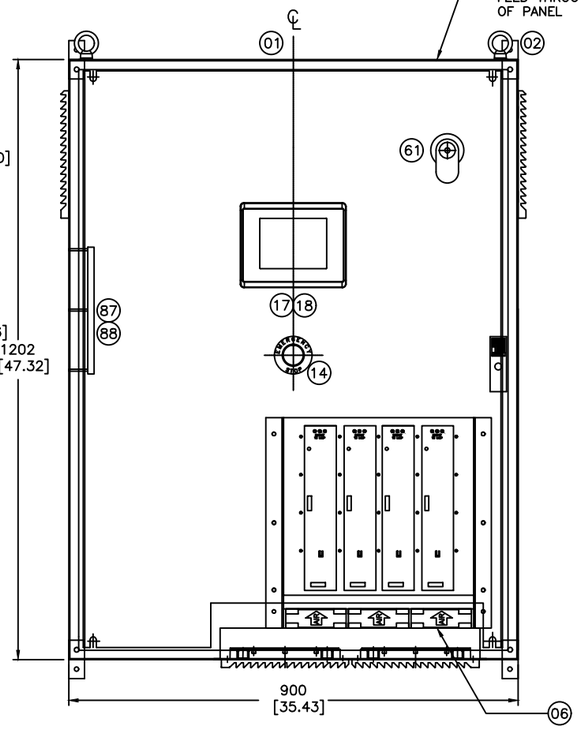


DETAIL 'B'
BALLAST LABELS
(2X SCALE)

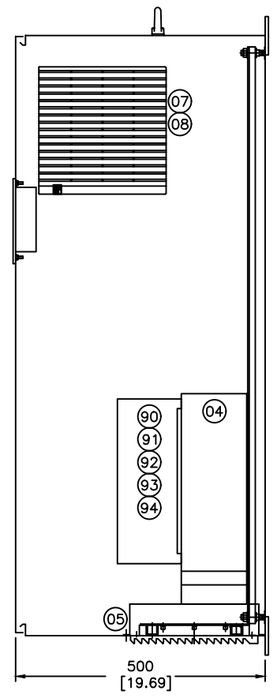
LEFT SIDE VIEW



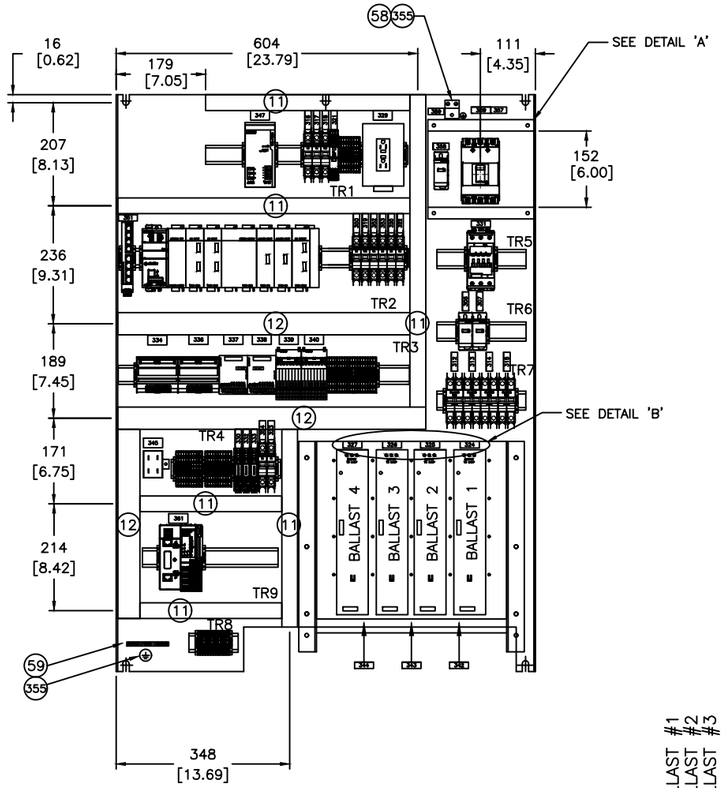
FRONT VIEW

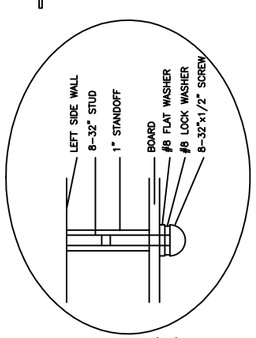


RIGHT SIDE VIEW



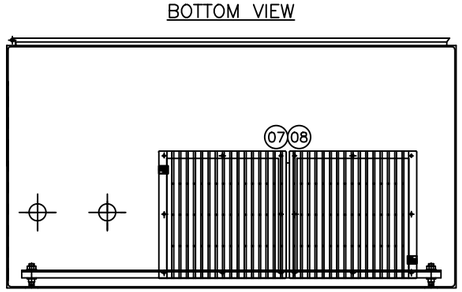
BACK PANEL LAYOUT





DETAIL 'C'
BOARD MOUNTING

BOTTOM VIEW



BALLAST #1
BALLAST #2
BALLAST #3
BALLAST #4
ENCLOSURE
SPARE
SPARE
CHAMBER

MAIN GROUND BAR

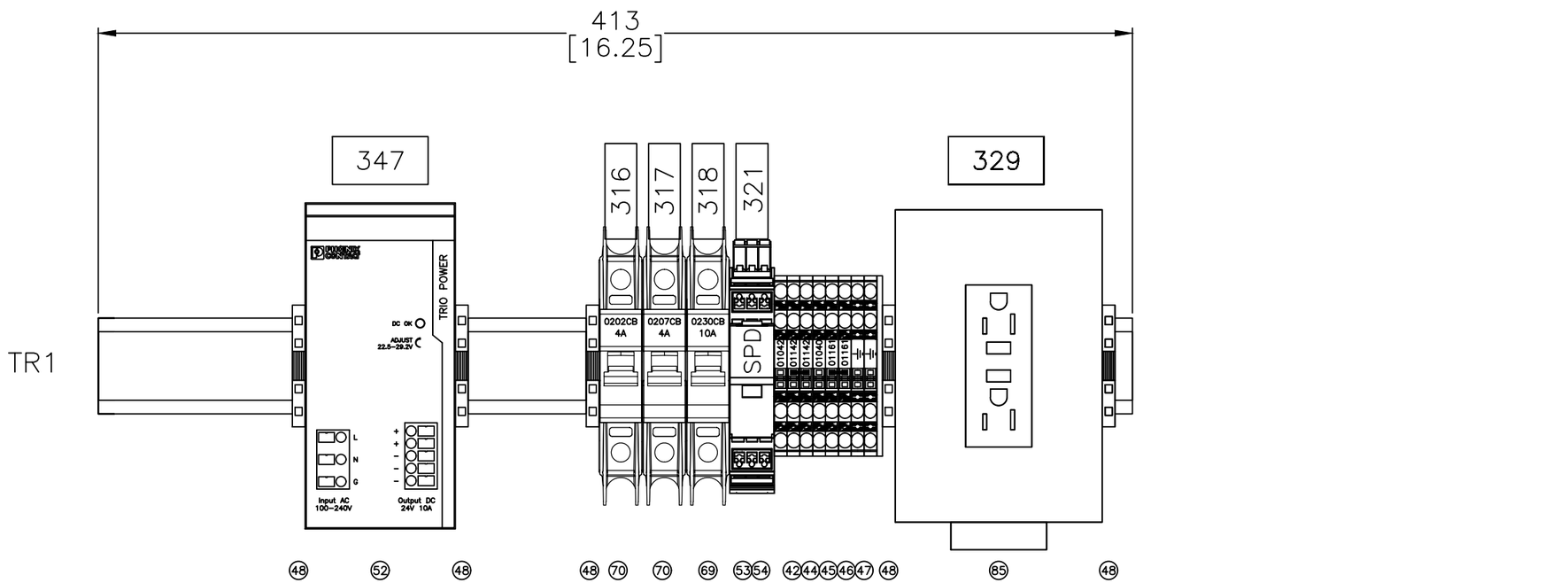
NOTES:
1) PANEL TO BE ASSEMBLED AS PER GUIDELINES STATED IN ES0127.
2) RUN ALL WIRING FROM DISTRIBUTION BLOCKS TO BALLASTS OUTSIDE OF WIRING DUCT.
3) RUN ALL WIRING FROM BALLASTS TO TR8 OUTSIDE OF WIRING DUCT.
4) ALL DIMENSION ARE IN mm [INCHES] UNLESS OTHERWISE SPECIFIED.
5) INSTALL ALL CONTROL CABLES (BOM ITEMS 87, 93 AND 94) FROM DOSIMETER BOARD TO BALLASTS OUTSIDE WIREDUCT ON THE LEFT SIDE OF PANEL. DO NOT INSTALL IN THIS DUCT, WIRES FROM ANY 120V CIRCUIT.
6) STARTER CAPACITOR TO BE SCREW MOUNTED.

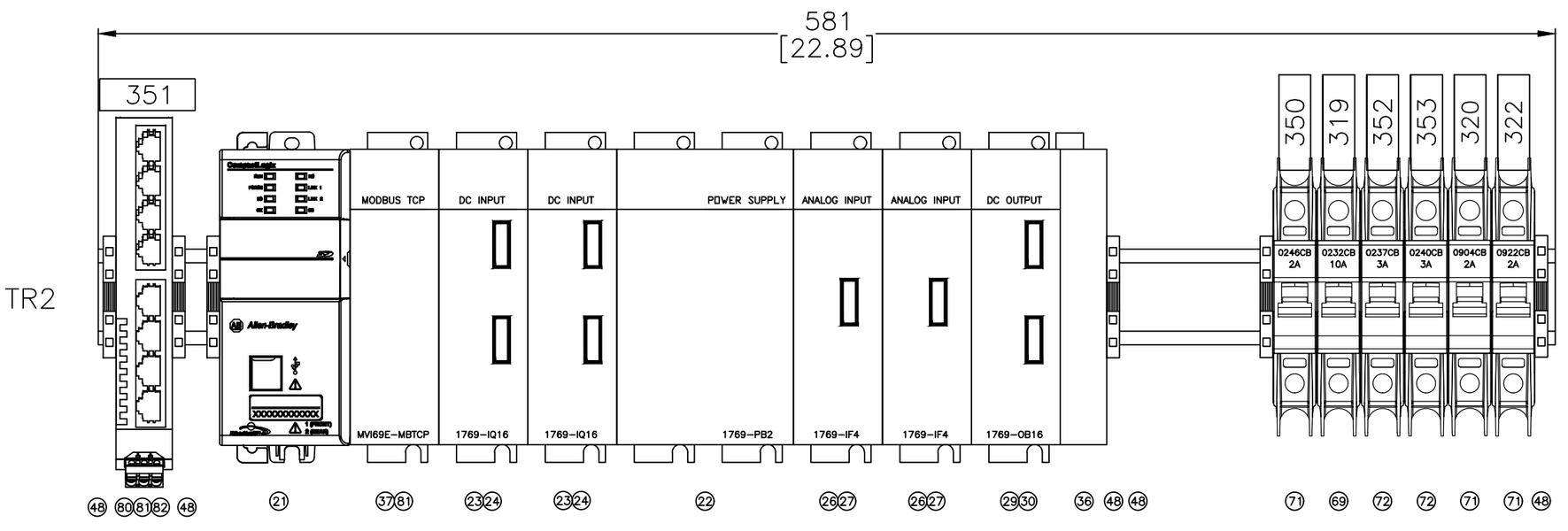
TROJAN UV
3020 GORE ROAD, LONDON, ONTARIO, CANADA, N5V 4T7

DESCRIPTION: CPP ASSY, UVSW12 IQALUIT NU
PANEL LAYOUT DRAWING

REVISED BY	CB	DWG NO.	REV
CHECKED BY	JK	829827	A
APPROVED BY	AL		
APPROVAL DATE (YYYY-MM-DD)	2023-04-04	SHEET 10 OF 15	SIZE D

0 0.5 1.0
1.0" ON ORIGINAL DWG
SCALE: NTS





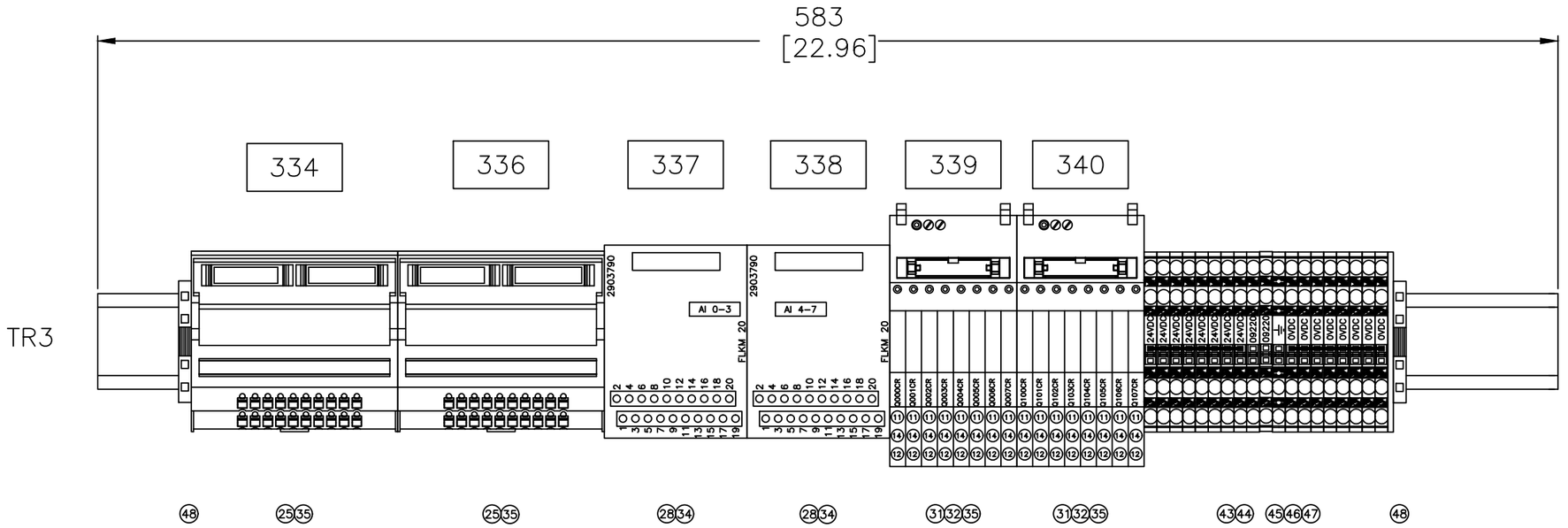
NOTES:
1) ALL DIMENSION ARE IN mm [INCHES] UNLESS OTHERWISE SPECIFIED.

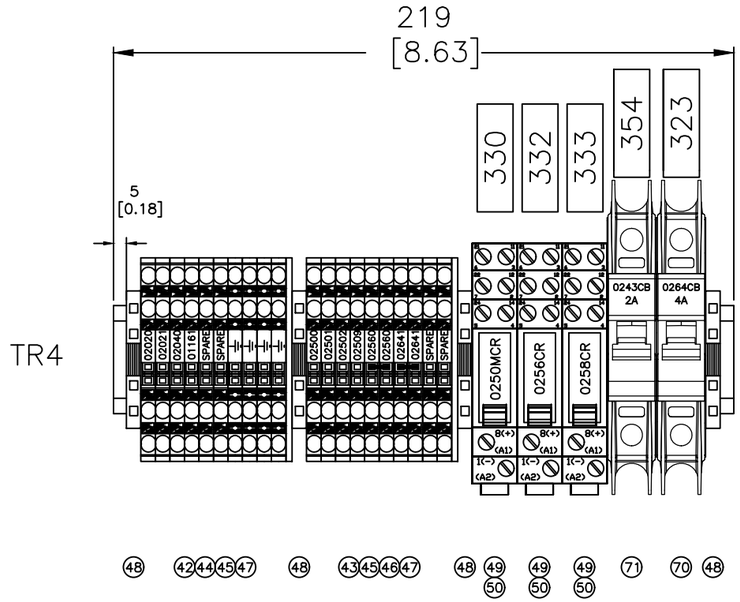
TROJAN UV
3020 GORE ROAD, LONDON, ONTARIO, CANADA, N5V 4T7

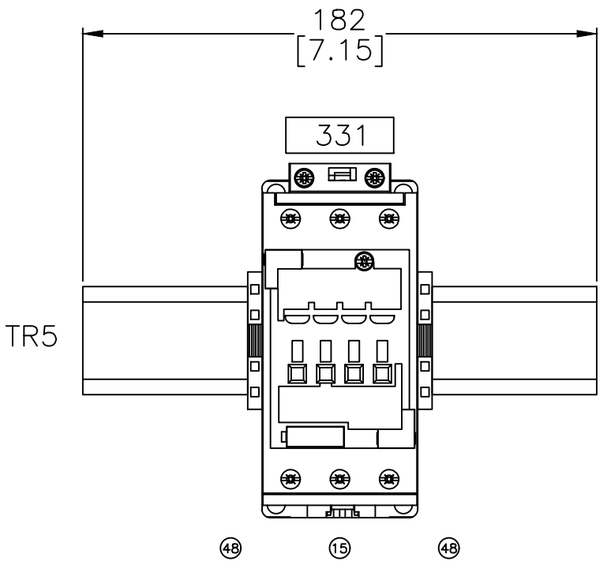
DESCRIPTION: CPP ASSY, UVSW12 IQALUIT NU
TERMINAL RAIL 1 & 2 DETAIL

REVISED BY	CB
CHECKED BY	JK
APPROVED BY	AL
APPROVAL DATE YYYY-MM-DD	2023-04-04
DWG NO.	829827
REV	A
SCALE:	NTS
SHEET	11 OF 15
SIZE	D

0 0.5 1.0
1.0" ON ORIGINAL DWG







NOTES:
1) ALL DIMENSION ARE IN mm [INCHES] UNLESS OTHERWISE SPECIFIED.

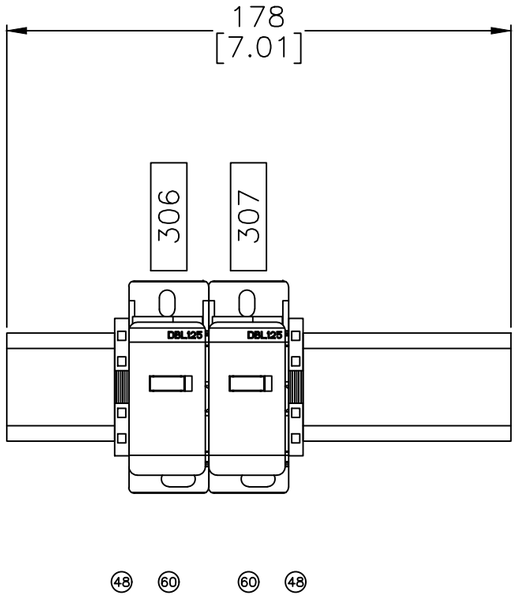
TROJANUV
3020 GORE ROAD, LONDON, ONTARIO, CANADA, N5V 4T7

DESCRIPTION: CPP ASSY, UVSW12 IQALUIT NU
TERMINAL RAIL 3, 4 & 5 DETAIL

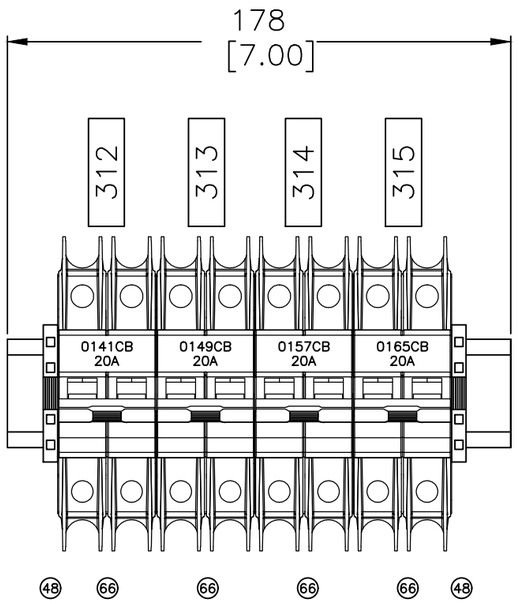
REVISED BY	CB	DWG NO.	REV
CHECKED BY	JK	829827	A
APPROVED BY	AL		
APPROVAL DATE (YYY-MM-DD)	2023-04-04	SHEET 12 OF 15	SIZE D

0 0.5 1.0
1.0" ON ORIGINAL DWG
SCALE: NTS

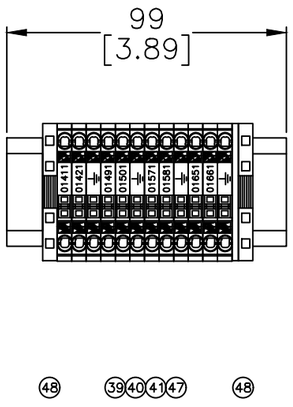
TR6



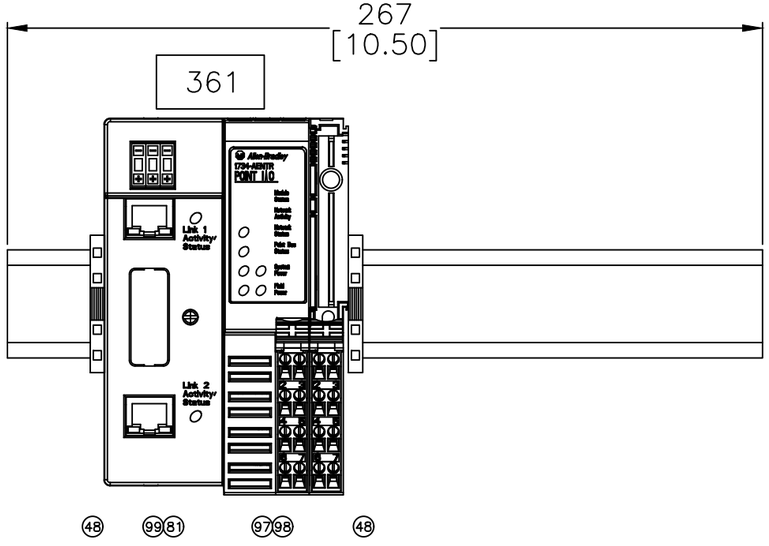
TR7



TR8



TR9



NOTES:
1) MANUFACTURERS TO WIRE TO TOP OF TERMINAL RAIL 8 (TR8). BOTTOM CONNECTION POINTS ARE TO BE RESERVED FOR LAMP WIRING TO THE REACTOR.
2) ALL DIMENSION ARE IN mm [INCHES] UNLESS OTHERWISE SPECIFIED.

TROJANUV
3020 GORE ROAD, LONDON, ONTARIO, CANADA, N5V 4T7

DESCRIPTION: CPP ASSY, UVSW12 IQALUIT NU
TERMINAL RAIL 6, 7 ,8 & 9 DETAIL

REVISED BY	CB	DWG NO.	REV
CHECKED BY	JK	829827	A
APPROVED BY	AL		
APPROVAL DATE YYYY-MM-DD	2023-04-04	SHEET 13 OF 15	SIZE D

0 0.5 1.0
1.0" ON ORIGINAL DWG
SCALE: NTS

NOTE:

1. ITEM #08 IS TO BE INCLUDED ON ITEM 01–ENCLOSURE, SW 12 WM SERIES 828987.
   ITEM #07 FINE MATS WILL COME IN PACKAGES OF 5.
2. SD CARD THAT IS INCLUDED WITH THE PLC CPU TO BE LEFT IN THE CPU SD CARD SLOT
3. ITEM #18 TO BE INSERTED IN HMI SD CARD SLOT.
4. USE APPROPRIATE NUMBER POSITION TERMINAL BLOCK JUMPERS.
5. TROJAN ONLY: REFERENCE LABEL BATTERY COMPONENT LIST ES0684 FOR BATTERY LABEL APPLICATION

6. ACCORDING TO UL 508A, SECTION 54, ALL FIELD WIRING CONDUCTORS, EXTERNAL TO THE PANEL SHALL BE "COPPER CONDUCTORS ONLY" AND TEMPERATURE RATINGS FOR THE FIELD WIRING CONDUCTORS
RATED LESS THAN 100 AMPS SHALL BE 75°C (167°F).
REFER THE FOLLOWING BELOW MENTIONED DETAILS FOR FIELD WIRING TERMINATION TIGHTENING TORQUE.

A. MAIN CIRCUIT BREAKER 7 N–m (61.95 lb–in).
B. DISTRIBUTION BLOCK 3.5– 5 N–m (31–44 lb–in).
C. GROUND LUG 5.65 N–m (50 lb–in).

100					
99	1	PLC, AB 2 PORT ETHERNET IP ADAPTER	ALLEN–BRADLEY	1734–AENTR	917827
98	1	PLC, AB TERMINAL BASE 8PT SCREW	ALLEN–BRADLEY	1734–TB	917958
97	1	PLC, AB RS–232 SERIAL INTERFACE MODULE	ALLEN–BRADLEY	1734–232ASC	917828
96					
95					
94	2	WIRE HARNESS, UV4E BLST–MCB 60"	TROJAN	912274–060	912274–060
93	2	WIRE HARNESS, UV4E BLST–MCB 69"	TROJAN	912274–069	912274–069
92	5	CLAMP, BALLAST HEATSINK UV8000	TROJAN	792345	792345
91	4	BALLAST, ELEC 3200W HF MP 1PHV	NEDAP	9935371	915109
90	A/R	CABLE, 14AWG 2CON 600V SHLD	TROJAN	913048	913048
89					
88	1	BOARD, UVSWIFT DOSIMETER 66MHZ	TROJAN	931109	931109
87	1	CABLE, NULL MODEM 9 PIN	STARTECH	SCNM9FF	903938
86					
85	1	DUPLEX RECEPTACLE 120VAC WITH GFI	PHOENIX CONTACT	5600462	914817
84					
83					
82	1	CABLE, ENET RJ45 SHIELDED 6FT	STARTECH	S45PATCH6BL	913756–006S
81	3	CABLE, ENET RJ45 SHIELDED 3FT	STARTECH	S45PATCH3BL	913756–003S
80	1	SWITCH, ENET FL 1008N–8PORT	PHOENIX CONTACT	1085256	919022–1085256
79					
78					
77					
76					
75					
ITEM	QTY	DESCRIPTION	MANUFACTURER	PART NUMBER	TROJAN NUMBER

	74					
	73					
	72	2	BREAKER, 3A 1P AC/DC C ABB	ABB	SU201M–C3	917139–MC1030
	71	4	BREAKER, 2A 1P AC/DC C ABB	ABB	SU201M–C2	917139–MC1020
	70	3	BREAKER, 4A 1P AC/DC C ABB	ABB	SU201M–C4	917139–MC1040
	69	2	BREAKER, 10A 1P AC/DC C ABB	ABB	SU201M–C10	917139–MC1100
	68					
	67					
	66	4	BREAKER, 20A 2P AC/DC C ABB	ABB	SU202M–C20	917139–MC2200
SEE NOTE 6	65	1	BREAKER, 80A 3P 600V 25KA ABB	ABB	XT1NU3080AFF000XXX	917143–N3080
	64	1	BREAKER, ROTARY BASE XT ABB	ABB	KXTBRHEBFP	916814–KXTBRHE
	63	2	BREAKER, LUG CPRSN 3PC ABB	ABB	KXT1CU – 3PC	917143–LUG3
	62	1	DISC, SHAFT 10x10x500mm ABB	ABB	OXP10X500	912786–10X500
	61	1	DISC, HANDLE RESET 10mm 3R ABB	ABB	OHB65J10B	912787–310
SEE NOTE 6	60	3	DIST BLOCK, 115A TE	TE CONNECTIVITY	DBL125	917305–125
SEE NOTE 6	59	1	GROUND BAR, 8TAP 6–14AWG	ILSCO	D167–8	916079–008
	58	1	LUG, GND 600V 2CON	ILSCO	AU–0	914278
	57	2	LTC LOW TERMINAL COVERS, XT1	ABB	KXT1LTC–3	917143–LTC3
	56					
	55					
	54	1	SPD, 120V 20A 1PH PHOENIX	PHOENIX CONTACT	2907922	917624–120
	53	1	SPD, BASE 1PH PUSH PHOENIX	PHOENIX CONTACT	2907929	917624–002
	52	1	PS, 24VDC 1P TRIO 10A	PHOENIX CONTACT	2866323	916051–323
	51					
	50	3	RELAY, 8A DPDT 24VDC AB	ALLEN BRADLEY	700–HK32Z24	915399–2Z24
	49	3	RELAY, SOCKET 8A DPDT AB	ALLEN BRADLEY	700–HN122	915461–HN122
	48	A/R	TERM BLK, END STOP CLIPFIX 35	PHOENIX CONTACT	3022276	916050–3022276
	47	A/R	TERM BLK, MARKER SHEET ZB5	PHOENIX CONTACT	1050004	916050–1050004
SEE NOTE 4	46	A/R	TERM BLK, JUMPER FBS	PHOENIX CONTACT	FBS 2–5 to FBS 50–5	916050G
	45	A/R	TERM BLK, END PLT D ST 2.5 QU	PHOENIX CONTACT	3030514	916050–3030514
	44	7	TERM BLK, PIT 2.5 PE QUAT GND	PHOENIX CONTACT	3209594	916049–3209594
	43	28	TERM BLK, PIT 2.5 QUATTRO BLU	PHOENIX CONTACT	3209581	916049–3209581
	42	12	TERM BLK, PIT 2.5 QUATTRO GRY	PHOENIX CONTACT	3209578	916049–3209578
	41	1	TERM BLK, END PLT D ST 2.5	PHOENIX CONTACT	3030417	916050–3030417
	40	4	TERM BLK, PIT 2.5 PE GND	PHOENIX CONTACT	3209536	916049–3209536
	39	8	TERM BLK, PIT 2.5 GRY	PHOENIX CONTACT	3209510	916049–3209510
	38					
SEE NOTE 5	37	1	PLC, AB CMPT PROSOFT MODBUS TCP	PROSOFT	MVI69E–MBTCP	917720
	36	1	PLC, AB CMPT LOGIX END CAP	ALLEN–BRADLEY	1769–ECR	913126
	35	6	PLC, AB CABLE 14P 0.5M	PHOENIX CONTACT	2288901	914046–005
	34	2	PLC, AB CABLE 20P 0.5M	PHOENIX CONTACT	2296391	914046–007
	33					
	32	16	RELAY, 6A 24VDC SPDT PIT PC / MARKER	PHOENIX CONTACT	2900299 / 1051003	915403–112
	31	2	PLC, WIRING SYSTEM RELAY ADAPTER	PHOENIX CONTACT	2295554	914044
	30	1	PLC, AB CMPT ADAPTER 16DO	PHOENIX CONTACT	2302463	914047–003
	29	1	PLC, AB CMPT LOGIX MDL 16DO	ALLEN–BRADLEY	1769–OB16	913129
	28	2	PLC, WIRING SYS TERMINAL 20P	PHOENIX CONTACT	2903790	917064–2903790
	27	2	PLC, AB CMPT ADAPTER 4AI/2AO	PHOENIX CONTACT	2304461	914047–001
	26	2	PLC, AB CMPT LOGIX MDL 4AI	ALLEN–BRADLEY	1769–IF4	913128
	25	2	PLC, AB CNTL WIRING SYS 2X14P	PHOENIX CONTACT	2904288	917064–2904288
	24	2	PLC, AB CMPT ADAPTER 16DI	PHOENIX CONTACT	2302450	914047–002
	23	2	PLC, AB CMPT LOGIX MDL 16DI	ALLEN–BRADLEY	1769–IQ16	913130
	22	1	PLC, AB CMPT LOGIX PS 2A 24VDC	ALLEN–BRADLEY	1769–PB2	914332
SEE NOTE 2	21	1	PLC, AB CMPT LOGIX CPU L33ER	ALLEN–BRADLEY	1769–L33ER	916772
	20					
	19					
SEE NOTE 3	18	1	MEMORY CARD, SD 1GB AB	ALLEN BRADLEY	1784–SD1	915871–100
SEE NOTE 5	17	1	PLC, AB HMI PV+7 07 512MB	ALLEN–BRADLEY	2711P–T7C22D9P	917408–007
	16					
	15	1	CONTACTOR, AF40 60A NA 24V	ABB	AF40–30–00–11	917180–40C024
	14	1	PUSH BUTTON, ESTOP PUSHPULL	ALLEN–BRADLEY	800T–FX6A5	912826
	13					
	12	A/R	WIRE DUCT, TYPE F LT GRY1.5x3	PANDUIT	F1.5X3LG6 / C1.5LG6	913437–006
	11	A/R	WIRE DUCT, TYPE F LT GRY 1x3	PANDUIT	F1X3LG6 / C1LG6	913437–004
	10	A/R	TERM BLK, DIN RAIL PERF 35X7.5	PHOENIX CONTACT	0801733	914147
	09					
SEE NOTE 1	08	4	FAN, FILTER ASSY 10"X10"RITTAL	RITTAL	3240.200	916850–3240200
SEE NOTE 1	07	1	FAN, FINE FILTER MAT 10"X10"	RITTAL	3182.100	916850–3182100
	06	3	FAN, 24VDC 1.0A 190 CFM	DELTA	FFB1224EHE	914469–24E
	05	1	HEATSINK, SW12 ADAPTOR PLATE	ABUMA	CUSTOM	828609
	04	1	HEATSINK ASSY, SW12 TRIPLE FAN	ERM	CUSTOM	828608
	03	1	TOP HAT BRACKET FOR BREAKER	CUSTOM	SEE DETAIL 'A' ON SHEET 10	–
	02	1	ENCL, BRACKET WALL MT M/STEEL	RALSTON	V–WMB	913965
	01	1	ENCLOSURE, SW12 WM SERIES	RITTAL	CUSTOM	828987
	ITEM	QTY	DESCRIPTION	MANUFACTURER	PART NUMBER	TROJAN NUMBER

TROJANUV
3020 GORE ROAD, LONDON, ONTARIO, CANADA, N5V 4T7

DESCRIPTION: CPP ASSY, UVSW12 IQALUIT NU
BILL OF MATERIALS

REVISED BY	
CHECKED BY	JK
APPROVED BY	AL
APPROVAL DATE YYYY–MM–DD	2023–04–04
DWG NO.	829827
REV	A
SCALE:	NTS
SHEET	14 OF 15
SIZE	D

1.0" ON ORIGINAL DWG (0 0.5 1.0)

ITEM	QTY	NAMEPLATE TYPE	DESCRIPTION 1	DESCRIPTION 2	DESCRIPTION 3
361	1	915433-1500753A	0246RIO	REMOTE I/O	RS-232 MODULE
360	1	915433-1500753A	ALL FIELD WIRING	USE COPPER	CONDUCTORS ONLY
359	1	915433-1250502A	TORQUE	50 lb.in	
358	1	915433-1250502A	TORQUE	31-44 lb.in	
357	1	915433-1250502A	TORQUE	61.95 lb.in	
356					
355	A/R	915433-GND			
354	1	915433-1500502A	0243CB	2A BREAKER	
353	1	915433-1500502A	0240CB	3A BREAKER	
352	1	915433-1500502A	0237CB	3A BREAKER	
351	1	915433-1500502A	0243ENET	ENET SWITCH	
350	1	915433-1500502A	0246CB	2A BREAKER	
349					
348					
347	1	915433-1500752A	0230PS	24VDC 10A	
346					
345	1	915433-1500753A	0203CAP	WPR MTR CAP	30uF
344	1	915433-1500502A	0268MTR	FAN3 (24VDC)	
343	1	915433-1500502A	0266MTR	FAN2 (24VDC)	
342	1	915433-1500502A	0264MTR	FAN1 (24VDC)	
341					
340	1	915433-1500753A	DISCRETE	OUTPUTS 8-15	(Q100-Q107)
339	1	915433-1500753A	DISCRETE	OUTPUTS 0-7	(Q000-Q007)
338	1	915433-1500753A	ANALOG	INPUTS 4-7	(AIW8-AIW14)
337	1	915433-1500753A	ANALOG	INPUTS 0-3	(AIW0-AIW6)
336	1	915433-1500753A	DISCRETE	INPUTS 16-31	(I200-I307)
335					
334	1	915433-1500753A	DISCRETE	INPUTS 0-15	(I000-I107)
333	1	915433-1500502A	0258CR	WPR RETRACT	
332	1	915433-1500502A	0256CR	WPR EXTEND	
331	1	915433-1500502A	0254CON	MAIN	
330	1	915433-1500501A	0250MCR		
329	1	915433-1500753A	0207REC	120VAC, 60Hz	4A MAX
328					
327	1	915433-1500502A	0165BLST	BALLAST4	
326	1	915433-1500502A	0157BLST	BALLAST3	
325	1	915433-1500502A	0149BLST	BALLAST2	
324	1	915433-1500502A	0141BLST	BALLAST1	
323	1	915433-1500502A	0264CB	4A BREAKER	
322	1	915433-1500502A	0922CB	2A BREAKER	
321	1	915433-1500502A	0211SPD	120VAC	
320	1	915433-1500502A	0904CB	2A BREAKER	
319	1	915433-1500502A	0232CB	10A BREAKER	
318	1	915433-1500502A	0230CB	10A BREAKER	
317	1	915433-1500502A	0207CB	4A BREAKER	
316	1	915433-1500502A	0202CB	4A BREAKER	
315	1	915433-1500502A	0165CB	20A BREAKER	
314	1	915433-1500502A	0157CB	20A BREAKER	
313	1	915433-1500502A	0149CB	20A BREAKER	
312	1	915433-1500502A	0141CB	20A BREAKER	
311					
310					
309	1	915433-1500502A	0102CB	80A	
308					
307	1	915433-1500501A	01080		
306	1	915433-1500501A	01070		
305					
304					
303					
302	1	915433-0500501A	L2		
301	1	915433-0500501A	L1		
300	1	915433-0500501A	N		

TROJANUV

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DESCRIPTION: CPP ASSY, UVSW12 IQALUIT NU NAMEPLATE LABELS

0 0.5 1.0
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APPROVAL DATE YYYY-MM-DD	2023-04-04

DWG NO. 829827 | REV A

SHEET 15 OF 15 | SIZE D

PART D

CONTROLS PHILOSOPHY

TROJAN UV
WATER CONFIDENCE™

CONTROLS PHILOSOPHY – Iqualuit Replacement, NU

Project# 161100016

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1.0 UVSwift™ System

The objective of this document is to provide details regarding the control strategy for the UVSwift™ System. The control philosophy outlines the major hardware components, system status, alarm conditions, and modes of operation of the UV System.

1.1 Hardware Details

The following is the list of hardware that is included in the System Controller located in a CPP.

Type	Details
PLC	Allen Bradley, L33ER
Discrete Input Module	Allen Bradley, IQ16
Discrete Input Module	Allen Bradley, IQ16
Analog Input Module	Allen Bradley, IF4
Analog Input Module	Allen Bradley, IF4
Discrete Output Module	Allen Bradley, OB16
Ballast Communications	RS-232 Interface Module, 1734-232ASC
Modbus SCADA	Prosoft MVI69-MBTCP
Network Type	ETHERNET
HMI	Allen Bradley, PV+7, 7”, ENET and Touch Screen

The PLC is configured to include the following reserved I/O points:

Discrete Inputs

Channel	Discrete Inputs to Trojan PLC	State/Action
1	Wiper Rev Counter	
2	Wiper Home Limit	ON = when HOME
3	Wiper Home Limit Signal Loss	ON = when AWAY
4	Reactor Cover On (Inner Dust Cover)	ON = no alarm
5	Reactor High Temperature	ON = no alarm
6	Spare	
7	Emergency Stop	OFF = emergency
8	Reactor Water Level OK	ON = no alarm
9	Reserved	
10	Reserved	
11	Reserved	
12	Reserved	
13	Reserved	
14	Reserved	
15	Remote ON/OFF (e.g., from plant PLC)	ON = command to start
16	Reserved	

Channel	Discrete Inputs to Trojan PLC	State/Action
1	Spare	
2	Spare	
3	Spare	
4	Outlet Valve Open	ON = valve OPEN
5	Outlet Valve Closed	ON = valve CLOSED
6	Outlet Valve Ready	ON = valve is available to be controlled
7	Reserved	
8	Reserved	
9	Spare	
10	Spare	
11	Spare	
12	Spare	
13	Spare	

14	Spare	
15	Spare	
16	Spare	

Analog Inputs

Channel	Analog Inputs to Trojan PLC	State/Action
1	Flow Meter	0 – 8.0 MLD
2	Reserved	
3	UV Intensity Sensor #1	0 – 66.2 mW/cm^2
4	UV Intensity Sensor #2	0 – 66.2 mW/cm^2

Channel	Analog Inputs to Trojan PLC	State/Action
1	UV Intensity Sensor #3	0 – 66.2 mW/cm^2
2	UV Intensity Sensor #4	0 – 66.2 mW/cm^2
3	Spare	
4	Spare	

Discrete Outputs

Channel	Discrete Outputs from Trojan PLC	State/Action
1	Reactor On Status	ON = disinfection warm-up completed / System ON
2	Critical Alarm	ON = no alarm
3	Major Alarm	ON = no alarm
4	Minor Alarm	ON = no alarm
5	Open Outlet Valve	ON = open valve
6	Close Outlet Valve	ON = close valve
7	Wiper Extend	ON = extend
8	Wiper Retract	ON = retract
9	Cooling Fans	ON = turn on ventilation within ballast cabinet
10	System Ready	ON = ready to be turned on / not in cool down / no critical alarms active
11	Spare	
12	Spare	

13	Reserved	
14	Reserved	
15	Open Cooling Valve	ON = open valve
16	Reserved	

1.2 Site Specific Design Data

The following parameters were used to configure the UV system and are specific for this site:

No of Reactors	2 (1 duty; 1 redundant)
No. of Lamps per Reactor	4
Reactor Model number	4L12
Design Target Log Inactivation	3.0
Design Target Pathogen	Cryptosporidium
Design Target Organism	MS2
Action Spectra Correction	None
Reactor Flow Rate	8.0 MLD
Total Site Flow	8.0 MLD
Flow Type	Analog
Design UVT	75%
UVT Type	Manual
Automatic Cleaning	Mech-Chem
UPS Present	No
Inlet Valve Control	None
Outlet Valve Control	Hardwired
Cooling Valve Control	Hardwired
Remote Control Input	Hardwired
Status and Alarm Outputs	Hardwired
SCADA Network Protocol	Modbus TCP/IP
RED Output	None
Intensity Output	None

1.3 Site Specific Control Strategy

The following items are non-standard control features for this system which deviates from the Trojan's UVSwift™ control strategy.

- Modbus SCADA protocol
- Replacement of existing project number 710066

1.4 Safety Features

The UVSwift™ control strategy employs a number of alarm conditions that will result in control action designed to protect the operator, the equipment, and maintain the delivered dose.

A number of critical interlock conditions will disable a UV reactor including low water level alarm, high reactor temperature alarm, high ballast temperature, wiper failure alarms, dust cap removed and multiple lamp or ballast alarms. Certain other alarm conditions will trigger a control action that may result in a reactor running at full power. Examples of this type of alarm would be a single lamp or ballast failure, or a sensor signal fault. These alarm conditions are described later in this document.

2.0 Control System Overview

2.1 General Description

The control system for the UVSwift™ system consists of a PLC controller with associated I/O in a local rack, an HMI for operator interface and system configuration, and a Dosimeter™ board which provides I/O termination points for the UV ballasts. Additionally the PLC and HMI will optionally be accessible through a remote dial-up modem for the purpose of monitoring logic and making online changes. A plant SCADA network may optionally be connected to the PLC through available network protocols and will be able to access designated read and write integer arrays.

The PLC communicates to the Dosimeter™ board via an RS232 remote I/O module, using a simple custom ASCII and uses a single byte summation checksum to ensure data integrity.

Alarms are grouped together with Common Critical, Common Major and Common Minor alarm bits that are set if any of the assigned conditions are active. Specific alarms are described in subsequent sections.

Common Critical Alarms - In the event that a critical alarm condition should occur, the controller will display the alarm message on the operator interface and immediately initiate a reactor shut down (all lamps off). The alarm condition would have to be cleared before another start-up sequence could be initialized.

Common Major Alarms - In the event that a major alarm condition should occur, the controller will display the alarm message on the operator interface and automatically ramp up the power level of all lamps in the affected reactor to 100% power. Some alarms will require acknowledgement or reset before the reactor will resume automatic dose pacing (If Auto Reactor is selected as mode of control).

Common Minor Alarms – In the event that a minor alarm condition should occur, the controller will display the alarm message on the operator interface to indicate maintenance is required or an abnormal condition exists that does not affect system operation.

2.2 System Fault Conditions

The following table summarizes all of the available general system alarms:

Alarm	Description	Alarm Severity	Delay	Control Action	Acknowledge/Reset Required

Communications Board Timeout	PLC is not communicating with the Dosimeter™ board	Critical	20 comm. Cycles	Ballast remains on at same power level for 30 sec	Acknowledge or First Scan
Plant SCADA Communications Failure	Failed to receive a watchdog register change from SCADA system	Critical	3.5 sec	Configurable	No
PLC Faulted	Major Controller fault has occurred	Critical	None	Ballast remains on at same power level for 30 sec	
E-stop pressed	E-stop switch pushed	Critical	None	Shut down reactor	Acknowledge
PLC Battery Low	PLC battery has a low output voltage	Minor	None	None	No
UPS Low Battery or UPS Fault	UPS has a low battery output voltage or has an internal fault.	Minor	30 sec	None	No
Main Power is Disconnected	Main power is not present and system is running on UPS power	Minor	None	Shut down reactor	Acknowledge
Main Power is Restored	Main power has been restored and the system is no longer running on UPS power	Minor	None	None	Acknowledge
I/O Simulation Enabled	I/O Simulation is enabled at the HMI screen	Minor	None	None	No, First Scan

3.0 Reactor Control

3.1 Reactor Control Architecture

Each Control Power Panel (CPP) controls the function of its associated reactor.

When a start-up sequence is initiated, the controller will operate the valves in their respective sequence and verify that the valves are operating correctly (if equipped) and perform a wipe sequence to verify that the wiping system is operational. Lamps are initially energized to 100% power for a warm-up period regardless of mode (i.e. either manual or auto). After the disinfection warm-up period has expired; typically 5 minutes, the valves (if equipped) will open and the system is ready to treat flow. The lamps then enter the operation warm-up period to ensure that the lamps have reached their full UV Intensity output. After the operation warm-up period has expired; typically 5 minutes, the lamps are automatically switched to the requested power level.

When power is restored after an electrical service interruption, and the Auto Restart option is enabled at the CPP, the entire start-up sequence will be re-initialized upon the power being restored. Once the "lamp cool-down" timer has expired; typically 5 minutes, all lamps will be re-ignited. Lamps cannot be turned on 'hot'; they must be given time to cool down before they are re-ignited.

3.2 Reactor General Fault Conditions

The following alarm conditions are monitored for reactor faults:

Alarm	Description	Alarm Severity	Delay	Control Action	Acknowledge/reset Required
Reactor Low Water Level	UV reactor does not contain enough water to activate the level switch	Critical	5 sec	Shut down reactor	Acknowledge
Reactor High Temperature	UV reactor high temperature switch tripped	Critical	None	Shut down reactor	Acknowledge
Reactor Cover is Off	Protective dust cover over on reactor removed	Critical	None	Shut down reactor	Acknowledge
Start Up Sequence Failed	A lamp failed to start	Critical	2 min	Shut down reactor	Acknowledge
Low UV Dose Major	Actual Dose is lower than the target Dose	Major	Major Delay	Run at Full Power	Acknowledge

3.3 Lamp Control and Monitoring

The PLC controller automatically adjusts ballast power levels. Each lamp is controlled by ballast which has power levels available from 26-100% ballast output (in 1% increments).

The electronic ballast detects lamp on/off status. The status of each individual lamp is displayed via the Reactor Overview Screen at the Operator Interface. Faulted lamps are indicated by specific lamp address on the Alarm Status Screen.

3.4 Lamp and Ballast Fault Conditions

The following alarm conditions are monitored for UV lamps and ballasts:

Alarm	Description	Alarm Severity	Delay	Control Action	Acknowledge/Reset Required
Multiple Lamp Alarm	The number of lamps that are failed in the reactor is greater than two	Critical	None	Shut down reactor	Acknowledge
Multiple Ballast Alarm	The number of ballasts that are failed in the reactor is greater than two	Critical	None	Shut down reactor	Acknowledge
Lamp Major Alarm (1 per lamp)	A lamp that is required to operate is not running after warm-up time	Major	5 sec	Run at full power	Acknowledge and Reset
Ballast Major Alarm (1 per ballast)	A ballast that is required to operate is not running after warm-up time	Major	5 sec	Run at full power	Acknowledge and Reset
Ballast High Temperature (1 per ballast)	A ballast has exceeded the high temperature set point	Major	5 sec	Run at full power	Acknowledge and Reset
Lamp End of Life Warning (1 per lamp)	A lamp has exceeded its rated end of life operating hours	Minor	None	None	No

3.5 Control Modes

The CPP for each UV reactor is placed in either local or remote control mode via a control mode selection on the Control Settings screens.

3.5.1 Local Control Mode

When the CPP is in Local mode, the operator will have a reactor Start/Stop pushbutton available on the System Overview screen. Selecting a reactor Start will request the start-up sequence for the reactor to be initiated if the reactor is ready for a start-up to occur. A reactor will be ready for start-up if there are no critical alarm conditions and the lamps are not in a cool-down mode. Selecting a reactor Stop will request the shut-down sequence for the reactor to be initiated.

3.5.2 Remote Control Mode

When the CPP is placed in Remote mode, the CPP responds to a discrete signal to initiate a start-up or shut down sequence in any operating mode (manual or automatic) from the plant PLC. This signal may be configured to be a hardwired input or a networked input that is transmitted over the SCADA interface connection.

Note: The remote PLC is unable to change the operation mode or adjust a manual power level setting (must be undertaken in person at the CPP). When Remote mode is not enabled the system can only be started and

stopped by the operator via the System Overview screen at the CPP (this is Local mode).

3.6 Operation Modes

The CPP for each UV reactor is placed in either Manual or Automatic operation mode via an operation mode selection on the Control Settings screens.

3.6.1 Manual Operation Mode

The reactor can be turned on or off, and ballast power levels can be set in Manual Mode from the Reactor Overview Screen on the operator interface.

Note: Major alarms will not cause an increase in power level to 100% when in Manual Operation Mode.

3.6.2 Automatic Operation Mode (Dose Pacing)

Dose pacing is applied to the reactor while in Automatic Mode only. In Automatic Mode the ballast power levels are controlled automatically to meet the target RED while conserving power.

In Automatic Mode, the reactor initially energizes to maximum power level. Once the lamp warm-up timer expires, the reactor stages down to its required power level ensuring that the target RED is maintained.

As UV demand increases, by either an increase in flow, a decrease in UV Transmittance, or a decrease in lamp intensity, the power level of the lamps is increased accordingly.

Equipment power levels are controlled so that the minimum power setting is selected to maintain the target RED. The target RED is calculated based on the operator entered Log Inactivation target and the current operating conditions.

In the event of a Major Alarm condition, all lamp power levels will be increased to 100% power.

3.7 Dose Calculation

The Trojan UV Dosimeter™ that predicts RED on-line is based on the hydraulic footprint of the reactor and current operating parameters of the system.

Based on an input flow signal (or manual value), an input UVT signal (or manual value), and AccUVSensor™ measurements the Trojan UV Dosimeter™ calculates RED and displays the RED delivered by the system on the operator interface in mJ/cm2. This RED prediction is then used in the Dose Pacing strategy to modulate lamp power.

If the UV Dosimeter™ predicted RED falls below the target RED value, a Low UV Dose alarm condition is set.

3.8 Off-Specification Monitoring

The PLC monitors the UVT, flow, AccUVSensor™ measurements, target and calculated RED, calculated validated dose, and lamp, ballast, and sensor status signals to ensure that the reactor is operating within its validated limits. The reactor is considered off-specification if it is operating outside of its validated limits.

On-Spec/Off-Spec status will be displayed on the operator interface.

The following alarm conditions are monitored for Off-Spec operation:

Alarm	Description	Alarm Severity	Delay	Control Action	Acknowledge/Reset Required
Off Specification – Low Validated Dose	Indicates that the validated dose is below the required dose.	Major	Configurable	Run at full power	No
Off Specification – Low S/S_0	Indicates that S/S_0 (Relative Lamp Output) is below the validated limit.	Major	Configurable	Run at full power	No
Off Specification – Low UVT	Indicates that the UV transmittance is below the validated limit.	Major	Configurable	Run at full power	No
Off Specification – High Flow	Indicates that the Flow rate is above the validated limit.	Major	Configurable	Run at full power	No
Off Specification – Low RED	Indicates that the Actual RED is below the Target RED.	Major	Configurable	Run at full power	No
Off Specification – Reactor Off with Valves Open	Indicates that the reactor is off and the valves do not have a closed status.	Major	Configurable	Run at full power	No
Log Inactivation Not Possible	Indicates that the reactor cannot treat the required log inactivation target	Major	Configurable	Run at full power	No
Off Specification – Invalid BRED	Indicates that a valid RED bias term cannot be determined at the current operating conditions.	Major	Configurable	Run at full power	No
Off Specification – Lamp Failed	Indicates that at least one lamp has failed	Major	None	Run at full power	No
Off Specification – Sensor Failed	Indicates that at least one sensor has failed	Major	None	Run at full power	No
Sensor Correction Factor Applied	Indicates a value greater than 1 is being used as a sensor correction factor	Minor	None	None	No

Some of the above alarms may trigger a Low UV Dose Major Alarm or a Log Inactivation Not Possible Major Alarm, which will result in the reactor operating at full power until the fault is cleared.

3.9 Reactor HMI Interface

3.9.1 Operator Interface for Reactor and Dose Control

The operator interface provides two screens that summarize the reactor and lamp operational information. The Reactor Overview screen provides a summary of the current operational status of the reactor and all of the lamps within the reactor, as well as provides buttons to allow the operator to perform a reactor startup or shutdown, or control the lamp power when in manual mode. This screen also provides a summary of the UV Dose control for the reactor and displays all of the variables that effect dose. The Reactor Overview contains the following information:

- Reactor Operation Mode – Auto, Manual, Manual Lamp
- Reactor Status – Off, On, Warming, Cooling
- Reactor Control Mode – Local, Remote
- Wiper Status – Idle, Wiping, Faulted, Not Present
- Flow Rate – Display and Entry (when in manual measure mode only)
- UVT – Display and Entry (when in manual measure mode only)
- Delivered RED (mJ/cm^2)
- Validated Dose Required (mJ/cm^2)
- Validated Dose (mJ/cm^2)
- Target Log Inactivation (Logs)
- Theoretical Log Inactivated (Logs)
- Validation Factor
- S/S_0
- Ballast Power Level (%)
- Individual Lamp Status – On, Off, Cooling, Warming, Faulted
- Reactor Operational Status Messages

Control buttons are provided to allow an operator to:

- Initiate a reactor start-up (when in Local Control Mode)
- Initiate a reactor shutdown (when in Local Control Mode)
- Enter a reactor power level (when in Manual Power Control Mode)
- Override a UVT value
- Override a Flow value

The Lamp Overview screen provides detailed information about each lamp in the reactor. This screen also provides buttons to allow an operator to reset the lamp cycles and lamp hour's values for each lamp. The Lamp Overview contains the following information for each lamp:

- Lamp Power (%)
- Lamp Cycles
- Lamp Runtime Hours

Control buttons are provided to allow an operator to:

- Reset lamp cycles and hours for each lamp
- Enter lamp runtime hours for each lamp

3.9.2 Plant Configuration Interface for Reactor and Dose Control

Some of the options and settings used for selecting reactor and dose control configuration will be available in a selection of Protected Settings screens

that are accessed with a password used by plant maintenance personnel. The following items will be available on these screens:

- Off-Specification Alarm Delay
- RED Analog Output Scaling (mJ/cm^2)
- Dose Settings Source
- Default Pathogen
- Default Log Inactivation (Logs)
- RED Safety Factor
- Default Challenge Organism
- Reactor Operation Mode
- Reactor Control Mode
- UPS Control Option
- Auto Restart Mode
- Minor Alarm Delay (minutes)
- SCADA Communication Failure Action

4.0 Valve Control

4.1 Cooling Water Valve Control

When Start-up is initiated the cooling valve opens. This ensures sufficient cooling flow through the reactor on start-up.

When a reactor shutdown is initiated, either by the user, or a remote signal, the cooling valve is opened. When a critical alarm condition occurs, the PLC will attempt to close the cooling valve.

An optional reactor hot standby mode may be used by setting the hot standby signal from SCADA. The lamps will decrease power to minimum and the cooling water will be used during this time to cool the lamps so that they do not need to switch off.

4.2 Outlet Valve Control

When the system start-up is initiated, the outlet valve for a reactor remains closed until the disinfection warm-up period expires. Once this occurs, the outlet valve opens and flow through the reactor is directed to the outlet. When a critical alarm condition occurs, the PLC will attempt to close the outlet valve.

When a system shut down is initiated, the outlet valve starts closing. The lamps will turn off when the outlet valve closed signal is received.

4.2.1 Outlet Valve Fault Conditions

The following alarm conditions are monitored for the Outlet valve:

Alarm	Description	Alarm Severity	Delay	Control Action	Acknowledge Required
Outlet Valve Fail to Open	Valve commanded to open but has not reached opened limit switch or has not left closed limit switch	Critical	Configurable	Shut down reactor	Acknowledge

Outlet Valve Fail to Close	Valve commanded to close but has not reached closed limit switch or has not left opened limit switch	Critical	Configurable	Shut down reactor	Acknowledge
Outlet Valve Not Ready	Valve is faulted or in Local Control Mode	Minor	5 sec	None	Acknowledge
Outlet Valve in Manual	Manual mode is selected at the HMI	Minor	None	None	No

4.3 Valve HMI Interface

4.3.1 Operator Interface for Valve Control

The operator interface will have a single dedicated screen that will be used to display Valve status (Inlet, Outlet or Cooling Devices) information and be used to control the valves.

The Valve Overview Screen contains following information for each valve that is controlled by the PLC:

- Operational Mode – Remote Manual, Remote Auto, SCADA, Local, Faulted
- Valve Status – Opened, Closed, Moving, Not Ready
- Valve Command banner
- Valve Ready Status banner

Control buttons are provided to allow an operator to:

- Select valve Auto or Manual Operational Mode
- Select valve Open command
- Select valve Close command

If valve control is not selected from the password protected operator valve settings screen, then no control options for that valve will appear on the Valve Overview screen.

4.3.2 Plant Configuration Interface for Valve Control

Some of the options and settings used for selecting Valve control configuration will be available in a Protected Settings screen that is accessed with a password used by plant maintenance personnel. The following items will be available on this screen for each valve:

- Valve Present selection
- Valve Opened Input Available
- Valve Closed Input Available
- Valve Ready Input Available
- Valve Open Output Available
- Valve Close Output Available
- Valve Alarm Delay (seconds)
- Valve I/O Type – Hardwired, Networked

5.0 ActiClean™ Cleaning System Control and Monitoring

5.1 Wiper Control Architecture

Automatic lamp cleaning is accomplished using the ActiClean™ Physical/Chemical wiper system that is controlled through the UV PLC. A motor powers a screw drive mechanism that extends the wiper to the end of the sleeves and then, after a short delay, retracts the wiper to its home position. A revolution sensor has been incorporated into the wiper system's design and is used to determine when the extend stroke end-of-travel position has been reached. A limit switch has also been included to sense when the wiper is at its home position inside the reactor. A cleaning sequence may be initiated manually at the Operator Interface, or operated automatically on fixed time interval. A wipe is also initiated any time a reactor is initially started up.

5.2 Wiper control modes

The wiper can be operated in three modes as listed below

- In Manual wiping mode, each wiping sequence can only be individually initiated by the operator via the Wiper Overview screen.
- In Fixed Interval mode, the operator at the Wiper Settings screens keys in the interval between wiping sequences. The operator may still manually initiate individual wiping sequences.
- In Off mode, the wiper is disabled.

5.3 Wiper General Fault Conditions

The following alarm conditions are monitored for the wiping system.

Alarm	Description	Alarm Severity	Delay	Control Action	Acknowledge Required
Wiper Home Limit Switch Fault	Wiper home switch contacts are in the same state indicating the switch has failed	Critical	2 sec	Shut down reactor	Acknowledge
Wiper Revolution Sensor Fault	Indicates a wiper has been commanded to move but is not triggering the revolution input sensor.	Critical	1 sec	Shut down reactor	Acknowledge
Wiper Extend Travel Time Exceeded	Wiper has not reached end of travel before configured travel time	Critical	Config urable	Shut down reactor	Acknowledge
Wiper Retract Travel Time Exceeded	Wiper has not reached home position before configured travel time	Critical	Config urable	Shut down reactor	Acknowledge

5.4 Wiping HMI Interface

5.4.1 Operator Interface for Wiper Control

On the operator interface, the Wiper Overview screen will be used to display wiper status information and be used to control the wiper actions.

The Wiper Overview screen contains the following information:

- Wiper Status – Idle, Wiping, Faulted, Not Present
- Wiper Mode – Off, Fixed Interval, Manual
- Wiper Position – At Home, Extending, Retracting, Undefined, Advanced, Critical Alarm
- Wiper Progress (%)
- Wiper Progress (Revs)
- Time Since Last Wipe
- Time to Next Wipe
- Wiper Interval Time
- Number of Wiper Cycles
- Wiper Status banners

Control buttons are provided to allow an operator to:

- Initiate a manual wipe
- Initiate a wiper return to home
- Enter a new value for wiper cycles

5.4.2 Plant Configuration Interface for Wiper Control

Some of the options and settings used for selecting wiper control configuration will be available in a Protected Setting screen that is accessed with a password used by plant maintenance personnel. The following items will be available on this screen:

- Wiper Cycle Interval Time
- Wiper Control Mode

6.0 Flow Input Signal

6.1 Flow Control Architecture

A flow signal is required in order to provide Dose Pacing functionality for the system. The flow can be transmitted to the UV PLC in two different ways. Most commonly, the flow is received as a 4-20 mA signal. In this mode, the input signal is scaled to a configurable engineering units range. Flow can be displayed in US MGD, GPM, L/S, M3/Hour or MLD units as standard options. The input signal is passed through a smoothing algorithm that reduces the effect of temporary spikes and drops in flow. Alternately, a flow signal may be passed from a Plant network through a configured SCADA system to a designated address in the UV PLC. The signal must be passed as 16-bit integer value that represents an engineering unit's signal multiplied by a "Flow Multiplier" value sent from the UV PLC to SCADA. The UV PLC will divide this value by the "Flow Multiplier" to get a scaled flow with 1 decimal place accuracy. In either of these modes, a manually entered flow value may be used to replace the measured flow value. This value will be used upon operator demand. In the event of a device or SCADA fault, a default value will be used.

6.2 Flow Fault Conditions

The following alarm conditions are monitored for the flow signal:

Alarm	Description	Alarm Severity	Delay	Control Action	Acknowledge Required
Low Flow Rate	Flow is below preset set point for configured time	Critical	Configurable	Shut down reactor	Acknowledge
Flow Meter Signal Out of Range	4-20 mA flow signal input is below 3.5 mA or above 20.5 mA	Critical	Major Delay	Shut down reactor	Acknowledge
Maximum Hydraulic Capacity Exceeded	Calculated flow rate is greater than the pre-set system hydraulic maximum capacity	Major	Major Delay	Run at Full Power	No
Flow Meter Manual Value Used	Manual Flow mode is selected at the HMI	Minor	None	None	No
Flow Greater than Design	Actual System flow is greater than system design flow	Minor	Minor Delay	None	No

6.3 Flow Signal HMI Interface

6.3.1 Operator Interface for Flow Control

The operator interface will display the scaled flow value in the selected Engineering Units on the Reactor Overview screen. The displayed value will represent the total reactor flow currently being used by the Dose Calculation routine and will be based on the current mode of operation for flow. If the system is using a manual flow value, the operator must enter the current flow value on the Overview screen.

6.3.2 Plant Interface for Flow Configuration

Some of the options and settings used for selecting flow signal configuration will be available in Protected Settings screens that are accessed with a password used by plant maintenance personnel. The following items will be available on these screens:

- Default Flow
- Flow Scale Max Value
- Low Flow Alarm Value
- Low Flow Alarm Delay (seconds)
- Low Flow Cooling Set Point
- Extra Cooling Time (minutes)
- Flow Signal Debounce (%)
- Flow Measurement Mode
- Flow Units
- Design Flow

7.0 UVT Input Signal

7.1 UVT Control Architecture

A UVT signal may be used in order to provide accurate Dose calculation functionality for the system. A 4-20mA analog UVT signal option is available on all systems. Alternately, a UVT signal may be passed from a Plant network through a configured SCADA system to a designated address in the UV PLC. The signal must be passed as 16-bit integer value that represents a percentage UVT signal multiplied by 10. The UV PLC will divide this value by 10 to get a scaled flow with 1 decimal place accuracy. A manually entered UVT value is available and may be selected if an online value is not available.

7.2 UVT Measurement Modes

If the UVT is received as a 4-20 mA signal, the input signal is scaled to an enterable 1 to 100% engineering units range. When UVT is received from an analyzer as a 4-20mA signal, the input signal is passed through a smoothing algorithm that reduces the effect of temporary spikes and drops in UVT. A manually entered UVT value will be used when selected by the operator. In the event of a device or SCADA fault, a default value will be used.

7.3 UVT Fault Conditions

The following alarm conditions are monitored for the UVT signal:

Alarm	Description	Alarm Severity	Delay	Control Action	Acknowledge Required
UVT Analyzer Signal Out of Range	4-20 mA UVT signal input is below 3.5 mA or above 20.5 mA	Minor	10 sec	Use Default UVT	Acknowledge
UVT Analyzer Fault	UVT meter failure mode signaled by discrete output	Minor	Configurable	Use Default UVT	Acknowledge
UVT Analyzer Manual Value Used	UVT mode is selected as manual at the HMI	Minor	None	None	No
UVT Less Than Design	Actual UVT is less than the design UVT	Minor	Minor Delay	None	No

7.4 UVT Signal HMI Interface

7.4.1 Operator Interface for UVT Control

The operator interface will display the scaled UVT value in % on the Reactor Overview screen. The displayed value will represent the UVT value currently being used by the Dose calculation and will be based on the current mode of operation for UVT. If the system is using a manual UVT value, the operator must enter the current UVT value on the Overview screen.

7.4.2 Plant Interface for UVT Configuration

Some of the options and settings used for selecting UVT signal configuration will be available in Protected Settings screens that are accessed with a password used by plant maintenance personnel. The following items will be available on these screens:

- Default UVT (%)
- UVT Analyzer Fault Alarm Delay (Seconds)
- UVT Signal Debounce (%)
- Online Max UVT (%)
- Online Min UVT (%)
- UVT Measure Mode
- Design UVT (%)

8.0 AccUVSensors™

One AccUVSensor™ is provided for each lamp to monitor the UV intensity. The signal for each sensor is amplified to 4-20mA and is sent to the controller for use in the UV Dosimeter™ dose calculation routine. UV intensity measurement is displayed on the Sensor Overview Screen for each AccUVSensor™. The UV intensity measurement is displayed in mW/cm^2. A reference sensor procedure may be initiated by the operator that will step through the process of checking the output of each UV sensor against a calibrated sensor.

8.1 AccUVSensor™ Fault Conditions

The following alarm conditions are monitored for the AccUVSensors™:

Alarm	Description	Alarm Severity	Delay	Control Action	Acknowledge Required
Sensor Signal Lost (1 alarm per sensor)	4-20 mA sensor signal input is below 3.5 mA	Major	Major Delay	Run at full power	Acknowledge
Sensor Signal Saturated (1 alarm per sensor)	4-20 mA sensor signal input is above 20.5 mA	Minor	Minor Delay	None	Acknowledge
Sensor Reference Check Required (1 alarm per sensor)	The reference check interval time has expired	Minor	Minor Delay	None	No
Sensor UV Intensity Deviation (1 alarm per sensor)	Measured Intensity differs from Theoretical Intensity	Minor	Minor Delay	None	No
UV Reference Sensor Procedure Active	Reference Sensor procedure is active	Minor	None	None	No

8.2 AccUVSensor™ HMI Interface

8.2.1 Operator Interface for AccUVSensor™

The operator interface will display the scaled intensity value for each AccUVSensor™ in mW/cm^2 on the Sensor Overview screen. The following information will be available for each sensor:

- Intensity Value (mW/cm^2)
- Sensor Current (mA)
- Sensor Runtime Days Since Check
- Sensor Check Interval (Days)

Control buttons are provided to allow an operator to:

- Reset runtime days for each sensor since reference check occurred
- Enter the reference sensor check screens

8.2.2 Plant Interface for AccUVSensor™ Configuration

Some of the options and settings used for selecting AccUVSensor™ signal configuration will be available in Protected Settings screens that are accessed with a password used by plant maintenance personnel. The following items will be available on these screens:

- Sensor Check Interval (days)
- Intensity Deviation Alarm Set Point (%)
- Sensor Correction Factor

9.0 SCADA Communication Requirements

The PLC will interface to the Plant SCADA system via Modbus TCP communication protocol. This will allow the SCADA to monitor the UV disinfection process.

Note: Not all points shown below will be required by every system.

9.1 SCADA Write

The following table resides in the Trojan PLC. The SCADA PLC writes data to the following table.

Array Element	Modbus Address	Comment	Data Type	Units	Scale
PSS_Write[0].0	41001/0	Sync Date and Time	Bit	1=Sync	
PSS_Write[1]	41002	LinkWord	Integer	Value Increases by One Every Second	
PSS_Write[2]	41003	Date and Time - Year	Integer	Year	
PSS_Write[3]	41004	Date and Time - Month	Integer	Month	
PSS_Write[4]	41005	Date and Time - Day	Integer	Day	
PSS_Write[5]	41006	Date and Time - Hour	Integer	Hour	
PSS_Write[6]	41007	Date and Time - Minute	Integer	Minute	
PSS_Write[7]	41008	Date and Time - Second	Integer	Second	
PSS_Write[10].0	41011/0	UV Start Request	Bit	1=Start	
PSS_Write[10].1	41011/1	UV Stop Request	Bit	1=Stop	
PSS_Write[10].2	41011/2	Ack All Alarms	Bit	1=Ack Alarms	
PSS_Write[10].3	41011/3	Request Minimum Power	Bit	1=Minimum Power	
PSS_Write[10].4	41011/4	Request Maximum Power	Bit	1=Maximum Power	
PSS_Write[10].5	41011/5	Hot Standby Request	Bit	1=Minimum Power and Cooling Valves Open	
PSS_Write[11]	41012	Target Log Inactivation	Integer	0.5 - 4.0 Log	x10
PSS_Write[12]	41013	Target Pathogen	Integer	0=Cryptosporidium, 1=Giardia	
PSS_Write[13]	41014	Challenge Organism	Integer	0=MS2, 1=T1	
PSS_Write[14]	41015	Target RED	Integer	mJ/cm²	x10
PSS_Write[20]	41021	UVT	Integer	70-100%	x10
PSS_Write[21]	41022	Flow	Integer	L/s	x10
PSS_Write[22].0	41023/0	Manual Wipe Request	Bit	1=Wipe Request	

9.2 SCADA Read Only

The following table resides in the Trojan PLC. The SCADA PLC reads data from the following table.

Array Element	Modbus Address	Comment	Data Type	Units	Scale
PSS_Read[0].0	40001/0	LinkBit	Bit	Flashing Bit	
PSS_Read[0].1	40001/1	Main Power Present	Bit	1=Power Present	
PSS_Read[0].2	40001/2	OEM Logged In	Bit	1=Logged In	
PSS_Read[0].3	40001/3	OP1 Logged In	Bit	1=Logged In	
PSS_Read[0].4	40001/4	Operator Logged In	Bit	1=Logged In	
PSS_Read[1]	40002	LinkWord	Integer	Value Increases by One Every Second (0-32000)	
PSS_Read[2]	40003	Date and Time - Year	Integer	Year	
PSS_Read[3]	40004	Date and Time - Month	Integer	Month	
PSS_Read[4]	40005	Date and Time - Day	Integer	Day	
PSS_Read[5]	40006	Date and Time - Hour	Integer	Hour	
PSS_Read[6]	40007	Date and Time - Minute	Integer	Minute	
PSS_Read[7]	40008	Date and Time - Second	Integer	Second	
PSS_Read[10].0	40011/0	Common Critical Alarm	Bit	1=Alarm Active	
PSS_Read[10].1	40011/1	Common Major Alarm	Bit	1=Alarm Active	
PSS_Read[10].2	40011/2	Common Minor Alarm	Bit	1=Alarm Active	
PSS_Read[10].3	40011/3	Ready	Bit	1=Ready to Run	
PSS_Read[10].4	40011/4	Startup Initiated	Bit	1=Startup Initiated	
PSS_Read[10].5	40011/5	Reactor On	Bit	1=On and Able to Treat Water	
PSS_Read[10].6	40011/6	Startup Completed	Bit	1=Startup Complete	
PSS_Read[10].7	40011/7	Shutdown Initiated	Bit	1=Shutdown Initiated	
PSS_Read[10].8	40011/8	Auto Restart Active	Bit	1=Active	
PSS_Read[10].9	40011/9	Sensor Reference	Bit	1=Active	

		Check Active			
PSS_Read[11]	40012	Remote Control Mode	Integer	0=Local, 1=Remote Hardwired, 2=Remote Networked	
PSS_Read[12]	40013	Operating Mode	Integer	0=Auto, 1=Manual	
PSS_Read[13]	40014	Status	Integer	0=Off, 1=Cooling, 2=Warming, 3=On, 5=Hot Standby, 6=Unknown	
PSS_Read[14]	40015	Theoretical Power Consumption	Integer	kWatts	x10
PSS_Read[15]	40016	Flow Units	Integer	0=MGD, 1=GPM, 2=MLD, 3=L/s, 4=m^3/Hr	
PSS_Read[16]	40017	Reactor Runtime Hours	Integer	Hours (0-23)	
PSS_Read[17]	40018	Reactor Runtime Days	Integer	Days	
PSS_Read[18]	40019	Disinfection Warmup Time Remaining	Integer	Seconds	
PSS_Read[19]	40020	Operation Warmup Time Remaining	Integer	Seconds	
PSS_Read[20]	40021	Cooling Time Remaining	Integer	Seconds	
PSS_Read[31]	40032	Target Log Inactivation	Integer	0.5 - 4.0 Log	x10
PSS_Read[32]	40033	Theoretical Log Inactivation	Integer	0.5 - 4.0 Log	x10
PSS_Read[33]	40034	Target Pathogen	Integer	0=Cryptosporidium, 1=Giardia	
PSS_Read[34]	40035	Challenge Organism	Integer	0=MS2, 1=T1	
PSS_Read[35]	40036	Dose Required	Integer	mJ/cm²	x10
PSS_Read[36]	40037	Validated Dose	Integer	mJ/cm²	x10
PSS_Read[37]	40038	Target RED	Integer	mJ/cm²	x100
PSS_Read[38]	40039	Calculated RED	Integer	mJ/cm²	x100
PSS_Read[39]	40040	Validation Factor	Integer		x10
PSS_Read[40].0	40041/0	UVT Analyzer Faulted	Bit	1=Faulted	
PSS_Read[40].1	40041/1	Measured UVT Used	Bit	1=Measured	
PSS_Read[40].2	40041/2	Manual UVT Used	Bit	1=Manual	

PSS_Read[40].3	40041/3	Default UVT Used	Bit	1=Default	
PSS_Read[41]	40042	Measured UVT Value	Integer	0-100%	x10
PSS_Read[42]	40043	Active UVT Value	Integer	0-100%	x10
PSS_Read[45].0	40046/0	Flow Meter Faulted	Bit	1=Faulted	
PSS_Read[45].1	40046/1	Measured Flow Used	Bit	1=Measured	
PSS_Read[45].2	40046/2	Manual Flow Used	Bit	1=Manual	
PSS_Read[45].3	40046/3	Default Flow Used	Bit	1=Default	
PSS_Read[46]	40047	Measured Flow Value	Integer	L/s	x10
PSS_Read[47]	40048	Active Flow Value	Integer	L/s	x10
PSS_Read[48]	40049	Flow Multiplier	Integer	1=1, 2=10, 3=100, 4=0.1, 5=0.01	
PSS_Read[50].0	40051/0	Wiper Faulted	Bit	1=Faulted	
PSS_Read[50].1	40051/1	Wiper Fill Mode Active	Bit	1=Active	
PSS_Read[51]	40052	Wiper Mode	Integer	0=Off, 1=Fixed Interval, 2=Manual, 3=Service	
PSS_Read[52]	40053	Wiper Position	Integer	0=At Home, 1=Extending, 2=Retracting, 3=Unknown, 4=Advanced, 5=Faulted	
PSS_Read[53]	40054	Wiper Runtime Cycles	Integer	Cycles	
PSS_Read[54]	40055	Wiper Percentage Complete	Integer	0-100%	
PSS_Read[55]	40056	Time Until Next Wipe (Hours)	Integer	Hours	
PSS_Read[56]	40057	Time Until Next Wipe (Minutes)	Integer	Minutes	
PSS_Read[70].0	40071/0	Outlet Valve Faulted	Bit	1=Faulted	
PSS_Read[70].3	40071/3	Outlet Valve Ready	Bit	1=Ready	
PSS_Read[70].4	40071/4	Outlet Valve Closed	Bit	1=Closed	
PSS_Read[70].5	40071/5	Outlet Valve Opened	Bit	1=Opened	
PSS_Read[71]	40072	Outlet Valve Mode	Integer	0=Not Present, 1=Remote Manual, 2=Remote Auto, 3=SCADA, 4=Local, 5=Faulted	

PSS_Read[80].0	40081/0	Ballast 1 Faulted	Bit	1=Faulted	
PSS_Read[80].1	40081/1	Lamp 1 Faulted	Bit	1=Faulted	
PSS_Read[80].2	40081/2	Lamp 1 On Status	Bit	1=On	
PSS_Read[80].3	40081/3	Sensor 1 Faulted	Bit	1=Faulted	
PSS_Read[80].4	40081/4	Sensor 1 Reference Check Required	Bit	1=Required	
PSS_Read[81]	40082	Ballast 1 Ballast Power Level	Integer	%	
PSS_Read[82]	40083	Lamp 1 Status	Integer	0=Off, 2=Warming, 3=Cooling, 4=On, 5=Faulted	
PSS_Read[83]	40084	Lamp 1 Runtime Hours Remaining Until EOL	Integer	Hours	
PSS_Read[84]	40085	Lamp 1 Runtime Cycles	Integer	Cycles	
PSS_Read[85]	40086	Sensor 1 UV Intensity	Integer	mW/cm^2	x10
PSS_Read[86]	40087	Sensor 1 Days Until Reference Check Required	Integer	Days	
PSS_Read[90].0	40091/0	Ballast 2 Faulted	Bit	1=Faulted	
PSS_Read[90].1	40091/1	Lamp 2 Faulted	Bit	1=Faulted	
PSS_Read[90].2	40091/2	Lamp 2 On Status	Bit	1=On	
PSS_Read[90].3	40091/3	Sensor 2 Faulted	Bit	1=Faulted	
PSS_Read[90].4	40091/4	Sensor 2 Reference Check Required	Bit	1=Required	
PSS_Read[91]	40092	Ballast 2 Ballast Power Level	Integer	%	
PSS_Read[92]	40093	Lamp 2 Status	Integer	0=Off, 2=Warming, 3=Cooling, 4=On, 5=Faulted	

PSS_Read[93]	40094	Lamp 2 Runtime Hours Remaining Until EOL	Integer	Hours	
PSS_Read[94]	40095	Lamp 2 Runtime Cycles	Integer	Cycles	
PSS_Read[95]	40096	Sensor 2 UV Intensity	Integer	mW/cm^2	x10
PSS_Read[96]	40097	Sensor 2 Days Until Reference Check Required	Integer	Days	
PSS_Read[100].0	40101/0	Ballast 3 Faulted	Bit	1=Faulted	
PSS_Read[100].1	40101/1	Lamp 3 Faulted	Bit	1=Faulted	
PSS_Read[100].2	40101/2	Lamp 3 On Status	Bit	1=On	
PSS_Read[100].3	40101/3	Sensor 3 Faulted	Bit	1=Faulted	
PSS_Read[100].4	40101/4	Sensor 3 Reference Check Required	Bit	1=Required	
PSS_Read[101]	40102	Ballast 3 Ballast Power Level	Integer	%	
PSS_Read[102]	40103	Lamp 3 Status	Integer	0=Off, 2=Warming, 3=Cooling, 4=On, 5=Faulted	
PSS_Read[103]	40104	Lamp 3 Runtime Hours Remaining Until EOL	Integer	Hours	
PSS_Read[104]	40105	Lamp 3 Runtime Cycles	Integer	Cycles	
PSS_Read[105]	40106	Sensor 3 UV Intensity	Integer	mW/cm^2	x10
PSS_Read[106]	40107	Sensor 3 Days Until Reference Check Required	Integer	Days	
PSS_Read[110].0	40111/0	Ballast 4 Faulted	Bit	1=Faulted	
PSS_Read[110].1	40111/1	Lamp 4 Faulted	Bit	1=Faulted	

PSS_Read[110].2	40111/2	Lamp 4 On Status	Bit	1=On	
PSS_Read[110].3	40111/3	Sensor 4 Faulted	Bit	1=Faulted	
PSS_Read[110].4	40111/4	Sensor 4 Reference Check Required	Bit	1=Required	
PSS_Read[111]	40112	Ballast 4 Ballast Power Level	Integer	%	
PSS_Read[112]	40113	Lamp 4 Status	Integer	0=Off, 2=Warming, 3=Cooling, 4=On, 5=Faulted	
PSS_Read[113]	40114	Lamp 4 Runtime Hours Remaining Until EOL	Integer	Hours	
PSS_Read[114]	40115	Lamp 4 Runtime Cycles	Integer	Cycles	
PSS_Read[115]	40116	Sensor 4 UV Intensity	Integer	mW/cm^2	x10
PSS_Read[116]	40117	Sensor 4 Days Until Reference Check Required	Integer	Days	

9.3 SCADA Alarms

The following table resides in the Trojan PLC. The SCADA PLC reads data from the following table if required.

Array Element	Modbus Address	Comment
Alarms[0].0	40201/0	1. PLANT SCADA COMMUNICATIONS FAILURE
Alarms[0].1	40201/1	2. COMMUNICATIONS BOARD TIMEOUT
Alarms[0].2	40201/2	3. PLC FAULTED
Alarms[0].3	40201/3	4. E-STOP PRESSED
Alarms[0].5	40201/5	6. PLC BATTERY LOW
Alarms[0].15	40201/15	16. IO SIMULATION ENABLED
Alarms[1].0	40202/0	17. REACTOR LOW WATER LEVEL
Alarms[1].1	40202/1	18. REACTOR HIGH TEMPERATURE
Alarms[1].3	40202/3	20. REACTOR COVER IS OFF
Alarms[1].4	40202/4	21. MULTIPLE BALLAST ALARM
Alarms[1].5	40202/5	22. MULTIPLE LAMP ALARM
Alarms[1].6	40202/6	23. START UP SEQUENCE FAILED
Alarms[1].7	40202/7	24. LOW UV DOSE MAJOR
Alarms[1].8	40202/8	25. REFERENCE SENSOR PROCEDURE ACTIVE
Alarms[2].0	40203/0	33. OFF SPECIFICATION - LOW VALIDATED DOSE
Alarms[2].1	40203/1	34. OFF SPECIFICATION - LOW S/S0
Alarms[2].2	40203/2	35. OFF SPECIFICATION - LOW UVT
Alarms[2].3	40203/3	36. OFF SPECIFICATION - HIGH FLOW
Alarms[2].4	40203/4	37. OFF SPECIFICATION - LOW RED
Alarms[2].5	40203/5	38. OFF SPECIFICATION - REACTOR OFF WITH VALVES OPEN
Alarms[2].6	40203/6	39. LOG INACTIVATION NOT POSSIBLE
Alarms[2].7	40203/7	40. SENSOR CORRECTION FACTOR APPLIED
Alarms[2].8	40203/8	41. OFF SPECIFICATION - INVALID BRED
Alarms[2].9	40203/9	42. OFF SPECIFICATION - INVALID MINIMUM RED
Alarms[2].10	40203/10	43. OFF SPECIFICATION - LAMP FAILED
Alarms[2].11	40203/11	44. OFF SPECIFICATION - SENSOR FAILED
Alarms[3].3	40204/3	52. UVT LESS THAN DESIGN
Alarms[3].8	40204/8	57. LOW FLOW RATE
Alarms[3].10	40204/10	59. FLOW METER SIGNAL OUT OF RANGE
Alarms[3].11	40204/11	60. FLOW METER MANUAL VALUE USED

Alarms[3].12	40204/12	61. MAXIMUM HYDRAULIC CAPACITY EXCEEEDED
Alarms[3].13	40204/13	62. FLOW GREATER THAN DESIGN
Alarms[4].0	40205/0	65. WIPER REVOLUTION SENSOR FAULT
Alarms[4].1	40205/1	66. WIPER HOME LIMIT SWITCH FAULT
Alarms[4].2	40205/2	67. WIPER EXTEND TRAVEL TIME EXCEEDED
Alarms[4].3	40205/3	68. WIPER RETRACT TRAVEL TIME EXCEEDED
Alarms[4].4	40205/4	69. WIPER POSITION UNKNOWN
Alarms[6].0	40207/0	97. OUTLET VALVE NOT READY
Alarms[6].1	40207/1	98. OUTLET VALVE FAIL TO OPEN
Alarms[6].2	40207/2	99. OUTLET VALVE FAIL TO CLOSE
Alarms[6].3	40207/3	100. OUTLET VALVE IN MANUAL
Alarms[7].0	40208/0	113. BALLAST 1 MAJOR ALARM
Alarms[7].2	40208/2	115. BALLAST 1 HIGH TEMPERATURE
Alarms[7].5	40208/5	118. LAMP 1 MAJOR ALARM
Alarms[7].7	40208/7	120. LAMP 1 END OF LIFE WARNING
Alarms[7].8	40208/8	121. SENSOR 1 SIGNAL LOST
Alarms[7].9	40208/9	122. SENSOR 1 SATURATED
Alarms[7].10	40208/10	123. SENSOR 1 UV INTENSITY DEVIATION
Alarms[7].11	40208/11	124. SENSOR 1 REFERENCE CHECK REQUIRED
Alarms[8].0	40209/0	129. BALLAST 2 MAJOR ALARM
Alarms[8].2	40209/2	131. BALLAST 2 HIGH TEMPERATURE
Alarms[8].5	40209/5	134. LAMP 2 MAJOR ALARM
Alarms[8].7	40209/7	136. LAMP 2 END OF LIFE WARNING
Alarms[8].8	40209/8	137. SENSOR 2 SIGNAL LOST
Alarms[8].9	40209/9	138. SENSOR 2 SATURATED
Alarms[8].10	40209/10	139. SENSOR 2 UV INTENSITY DEVIATION
Alarms[8].11	40209/11	140. SENSOR 2 REFERENCE CHECK REQUIRED
Alarms[9].0	40210/0	145. BALLAST 3 MAJOR ALARM
Alarms[9].2	40210/2	147. BALLAST 3 HIGH TEMPERATURE
Alarms[9].5	40210/5	150. LAMP 3 MAJOR ALARM
Alarms[9].7	40210/7	152. LAMP 3 END OF LIFE WARNING
Alarms[9].8	40210/8	153. SENSOR 3 SIGNAL LOST
Alarms[9].9	40210/9	154. SENSOR 3 SATURATED
Alarms[9].10	40210/10	155. SENSOR 3 UV INTENSITY DEVIATION
Alarms[9].11	40210/11	156. SENSOR 3 REFERENCE CHECK REQUIRED

Alarms[10].0	40211/0	161. BALLAST 4 MAJOR ALARM
Alarms[10].2	40211/2	163. BALLAST 4 HIGH TEMPERATURE
Alarms[10].5	40211/5	166. LAMP 4 MAJOR ALARM
Alarms[10].7	40211/7	168. LAMP 4 END OF LIFE WARNING
Alarms[10].8	40211/8	169. SENSOR 4 SIGNAL LOST
Alarms[10].9	40211/9	170. SENSOR 4 SATURATED
Alarms[10].10	40211/10	171. SENSOR 4 UV INTENSITY DEVIATION
Alarms[10].11	40211/11	172. SENSOR 4 REFERENCE CHECK REQUIRED

Revision History

Rev	Description	Rev By	Reviewed By	Date
1.0	For Submittal	JLT	JM	27-Feb-2023
1.				
1.				
1.				
1.				

PART

E

WARRANTIES

Equipment Limited Warranty

The following terms and conditions will govern the equipment warranty provided by Trojan Technologies to the Owner/Operator:

Period of Coverage: Trojan Technologies ("Trojan") warrants to the Owner/Operator noted above (the "Customer") that if within 12 calendar months from equipment Substantial Completion or 18 calendar months from the date of delivery (the "Warranty Period"), whichever comes first, equipment manufactured by Trojan (the "Equipment") will be free from defects in material and workmanship and will function in accordance with the specifications agreed to by Trojan for the Equipment.

> "Substantial Completion" is the date on which the Equipment commissioning and start-up is sufficiently completed such that the Equipment is capable of being put into operation such that the Owner can utilize the Equipment for its intended disinfection use.

Customer must notify Trojan in writing within 5 days of the date of any Equipment failure. This notification shall include a description of the problem, a copy of the operator's log, a copy of the Customer's maintenance record and any analytical results detailing the problem. If Customer has not maintained the operator's log and maintenance record in the manner directed in the Operation and Maintenance manual, or does not notify Trojan of the problem as specified above, this warranty may, in Trojan's discretion, be invalid.

If a defect occurs, Trojan will, at its option, repair or replace the defective component free of charge, provided that:

1. Customer fully cooperates with Trojan, in the manner requested by Trojan, in attempting to diagnose and resolve the problem by way of telephone support. If the problem can be diagnosed and verified by telephone support and a replacement part is required, Trojan will either ship at Trojan's expense, a repaired, reworked or new part to the Customer, who will install such part as directed by Trojan, or direct Customer to acquire, at Trojan's expense, such part from a third party and to install such part as directed by Trojan;
2. In the event that Trojan determines that the problem cannot be resolved by way of telephone support and/or shipment by Trojan, or acquisition by the Customer of a replacement part for installation by the Customer, Trojan will send one or more persons to make an onsite inspection of the problem. If an onsite visit is made, Trojan personnel will evaluate the problem and repair or replace any Equipment determined to be in breach of this warranty. If the problem is not attributable to a breach of this warranty, Trojan reserves the right to invoice the Customer for this service; and
3. The Equipment is covered and the failure occurs within the Warranty Period

Trojan will, at its option, use new and/or reconditioned parts in performing warranty repair. Trojan has the right to use parts or products of original or improved design in the repair or replacement.

The products or general components replaced or repaired free of charge under the Equipment Limited Warranty are warranted only for the *remaining* portion of the original Equipment Limited Warranty Period.

Limitations: This warranty shall not apply to any failure or defect which results from:

- the Equipment not being operated and maintained in strict accordance with instructions specified in the Operation and Maintenance manual or Product Bulletin or which results from mishandling, misuse, neglect, improper storage, improper operation of the Equipment with other equipment furnished by the Customer or by other third parties or from defects in designs or specifications furnished by or on behalf of the Customer by a person other than Trojan.
- Equipment that has been altered or repaired after start-up by anyone except: (a) authorized representatives of Trojan, or (b) Customer acting under specific written instructions from Trojan.
- Use of parts not supplied or approved by Trojan

This warranty does not cover:

- Equipment components manufactured by third parties but furnished to Customer by Trojan are warranted by the original manufacturer, only to the extent of the original manufacturer's warranty
- Normal wear and tear of the product
- Consumable components including but not limited to wiper seals, cleaning chemical, batteries
- Trojan supplied components that are the subject of a separate warranty
- Costs related to removal, installation, or troubleshooting of a component
- Physical damage
- Improper installation
- Acts of God, terrorism, biological infestations, or input voltage that create operating conditions beyond the minimum or maximum limits listed in the Operations Manual including high input voltage from generators and lightening strikes
- Damage caused by improper return packaging
- Taxes, duties or brokerage fees (if any)

This warranty is the exclusive remedy for all claims based on a failure of or defect in the Equipment, whether the claim is based on contract (including fundamental breach), tort (including negligence), strict liability or otherwise. This warranty is in lieu of all other warranties whether written, oral, implied or statutory. Without limitation, no warranty of merchantability or fitness for a particular purpose shall apply to the Equipment.

Trojan does not assume any liability for personal injury or property damage caused by use or misuse of the Equipment. Trojan shall not in any event be liable for special, incidental, indirect or consequential damages including, without limitation, lost profits, lost business opportunities, lost revenue or loss or depreciation of goodwill, even if it has been advised of the possibility thereof. Trojan's liability shall, in all instances, be limited to repair or replacement of Equipment in breach of this warranty and shall not exceed the cost of such repair or replacement. This liability with respect to repair or replacement will terminate upon the expiration date of this warranty.

In addition to the foregoing, in no event shall Trojan's liability relating to the Equipment, or the agreement between Trojan and the Customer relating to the Equipment, exceed that portion of the purchase price for the Equipment which is actually paid to Trojan.

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3020 Gore Road, London, Ontario, Canada N5V 4T7 T 519.457.3400 F 519.457.3030 www.trojanuv.com

Medium Pressure Lamp Limited Warranty
TrojanUVSwift™ (Models L12)

Warranty Coverage:

The following warranty applies to Trojan Technologies Medium Pressure Lamps (the "Lamps") for the TrojanUVSwift, models ending in "L12". The warranty is only valid with respect to a Lamp that is properly stored, handled and installed as specified in the Operation and Maintenance manual supplied with the system in which the Lamp is installed or as outlined in Product Bulletins. Without limiting the generality of the foregoing, any excess vibration or improper operation of a Lamp shall void this warranty. In addition, Trojan Technologies shall not be liable for any Lamp failure which results from UV equipment not being operated and maintained in strict accordance with the instructions set out in the Operation and Maintenance manual or as outlined in Product Bulletins.

In order to process any Lamp warranty claim, Trojan Technologies requires the Customer to provide a copy of the operator's log, all maintenance records and a completed Lamp Warranty Claim Form (see attachment) within one (1) month of the lamp failure. Failure to meet these conditions will void the Lamp warranty.

Trojan Technologies also reserves the right to require the Customer to return a failed Lamp to Trojan Technologies' facilities for inspection. Failure to return the Lamp when requested shall void the warranty.

Period of Coverage:

Where a Lamp has been stored, handled and installed as specified in the Operation and Maintenance manual or as outlined in Product Bulletins, and the relevant UV equipment has been operated and maintained in accordance with instructions specified in the Operation and Maintenance manual, and:

1. The Lamp fails within the first 3,000 hours of operation, Trojan Technologies shall provide the Customer with a replacement Lamp free of charge.

2. The Lamp fails after 3,000 hours and prior to 5,000 hours of operation, Trojan Technologies shall provide the Customer with a replacement Lamp at a discounted price. The following formula is used to determine the discounted price for replacement Lamps:

   Replacement Lamp Price = ((Lamp Operating Hours) / 5,000 x Lamp List Price)

Regardless of actual Lamp operating hours, the Lamp warranty is void if the date of Lamp failure occurs more than thirty-six (36) calendar months after the Lamp shipment date from Trojan Technologies.

The above operating conditions of Lamps are based on an average of 4 On/Off cycles, per 24 hour period, accumulated over the total guaranteed life of the Lamp.

Limitations:

This limited warranty does not cover:

- Lamps that have been used with parts not supplied or approved by Trojan Technologies
- Lamps that have been physically damaged or fail due to corrosion, exposure to contaminants (e.g. effluent), incorrect installation or operation,
- Costs related to removal, installation, or troubleshooting
- Damage caused by improper return packaging
- Taxes, duties or brokerage fees (if any)

The above warranty is the exclusive remedy for all claims based on a failure of or defect in a Lamp, whether the claim is based on contract (including fundamental breach), tort (including negligence), strict liability or otherwise. This warranty is in lieu of all other warranties whether written, oral, implied or statutory. Without limitation, no warranty of merchantability or of fitness for a particular purpose shall apply to a Lamp.

Trojan Technologies does not assume any liability for personal injury or property damage caused by use or misuse of a Lamp. Trojan Technologies shall not in any case be liable for special, incidental, indirect or consequential damages, even if it has been advised of the possibility thereof. Trojan Technologies' liability shall not, in any case, exceed the cost of replacement of a defective Lamp.

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TROJANUV

Warranty Claim Form

Complete all applicable info

Check one:
- ☐ Lamp Driver
- ☐ Lamp
- ☐ UV Sensor

Check one:
- ☐ TrojanUVSwift
- ☐ TrojanUVSwiftSC
- ☐ TrojanUVSwiftECT
- ☐ TrojanUVTelos

- ☐ TrojanUVFit
- ☐ TrojanUVPhox
- ☐ TrojanUVFlex
- ☐ TrojanUVTorrent
- ☐ TrojanUVTorrentECT

Site/Project Name: _____

Project/Serial #: _____

Part Number: _____

No.	Date of Installation	Date of Failure	Chamber #	Lamp / Lamp Driver / Sensor #	Chamber Hours at Installation	Chamber Hours at Failure	Net Operating Hours	On/Off Cycles	Serial /Lot Number
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									

Notes:

Completed By: _____

Phone #: _____

Email: _____

*** Submit failures on warranty claim form monthly otherwise warranty claim may be void.**

* Items that are damaged, show signs of corrosion, have been exposed to water, or were not handled, installed, or operated according to the O&M manual are not valid for warranty.

For electronic copy of form please contact our Customer Care Representatives (CCR's) at na.warranty@trojanuv.com

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3020 Gore Road, London, Ontario, Canada N5V 4T7 T 519.457.3400 F 519.457.3030 www.trojanuv.com

Lamp Driver Limited Warranty
TrojanUVSwift™ (Model L12)

Warranty Coverage:

The following warranty applies to the Trojan Technologies Lamp Driver (the "Lamp Driver") for the TrojanUVSwift, models ending in "L12". The warranty is only valid with respect to a new Lamp Driver that is purchased as: (i) a component of a new system, (ii) a spare part shipped with a new system, or (iii) a purchased replacement component, and that is properly stored, handled and installed as specified in the Operation and Maintenance manual supplied with the system in which the Lamp Driver is installed or as outlined in Product Bulletins. Without limiting the generality of the foregoing, any excess vibration or improper operation of the Lamp Driver shall void this warranty. In addition, Trojan Technologies shall not be liable for any Lamp Driver failure which results from UV equipment not being operated and maintained in strict accordance with the instructions set out in the Operation and Maintenance manual or Product Bulletins.

In order to assess and process any Lamp Driver warranty claim, Trojan Technologies requires the customer to notify Trojan within one (1) month of the failure and submit a completed Lamp Driver Claim Form (See Attachment) otherwise the warranty shall be void.

Trojan Technologies reserves the right to require the Customer to return failed Lamp Drivers to Trojan Technologies' facilities for inspection along with the operator's log and maintenance records. Failure to return the Lamp Driver or provide logs or records when requested shall void the warranty. Trojan Technologies will cover the return shipping expense.

Period Of Coverage:

Where a Lamp Driver has been stored, handled and installed as specified in the Operation and Maintenance manual, and the relevant UV equipment has been operated and maintained in accordance with instructions specified in the Operation and Maintenance manual or Product Bulletin, and:

1. the Lamp Driver fails within one (1) calendar year after the Warranty Start Date, Trojan Technologies shall provide the Customer with a replacement Lamp Driver free of charge;

2. the Lamp Driver fails after the first (1st), and before the fifth (5th), anniversary of the Warranty Start Date, Trojan Technologies shall provide the Customer with a replacement Lamp Driver at a discounted price. The following formula is used to determine the discounted price for replacement Lamp Drivers:

   Replacement Lamp Driver Price = ((Number of Elapsed Months) / 60 x Lamp Driver List Price)

The "Warranty Start Date" is, in the case of a Lamp Driver forming part of a new system installation or shipped as a spare part with a new system, the commissioning date of the new system and, in the case of a Lamp Driver purchased as a replacement component, the shipment date of the Lamp Driver. One "Elapsed Month" shall be deemed to have passed at the beginning of the day in each subsequent month that is the same calendar day as the day on which the Warranty Start Date falls, or the first day of the next following month if the Warranty Start Date falls on a day not present in any particular month. (For example, if the Warranty Start Date is January 10, one Elapsed Month will have occurred on each of February 10 and March 10, but if the Warranty Start Date is January 29, one Elapsed Month will have occurred on each of March 1 and March 29.)

Limitations:

This limited warranty does not cover:

- Lamp Drivers that have been used with parts not supplied or approved by Trojan Technologies
- Lamp Drivers that have been physically damaged or fail due to corrosion, improper installation, exposure to moisture or abnormal stresses
- Damage caused by power quality disturbances falling outside the acceptable voltage tolerance of the ITIC (CBEMA) curve referenced from IEEE Standard 1100-2005
- Costs related to troubleshooting, removal or installation
- Damage caused by improper return packaging
- Taxes, duties or brokerage fees, if any.

The above warranty is the exclusive remedy for all claims based on a failure of or defect in a Lamp Driver, whether the claim is based on contract (including fundamental breach), tort (including negligence), strict liability or otherwise. This warranty is in lieu of all other warranties whether written, oral, implied or statutory. Without limitation, no warranty of merchantability or of fitness for a particular purpose shall apply to a Lamp Driver.

Trojan Technologies does not assume any liability for personal injury or property damage caused by use or misuse of a Lamp Driver. Trojan Technologies shall not in any case be liable for special, incidental, indirect or consequential damages, even if it has been advised of the possibility thereof. Trojan Technologies' liability shall not, in any case, exceed the cost of the Lamp Driver.

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TROJANUV

Warranty Claim Form

Complete all applicable info

Check one:
- ☐ Lamp Driver
- ☐ Lamp
- ☐ UV Sensor

Check one:
- ☐ TrojanUVSwift
- ☐ TrojanUVSwiftSC
- ☐ TrojanUVSwiftECT
- ☐ TrojanUVTelos

- ☐ TrojanUVFit
- ☐ TrojanUVPhox
- ☐ TrojanUVFlex
- ☐ TrojanUVTorrent
- ☐ TrojanUVTorrentECT

Site/Project Name: _____

Project/Serial #: _____

Part Number: _____

No.	Date of Installation	Date of Failure	Chamber #	Lamp / Lamp Driver / Sensor #	Chamber Hours at Installation	Chamber Hours at Failure	Net Operating Hours	On/Off Cycles	Serial /Lot Number
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									

Notes:

Completed By: _____

Phone #: _____

Email: _____

*** Submit failures on warranty claim form monthly otherwise warranty claim may be void.**

* Items that are damaged, show signs of corrosion, have been exposed to water, or were not handled, installed, or operated according to the O&M manual are not valid for warranty.

For electronic copy of form please contact our Customer Care Representatives (CCR's) at na.warranty@trojanuv.com

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UV Intensity Sensor Limited Warranty
TrojanUVSwift™ and TrojanUVSwift™ECT

Warranty Coverage:

The following warranty applies to the Trojan Technologies UV Intensity Sensor (the "Sensor") for the TrojanUVSwift and TrojanUVSwiftECT. The warranty is only valid with respect to a new Sensor that is purchased as: (i) a component of a new system, (ii) a spare part shipped with a new system, or (iii) a purchased replacement component, and that is properly stored, handled and installed as specified in the Operation and Maintenance manual supplied with the system in which the Sensor is installed or as outlined in Product Bulletins. Without limiting the generality of the foregoing, any excess vibration or improper operation of the Sensor shall void this warranty. In addition, Trojan Technologies shall not be liable for any Sensor failure which results from UV equipment not being operated and maintained in strict accordance with the instructions set out in the Operation and Maintenance manual or Product Bulletins.

In order to assess and process any Sensor warranty claim, Trojan Technologies requires the customer to notify Trojan within one (1) month of the failure and submit a completed Sensor Claim Form (See Attachment) otherwise the warranty shall be void.

Trojan Technologies reserves the right to require the Customer to return failed Sensors to Trojan Technologies' facilities for inspection along with the operator's log and maintenance records. Failure to return the Sensor or provide logs or records when requested shall void the warranty. Trojan Technologies will cover the return shipping expense.

Period Of Coverage:

Where a Sensor has been stored, handled and installed as specified in the Operation and Maintenance manual, and the relevant UV equipment has been operated and maintained in accordance with instructions specified in the Operation and Maintenance manual or Product Bulletin, and:

1. the Sensor fails within one (1) calendar year after the Warranty Start Date, Trojan Technologies shall provide the Customer with a replacement Sensor free of charge;

2. the Sensor fails after the first (1^{st}), and before the fifth (5^{th}), anniversary of the Warranty Start Date, Trojan Technologies shall provide the Customer with a replacement Sensor at a discounted price. The following formula is used to determine the discounted price for replacement Sensors:

   Replacement Sensor Price = ((Number of Elapsed Months) / 60 x Sensor List Price)

The "Warranty Start Date" is, in the case of a Sensor forming part of a new system installation or shipped as a spare part with a new system, the commissioning date of the new system and, in the case of a Sensor purchased as a replacement component, the shipment date of the Sensor. One "Elapsed Month" shall be deemed to have passed at the beginning of the day in each subsequent month that is the same calendar day as the day on which the Warranty Start Date falls, or the first day of the next following month if the Warranty Start Date falls on a day not present in any particular month. (For example, if the Warranty Start Date is January 10, one Elapsed Month will have occurred on each of February 10 and March 10, but if the Warranty Start Date is January 29, one Elapsed Month will have occurred on each of March 1 and March 29.)

Limitations:

This limited warranty does not cover:

- Sensor Calibration. Calibration is considered a routine maintenance item.
- Sensors that have been used with parts not supplied or approved by Trojan Technologies.
- Sensors that have been physically damaged or fail due to corrosion, improper installation, exposure to moisture, or abnormal stresses.
- Costs related to removal, installation, or troubleshooting.
- Damage caused by improper return packaging.
- Taxes, duties or brokerage fees, if any.

The above warranty is the exclusive remedy for all claims based on a failure of or defect in a Sensor, whether the claim is based on contract (including fundamental breach), tort (including negligence), strict liability or otherwise. This warranty is in lieu of all other warranties whether written, oral, implied or statutory. Without limitation, no warranty of merchantability or of fitness for a particular purpose shall apply to a Sensor.

Trojan Technologies does not assume any liability for personal injury or property damage caused by use or misuse of a Sensor. Trojan Technologies shall not in any case be liable for special, incidental, indirect or consequential damages, even if it has been advised of the possibility thereof. Trojan Technologies' liability shall not, in any case, exceed the cost of the Sensor.

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TROJANUV

Warranty Claim Form

Complete all applicable info

Check one:
- ☐ Lamp Driver
- ☐ Lamp
- ☐ UV Sensor

Check one:
- ☐ TrojanUVSwift
- ☐ TrojanUVSwiftSC
- ☐ TrojanUVSwiftECT
- ☐ TrojanUVTelos
- ☐ TrojanUVFit
- ☐ TrojanUVPhox
- ☐ TrojanUVFlex
- ☐ TrojanUVTorrent
- ☐ TrojanUVTorrentECT

Site/Project Name: _____

Project/Serial #: _____

Part Number: _____

No.	Date of Installation	Date of Failure	Chamber #	Lamp / Lamp Driver / Sensor #	Chamber Hours at Installation	Chamber Hours at Failure	Net Operating Hours	On/Off Cycles	Serial /Lot Number
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									

Notes:

Completed By: _____

Phone #: _____

Email: _____

*** Submit failures on warranty claim form monthly otherwise warranty claim may be void.**

* Items that are damaged, show signs of corrosion, have been exposed to water, or were not handled, installed, or operated according to the O&M manual are not valid for warranty.

For electronic copy of form please contact our Customer Care Representatives (CCR's) at na.warranty@trojanuv.com

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3020 Gore Road, London, Ontario, Canada N5V 4T7 T 519.457.3400 F 519.457.3030 www.trojanuv.com

PERFORMANCE GUARANTEE

Trojan Technologies certifies to Iqaluit Replacement, NU that the TrojanUVSwift™ disinfection equipment supplied will provide 3 Log Inactivation of Giardia and 3 Log Inactivation of Cryptosporidium and provided the following criteria is upheld.

PEAK FLOW: 4 MLD / UV Chamber @ Design UVT 75% (2 Duty Chambers)

8 MLD / UV Chamber @ Average Operating UVT 83% (1 Duty Chamber/ 1 Redundant Chamber)

DESIGN UV TRANSMITTANCE @ 253.7 nm: 75% Minimum

AVERAGE OPERATING UV TRANSMITTANCE @ 253.7 nm: 83% Minimum

TROJAN LAMP HOURS: ≤ 5,000

This performance guarantee is also contingent upon proper care and maintenance of the unit, as detailed within the Operation and Maintenance Manual, and the use of Trojan approved parts. The performance guarantee is specific to the plant treatment process and water quality reviewed at the time of bid and conditioned on the absence of water and operating conditions which may adversely affect the equipment provided, including water conditions falling outside of the parameters listed above.

PART F

SAFETY DATA SHEET (SDS)

SAFETY DATA SHEET

1 Product and Company Identification

Product identifier	ActiClean™ Gel
CAS #	Glass cleaner
Recommended restrictions	None known
Manufacturer information	Trojan Technologies
	3020 Gore Road
	London, ON N5V 4T7 CA
	Phone: 519-457-3400
	Phone: 888-220-6118
CANUTEC	Phone: 613-996-6666

2 Hazards Identification

Physical hazards	Not classified
Health hazards	Not classified
Environmental hazards	Not classified
WHMIS 2015 defined hazards Label elements	
Hazard symbol	None
Signal word	None
Hazard statement	The mixture does not meet the criteria for classification.
Precaution statement	
Prevention	Observe good industrial hygiene practices.
Response	Wash hands after handling.
Storage	Store away from incompatible materials.
Disposal	Dispose of waste and residues in accordance with local authority requirements.
WHMIS 2015: Health Hazard(s) not otherwise classified (HHNOC)	None known
WHMIS 2015: Physical Hazard(s) not otherwise classified (PHNOC)	None known
Hazard(s) not otherwise classified (HNOC)	None known
Supplemental information	None

3 Composition/Information on Ingredients

Mixture Composition comments	This product is considered non-hazardous by WHMIS/OSHA criteria.

4 First Aid Measures

Inhalation	If symptoms develop move victim to fresh air. If symptoms persist, obtain medical attention.
Skin Contact	Flush with cool water. Wash with soap and water. Obtain medical attention if irritation persists.
Eye Contact	Hold eye open and rinse gently with water for 15-20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye.
Ingestion	Rinse mouth. Do not induce vomiting. If vomiting occurs, have victim lean forward to reduce risk of aspiration. Never give anything by mouth if victim is unconscious, or convulsing.
Most important symptoms/effects, acute and delayed	Direct contact with eyes may cause temporary irritation.
Indication of immediate medical attention and special treatment needed	Treat patient symptomatically.
General Information	If feeling unwell, seek medical advice (show the label and SDS where possible). Ensure medical personnel are aware of the material(s) involved, and take precautions to protect themselves. Avoid contact with eyes and skin. Keep out of reach of children.

5 Fire Fighting Measures

Suitable extinguishing media	Water fog. Foam. Dry chemical powder. Carbon dioxide (CO_2).
Unsuitable extinguishing media	Do not use water jet as an extinguisher, as this will spread the fire.
Specific hazards arising from the chemical	During fire, gases hazardous to health may be formed.
Special protective equipment and precautions for firefighters	Self-contained breathing apparatus and full protective clothing must be worn in case of fire.
Fire-fighting equipment/instructions	Move containers from fire area if you can do so without risk.
Specific methods	Use standard firefighting procedures and consider the hazards of other involved materials.
General fire hazards	No unusual fire or explosion hazards noted.
Hazardous combustion Products	May include and are not limited to: Oxides of carbon.

6 Accidental Release Measures

Personal precautions, protective equipment and emergency procedures	Keep unnecessary personnel away. For personal protection, refer to Section 8.
Methods and materials for containment and cleanup	Large Spills: Stop the flow of material, if this is without risk. Dike the spilled material, where this is possible. Cover with plastic sheet to prevent spreading. Absorb in vermiculite, dry sand or earth and place into containers. Following product recovery, flush area with water. Small Spills: Wipe up with absorbent material (e.g. cloth, fleece). Clean surface thoroughly to remove residual contamination.
Environmental precautions	Never return spills to original containers for re-use. For waste disposal, refer to Section 13.

7 Handling and Storage

Precautions for safe handling	Wash thoroughly after handling. Use good industrial hygiene practices in handling this material. When using do not eat or drink.
Conditions for safe storage, including any incompatibilities	Store in original tightly closed container. Store away from incompatible materials (refer to Section 10). Keep out of reach of children.

8 Exposure Controls/Personal Protection

Occupational exposure limits	No exposure limits noted for ingredient(s).
Biological limit values	No biological exposure limits noted for the ingredient(s).
Appropriate engineering controls	Good general ventilation (typically 10 air changes per hour) should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level.
Individual protection measures, such as personal protective equipment, Eye/face protection	
Eye/face protection	Wear safety glasses with side shields (or goggles).
Skin protection:	
Hand protection	Impervious gloves. Confirm with reputable supplier first.
Other	Wear suitable protective clothing. As required by employer code.
Respiratory protection	Not normally required.
Thermal hazards	Not applicable
General hygiene considerations	Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants. When using do not eat or drink.

9 Physical and Chemical Properties

Appearance	Gel
Physical State	Liquid
Form	Gel
Colour	Off-white
Odor	Odorless
Odor Threshold	Not available
pH	1
Melting Point / Freezing Point	-5ºC (23ºF)
Initial Boiling Point	> 100ºC (> 212ºF)
Pour Point	Not available
Specific gravity	1.1
Partition coefficient (n-octanol/water)	Not available
Flash Point	Not available
Evaporation Rate	Not available
Flammability (solid, gas)	Not applicable
Upper/Lower Explosive Limits	Not available
Vapor Pressure	Not available
Vapor Density	Not available
Relative Density	Not available
Solubility(ies)	Not available
Auto-ignition Temperature	Not available

Decomposition Temperature	Not available
Viscosity	Viscous
Other information:	
Explosive properties	Not explosive
Oxidizing properties	Not oxidizing

10 Stability and Reactivity

Reactivity	Reacts violently with strong alkaline substances. This product may react with reducing agents. This product may react with strong oxidizing agents.
Possibility of hazardous reactions	No dangerous reaction known under conditions of normal use.
Chemical stability	Material is stable under normal conditions.
Conditions to avoid	Do not mix with other chemicals.
Incompatible materials	Not corrosive to SAE 1020 Steel or non-clad Aluminum based on test data (UN Manual of Tests and Criteria, Part III, Section 37.1 -Corrosion to metals). May react with soft metals such as aluminum and zinc producing flammable hydrogen gas, Caustics, and Lead.
Hazardous decomposition products	May include and are not limited to : Oxides of carbon.

11 Toxicological Information

Routes of exposure	Eye, Skin contact, Inhalation, Ingestion.
Information on likely routes of exposure	
Ingestion	Expected to be a low ingestion hazard. May cause stomach distress, nausea or vomiting.
Inhalation	Health injuries are not known or expected under normal use.
Skin contact	Not corrosive or irritating to skin based on test data.
	No adverse effects due to skin contact are expected.
Eye contact	Not corrosive or irritating to eyes based on test data.
Symptoms related to the physical, chemical and toxicological characteristics	Direct contact with eyes may cause temporary irritation.
Information on toxicological effects	
Acute toxicity	Not available
Skin corrosion/irritation	Prolonged skin contact may cause temporary irritation.
Exposure minutes	Not available
Erythema value	Not available
Oedema value	Not available
Serious eye damage/eye irritation	Direct contact with eyes may cause temporary irritation.
Corneal opacity value	Not available
Iris lesion value	Not available
Conjunctival reddening value	Not available
Recover days	Not available
Respiratory or skin sensitization	
Respiratory sensitization	Not a respiratory sensitizers.
Skin sensitization	This product is not expected to cause skin sensitization.
Mutagenicity	No data available to indicate product or any components present at greater than 0.1% are mutagenic or genotoxic.

Carcinogenicity

US - California Proposition 65 - CRT: Listed date/Carcinogenic substance

Crystalline silica (CAS 14808-60-7)

US. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)

Not listed

Reproductive toxicity	This product is not expected to cause reproductive or developmental effects.
Teratogenicity	Not available
Specific target organ toxicity (single exposure)	Not classified
Specific target organ toxicity (repeated exposure)	Not classified
Aspiration hazard	Not an aspiration hazard.

12 Ecological Information

Ecotoxicity	Not available
Persistence and degradability	Not available
Bioaccumulative potential	
Mobility in soil	Not available
Mobility in general	Not available
Other adverse effects	Not available

13 Disposal Information

Disposal instructions	Collect and reclaim or dispose in sealed containers at licensed waste disposal site. Dispose in accordance with all applicable regulations.
Local disposal regulations	Dispose in accordance with all applicable regulations.
Hazardous waste code	The waste code should be assigned in discussion between the user, the producer and the waste disposal company.
Waste from residues / unused products	Dispose of in accordance with local regulations. Empty containers or liners may retain some product residues. This material and its container must be disposed of in a safe manner (see: Disposal instructions).
Contaminated packaging	Since emptied containers may retain product residue, follow label warnings even after container is emptied. Empty containers should be taken to an approved waste handling site for recycling or disposal.

14 Transport Information

Transport of Dangerous Goods (TDG) Proof of Classification	In accordance with Part 2.2.1 (SOR/2014-152) of the Transportation of Dangerous Goods. Regulations, we certify that the classification of this product is correct as of the SDS date of issue.

U.S. Department of Transportation (DOT)

Not regulated as dangerous goods.

Transportation of Dangerous Goods (TDG - Canada)

Not regulated as dangerous goods.

15. Regulatory Information

Canadian federal regulations	This product has been classified in accordance with the hazard criteria of the HPR and the SDS contains all the information required by the HPR.	
Canada DSL Challenge Substances: Listed substance		
	Crystalline silica (CAS 14808-60-7)	Listed
Export Control List (CEPA 1999, Schedule 3)		Not listed
Greenhouse Gases		Not listed
Precursor Control Regulations		Not regulated
WHMIS 2015 Classifications		Not applicable
US federal regulations		
TSCA Section 12(b) Export Notification (40 CFR 707, Subpt. D)		Not regulated
CERCLA Hazardous Substance List (40 CFR 302.4)		
	Phosphoric acid (CAS 7664-38-2)	Listed
US. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)		Not listed
Superfund Amendments and Reauthorization Act of 1986 (SARA)		
Hazard categories		
	Immediate Hazard - No	
	Delayed Hazard - No	
	Fire Hazard - No	
	Pressure Hazard - No	
	Reactivity Hazard - No	
SARA 302 Extremely hazardous substance		No
SARA 311/312 Hazardous chemical		No
SARA 313 (TRI reporting)		Not regulated
Other federal regulations		
Clean Air Act (CAA) Section 112 Hazardous Air Pollutants (HAPs) List		Not regulated
Clean Air Act (CAA) Section 112(r) Accidental Release Prevention (40 CFR 68.130)		Not regulated
US state regulations		
US state regulations		
US - California Hazardous Substances (Director's): Listed substance		
	Phosphoric acid (CAS 7664-38-2)	Listed
US - Illinois Chemical Safety Act: Listed substance		
	Phosphoric acid (CAS 7664-38-2)	Listed
US - Louisiana Spill Reporting: Listed substance		
	Phosphoric acid (CAS 7664-38-2)	Listed
US - Minnesota Haz Subs: Listed substance		
	Crystalline silica (CAS 14808-60-7)	Listed
	Phosphoric acid (CAS 7664-38-2)	Listed
	Urea (CAS 57-13-6)	Listed
US - New Jersey RTK - Substances: Listed substance		
	Crystalline silica (CAS 14808-60-7)	
	Phosphoric acid (CAS 7664-38-2)	

US - Texas Effects Screening Levels: Listed substance

Crystalline silica (CAS 14808-60-7)	Listed
Phosphoric acid (CAS 7664-38-2)	Listed
Urea (CAS 57-13-6)	Listed

US. Massachusetts RTK - Substance List

Crystalline silica (CAS 14808-60-7)

Phosphoric acid (CAS 7664-38-2)

US. New Jersey Worker and Community Right-to-Know Act Not regulated

US. Pennsylvania Worker and Community Right-to-Know Law

Crystalline silica (CAS 14808-60-7)

Phosphoric acid (CAS 7664-38-2)

US. Rhode Island RTK

Phosphoric acid (CAS 7664-38-2)

US. California Proposition 65

WARNING: This product contains a chemical known to the State of California to cause cancer.

US - California Proposition 65 - CRT: Listed date/Carcinogenic substance

Crystalline silica (CAS 14808-60-7)	Listed: October 1, 1988

Inventory status

Country(s) or region	Inventory name	On inventory (yes/no)*
Canada	Domestic Substances List (DSL)	Yes
Canada	Non-Domestic Substances List (NDSL)	No
United States & Puerto Rico	Toxic Substances Control Act (TSCA)	Yes

*A “Yes” indicates that all components of this product comply with the inventory requirements administered by the governing country(s).

16. Other Information

Disclaimer

The information in the sheet was written based on the best knowledge and experience currently available. Information contained herein was obtained from sources considered technically accurate and reliable. While every effort has been made to ensure full disclosure of product hazards, in some cases data is not available and is so stated. Since conditions of actual product use are beyond control of the supplier, it is assumed that users of this material have been fully trained according to the requirements of all applicable legislation and regulatory instruments. No warranty, expressed or implied, is made and supplier will not be liable for any losses, injuries or consequential damages which may result from the use of or reliance on any information contained in this document.

NFPA Code (Health: 1) (Flammability: 0) (Reactivity: 0)

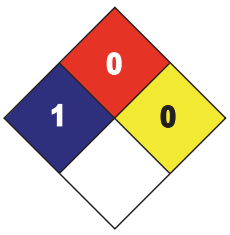
Issue Date 22-January-2018

Version # 01

Effective Date 22-January-2018

Prepared by Manufacturer Personnel

LEGEND	
Severe	4
Serious	3
Moderate	2
Slight	1
Minimal	0



Other Information

For an updated SDS, please contact the supplier/manufacturer listed on the first page of the document.

SAFETY DATA SHEET

1 Product and Company Identification

Product identifier	Medium Pressure UV Lamp
CAS #	Mixture
Product use	Ultraviolet (UV) Lamp
Recommended restrictions	None known
Manufacturer information	Trojan Technologies
	3020 Gore Road
	London, ON N5V 4T7 CA
	Phone: 519-457-3400
	Phone: 888-220-6118
Technical assistance #	
Within North America	Phone: 866-388-0488
Outside North America	Phone: 519-457-2318

2 Hazards Identification

Physical hazards	Not applicable to intact lamps.
Health hazards	Not applicable to intact lamps.
Environmental hazards	Not applicable to intact lamps.
WHMIS 2015 defined hazards Label elements	
Hazard symbol	Not applicable to intact lamps.
Signal word	Not applicable to intact lamps.
Hazard statement	Not applicable to intact lamps.
WHMIS 2015: Health Hazard(s) not otherwise classified (HHNOC)	None known
WHMIS 2015: Physical Hazard(s) not otherwise classified (PHNOC)	None known
Hazard(s) not otherwise classified (HNOC)	None known
Supplemental information	None

3 Composition/Information on Ingredients

Components	**CAS**	**# Percent**
Mercury	7439-97-6	<0.1

Composition Comments *Lamp consisting of quartz glass containing mercury.

4 First Aid Measures

Inhalation	Not applicable to intact lamps.
Skin Contact	Not applicable to intact lamps.
Eye Contact	Not applicable to intact lamps.
Ingestion	Not applicable to intact lamps.
General Information	Burns caused by overexposure or severe injuries caused by fragment of quartz glass should be treated by a physician. Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves. If you feel unwell, seek medical advice (show the label where possible). Show this safety data sheet to the doctor in attendance. Avoid contact with eyes and skin. Keep out of reach of children. There are no known health hazards from exposure to intact, un-energized lamps.

5 Fire Fighting Measures

Flammable properties	Not flammable by WHMIS/OSHA criteria.
Suitable extinguishing media	Extinguishing powder, foam, or water.
Unsuitable extinguishing media	Not available
Specific hazards arising from the chemical	Not available
Special protective equipment and precautions for firefighters	Self-contained breathing apparatus and full protective clothing must be worn in case of fire.
Specific methods	Use standard firefighting procedures and consider the hazards of other involved materials.
General fire hazards	No unusual fire or explosion hazards noted.
Hazardous combustion	May include and are not limited to: Mercury, metallic oxides.
Products	Lamp is not combustible.

6 Accidental Release Measures

Personal precautions, protective equipment and emergency procedures	Keep unnecessary personnel away. Do not touch damaged containers or spilled material unless wearing appropriate protective clothing.
Methods and materials for containment	In the event of a lamp breakage, appropriate action should be taken to contain the amalgam mercury. In a dry scenario where the lamp is not operating, solid amalgam mercury can be easily captured. In an operating closed- or open-channel system, in case of a lamp and sleeve breakage in a system treating the water flow, no containment measure is available. Prevent entry of the mercury into waterways, sewers, or other catchment systems.
Methods and materials for cleanup	If lamps are broken, ventilate the area where the breakage occurred. Take the usual precautions for collecting broken glass. Clean up with a mercury vacuum cleaner or with other suitable means that avoids dust and mercury vapor generation. DO NOT USE A STANDARD VACUUM. Place collected materials in a closed container to avoid generating dust. In the event of a lamp breakage, appropriate action should be taken to contain the spill. Additional guidance on cleaning up broken lamps may be obtained at: http://www2.epa.gov/cfl/cleaning-broken-cfl#instructions.
Environmental precautions	Do not discharge into lakes, streams, ponds or public waters. Do not contaminate water courses or ground. Prevent entry into waterways, sewers, basements or confined areas. This material is a water pollutant and should be prevented from contaminating soil or from entering sewage and drainage systems and bodies of water. Prevent entry into waterways, sewers, basements or confined areas. This material is a water pollutant and should be prevented from contaminating soil or from entering sewage and drainage systems and bodies of water.

7 Handling and Storage

Precautions for safe handling	Handle carefully to avoid breakage. Ensure adequate ventilation. Use good industrial hygiene practices in handling this material.
Conditions for safe storage, including any incompatibilities	Keep out of reach of children. Keep in properly labeled containers.

8 Exposure Controls/Personal Protection

Occupational exposure limits

US. ACGIH Threshold Limit Values

Components	Type	Value
Mercury (CAS 7439-97-6)	TWA	0.025 mg/m^3

US. OSHA Table Z-2 (29 CFR 1910.1000)

Components	Type	Value
Mercury (CAS 7439-97-6)	TWA	0.1 mg/m^3

Exposure limits	Exposure to mercury is only possible due to lamp breakage, refer Section 6.
Biological limit values	No biological exposure limits noted for the ingredient(s).
Appropriate engineering controls	Use only under good ventilation conditions.

Individual protection measures, such as personal protective equipment

Eye/face protection	Avoid contact with eyes. Wear appropriate safety glasses with side shields (or goggles). In operation, UV lamps emit non-ionizing radiation in the 180~400 nanometer wavelength region of the electromagnetic spectrum. The UV light intensity greatly exceeds levels found in nature. Exposure can result in temporary or permanent eye injury, skin burns or other serious effects. Individuals present where UV lamps are in operation are at risk for UV exposure if the appropriate shielding and Personal Protective Equipment (PPE) are not used. Refer to product manuals and product warning labels for safe operating procedures and Personal Protective Equipment.
Skin protection:	
Hand protection	Avoid contact with the skin. Wear impervious gloves. Confirm from a reputable supplier first. If glass is broken, use cut resistance gloves to prevent injury.
Other	Emergency responders should wear impermeable clothing and footwear when responding to a situation where contact with the mercury liquid is possible. Wash hands IMMEDIATELY if mercury leakage occurs. Contaminated clothes must be changed immediately and discarded appropriately.
Respiratory protection	Where exposure guideline levels may be exceeded, use an approved NIOSH respirator.
Thermal hazards	Not applicable
General safety and hygiene consideration	Ultraviolet radiation is emitted from the lamps. Use of approved safety glasses and/or face shield to block UV radiation. Handle in accordance with good industrial hygiene and safety practice.

9 Physical and Chemical Properties

Appearance	Article (Solid)
Color	Colorless
Form	Quartz tube containing mercury and other metals.
Odor	Odorless
Odor Threshold	Not available
Physical State	Solid
pH	Not available
Freezing point	Not available
Boiling point	Not applicable
Pour point	Not available
Evaporation rate	Not available
Flash point	Not applicable
Auto-ignition temperature	Not available
Flammability limits in air, upper, % by volume	Not available
Flammability limits in air, lower, % by volume	Not available
Vapor pressure	In case of breakage, mercury vapor pressure: <0.01 mm Hg at room temperature.

10 Stability and Reactivity

Reactivity	Mercury is contained in a glass tube and therefore is not able to react with chemicals within the surrounding environment.
Possibility of hazardous reactions	Hazardous polymerization does not occur.
Chemical stability	Stable under recommended storage conditions.
Conditions to avoid	None identified for intact lamps.
Incompatible materials	Mercury is contained in a glass tube and therefore is not able to react with chemicals within the surrounding area.
Hazardous decomposition products	None identified for intact lamps. In case of breakage: May include and are not limited to: Mercury, metallic oxides.

11 Toxicological Information

Toxicological data

Components	**Species**	**Test Results**
Mercury (CAS 7439-97-6)		
Acute		
Inhalation		
LC50	Rat	2.3 ppm, 4 hr
LD50		
Not Available		

Emergency overview	The lamp, which consists of quartz glass, is not dangerous under regular conditions. This item is a manufactured article. The mercury within the lamp is only available if the lamp is broken. Please follow standard health and safety guidelines for the use of this product.

The following statements are applicable only in case of accidental breakage of the lamp:

Routes of exposure	Eye, Skin contact, Skin absorption, Inhalation, Ingestion.

Information on likely routes of exposure:

Eyes	May cause irritation.

Skin	May cause irritation.

US ACGIH Threshold Limit Values: Skin designation	
Mercury (CAS 7439-97-6)	Hg Can be absorbed through the skin

US. NIOSH: Pocket Guide to Chemical Hazards	
Mercury (CAS 7439-97-6)	VAP Hg Can be absorbed through the skin.

Inhalation	May cause respiratory tract irritation.
Ingestion	May cause stomach distress, nausea or vomiting.
Dermal	May cause irritation.
Chronic Effects	Long-term occupational exposure to moderate to high levels of mercury (0.035 to 0.1 mg/m^3) has resulted in both nervous system and kidney effects. Significant toxicity has been observed in animals exposed to low concentrations.
Carcinogenicity	Non-hazardous by WHMIS/OSHA criteria.
ACGIH Carcinogens	Mercury (CAS 7439-97-6) A4 Not classifiable as a human carcinogen.
IARC Monographs. Overall Evaluation of Carcinogenicity	
	Mercury (CAS 7439-97-6) Volume 58 - 3 Not classifiable as to carcinogenicity to humans.
Mutagenicity	Non-hazardous by WHMIS/OSHA criteria.
Reproductive effects	Non-hazardous by WHMIS/OSHA criteria.
Teratogenicity	Animal studies indicate that mercury exposure during pregnancy can cause subtle behavioral changes in offspring, in the absence of harmful effects in the mothers.
Name of Toxicologically Synergistic Products	Not available
Signs and symptoms	Symptoms of overexposure may be headache, dizziness, tiredness, nausea and vomiting.

12 Ecological Information

Ecotoxicity	See below		
Ecotoxicological data			
Components	**Species**	**Test Results**	
Mercury (CAS 7439-97-6)			
Aquatic			
Fish	LC50 Indian catfish (Heteropneustes fossils)	0.099 mg/l, 96 hours	
Persistence and degradability	Not available		
Bioaccumulation / Accumulation	Not available		
US CWA Bioaccumulative Chemicals of Concern: Listed substance			
	Mercury (CAS 7439-97-6)		Listed
	US CWA Bioaccumulative Chemicals of Concern:		Listed substance
Mobility in environmental media	Not available		
Environmental effects	Not available		
Aquatic toxicity	Not available		
Partition coefficient	Not available		
Chemical fate information	Not available		

13 Disposal Information

Disposal instructions	Waste must be disposed of in accordance with federal, state/provincial and local environmental control regulations. This material and its container must be disposed of as hazardous waste.
Waste from residues / unused Products	Not available
Contaminated packaging	Not available

14 Transport Information

UN number	
TDG/US DOT	3506
IMDG/IMO	3506
IATA/ICAO	3506
Remarks TDG/US DOT	This product is not subject to the transportation regulations of dangerous goods by road (ADR) based on special provision 366 (<1 kg mercury per article).
Remarks IMDG/IMO	This product is not subject to the transportation regulations of dangerous goods by sea (IMDG) based on special provision 366 (<1 kg mercury per article).
* Remarks IATA/ICAO	For transport exemptions consult IATA special provisions A48, A69 and A191.
UN proper shipping name	
TDG/US DOT	MERCURY CONTAINED IN MANUFACTURED ARTICLES
IMDG/IMO	MERCURY CONTAINED IN MANUFACTURED ARTICLES
IATA/ICAO	MERCURY CONTAINED IN MANUFACTURED ARTICLES
Transport hazard class(es)	
TDG/US DOT	8 (6.1)
IMDG/IMO	8 (6.1)
IATA/ICAO	8 (6.1)
Packing group	
TDG/US DOT	none
IMDG/IMO	none
IATA/ICAO	none
Environmental hazards	
Marine pollutant	No

15 Regulatory Information

Canadian federal regulations	This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all the information required by the Controlled Products Regulations.	
Canada CEPA Schedule I: Listed substance		
	Mercury (CAS 7439-97-6)	Listed
Canada WHMIS Ingredient Disclosure: Threshold limits		
	Mercury (CAS 7439-97-6)	0.1%
WHMIS classification	Exempt - Manufactured article	
Occupational Safety and Health Administration (OSHA)		
29 CFR 1910.1200 hazardous chemical		No
US federal regulations	This product is a manufactured article and is exempt	
US EPCRA (SARA Title III) Section 313 - Toxic Chemical: De minimis concentration		
	Mercury (CAS 7439-97-6)	1.0 %

Substance is not eligible for the de minimis exemption except for the purposes of supplier notification requirements.

US EPCRA (SARA Title III) Section 313 - Toxic Chemical: Reportable threshold

Mercury (CAS 7439-97-6)	10 lbs

US EPCRA (SARA Title III) Section 313 - Toxic Chemical: Listed substance

Mercury (CAS 7439-97-6)	Listed

TSCA Section 12(b) Export Notification (40 CFR 707, Subpt. D)

Mercury (CAS 7439-97-6)	1.0 % One-Time Export Notification only.

US CWA Bioaccumulative Chemicals of Concern: Listed substance

Mercury (CAS 7439-97-6)	Listed

US CWA Section 307(a)(1) Toxic Pollutants: Listed substance

Mercury (CAS 7439-97-6)	Listed

CERCLA Hazardous Substance List (40 CFR 302.4)

Mercury (CAS 7439-97-6)	Listed

US CAA Section 112(i) High-Risk Hazardous Air Pollutants (HAPs): Weight factor

Mercury (CAS 7439-97-6)	100

US CAA Section 112(i) High-Risk Hazardous Air Pollutants (HAPs): Listed substance

Mercury (CAS 7439-97-6)	Listed

Clean Air Act (CAA) Section 112(r) Accidental Release Prevention (40 CFR 68.130)

Not regulated

Clean Air Act (CAA) Section 112 Hazardous Air Pollutants (HAPs) List

Mercury (CAS 7439-97-6)	Listed

CERCLA (Superfund) reportable quantity

Mercury: 1

Superfund Amendments and Reauthorization Act of 1986 (SARA)

Hazard categories

Immediate Hazard	- Yes
Delayed Hazard	- Yes
Fire Hazard	- No
Pressure Hazard	- No Reactivity
Hazard	- No

WARNING: This product contains a chemical known to the State of California to cause birth defects or other reproductive harm.

State regulations

US - California Hazardous Substances (Director's): Listed substance

Mercury (CAS 7439-97-6)	Listed

US - California Proposition 65 - Carcinogens & Reproductive Toxicity (CRT): Listed substance

Mercury (CAS 7439-97-6)	Listed

US - Illinois Chemical Safety Act: Listed substance

Mercury (CAS 7439-97-6)	Listed

US - Louisiana Spill Reporting: Listed substance

Mercury (CAS 7439-97-6)	Listed

US - Michigan Critical Materials Register: Parameter number

Mercury (CAS 7439-97-6)	Listed

US - Minnesota Haz Subs: Listed substance

Mercury (CAS 7439-97-6)	Listed

US - New Jersey RTK - Substances: Listed substance

Mercury (CAS 7439-97-6)	Listed

US - New York Release Reporting: Hazardous Substances: Listed substance

Mercury (CAS 7439-97-6)	Listed

US - North Carolina Toxic Air Pollutants: Listed substance

Mercury (CAS 7439-97-6)	Listed

US - Pennsylvania RTK - Hazardous Substances: All compounds of this substance are considered environmental hazards

Mercury (CAS 7439-97-6)	Listed

US - Texas Effects Screening Levels: Listed substance

Mercury (CAS 7439-97-6)	Listed

US - Washington Chemical of High Concern to Children: Listed substance

Mercury (CAS 7439-97-6)	Listed

US. Massachusetts RTK - Substance List

Mercury (CAS 7439-97-6)	Listed

US. Pennsylvania RTK - Hazardous Substances

Mercury (CAS 7439-97-6)	Listed

US. Rhode Island RTK

Mercury (CAS 7439-97-6)	Listed

Country(s) or region	Inventory name	On inventory (yes/no)*
Canada	Domestic Substances List (DSL)	Yes
Canada	Non-Domestic Substances List (NDSL)	No
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

*A “Yes” indicates that all components of this product comply with the inventory requirements administered by the governing country(s).

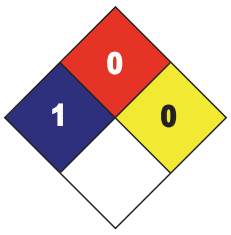
16 Other Information

Disclaimer

The information in the sheet was written based on the best knowledge and experience currently available. Information contained herein was obtained from sources considered technically accurate and reliable. While every effort has been made to ensure full disclosure of product hazards, in some cases data is not available and is so stated. Since conditions of actual product use are beyond control of the supplier, it is assumed that users of this material have been fully trained according to the requirements of all applicable legislation and regulatory instruments. No warranty, expressed or implied, is made and supplier will not be liable for any losses, injuries or consequential damages which may result from the use of or reliance on any information contained in this document.

NFPA Code	(Health: 1) (Flammability: 0) (Reactivity: 0)
Issue Date	15-February-2018
Version #	01
Effective Date	15-February-2018
Prepared by	Manufacturer Personnel

LEGEND	
Severe	4
Serious	3
Moderate	2
Slight	1
Minimal	0



Other Information

For an updated SDS, please contact the supplier/manufacturer listed on the first page of the document.

In the event of a lamp breakage, appropriate action should be taken to contain the spill. Lamp breakage can occur in several scenarios, each requiring different action. In an operating closed- or open-channel system, a lamp and sleeve break will be very difficult to contain since the mercury vapor will quickly condense, be diluted, and subsequently carried away by the flowing wastewater/water stream. Please refer to the Section 6 in order to respond to a lamp breakage.

SAFETY DATA SHEET

1 Product and Company Identification

Product identifier	100% T Reference Solution
CAS #	Mixture
Product use	Analytical Calibration
Recommended restrictions	None known
Manufacturer information	Trojan Technologies
	3020 Gore Road
	London, ON N5V 4T7 CA
	Phone: 519-457-3400
	Phone: 888-220-6118
CANUTEC	Phone: 613-996-6666

2 Hazards Identification

Physical hazards	Not classified
Health hazards	Not classified
Environmental hazards	Not classified
WHMIS 2015 defined hazards Label elements	
Hazard symbol	None
Signal word	None
Hazard statement	The mixture does not meet the criteria for classification.
Precaution statement	
Prevention	Observe good industrial hygiene practices.
Response	Wash hands after handling.
Storage	Store away from incompatible materials.
Disposal	Dispose of waste and residues in accordance with local authority requirements.
WHMIS 2015: Health Hazard(s) not otherwise classified (HHNOC)	None known
WHMIS 2015: Physical Hazard(s) not otherwise classified (PHNOC)	None known
Hazard(s) not otherwise classified (HNOC)	None known
Supplemental information	None

3 Composition/Information on Ingredients

Mixture Composition comments	This product is considered non-hazardous by WHMIS/OSHA criteria.

4 First Aid Measures

Inhalation	If symptoms develop move victim to fresh air. If symptoms persist, obtain medical attention.
Skin Contact	Flush with cool water. Wash with soap and water. Obtain medical attention if irritation persists.
Eye Contact	Hold eye open and rinse gently with water for 15-20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye.
Ingestion	Rinse mouth. Do not induce vomiting. If vomiting occurs, have victim lean forward to reduce risk of aspiration. Never give anything by mouth if victim is unconscious, or convulsing.
Indication of immediate medical attention and special treatment needed	Direct contact with eyes may cause temporary irritation.
General Information	If feeling unwell, seek medical advice (show the label and SDS where possible). Ensure medical personnel are aware of the material(s) involved, and take precautions to protect themselves. Avoid contact with eyes and skin. Keep out of reach of children.

5 Fire Fighting Measures

Suitable extinguishing media	Water fog. Foam. Dry chemical powder. Carbon dioxide (CO_2).
Unsuitable extinguishing media	Do not use water jet as an extinguisher, as this will spread the fire.
Specific hazards arising from the chemical	During fire, gases hazardous to health may be formed.
Special protective equipment and precautions for firefighters	Self-contained breathing apparatus and full protective clothing must be worn in case of fire.
Fire-fighting equipment/instructions	Move containers from fire area if you can do so without risk.
Specific methods	Use standard firefighting procedures and consider the hazards of other involved materials.
General fire hazards	No unusual fire or explosion hazards noted.
Hazardous combustion Products	May include and are not limited to: Oxides of carbon.

6 Accidental Release Measures

Personal precautions, protective equipment and emergency procedures	Keep unnecessary personnel away. For personal protection, refer Section 8.
Methods and materials for containment and cleanup	Large Spills: Stop the flow of material, if this is without risk. Dike the spilled material, where this is possible. Cover with plastic sheet to prevent spreading. Absorb in vermiculite, dry sand or earth and place into containers. Following product recovery, flush area with water. Small Spills: Wipe up with absorbent material (e.g. cloth, fleece). Clean surface thoroughly to remove residual contamination.
Environmental precautions	Never return spills to original containers for re-use. For waste disposal, refer Section 13.

7 Handling and Storage

Precautions for safe handling	Wash thoroughly after handling. Use good industrial hygiene practices in handling this material. When using do not eat or drink.
Conditions for safe storage, including any incompatibilities	Store in original tightly closed container. Store away from incompatible materials (refer Section 10. Keep out of reach of children.

8 Exposure Controls/Personal Protection

Occupational exposure limits	No exposure limits noted for ingredient(s).
Biological limit values	No biological exposure limits noted for the ingredient(s).
Appropriate engineering controls	Good general ventilation (typically 10 air changes per hour) should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level.
Individual protection measures, such as personal protective equipment, Eye/face protection	
Eye/face protection	Wear safety glasses with side shields (or goggles).
Skin protection: Hand protection Other	Impervious gloves. Confirm with reputable supplier first. Wear suitable protective clothing. As required by employer code.
Respiratory protection	Not normally required
Thermal hazards	Not applicable
General hygiene considerations	Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants. When using do not eat or drink.

9 Physical and Chemical Properties

Appearance	Liquid
Odor	Odorless
Odor Threshold	Not available
pH	~7
Melting Point / Freezing Point	0ºC (32ºF)
Initial Boiling Point	100ºC (212ºF)
Specific gravity	1.00
Flash Point	Not applicable
Evaporation Rate	Not available
Flammability (solid, gas)	Not applicable
Vapor Pressure	Not available
Vapor Density	Not available
Relative Density	Not available
Auto-ignition Temperature	Not available
Decomposition Temperature	Not available
Other information:	
Explosive properties	Not explosive
Oxidizing properties	Not oxidizing

10 Stability and Reactivity

Reactivity	None known
Possibility of hazardous reactions	No dangerous reaction known under conditions of normal use.
Chemical stability	Material is stable under normal conditions.
Conditions to avoid	Do not mix with other chemicals.
Incompatible materials	Not corrosive to SAE 1020 Steel or non-clad Aluminum based on test data (UN Manual of Tests and Criteria, Part III, Section 37.1 -Corrosion to metals).
Hazardous decomposition products	May include and are not limited to : Oxides of carbon.

11 Toxicological Information

Routes of exposure	Eye, Skin contact, Inhalation, Ingestion.
Information on likely routes of exposure	
Ingestion	Expected to be a low ingestion hazard. May cause stomach distress, nausea or vomiting.
Inhalation	Health injuries are not known or expected under normal use.
Skin contact	Not corrosive or irritating to skin based on test data.
	No adverse effects due to skin contact are expected.
Eye contact	Not corrosive or irritating to eyes based on test data.
Symptoms related to the physical, chemical and toxicological characteristics	Direct contact with eyes may cause temporary irritation.
Information on toxicological effects	
Acute toxicity	Not available
Skin corrosion/irritation	Prolonged skin contact may cause temporary irritation.
Exposure minutes	Not available
Erythema value	Not available
Oedema value	Not available
Serious eye damage/eye irritation	Direct contact with eyes may cause temporary irritation.
Corneal opacity value	Not available
Iris lesion value	Not available
Conjunctival reddening value	Not available
Recover days	Not available
Respiratory or skin sensitization	
Respiratory sensitization	Not a respiratory sensitizers.
Skin sensitization	This product is not expected to cause skin sensitization.
Mutagenicity	No data available to indicate product or any components present at greater than 0.1% are mutagenic or genotoxic.
Carcinogenicity	
US - California Proposition 65 - CRT: Listed date/Carcinogenic substance	
	Formaldehyde (CAS 50-00-0)
US. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)	
	Not listed
Reproductive toxicity	This product is not expected to cause reproductive or developmental effects.
Teratogenicity	Not available

Specific target organ toxicity (single exposure)	Not classified
Specific target organ toxicity (repeated exposure)	Not classified
Aspiration hazard	Not an aspiration hazard.

12 Ecological Information

Ecotoxicity	Not available
Persistence and degradability	Not available
Bioaccumulative potential	
Mobility in soil	Not available
Mobility in general	Not available
Other adverse effects	Not available
Aquatic toxicity	Toxic to aquatic life.

13 Disposal Information

Disposal instructions	Collect and reclaim or dispose in sealed containers at licensed waste disposal site. Dispose in accordance with all applicable regulations.
Local disposal regulations	Dispose in accordance with all applicable regulations.
Hazardous waste code	The waste code should be assigned in discussion between the user, the producer and the waste disposal company.
Waste from residues / unused products	Dispose of in accordance with local regulations. Empty containers or liners may retain some product residues. This material and its container must be disposed of in a safe manner (see: Disposal instructions).
Contaminated packaging	Since emptied containers may retain product residue, follow label warnings even after container is emptied. Empty containers should be taken to an approved waste handling site for recycling or disposal.

14 Transport Information

Transport of Dangerous Goods (TDG) Proof of Classification	In accordance with Part 2.2.1 (SOR/2014-152) of the Transportation of Dangerous Goods. Regulations, we certify that the classification of this product is correct as of the SDS date of issue.

U.S. Department of Transportation (DOT)

Not regulated as dangerous goods.

Transportation of Dangerous Goods (TDG - Canada)

Not regulated as dangerous goods.

15. Regulatory Information

Canadian federal regulations	This product has been classified in accordance with the hazard criteria of the HPR and the SDS contains all the information required by the HPR.	
Canada DSL Challenge Substances: Listed substance		
	Formaldehyde (CAS 50-00-0)	Listed
Export Control List (CEPA 1999, Schedule 3)		Not listed
Greenhouse Gases		Not listed
Precursor Control Regulations		Not regulated
WHMIS Classifications		Not applicable
US federal regulations		
TSCA Section 12(b) Export Notification (40 CFR 707, Subpt. D)		Not regulated
CERCLA Hazardous Substance List (40 CFR 302.4)		
	Formaldehyde (CAS 50-00-0)	Listed
US. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)		Not listed
Superfund Amendments and Reauthorization Act of 1986 (SARA)		
Hazard categories		
	Immediate Hazard - No	
	Delayed Hazard - No	
	Fire Hazard - No	
	Pressure Hazard - No	
	Reactivity Hazard - No	
SARA 302 Extremely hazardous substance		No
SARA 311/312 Hazardous chemical		No
SARA 313 (TRI reporting)		No
Other federal regulations		
Clean Air Act (CAA) Section 112 Hazardous Air Pollutants (HAPs) List		Not regulated
Clean Air Act (CAA) Section 112(r) Accidental Release Prevention (40 CFR 68.130)		Not regulated

Inventory status

Country(s) or region	Inventory name	On inventory (yes/no)*
Canada	Domestic Substances List (DSL)	Yes
Canada	Non-Domestic Substances List (NDSL)	No
United States & Puerto Rico	Toxic Substances Control Act (TSCA)	Yes

*A “Yes” indicates that all components of this product comply with the inventory requirements administered by the governing country(s).

16. Other Information

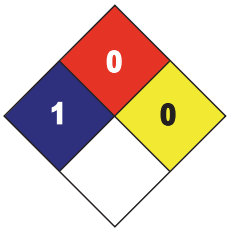
Disclaimer

The information in the sheet was written based on the best knowledge and experience currently available. Information contained herein was obtained from sources considered technically accurate and reliable. While every effort has been made to ensure full disclosure of product hazards, in some cases data is not available and is so stated. Since conditions of actual product use are beyond control of the supplier, it is assumed that users of this material have been fully trained according to the requirements of all applicable legislation and regulatory instruments. No warranty, expressed or implied, is made and supplier will not be liable for any losses, injuries or consequential damages which may result from the use of or reliance on any information contained in this document.

NFPA Code

(Health: 1)
(Flammability: 0)
(Reactivity: 0)

LEGEND	
Severe	4
Serious	3
Moderate	2
Slight	1
Minimal	0



Issue Date 02-March-2018

Version # 01

Effective Date 02-March-2018

Prepared by Manufacturer Personnel

Other Information

For an updated SDS, please contact the supplier/manufacturer listed on the first page of the document.

SAFETY DATA SHEET

1 Product and Company Identification

Product identifier	Quartz Cuvette Cleaner
Synonym	P19311, Cuvette Cleaner
CAS #	Mixture
Product use	For use with Trojan P254 UV Photometer
Recommended restrictions	None known
Manufacturer information	Trojan Technologies
	3020 Gore Road
	London, ON N5V 4T7 CA
	Phone: 519-457-3400
	Phone: 888-220-6118
CANUTEC	Phone: 613-996-6666

2 Hazards Identification

Classification of the chemical

This material is classified as hazardous under U.S. OSHA regulations (29CFR 1910.1200) (Hazcom 2012) and Canadian WHMIS regulations (Hazardous Products Regulations) (WHMIS 2015).

Health hazards

Corrosive to Metals.

Skin Corrosion/Irritation.

Serious eye damage/eye irritation.

Specific Target Organ Toxicity, Single Exposure.

WHMIS 2015 defined hazard

Hazard symbol

Signal word DANGER!

Hazard statement

May be corrosive to metals.

Causes severe skin burns and eye damage.

May cause respiratory irritation.

Precautionary statement

Prevention

Do not breathe mist or vapor.

Wash thoroughly after handling.

Wear protective gloves/clothing and eye/face protection.

Keep away from combustible material.

Response

If swallowed: Rinse mouth. DO NOT induce vomiting.

IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower.

IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

IF INHALED: Remove person to fresh air and keep comfortable for breathing.

Immediately call a POISON CENTRE or doctor/physician.

Absorb spillage to prevent material damage.

Storage

Keep in a cool place.

Store in original, vented, closed containers.

Disposal	Dispose of contents/container in accordance with local/regional/national/international regulations.
Other hazards	Other hazards which do not result in classification: Ingestion can cause irritation and corrosive action in the mouth, stomach and digestive tract. Toxic fumes, gases or vapors may evolve on burning. May intensify fire; Nitric acid is an oxidizer.

3 Composition/Information on Ingredients

Components	CAS#	Percent
Nitric Acid	7697-37-2	6-13

4 First Aid Measures

Inhalation	If symptoms develop move victim to fresh air. If symptoms persist, obtain medical attention. If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen by qualified medical personnel only. Seek immediate medical attention/advice.
Skin Contact	In case of contact, immediately flush skin with plenty of water for at least 30 minutes. Get medicalattention. Remove contaminated clothing and launder before use.
Eye Contact	In case of contact or suspected contact, immediately flush eyes with plenty of water for at least 20 to 30 minutes and get medical attention immediately after flushing.
Ingestion	Guard against aspiration into lungs by having the individual turn on to their left side. Rinse mouth with water. Seek immediate medical attention. Do not induce vomiting. Never give anything by mouth if victim is rapidly losing consciousness, unconscious or convulsing.
General Information	If feeling unwell, seek medical advice (show the label and SDS where possible). Ensure medical personnel are aware of the material(s) involved, and take precautions to protect themselves. Avoid contact with eyes and skin. Keep out of reach of children.

5 Fire Fighting Measures

Suitable extinguishing media	Fires should be flooded with large amounts of water. Avoid using other types of extinguishing materials, such as foam or dry chemicals.
Unsuitable extinguishing media	Avoid using Carbon dioxide or other similar extinguishing agents as they are not effective in fires involving oxidizers.
Specific hazards arising from the chemical	Substance releases oxygen when heated, which may increase the severity of an existing fire. Burning produces obnoxious and toxic fumes. Contact with most metals will generate flammable hydrogen gas. Contact with water will generate considerable heat.
Special protective equipment and precautions for firefighters	Self-contained breathing apparatus and full protective clothing must be worn in case of fire.
Indication of immediate medical attention required	Treat patient symptomatically.
Specific methods	Fight fires from a safe distance. Evacuate personnel to safe areas. Firefighters should wear proper protective equipment and self-contained breathing apparatus with full face piece operated in positive pressure mode. A full-body chemical resistant suit should be worn. Move containers from fire area if safe to do so. Water spray may be useful in cooling equipment exposed to heat and flame.
General fire hazards	No unusual fire or explosion hazards noted.
Hazardous combustion Products	Oxygen; Nitrogen oxides.

6 Accidental Release Measures

Personal precautions, protective equipment and emergency procedures	All persons dealing with clean-up should wear the appropriate protective equipment including self-contained breathing apparatus. Keep all other personnel upwind and away from the spill/release. Restrict access to area until completion of clean-up. Refer to protective measures listed in Section 7 and Section 8.
Methods and materials for containment and cleanup	Neutralize with lime slurry, limestone, or soda ash. Isolate spill and stop leak where safe. Flush area with water to remove trace residue. Contain spill with sand or other inert materials. Pick up solids and put in an appropriate sealed container for later disposal. Isolate hazard area and restrict access.

7 Handling and Storage

Precautions for safe handling	Avoid breathing vapor. Avoid contact with eyes, skin and clothing. Use with adequate ventilation.
Conditions for safe storage, including any incompatibilities	Tanks must be diked. Store in a cool, dry, well ventilated area. Place away from incompatible materials. Will corrode incompatible metals and many plastic materials. 304 or 347 stainless steel are acceptable materials of construction. Tanks should be vented and painted white or in light, heat-reflecting colors. Ensure that all pumps, valves, meters are of compatible material.

8 Exposure Controls/Personal Protection

Occupational exposure limits	No exposure limits noted for ingredient(s).
Biological limit values	No biological exposure limits noted for the ingredient(s).
Appropriate engineering controls	Good general ventilation (typically 10 air changes per hour) should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level.
Individual protection measures, such as personal protective equipment:	
Eye/face protection	Wear eye/face protection. Chemical splash goggles are recommended. A full face shield may also be necessary.
Skin protection:	Wash hands IMMEDIATELY if mercury leakage occurs.
Hand protection	Impervious gloves. Confirm with reputable supplier first.
Other	Where contact is likely, wear chemical-resistant gloves, a chemical suit, rubber boots, and chemical safety goggles plus a face shield. Ensure that eyewash stations and safety showers are proximal to the work-station location.
Respiratory protection	If airborne concentrations exceed the Occupational Exposure Limit, use a NIOSH/MSHA approved full face-piece respirator with acid gas cartridges. Do not use organic vapor and acid gas combination cartridges as these contain charcoal, which is incompatible with oxidizing acids.
Thermal hazards	Not applicable
General hygiene considerations	Handle in accordance with good industrial hygiene and safety practice.

9 Physical and Chemical Properties

Appearance	Clear to Brownish/Yellow
Physical state	Liquid
Odor	Slightly Pungent, Antiseptic like
Odor Threshold	Not available
pH	Not available
Melting Point / Freezing point	Not available
Initial Boiling point	Not applicable
Pour point	Not available

Specific gravity	1.096
Partition coefficient (n-octanol/water)	Not available
Flash Point	Not available
Evaporation Rate	Not available
Flammability(solid, gas)	Not applicable
Upper/Lower Explosive Limits	Not available
Vapor Pressure	Not available
Vapor Density	Not available
Relative Density	Not available
Solubility(ies)	Not available
Auto-ignition Temperature	Not available
Decomposition Temperature	Not available
Viscosity	Viscous
Other information:	
Explosive properties	May be reactive and decompose violently.
Oxidizing properties	Oxidizer; Will accelerate combustion and increase the risk of fire and explosion in combustible or flammable materials.

10 Stability and Reactivity

Reactivity	Corrosive to mild metals such as copper, aluminum, brass, iron, and mild steel. Not corrosive to 304L or 316 stainless steel. Will release flammable and potentially explosive hydrogen gas on contact with amphoteric metals.
Possibility of hazardous reactions	No dangerous reaction known under conditions of normal use.
Chemical stability	Material is stable under normal conditions.
Conditions to avoid	Do not mix with other chemicals.
Incompatible materials	Alkalies. Reducing agents. Combustible materials. Metals. Organic materials. Acids. Moisture.
Hazardous decomposition products	May include and are not limited to: Oxides of carbon.

11 Toxicological Information

Routes of exposure	Eye, Skin contact, Inhalation, Ingestion.
Information on likely routes of exposure:	
Ingestion	Corrosive! May cause severe pain in the mouth, chest and abdomen, leading to cough, vomiting and collapse. Ingestion may cause gastritis possibly progressing to necrosis or hemorrhage.
Inhalation	Causes severe respiratory irritation. Material is irritating to mucous membrane and upper respiratory tract. Exposure can cause coughing, chest pains and difficulty in breathing. Vapors may cause pulmonary edema.
Skin contact	Corrosive. Concentrated nitric acid chars the tissue with a characteristic yellow coloration. Causes severe burns. Severe and fatal skin burns can occur with necrosis and scarring. No adverse effects due to skin contact are expected.
Eye contact	Corrosive to eye tissue and may cause severe damage or blindness.
Information on toxicological effects:	
Acute toxicity	Not available
Skin corrosion/irritation	Prolonged skin contact may cause temporary irritation.
Exposure minutes	Not available

Erythema value	Not available
Oedema value	Not available
Serious eye damage/eye irritation	Direct contact with eyes may cause temporary irritation.
Corneal opacity value	Not available
Iris lesion value	Not available
Conjunctival reddening value	Not available
Recover days	Not available
Respiratory or skin sensitization:	
Respiratory sensitization	Not a respiratory sensitizer.
Skin sensitization	This product is not expected to cause skin sensitization.
Mutagenicity	No data available to indicate product or any components present at greater than 0.1% are mutagenic or genotoxic.
Carcinogenicity	No components are listed as carcinogens by ACGIH, IARC, OSHA or NTP.
Reproductive toxicity	This product is not expected to cause reproductive or developmental effects.
Teratogenicity	Not available
Specific target organ toxicity (single exposure)	Not classified
Specific target organ toxicity (repeated exposure)	Not classified
Aspiration hazard	Not an aspiration hazard.

12 Ecological Information

Ecotoxicity	Product may cause harm in the environment due to its low pH. Do not allow material to contaminate ground water system.
Persistence and degradability	Not available
Bioaccumulative potential	
Mobility in soil	Not available
Mobility in general	Not available
Other adverse effects	Not available
Aquatic toxicity	Toxic to aquatic life.

13 Disposal Information

Disposal instructions	Waste must be disposed of in accordance with federal, state/provincial and local environmental control regulations. This material and its container must be disposed of as hazardous waste.
Local disposal regulations	Dispose in accordance with all applicable regulations.
Hazardous waste code	The waste code should be assigned in discussion between the user, the producer and the waste disposal company.
Waste from residues/unused products	Dispose of in accordance with local regulations. Empty containers or liners may retain some product residues. This material and its container must be disposed of in a safe manner (see: Disposal instructions).
Contaminated packaging	Since emptied containers may retain product residue, follow label warnings even after container is emptied. Empty containers should be taken to an approved waste handling site for recycling or disposal.

14 Transport Information

DOT		IATA	
UN-No	UN2031	**UN-No**	UN2031
Proper Shipping Name	Nitric Acid	**Proper Shipping Name**	Nitric Acid
Hazard Class	8	**Hazard Class**	8
Subsidiary Hazard Class	5.1	**Subsidiary Hazard Class**	5.1
Packing Group	II	**Packing Group**	II

TDG		IMDG/IMO	
UN-No	UN2031	**UN-No**	UN2031
Proper Shipping Name	Nitric Acid	**Proper Shipping Name**	Nitric Acid
Hazard Class	8	**Hazard Class**	8
Packing Group	II	**Packing Group**	II

15 Regulatory Information

Canadian federal regulations This product has been classified in accordance with the hazard criteria of the HPR and the SDS contains all the information required by the HPR.

Canada DSL Challenge Substances: Listed substance

Nitric Acid (CAS 7697-37-2) Listed

Export Control List (CEPA 1999, Schedule 3) Not listed

Greenhouse Gases Not listed

Precursor Control Regulations Not regulated

WHMIS classification C Oxidizing Materials

E Corrosive Materials

US federal regulations

TSCA Section 12(b) Export Notification (40 CFR 707, Subpt. D)

Nitric acid (CAS 7697-37-2) Listed

CERCLA Hazardous Substance List (40 CFR 302.4)

Nitric acid (CAS 7697-37-2) Listed

US. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050) Not listed

Superfund Amendments and Reauthorization Act of 1986 (SARA)

Hazard categories

Immediate Hazard	- Yes
Delayed Hazard	- No
Fire Hazard	- No
Pressure Hazard	- No
Reactivity Hazard	- Yes

SARA 302 Extremely hazardous substance

Nitric acid (CAS 7697-37-2) Listed

SARA 311/312 Hazardous chemical

Nitric acid (CAS 7697-37-2) Listed

SARA 313 (TRI reporting)

Nitric acid (CAS 7697-37-2) Listed

Other federal regulations

Clean Air Act (CAA) Section 112 Hazardous Air Pollutants (HAPs) List Not regulated

Clean Air Act (CAA) Section 112(r) Accidental Release Prevention (40 CFR 68.130) Not regulated

Inventory status

Country(s) or region	Inventory name	On inventory (yes/no)*
Canada	Domestic Substances List (DSL)	Yes
Canada	Non-Domestic Substances List (NDSL)	No
United States & Puerto Rico	Toxic Substances Control Act (TSCA)	Yes

***A "Yes" indicates that all components of this product comply with the inventory requirements administered by the governing country(s)**

16 Other Information

Disclaimer

The information in the sheet was written based on the best knowledge and experience currently available. Information contained herein was obtained from sources considered technically accurate and reliable. While every effort has been made to ensure full disclosure of product hazards, in some cases data is not available and is so stated. Since conditions of actual product use are beyond control of the supplier, it is assumed that users of this material have been fully trained according to the requirements of all applicable legislation and regulatory instruments. No warranty, expressed or implied, is made and supplier will not be liable for any losses, injuries or consequential damages which may result from the use of or reliance on any information contained in this document.

NFPA Code (Health: 3) (Flammability: 0) (Reactivity: 0)

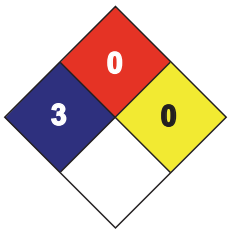
Issue Date 12-March-2018

Version # 01

Effective Date 12-March-2018

Prepared by Manufacturer Personnel

LEGEND	
Severe	4
Serious	3
Moderate	2
Slight	1
Minimal	0



Other Information For an updated SDS, please contact the supplier/manufacturer listed on the first page of the document.

PART

G

MANUFACTURER'S MANUALS

TROJAN UV™
A TROJAN TECHNOLOGIES BUSINESS

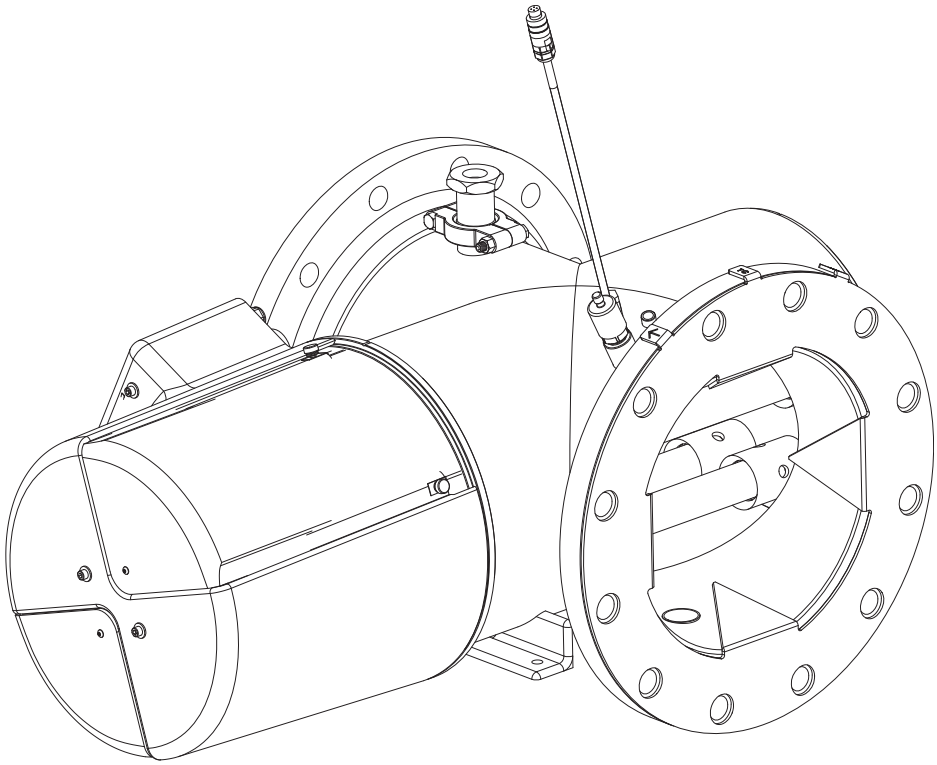
TROJANUVSWIFT® L12

Operation and Maintenance

User Manual

Original Instructions

Edition 4



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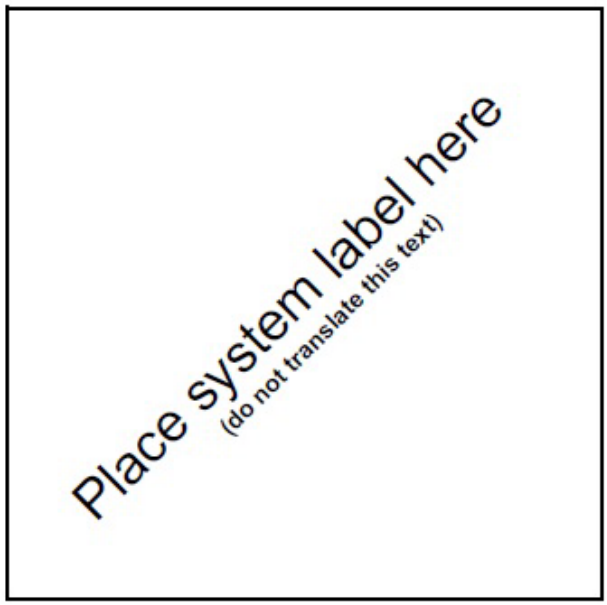

If you require technical assistance, please contact the Technical Assistance Center (TAC) using the contact information below:

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

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

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Section 1 Specifications

Specifications are subject to change without notice.

System	TROJANUVSWIFT® 12
Hydrostatic Pressure Test	1.5x rating
Maximum System Pressure	10 bar (150 psi) or 5 bar (75 psi) - Refer to System Description
Maximum Ambient Operating Temperature	0° C to 40° C (32° F to 104° F)
UV Chamber	
Maximum Water Temperature	0° C to 30° C (32° F to 86° F)
Material	316L Stainless Steel, Pickled, and Passivated
Weight (Dry)	136 kg (300 lbs)
UV Lamp Input	3.0 kW
Inlet/Outlet Connections	Refer to System Description
Vent and Drain Connections	
Level Sensor	Installed
Temperature Switch	
Control Power Panel	
Material	Refer to System Description
Rating	
Mounting	
Weight	
Controller Type	
Power Requirements	
UV Sensor	
Range	Refer to System Description
Sleeve Type	Synthetic Quartz, Type 021AL
Certifications	
UL, CE, NSF 60 and 61	

Section 2 Safety Information

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

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

2.1 Use of Hazard Information

⚠ DANGER

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

⚠ WARNING

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

⚠ CAUTION

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

NOTICE

Indicates a situation that is not related to personal injury.

2.2 Precautionary Labels

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

	Electrical equipment marked with this symbol may not be disposed of in European public disposal systems. In conformity with European local and national regulations (EU Directive 2002/96/EC), European electrical equipment users must now return old or end-of life equipment to the Producer for disposal at no charge to the user. ***Note:*** *For recycling, please contact the equipment producer or supplier for instructions on how to return end-of-life equipment, producer-supplied electrical accessories, and all auxiliary items for proper disposal. No equipment is to be returned without authorization. Local recycling programs may be used. For the manufacturer recycling UV lamp program or producer-supplied electrical accessories and auxiliary items, contact the equipment supplier for proper disposal instructions.*
	This symbol indicates there is Mercury present.
	This is the safety alert symbol. Obey all safety messages that follow this symbol to avoid potential injury. When on the equipment, refer to the Operational and Maintenance manual for additional safety information.
	This symbol indicates a risk of electrical shock and/or electrocution exists.
	This symbol indicates the marked item has stored energy. Obey procedures to wait 5 (five) minutes after disconnecting main power, to allow stored energy to dissipate.
	This symbol indicates the marked equipment may contain a component that can eject forcibly. Obey all procedures to safely depressurize.

	This symbol indicates a potential crushing pinch hazard.
	This symbol indicates a trained and competent lift operator should be used to move the equipment.
	This symbol indicates a body crush hazard. People should stay clear from under overhead loads.
	This symbol indicates surfaces may be slippery and there is a potential fall hazard.
	This symbol indicates there is a potential UV hazard. Proper protection must be worn.
	This symbol indicates the marked item could be hot and should not be touched without care.
	This symbol indicates the marked item should not be touched.
	This symbol indicates a risk of electrical shock and/or electrocution exists. All appropriate lockout tag out procedures must be obeyed.
	This symbol indicates to secure the device with a safety device / hook.
	This symbol indicates a safety glasses with side protection is required for protection against UV exposure.
	This symbol indicates a UV rated full face shield is required. Face shields are to be worn with safety glasses or safety goggles.
	This symbol indicates gloves must be worn.
	This symbol indicates safety boots must be worn.
	This symbol indicates a hard hat must be worn.

This symbol indicates the operator must read all available documentation to perform required procedures.

2.3 Safety Precautions

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

⚠ DANGER

Arc Flash and Shock Hazard - Live Electrical Circuit Present. Hazardous Voltage.

- Failure to follow these instructions will result in electrical shock, injury or death from electrocution.
- Devices inside this equipment contain stored energy.
- NEVER work inside this equipment until at least 5 (five) minutes after disconnecting main power to allow stored energy to dissipate.
- Lockout tag out all sources of power before performing any inspection, repair, or maintenance. ***There may be more than one source of power!***

⚠ DANGER

Shock Hazard.

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

⚠ DANGER

Pressurized Device - Impalement Hazard.

- Failure to follow these instructions will result in serious injury or death due to forcible ejection of materials from UV chamber.
- ALWAYS follow lockout tag out procedures, as required by ***Operation and Maintenance Manual***.
- NEVER perform any physical inspection, repair, maintenance or service on UV chamber unless UV chamber has been isolated, depressurized and open to atmosphere. Where UV chambers are interconnected in series and vertically stacked, only the top UV chamber must be open to atmosphere.

  Exception: Performing Reference Sensor check in compliance with "Install or Remove a Reference Sensor" in Operation and Maintenance Manual.
- NEVER pressurize UV chamber without service end cap properly installed.
- NEVER stand in front of UV lamp section while UV chamber is undergoing a hydrostatic pressure test. Stand to the side of the UV chamber while looking for leaks.
- ***If a leak is observed, depressurize immediately, drain, repair and retest.***

⚠ WARNING

Personal Injury Hazard.

- Use of parts not approved by the manufacturer may cause personal injury, damage to the UV system or malfunction of the UV System and may void the manufacturer's warranty.
- Use of UV Lamps and Lamp Drivers, not approved by the manufacturer, will void UL and CE product safety certifications.
- The parts listed in Section 12 are approved by the manufacturer.

⚠ WARNING

Body Crush Hazard.

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

⚠ CAUTION

UV Light Hazard.

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

⚠ CAUTION

Burn Hazard.

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

⚠ CAUTION

Slip and Fall Hazard.

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

NOTICE

Hg

Mercury Chemical Hazard.

- UV lamps contain mercury. Consult and obey local regulations and regulatory agency guidelines for UV lamp disposal requirements and for the removal and disposal of mercury waste.
- NEVER use a vacuum cleaner to clean up broken UV lamps as this will scatter the mercury. All mercury-contaminated debris must be cleaned up as hazardous waste.
- ALWAYS use care to prevent accidental UV lamp breakage and be aware of the risk of mercury release in the event of UV lamp breakage.
- ALWAYS use a mercury spill containment kit in the event of UV lamp breakage. Mercury spill kits should be readily available and include detailed instructions for the safe cleanup of mercury releases.
- For questions about safe UV lamp clean up, UV lamp recycling. or the purchase of a mercury spill containment kit, contact the manufacturer at tac@trojantechnologies.com.

NOTICE

Personal Protective Equipment Required.

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

NOTICE

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

NOTICE

The **TrojanUVSwift®** has been validated through microbial testing. Through this testing, performance data has been generated for UV dose delivery to inactivate Cryptosporidium, Giardia, and Adenovirus.

NOTICE

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

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

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

2) Refer to the Safety Data Sheets for accidental exposure to supplied materials.

Section 3 General Information

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

3.1 Acceptable Noise Levels

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

3.2 Patents and Permissions

The UV system described in this manual, may be protected by one or more patents in the United States of America, Canada, and / or other countries. For a list of patents owned by Trojan Technologies, go to: www.trojantechnologies.com/patents.

3.3 Abbreviations and Acronyms

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

Table 1 Abbreviations and Acronyms

Abbreviation/Acronym	Description
CPP	Control Power Panel
HMI	Human Machine Interface
PLC	Programmable Logic Controller
RED	Reduction Equivalency Dose
SCADA	System Control and Data Acquisition
UPS	Uninterrupted Power Supply
UVT	Ultraviolet Transmittance

3.4 System Overview

The main components of the system are:

- Control Power Panel (CPP)
- UV Chamber

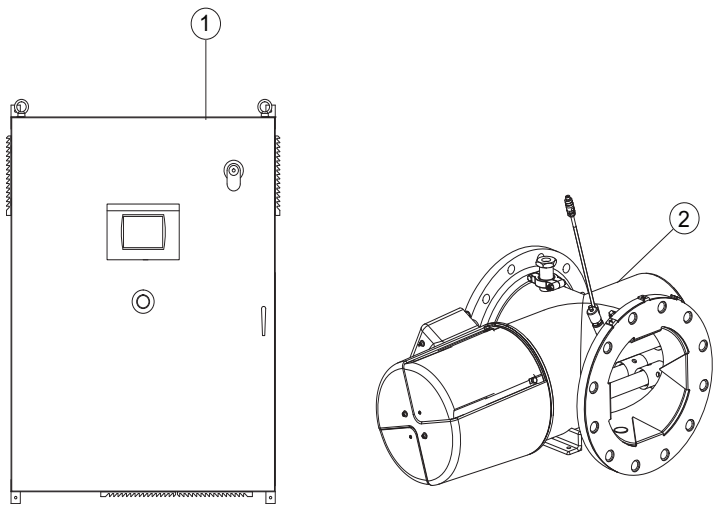


Figure 1 System Components

1	CPP (shown for illustration purposes)	**2**	UV Chamber

UV Chamber

The UV chamber is a stainless steel pipe cross which houses the UV lamps. The UV lamps are enclosed in lamp sleeves and are mounted horizontally in a cross-flow arrangement inside the UV chamber. Refer to the System Description for the number of UV Lamps installed. The selected number of UV lamps depends on the water quality and flow rate.

ActiClean® Cleaning System

The system offers automatic on-line sleeve cleaning. Trojan's patented chemical/mechanical cleaning system uses stainless steel wiper collars containing a NSF60 certified acid cleaning solution located between two food-grade rubber wiper seals.

All lamp sleeves are cleaned simultaneously. The frequency of the cleaning is adjustable via the CPP's operator interface.

UV Sensor

The UV sensor measures the UV intensity within the UV chamber. One (1) UV sensor per UV lamp is provided. The UV sensor is located within the UV chamber and each is housed within its own protective lamp sleeve. The UV sensor sleeves are automatically cleaned by the ACS.

Temperature Switch

The temperature switch will trigger a warning alarm if the effluent temperature of the UV chamber exceeds 120 °F (+ 9 ºF) / 50 °C (+ 5 ºC). This alarm will be displayed on the CPP Operator Interface.

Level Sensor

A level sensor is incorporated into each UV chamber. This level sensor is used to detect water level in the pipe and will shut the system off in the event of a low water level to prevent any damage to the equipment.

Control Power Panel (CPP)

The Control Power Panel (CPP) is an enclosure that provides power distribution to the UV chamber and contains the main interface for the system. It includes a PLC based controller with input and output connection points and communication hardware.

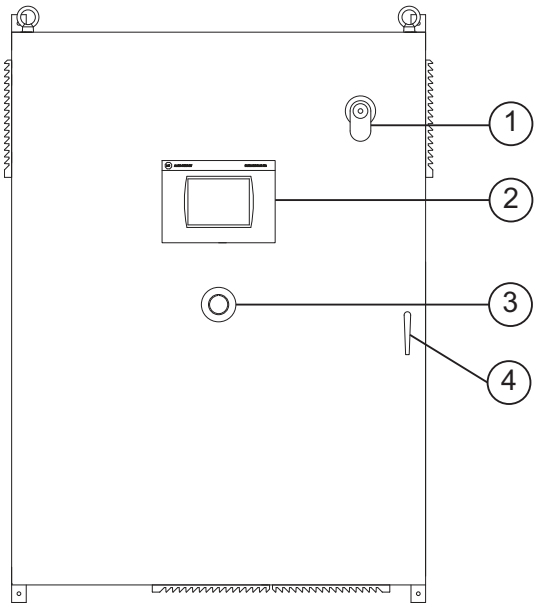


Figure 2 CPP Components

1	Lockable Disconnect Handle	**3**	E-stop
2	Operator Interface	**4**	Door Handle

The main power supply is brought into the CPP. The CPP contains the UV lamp power supplies and provides power distribution to the UV lamps, UV sensor(s), and ActiClean® Cleaning System (ACS).

Section 4 Lockout Tag Out

DANGER

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

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

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

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

4.1 Lockout Tag Out Procedure

4.1.1 Equipment Shutdown

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

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

4.1.2 Deactivate Energy Sources

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

1. Identify and deactivate the main isolating device of each energy source:
   -  Electrical Energy (Incoming Power)
   -  Water Pressure (Potential Power)
   -  Thermal (Thermal Energy)
   -  UV Light (Radiation Energy)
   -  Mechanical (Kinetic Energy)
2.  Disconnect all electrical equipment from power:
   - Disconnect all electrical equipment.
   - Power off and disconnect electrical power to hard-wired equipment.
3.  Dissipate stored electrical energy in capacitors.
4. Close all shut-off valves.
5. Secure moving parts to avoid unintended movement.

4.1.3 Lockout Tag Out Energy Sources

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

4.1.4 Verify the Lockout

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

4.2 Remove the Lockout Tag Out

When the work is finished, the lockout tag out can be removed.

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

Section 5 System Startup and Shutdown

⚠ DANGER

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

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

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

Do not operate the UV system until the UV Chamber is completely filled with water.

To prevent alarm conditions, overheating or equipment damage, process water level and flow in the UV Chamber must be established and maintained at all times when UV lamps are in operation. Follow all provided site-specific instructions about automatic or manual power to operate the system.

5.1 Pre-startup Checklist

Ensure that:

- The UV Chamber is fully assembled—all cables, UV lamps and the UV sensor are installed.
- The wiper motor is attached
- The service end cap is attached and fastened with supplied hardware.
- There is water in the UV Chamber.
- There are no water leaks in the UV Chamber.
- The air vent is operating correctly.
- The drainage or water bypass provisions are followed until UV system starts.

5.2 Startup the UV System from SCADA

Prerequisites:

- Pre-start Checklist. Refer to Section 5.1.

Startup Overview:

The UV system is configured to enable on/off control of the system through SCADA communications.

Startup Procedure:

1. The plant SCADA:
   - Changes the UV System Local / Remote control mode to “Networked” or “Hardwired”.
   - Does not allow flow in the UV Chamber.
   - Ensures that there are no Critical Alarms present in the UV system.
   - Sets the UV Chamber ON bit
2. The UV system control logic:
   - Sets the UV Chamber to Warming state.
   - Sets the UV Chamber Startup Initiated Bit
   - Sets the power level at 100%.
   - Does not register any alarm until a 20-second startup timer has expired. This prevents false alarms during system startup. In addition, most alarms have individual delay timers associated with them.
3. When warming is complete, and no major or critical alarms are present, the UV system:
   - Sets the UV Chamber On bit.
   - Clears the UV Chamber Startup Initiated Bit.

4. The plant:
    - Resolves any active alarms.
    - Allows flow through the UV Chamber.
5. For Pacing systems, the UV system will adjust the UV lamp power after the operational delay time.

Note: *A precautionary lamp driver / lamp cool-down timer may be active at system start up. For the duration of the cool-down mode (a factory-set time that is usually five minutes) it will not be possible to initiate system start up.*

5.3 Startup the UV System from Local

Prerequisites:

- Pre-start Checklist. Refer to Section 5.1.

Startup Overview:

The UV system is configured to enable on/off control of the system through the local CPP interface.

Startup Procedure:

1. The plant:
- Ensures there are no Critical Alarms present on the UV system.
- Does not allow flow during startup.
- Changes the UV system Operation Mode from REMOTE to LOCAL.
2. The UV system control logic (Microprocessor Board):
- Sets the UV chamber to Warming state.
- Displays the warm up status with countdown timer display on microprocessor interface.
- Sets the power level at 100%.
- Does not register any alarm until a 20-second startup timer has expired. This prevents false alarms during system startup. In addition, most alarms have individual delay timers associated with them.
3. When warming is complete, and no major or critical alarms are present, the UV system:
- Shows “System On-Line” on the microprocessor user interface.
4. The plant:
- Resolves any active alarms.
- Allows flow through the UV chamber.
5. For Pacing systems, the UV system will adjust the UV lamp power.

5.4 Shutdown the UV System from SCADA

Prerequisites:

- Pre-start Checklist. Refer to Section 5.1.

Shutdown Procedure:

1. The plant:
    - Stops process flow through UV Chamber.
    - Clears the UV Chamber Startup Initiated Bit.
2. The UV system:
    - Clears the UV Chamber ON bit.

5.5 Shutdown the UV System from Local

Prerequisites:

- Pre-start Checklist. Refer to Section 5.1.

Shutdown Procedure:

1. The User/Operator:
   - Presses the “Initiate Shutdown” button on the Operator Interface. Refer to Section 8.2.4
2. The UV system:
   - Changes the status from Online to Shutdown.

Section 6 Shipment and Storage

The following instructions outline the duties and responsibilities of the contractor on receiving the system equipment.

The contractor assumes responsibility for the system equipment after it has arrived at the project site.

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

6.1 Shipping Contents

The system consists of two major components, the UV chamber and the Control Power Panel. Some components may be disconnected at the UV chamber for shipment.

6.2 How the Equipment is Shipped

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

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

6.3 Storage Requirements before the Installation

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

Storage area conditions:

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

If indoor storage is not possible, the panel may be stored outdoors, with additional conditions:

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

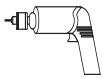
DANGER

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

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

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

7.1 Tools and Materials

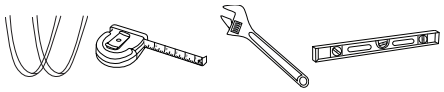
Symbols	Description	Symbols	Description
	Lifting straps (properly sized and rated for equipment load)		Measuring tape
	Level		Lint free cloth (i.e. Kimwipes)
	Flange bolt		Adjustable wrench
	Drill with bits		T Handle allen wrench

7.2 UV Chamber

Prerequisites:

- Clear area where UV chamber will be installed.
- Remove the service end cap and note the position of UV lamp 1.

Tools:



Materials:

- Gasket (x3)
- Flow Conditioner

Note: *Mounting hardware and gaskets to be supplied by Contractor.*

Procedure:

1. Position the lifting straps around the body of the UV chamber. The flanges will be on either side of the lifting straps. Use a crane to lift the UV chamber into position.

2. The UV chamber may be installed horizontally or vertically. Refer to the project layout drawings for correct location and orientation

   Note: *UV lamp 1 is to be installed at the inlet side of the connecting piping.The flow through the UV chamber may go in either direction as long as UV lamp 1 is oriented towards the inlet or upstream side.*

   a. For horizontal installations:

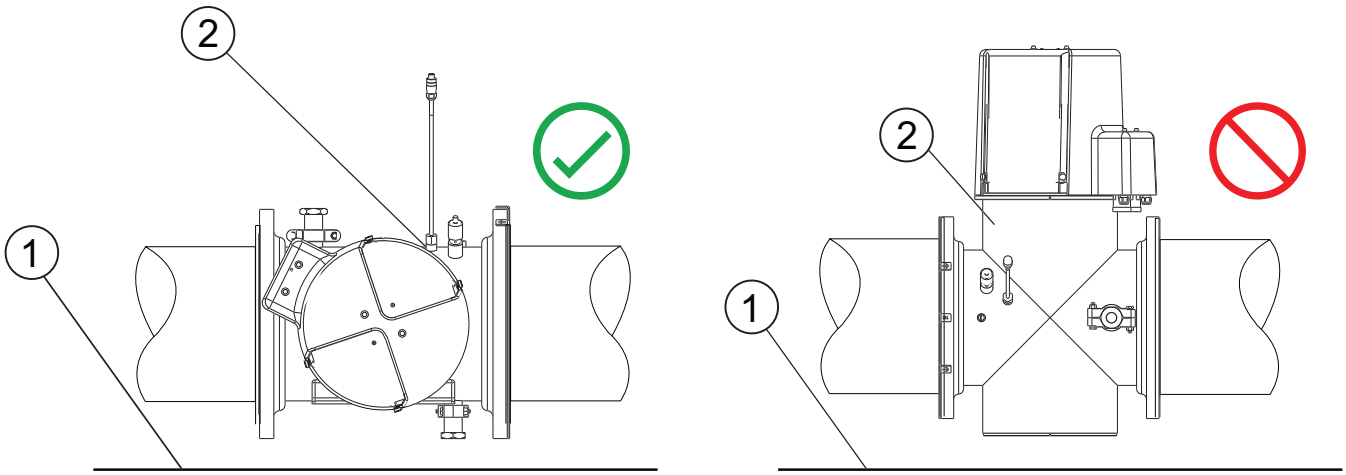


Figure 3 Horizontal Installation

1	Floor Line	**2**	UV Chamber

Note: *Make sure the service end cap is in the same horizontal plane as the pipe section.*

   b. For vertical installations:

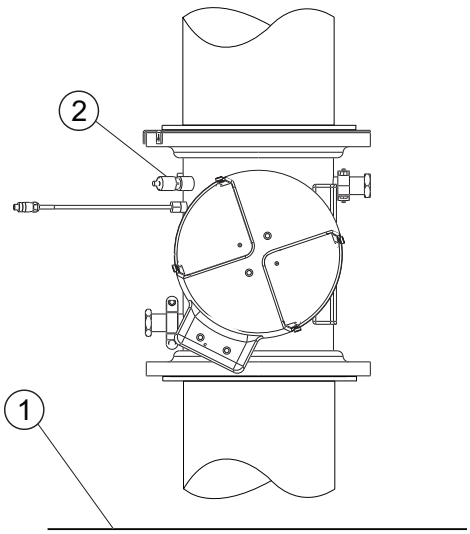


Figure 4 Vertical Installation

1	Floor line	**2**	Level Sensor (always position at the top)

3. Install flow conditioner between the inlet flange and the plant piping.

   a. Install gaskets on both sides of the flow conditioner.

   b. Ensure the flow conditioner tongues are pointed in towards center of the UV chamber. Refer to Figure 5.

   c. Ensure base of tongues to run either parallel or perpendicular to the UV lamps.

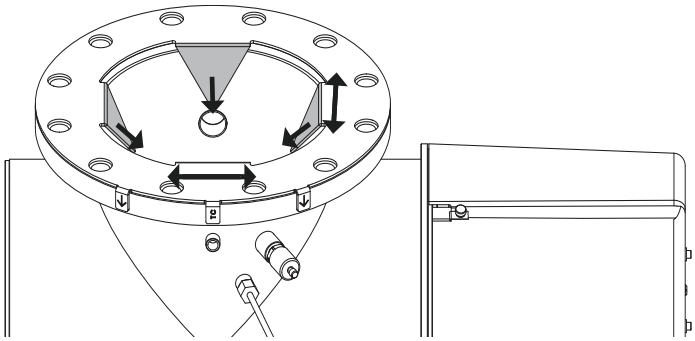


Figure 5 Flow Conditioner Installation

d. There are also two visual aids for quickly checking correct installation of the flow conditioner. Refer to Figure 6.

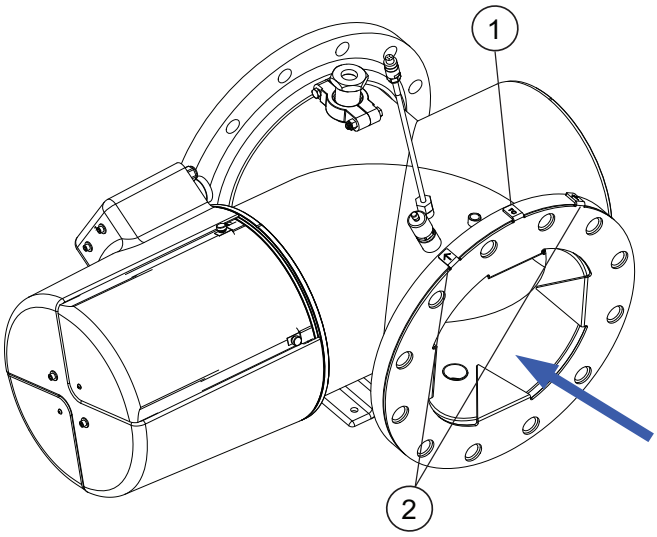


Figure 6 Visual Aid

1	Top of Center	**2**	Flow Direction tape (on inlet flange only)

Note: *The UV chamber is supported by the plant piping through the flanged connections. If pipe supports are required, they are to be designed and supplied by others.*

4. Install flange mounting hardware on both sides of the UV chamber, leveling the UV chamber left to right for horizontal installations and top to bottom for vertical installations.

Note: *The UV chamber is installed such that it remains full of water at all times during operation, and must be mounted level to ensure it drains properly when service is required.*

7.3 Drain and Vent Connections

The UV chamber has a cooling / vent port on top and a cooling/drain port on the bottom. Refer to project layout drawings for connection size.

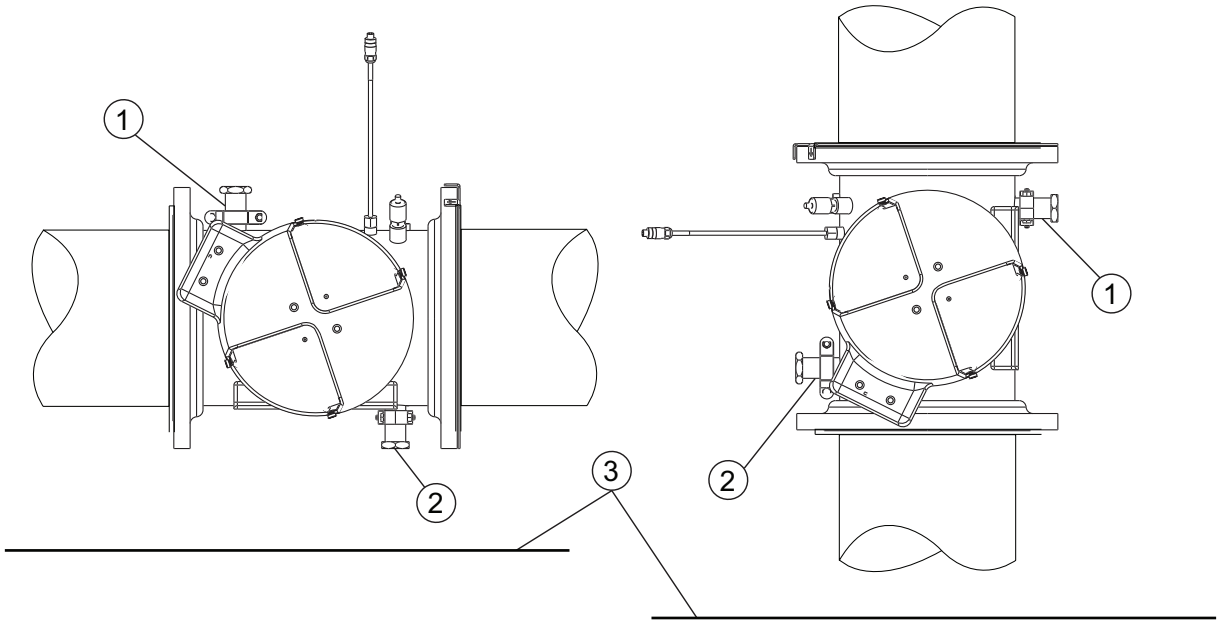


Figure 7 Drain and Vent

1	3A Sanitary Cooling / Vent Port	**3**	Floor Line
2	3A Sanitary Cooling / Drain Port		

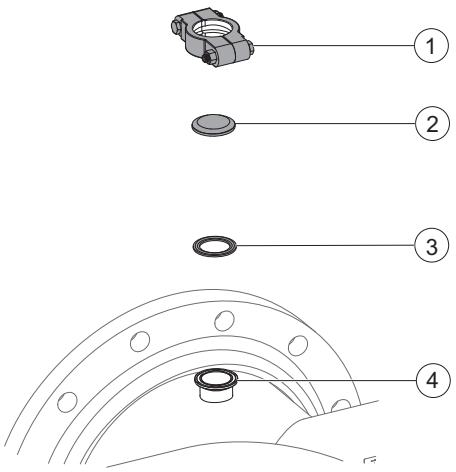


Figure 8 3A Sanitary Fitting Installation

1	Clamp	**3**	Gasket
2	Cap	**4**	Cooling/ Drain or Vent

Note: *There is an optional NPT fitting (not shown), which can be substituted with the cap portion of the assembly.*

7.3.1 Level Sensor and Temperature Switch

The level sensor is a conductance type switch with ¼" NPT mounting. The level sensor is provided with 600 mm (24 in.) of wiring and a disconnect. A matching disconnect is provided and the connecting cable length varies depending on the distance to the junction box.

The level sensor and temperature switch are pre-mounted on the UV chamber.

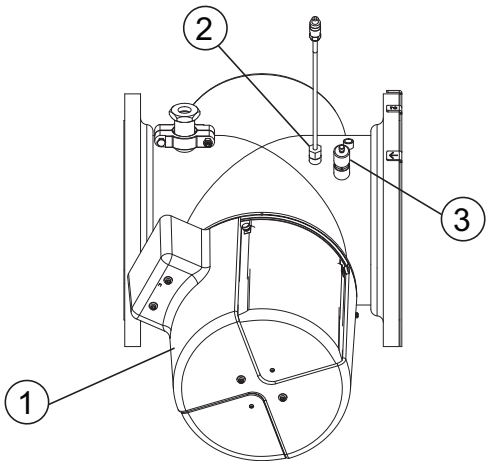


Figure 9 Level Sensor and Temperature Switch

1	Service End Cap	**3**	Level Sensor
2	Temperature Switch		

7.3.2 Cooling Water Flow

The following table is to used as a guide for installations where the UV chamber is to be isolated with upstream and downstream valves closed with the UV lamps powered on. The cooling flow loop utilizes supplied ports located on UV chamber and must maintain UV chamber temperatures below the lower tolerance of the temperature switch, 50 ºC (120 °F). The table below summarizes recommended steady state flow rates given a specific influent temperature.

Note: *These values are not to be applied to other pipe configurations. For alternate pipe arrangements, an on-site test would confirm actual minimum requirements.*

2L12 & 4L12 Horizontal Cooling Water Flows					
Influent Temperature (ºC)	10	15	20	25	30
Recommended Minimum Flow rate (USGPM)	5 Min	5	5	10	15+
Recommended Minimum Flow rate (Liters/Second)	0.32 Min	0.32	0.32	0.63	0.95+
Only horizontal orientation tested for UVS12. Worst-case hydraulic conditions tested by using capped flanges that eliminate cooling benefits of water in connecting pipe. Water to fill connecting pipe and flow from bottom to top through supplied reactor					

Note: *Refer to project layout drawings for cooling loop diagram.*

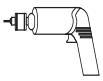
7.3.3 Control Power Panel

Prerequisites:

- Lockout tag out devices as necessary. Refer to Section 4.
- Refer to project layout drawings for required install location.
- Refer to project electrical drawings for required electrical connections.

- Install four (4) mounting brackets to CPP - (shipped inside of CPP).

Tools:



Materials:

- Expansion anchors (by others)

Procedure:

1. Connect lifting straps to the lifting lugs located on the top of the CPP. Use a crane to lift the CPP into position.
2. Mount the CPP to wall using 4 expansion anchors.

   Note: *300 mm (12 inches) minimum clearance is required on each side of the CPP.*

7.3.4 Equipment Interconnections

Refer to the general layout drawings provided by the manufacturer. If the supplied layout drawings do not match the site conditions, contact the manufacturer for assistance.

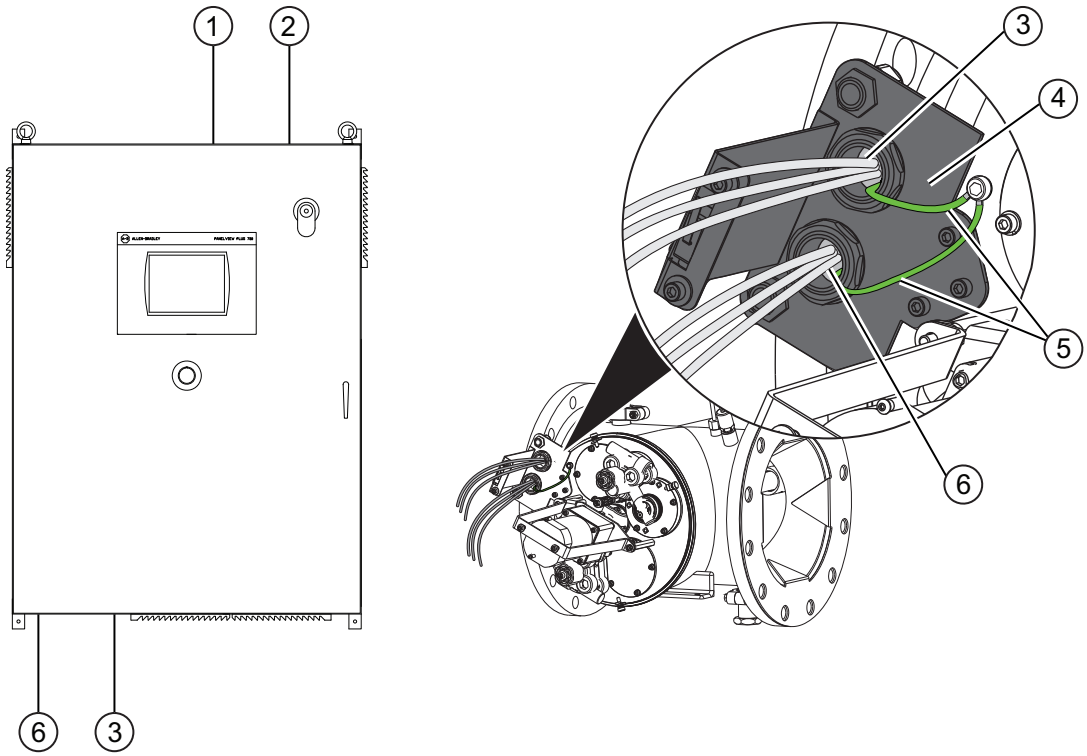


Figure 10 CPP to UV Chamber Interconnections

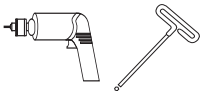
1	Discrete and Analog Wiring	**4**	Electrical Bracket
2	Main Power Supply	**5**	Ground Wire Connection
3	UV Lamp Cabling (CPP to UV Chamber*)	**6**	Controls Cabling (CPP to UV Chamber*)

*Flex conduit not shown for illustration purposes.

Prerequisites:

- Lockout tag out devices as necessary. Refer to Section 4.
- Refer to project layout drawings for required install location.
- Refer to project electrical drawings for required electrical connections.

Tools:



Materials:

- Controls cabling and conduit (CPP to UV Chamber)
- UV lamp cabling and conduit (CPP to UV Chamber)
- Sealing rings (by others)

Procedure:

1. Drill a hole on the top right side of the CPP enclosure, just above the disconnect, terminate the main power supply to the termination strip. Refer to Figure 10, Electrical and Layout Drawings for positioning.
2. Drill a hole on the top of the CPP enclosure just to the left of the main power supply. Bring in the discrete and analog signal wiring (e.g. flow meter, valves, UVT, alarm wires, etc.). Refer to Figure 10, Electrical and Layout Drawings for positioning.
3. Attach interconnects contained in the two (2) flex conduits originating from the bottom of the CPP to the UV Chamber.
   a. Mount the electrical bracket on the UV chamber.
   b. Connect the labelled ground wires to the UV chamber using the ground lug.
   c. Connect all the labelled cabling to the correspondingly labelled item on the UV chamber (except the UV lamps and UV sensor cables).

7.4 UVI Sensor(s), UV Lamps and Sleeves

NOTICE
Trojan Technologies personnel must install the UVI Sensors, UVI Sensor Sleeves, UV Lamps and Lamp Sleeves into the UV Chamber. DO NOT remove the sleeve port caps from the UV Chamber.

7.5 Hydrostatic Test

Prerequisites:

- Complete Electrical Interconnections. Refer to Section 7.3.4.
- Make sure the drain valve is closed.

Materials:

Procedure:

1. Slowly fill the UV chamber with water.
   a. Stand off to the side and make sure the area is clear of all plant personnel.
   b. Pressurize the UV chamber.
   c. Check for leaks.
   d. Wait twenty minutes.
2. If leaks are found:
   a. Depressurize and drain the UV chamber. Refer to Section 9.4.
   b. Fix the leaks.
   c. Fill the UV chamber and do a pressure test. Check for leaks.
3. If there are no leaks, depressurize the UV chamber. Refer to Section 9.4.

7.6 Startup and System Commission

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

⚠ DANGER

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

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

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

The system is designed to operate automatically. Each system is custom sized and programmed to meet site-specific objectives.

8.1 Control Power Panel

The operation of the system is managed at the CPP by its PLC based controller, which continuously monitors and controls system functions. The operator interface allows complete control and monitoring of the entire system.

8.1.1 Power Up / Power Down

When the CPP is started up, the PLC controller and Operator Interface performs self-diagnostics and reads the status of all inputs and set outputs. Once the power up sequence is complete, the Chamber (Reactor) Overview (Home) screen is displayed on the Operator Interface.

After the) system is powered up, the operator should verify that the Operator Interface and programmable controller are communicating with each other via the Information Overview Screen.

8.2 Operator Interface Navigation

It is recommended that touch screen fields are pressed with the non-writing end of a pen or a similar blunt-point instrument, rather than through finger presses. Some entry fields have been developed with touch areas that are too small for most fingertips. Avoid using excessive force when pressing the screen.

The Operator Interface screens on the CPP vary with the system configuration. The screens described in this section of the manual may not be the same as the screens shown on the CPP.

In case of an entry that is alpha or numeric in nature, a keypad will appear with alphanumeric values when the operator touches the entry field to change or set the value / entry. Type in the value / entry desired and then touch **ENTER** (↵) located on the keypad.

The operator may run each UV chamber in automatic mode, which allows the PLC controller to monitor and control the UV dosage or in manual mode through the Operator Interface.

8.2.1 Screen Navigation Bar

Figure 11 Screen Navigation Bar

The Operator Interface consists of a graphical active matrix touch screen display. The entire unit is mounted on the Control Power Panel (CPP) door.

The Screen Navigation Bar allows access to the following screens and system information:

Table 2 Operator Interface Screen

Icon	Screen	System Information
	UV Chamber Overview	An operational summary of the UV Chamber. Allows access to display process variables such as flow and UVT values
	Alarm Status	Displays a list of the currently active alarms and allows access to Alarm History screen and lamp driver diagnostics. Icon will flash with a color if the alarm is active: • Red - Critical • Orange - Major • Yellow - Minor
	Trend	Displays trend data.
	Log In / Out	Login and logout icons on the Navigation bar to allow control of user security level.
	System Information	Shows information about the system hardware, software and rack diagnostics.
	System Settings	Allows access to system configuration settings as allowed by current security level. Settings are organized in pages by function.
	Wiper Overview	Allows access to control Wiper system.
	Lamps Overview	Allows access to monitor UV lamps and display specific information.
	Sensor Overview	Allows access to monitor sensors and display specific information.
	Valve Overview	Allows access to control and monitor inlet, cooling, and outlet devices.

8.2.2 Screen Color Codes and Icons

The Operator Interface screens utilizes the following color codes within all user screens:

Table 3 Color Codes and User Screens

Icon	System Information
Black text on a gray background	Represents static text or numeric data that is unable to be changed by an operator at the current security level.
Black text on a white background	Represents an active button or numeric entry field that will either change the currently displayed screen, or will allow entry of numeric data.
Black text on a yellow background	Represents a function that is a manually controlled mode.

Table 3 Color Codes and User Screens

Light blue background for text or symbol	Represents a running status for UV lamps.
Black background for text and symbol	Represents a not running status for UV lamps.
Red background for text and symbol	Represent faulted equipment.
White text on a blue background	Represents a function controlled by the PLC.

8.2.3 Operator-level Access

The user interface screens that are described in this section require only operator-level access.

8.2.3.1 Login

User	Password
OP1 access	11111
Technician Access	Service Provider Access only

8.2.4 UV Chamber (Reactor) Overview Screen

The UV Chamber (Reactor) Overview screen main function provides the operator with a quick status overview of the system and the UV Chamber. The center left portion of the screen indicates what kind of system control mode the plant is using (i.e. Auto or Manual). The UV Chamber Overview screen gives a visual display of the UV lamps and their current status. UV Lamp status information is displayed along with text messages informing the operator of specific events (i.e. Start Up Complete).

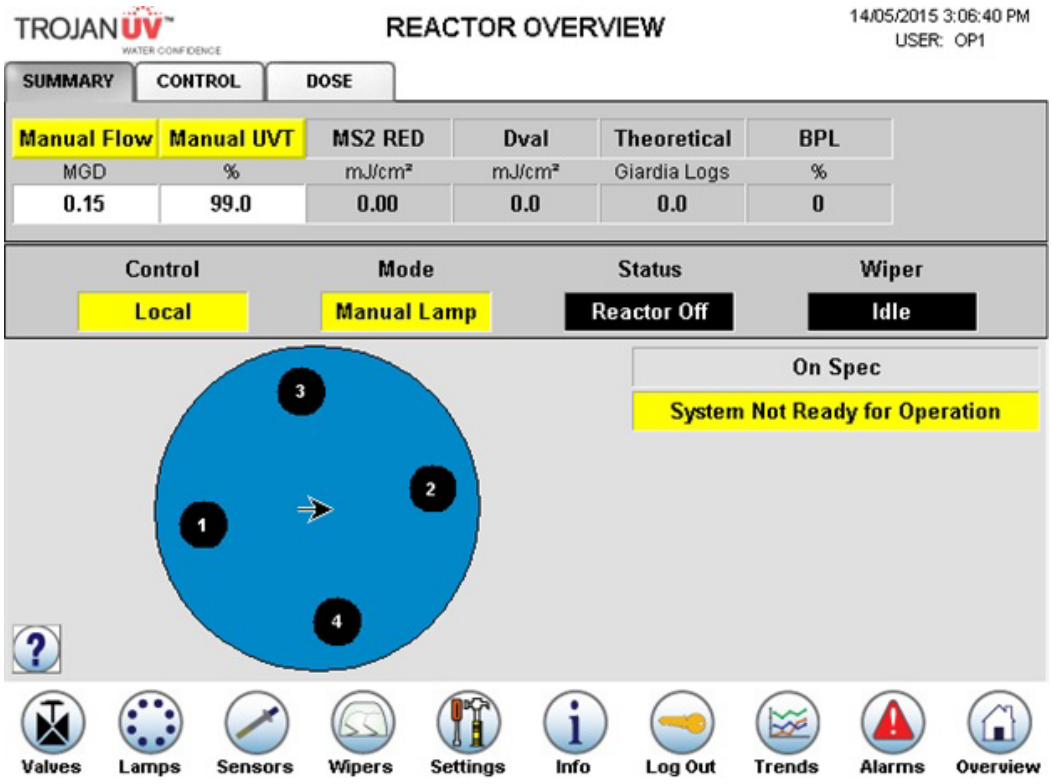


Figure 12 UV Chamber Overview Screen - Summary (Off spec disabled)

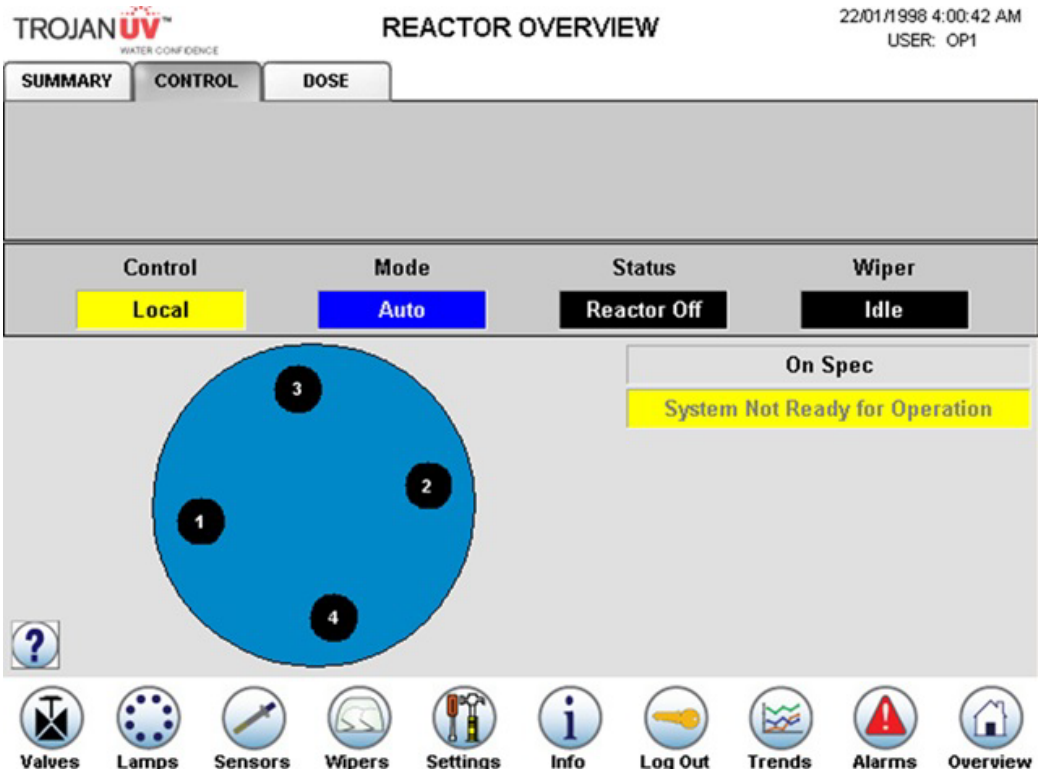


Figure 13 UV Chamber Overview Screen - Control

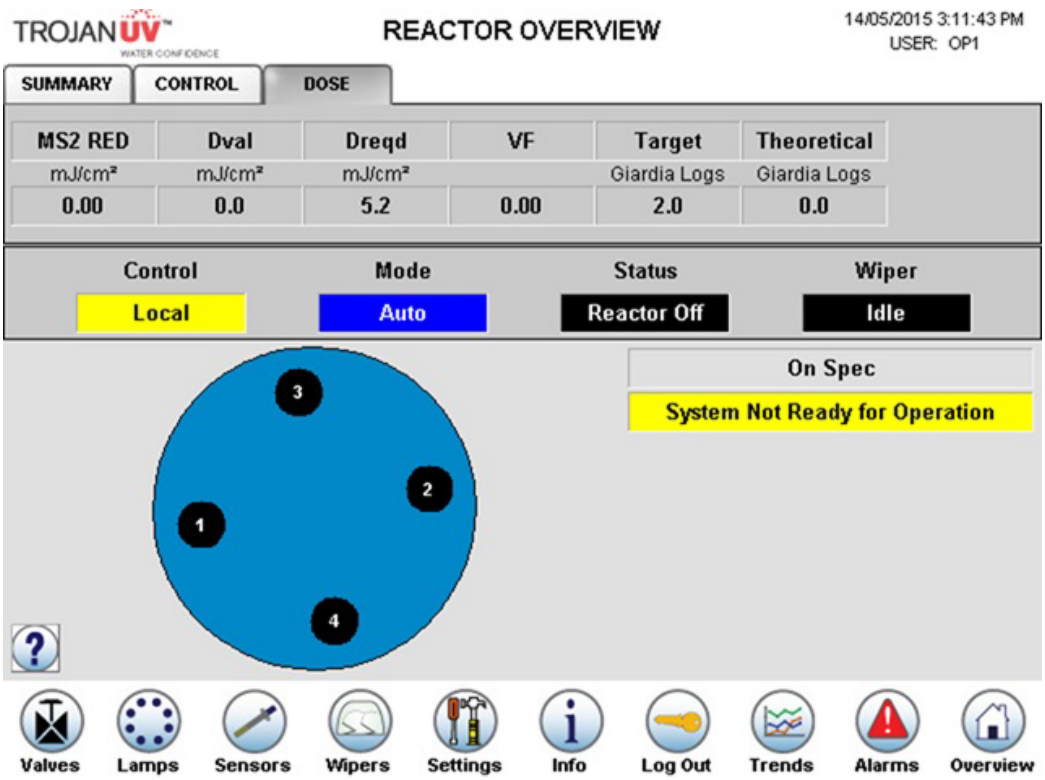


Figure 14 UV Chamber Overview Screen - Dose

8.2.5 Display Screens

8.2.5.1 Wiper Overview Screen

The Wiper Overview Screen provides the operator with information on the wiper system status and allows the operator to manually initiate a wipe sequence and home the wiper. Press the **MANUAL WIPE** button to manually initiate a wipe sequence, or press the **HOME WIPER** button to manually home the wiper, if the wiper position becomes undefined. The total number of wipe cycles is displayed in the lower left side of the screen.

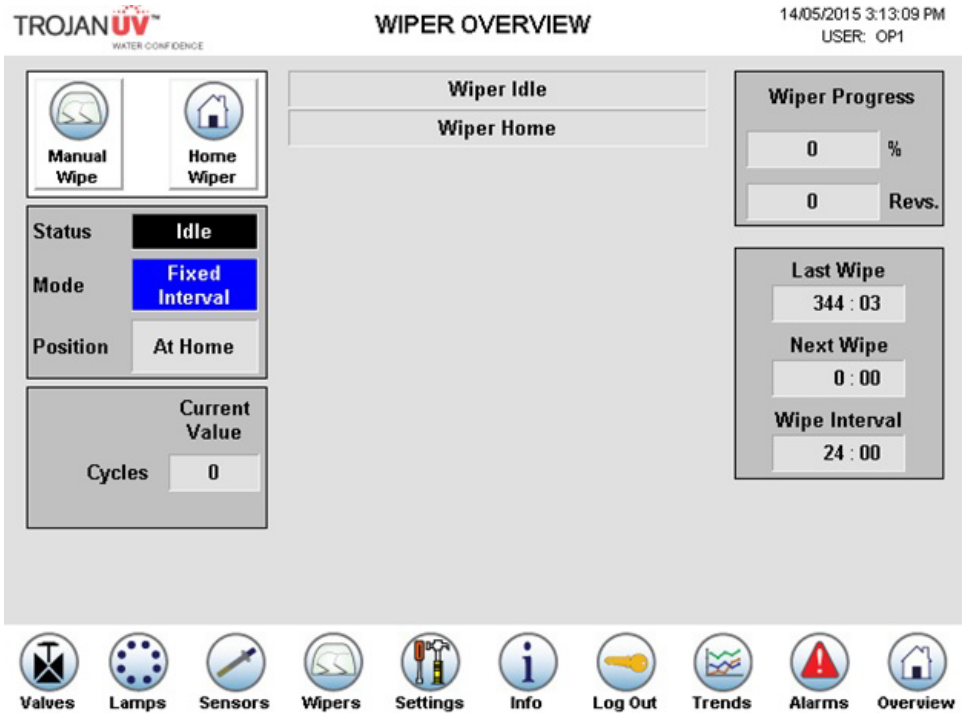


Figure 15 Wiper Overview

Action	Procedure
Initiate a Wipe Sequence	**1** Press the **MANUAL WIPE** push button on the Wiper Overview screen.
Return the Wiper to the Home position	**1** Press the **HOME WIPER** push button on the Wiper Overview screen.

8.2.5.2 Sensor Overview Screen

The Sensor Overview Screen displays the readings for each UV sensor (Sensor 1, Sensor 2, etc) in mW / cm^2 and mA. It displays the number of days that the UV sensor has been in use and the time until the next requirement for reference check in days.

The operator can reset sensor runtime via this screen provided that the operator has entered the minimum required password security access. Once a UV sensor has been checked against the reference sensor, the operator can reset the UV sensor's runtime (in days) by pressing on the individual sensor reset push button.

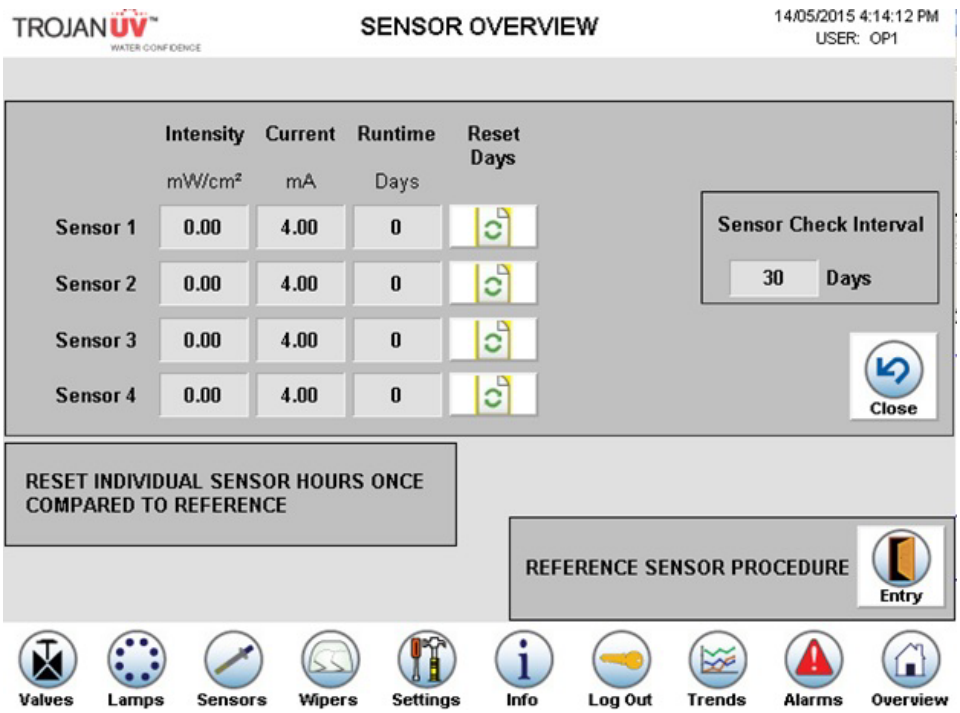


Figure 16 Sensor Overview

8.2.5.3 Valve Overview Screen

The Valve Overview screen provides a status display to the operator of the Valves (Inlet, Outlet or Cooling Devices) controlled by the UV system.

Note: *The valve configuration displayed on the screen is project specific. Non-controlled valves will display as "Not Present" or similar.*

The Valve Overview screen will provide the same information about each valve. If the valve(s) are being controlled by the UV system, then this screen will indicate the valve position and/or status (i.e. open, closed or moving). The operator can open, close or specify **AUTO / MANUAL** control of the valve from this screen. When an operation (i.e. opening valve) is complete, a signal will be sent back to the controller and the status will be updated in this screen. Refer to Figure 17.

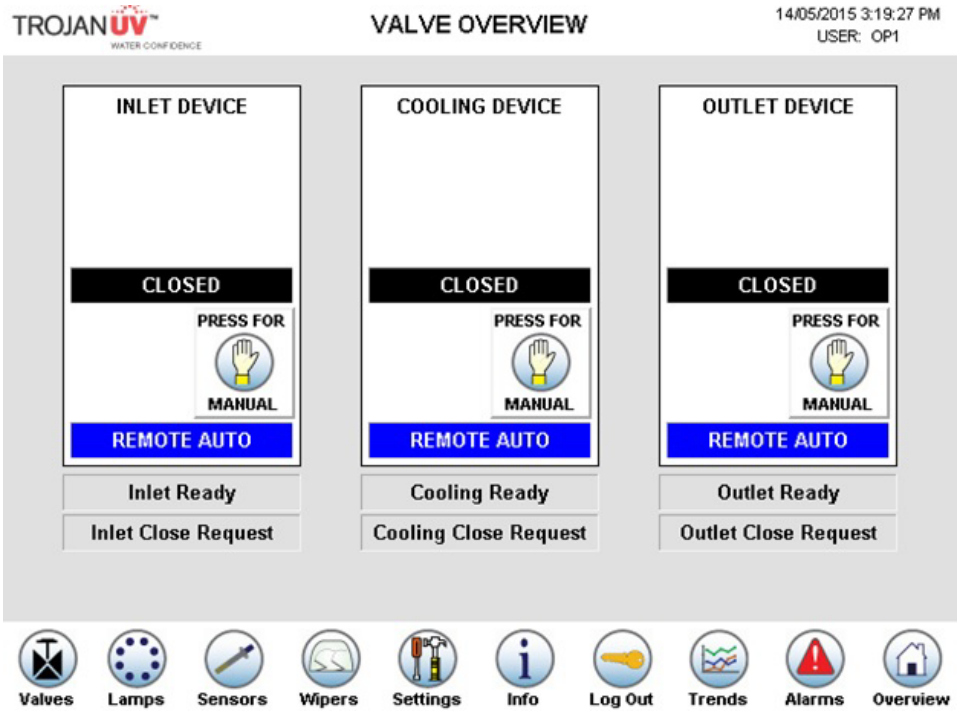


Figure 17 Valve Overview

8.2.5.4 Trend Overview Screen

The Trend Overview screen is the trending screen that displays the Flow, % UVT and RED values with respect to time. The trend object pens will be refreshed every 30 seconds.

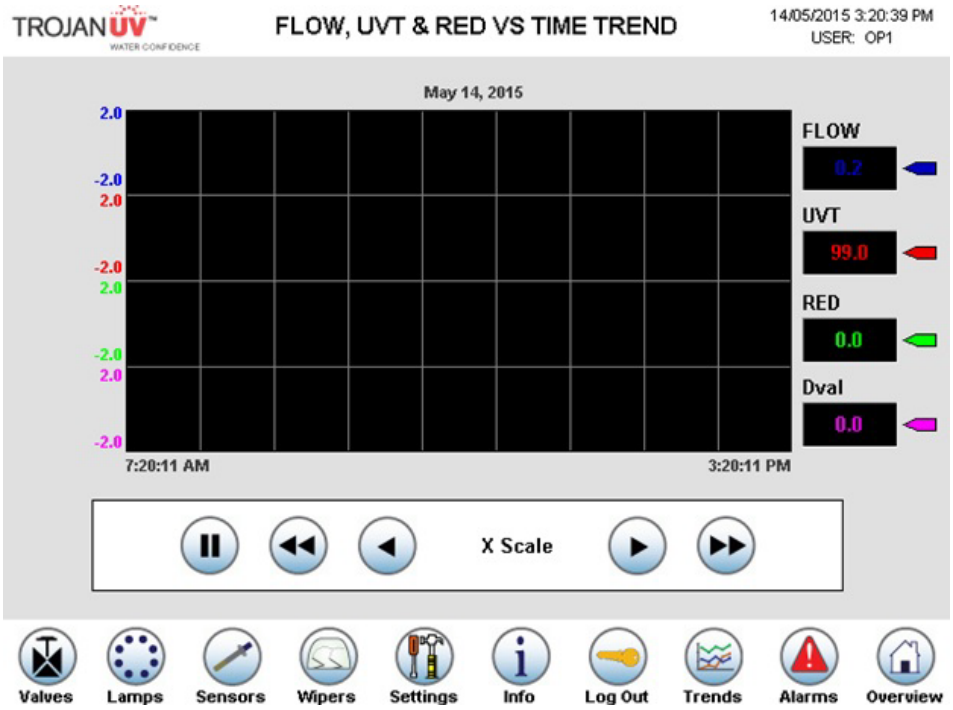


Figure 18 Trend Overview

8.2.5.5 PLC and HMI Status Screen

The PLC and HMI Status screen displays information that may need clarification, (i.e. Software and firmware revisions). This screen provides the operator with status information relating to the PLC and HMI hardware revision levels, the PLC and HMI program application revision levels, the PLC status and mode, PLC program scan information and PLC program memory.

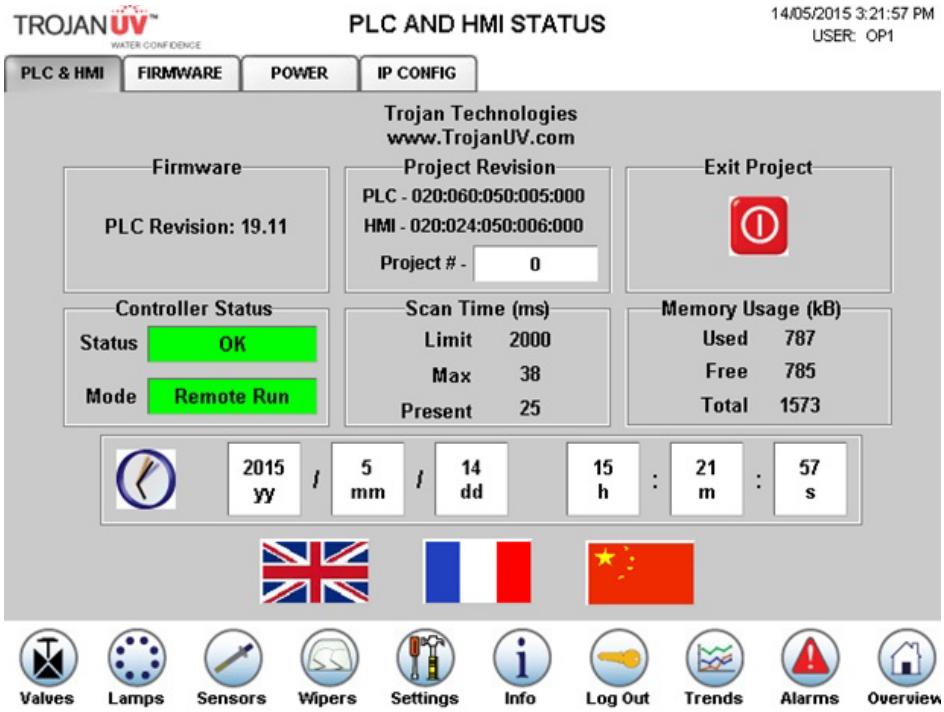


Figure 19 PLC and HMI Status

To Change	Procedure
System Clock	**1** Touch the hour, minutes or seconds window. **2** Enter the value using the pop-up numeric touch pad. ***Note:*** *System clock can also be changed through SCADA (if applicable).*

8.2.5.6 IP Configuration Screen

The IP Configuration screen displays IP address information.

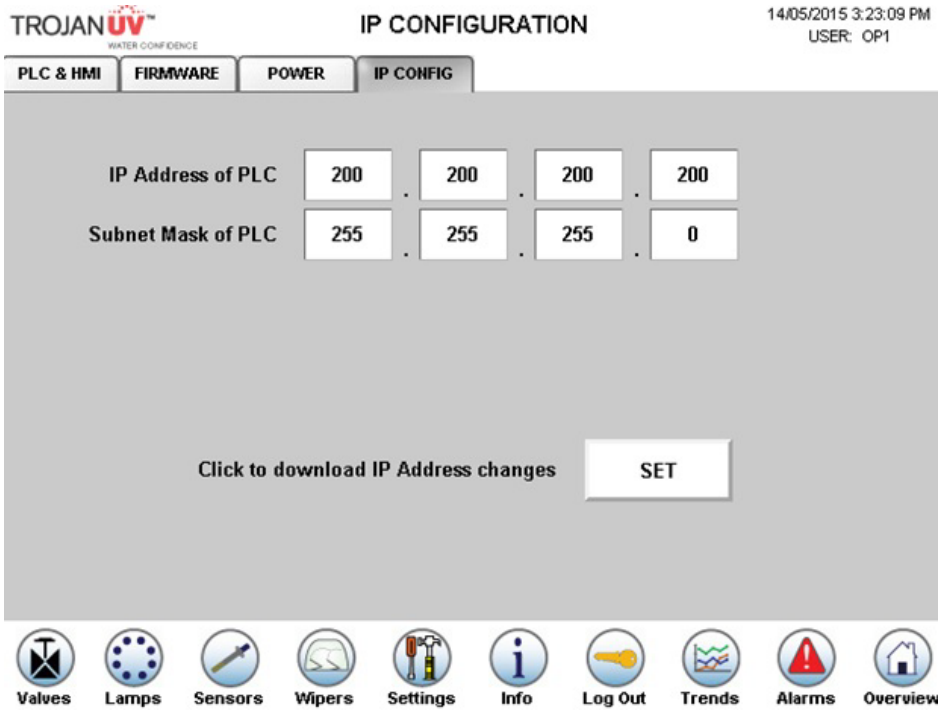


Figure 20 IP Configuration

8.2.5.7 Power Information Screen

The Power Information screen displays the power consumption of the UV system and lamp drivers.

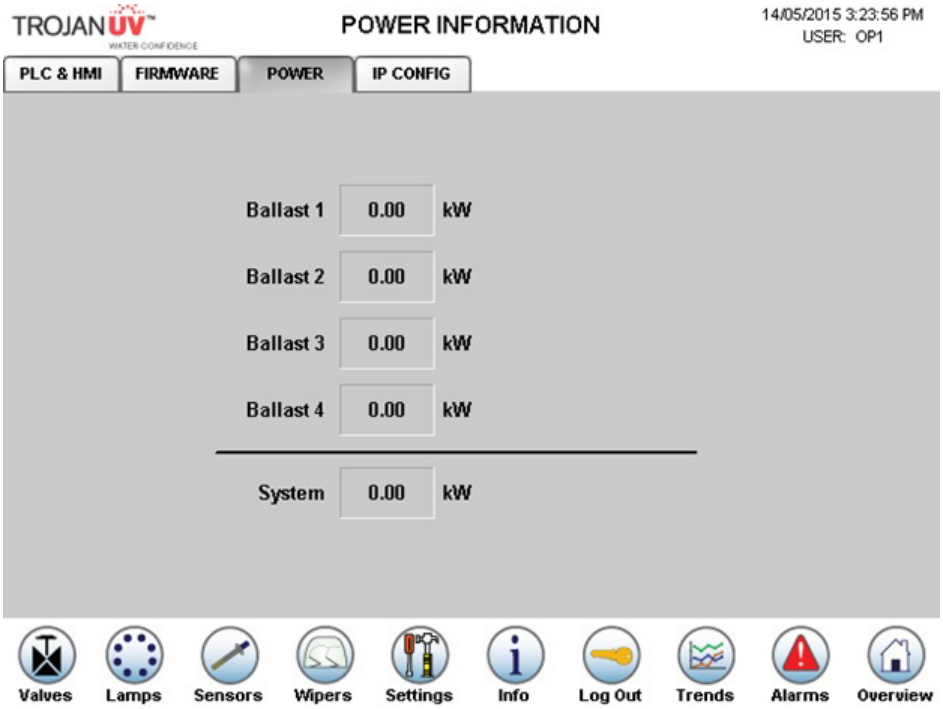


Figure 21 Power Information

8.2.5.8 Equipment Firmware Information Screen

The Equipment Firmware Information screen displays the current firmware of the UV system.

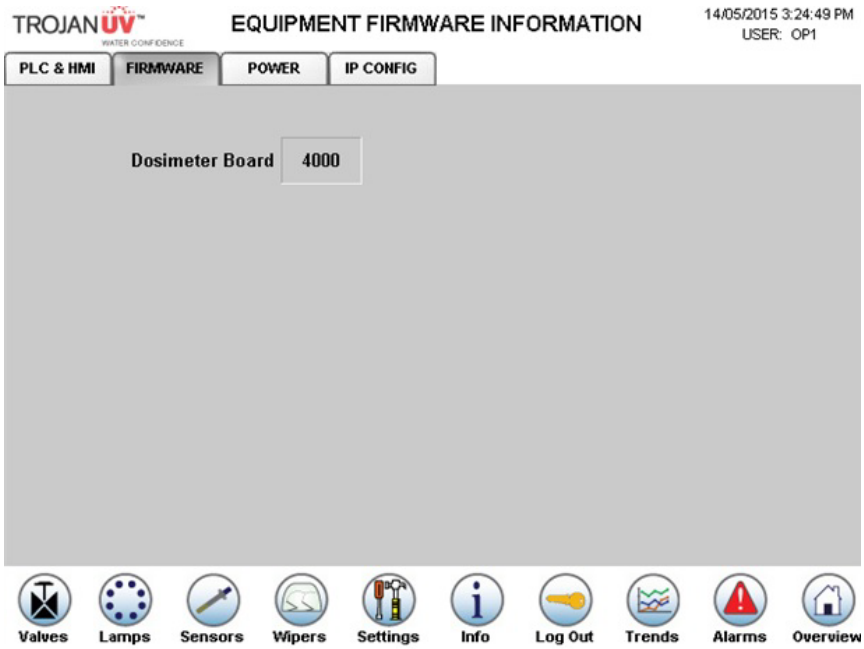


Figure 22 Equipment Firmware Information

8.2.5.9 Lamp Overview Screen

The Lamp Overview screen shows information about the Lamp Current, Voltage and Power, Hours of Operation and Number of Cycles in the system.

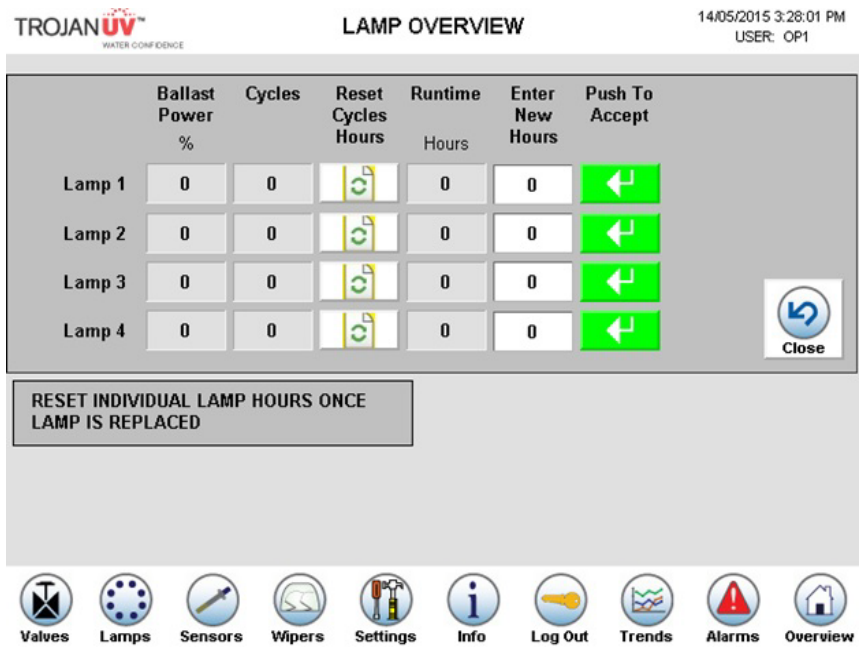


Figure 23 Lamp Overview

Action	Procedure
Set Lamp Runtime Cycles and Hours	**1** Replace a UV lamp. Refer to Section 9.7.2. **2** Touch the “Reset Cycle Hours” button ( ) for the replaced UV lamp or manually enter a value in the “Enter New Hours” box. Push **ENTER** (↵) button to accept.

8.2.5.10 Alarm Screen

The Alarm screen provides access to either the Active Alarms display, the Lamp Driver Diagnostics or the Alarm History display.

Active Alarms

On the Active Alarm screen, only active alarms are displayed, the operator cannot acknowledge alarms through this view. Touch “**Reset”** to reset the faults.

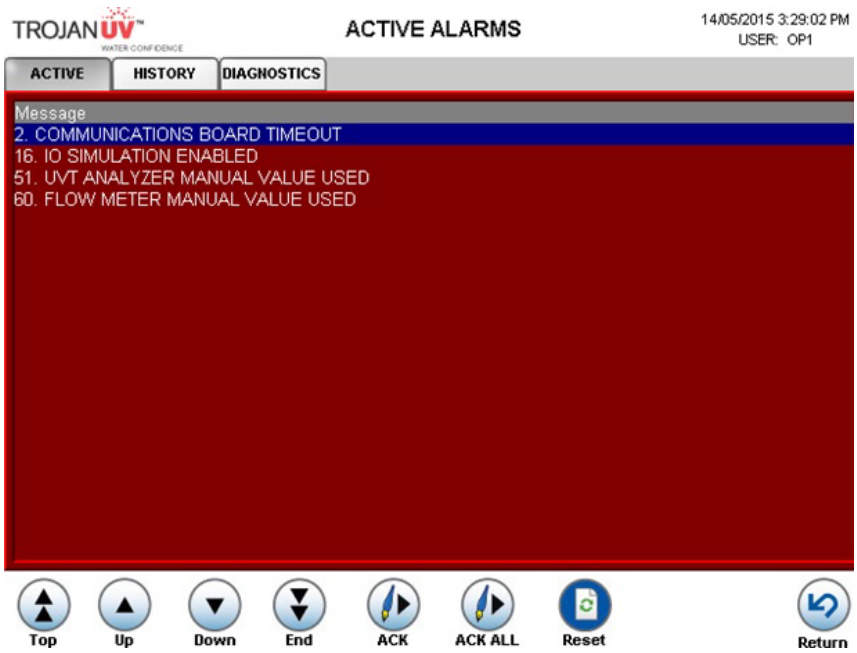


Figure 24 Active Alarm

Historical Alarms Screen

On the Historical Alarms screen, all alarms are displayed as shown in Figure 25. Touch **Reset** to reset the faults.

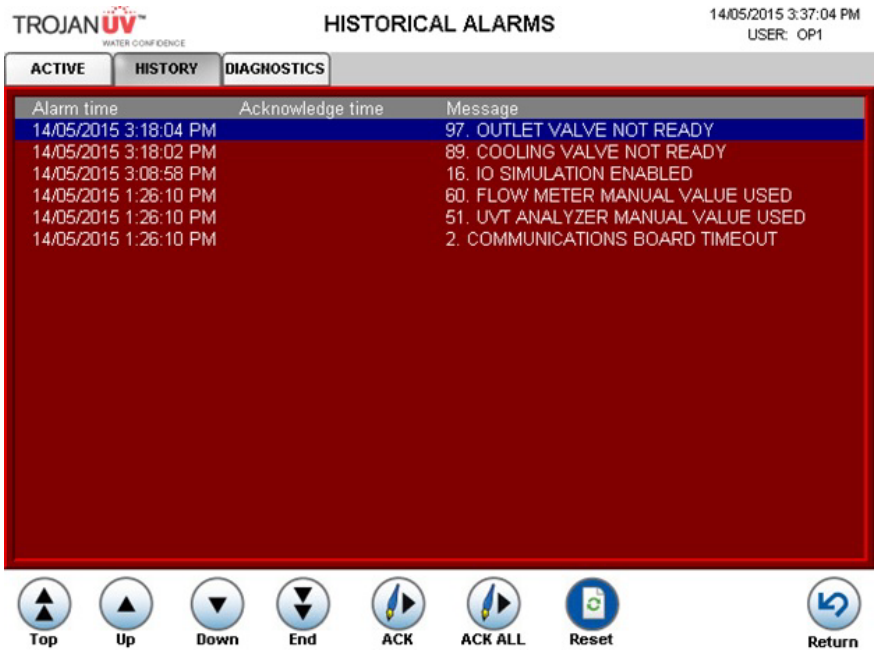


Figure 25 Historical Alarm

Action	Procedure
Acknowledge Alarms	**1** Resolve the alarm condition. **2** Use the UP or DOWN buttons to highlight the required alarm. **3** Touch the ACK button to acknowledge a specific alarm. **4** Touch the ACK ALL button to acknowledge all alarms.

Diagnostic Alarms Screen

On the Diagnostic Alarms screen, all alarms are displayed as shown in Figure 26. Touch **Reset** to reset the faults.

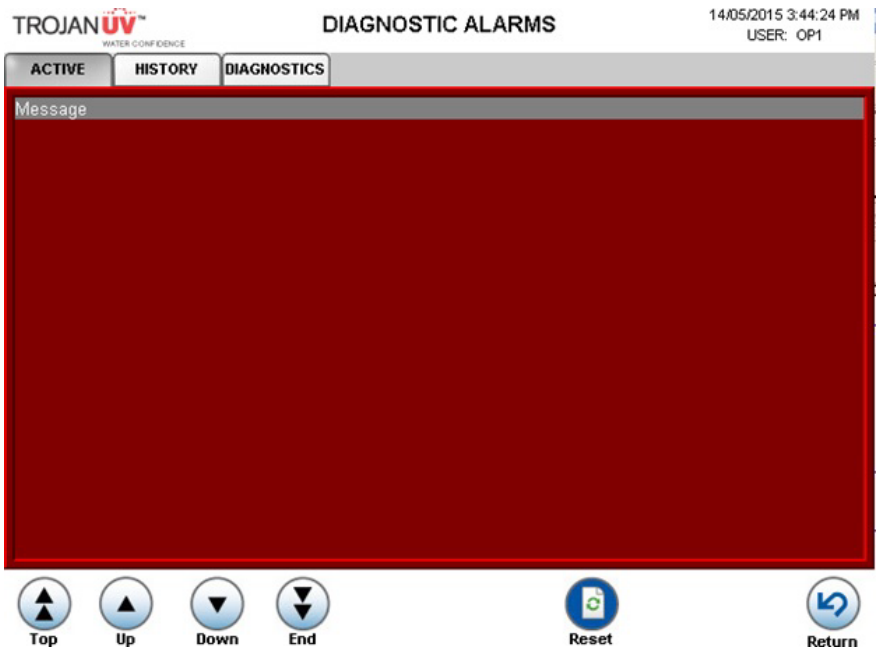


Figure 26 Diagnostic Alarms

Alarm Banner Screen

The Alarm Banner screen is a pop up screen that will display in front of any screen. It signals to the operator that an alarm has occurred and is active. The operator can acknowledge the alarm from this screen.

Figure 27 Alarm Banner Screen

8.2.6 Settings Screens

The configuration settings for the UV system are accessed, reviewed or changed through the System Settings Screens. Push the numeric entry box, enter the value, then push ENTER. Use the pop-up numeric touch pad to enter the desired value.

8.2.6.1 Dose Settings Screen (Off -Specification Mode disabled)

The operator will be able to change the RED target setpoint, the RED analog output scale value, and the RED Source to either Manual or SCADA. This screen also lists the validation report being used.

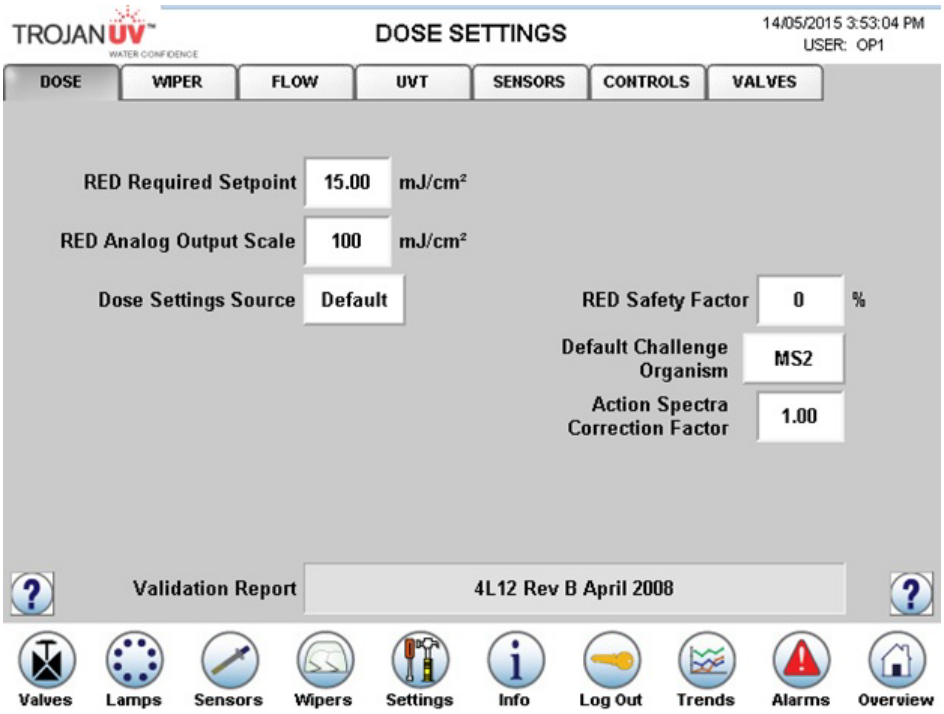


Figure 28 DOSE Settings (Off spec disabled)

To Change	Procedure
RED Target Setpoint	**1** Touch the value in the RED Target Setpoint numeric input field to select input focus. A pop-up keypad will appear on the screen beside the field you wish to change. Enter a value using the pop-up numeric keypad. **2** Once the correct value is entered press **ENTER** (↵). This will accept the change.
RED Output Scale	**1** Touch the value in the Dose output scale numeric input 1. field to select input focus. A pop-up keypad will appear on the screen beside the field you wish to change. Enter a value using the pop-up numeric keypad. **2** Once the correct value is entered press **ENTER** (↵). This will accept the change.
RED Source	**1** Touch the maintained selector next to the RED Source text. The types of RED Target Mode control include Manual or SCADA. The type of control the system is currently using is the state displayed on the function's maintained selector. • MANUAL – Value is entered manually on site. • SCADA – Value written to CPP via Plant SCADA.
Challenge Organism	**1** Touch the maintained selector next to the Challenge Organism text. The types of Challenge Organism include T1 or MS2. **2** Once the correct Challenge Organism is entered press **ENTER** (↵). This will accept the change.
Action Spectra Correction Factor (CF)	A correction factor to account for greater proportional inactivation of a challenge microorganism compared to the target pathogen that result from differences in action spectra.

8.2.6.2 Dose Settings Screen (Off -Specification Mode enabled)

The operator will be able to change Off-Spec delay, Dose output scale, Dose source, Target Pathogen, Target Log Inactivation, Dose Safety Factor, and Challenge Organism.

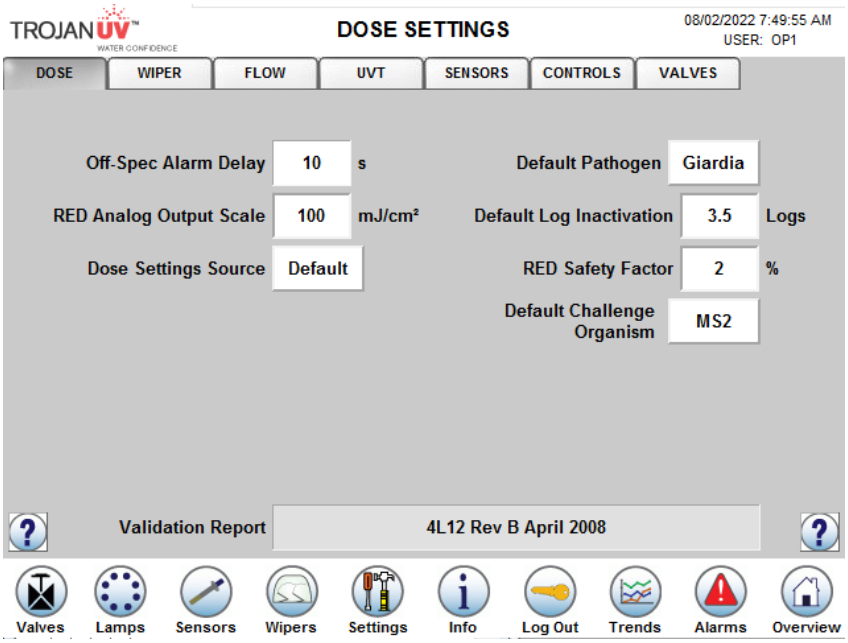


Figure 29 DOSE Settings (Off spec enabled)

To Change	Procedure
Off-Spec Delay	**1** Touch the maintained selector next to the Off-Spec delay text A pop-up keypad will appear on the screen beside the field you wish to change. Enter a value using the pop-up numeric keypad. **2** Once the correct value is entered press **ENTER** (↵). This will accept the change.
Dose Output Scale	**1** Touch the value in the Dose output scale numeric input field to select input focus. A pop-up keypad will appear on the screen beside the field you wish to change. Enter a value using the pop-up numeric keypad. **2** Once the correct value is entered press **ENTER** (↵). This will accept the change.
Target Pathogen	**1** Touch the maintained selector next to the RED Source text. Select the target pathogen. **2** Once the correct Target Pathogen is entered press **ENTER** (↵). This will accept the change.
Target Log Inactivation	**1** Touch the maintained selector next to the Target Log Inactivation text. A pop-up keypad will appear on the screen beside the field you wish to change. Enter a value using the pop-up numeric keypad. The Target Log Inactivation can range from 0.5 - 4.0. **2** Once the correct value is entered press **ENTER** (↵). This will accept the change.
Dose Safety Factor	**1** Touch the maintained selector next to the Dose Safety Factor text. A pop-up keypad will appear on the screen beside the field you wish to change. Enter a value using the pop-up numeric keypad. **2** Once the correct value is entered press **ENTER** (↵). This will accept the change.
Challenge Organism	**1** Touch the maintained selector next to the Challenge Organism text. The types of Challenge Organism include T1 or MS2. **2** Once the correct Challenge Organism is entered press **ENTER** (↵). This will accept the change.

8.2.6.3 Wiper Settings Screen

This screen allows the operator to enter the Wiper Cycle Interval Time.

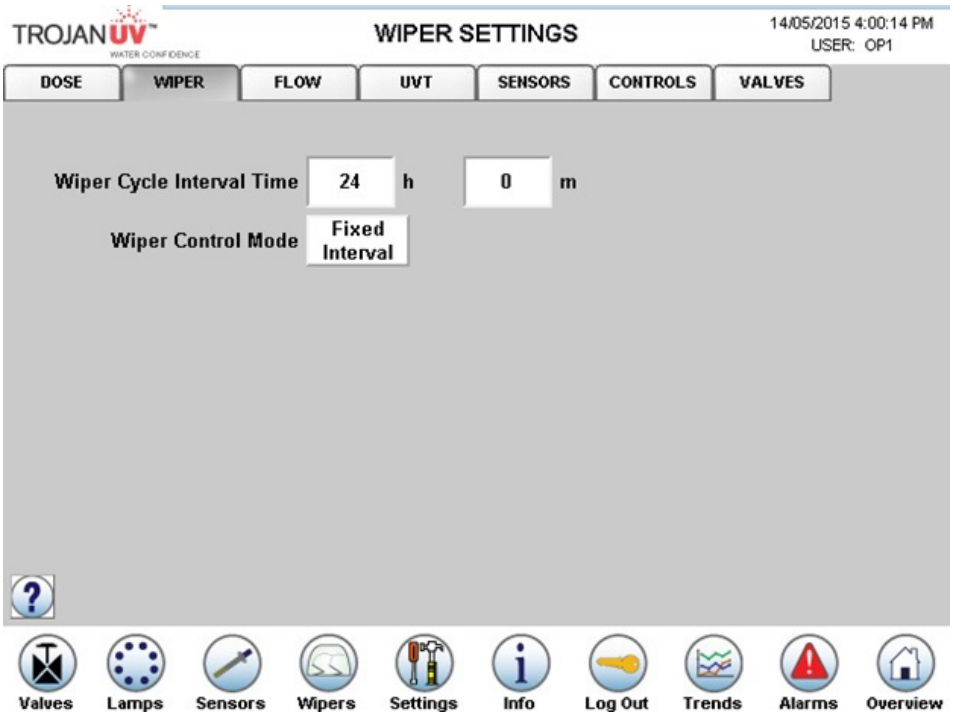


Figure 30 Wiper Settings

Setting	Description
Wiper Cycle Interval Time	Sets the time between wipes when operating wiper in Fixed interval mode.
Wiper Control Mode	Sets wiper mode of operation. • MANUAL – Allows the operator to manually initiate wipes from the Wiper Overview screen. • Fixed Interval – Automatic wiping at fixed intervals while the UV Chamber is on. • Off – Wiper Disabled.

8.2.6.4 Flow Settings Screen

This screen allows the operator to select the Flow Meter parameters and Flow Alarm setpoints.

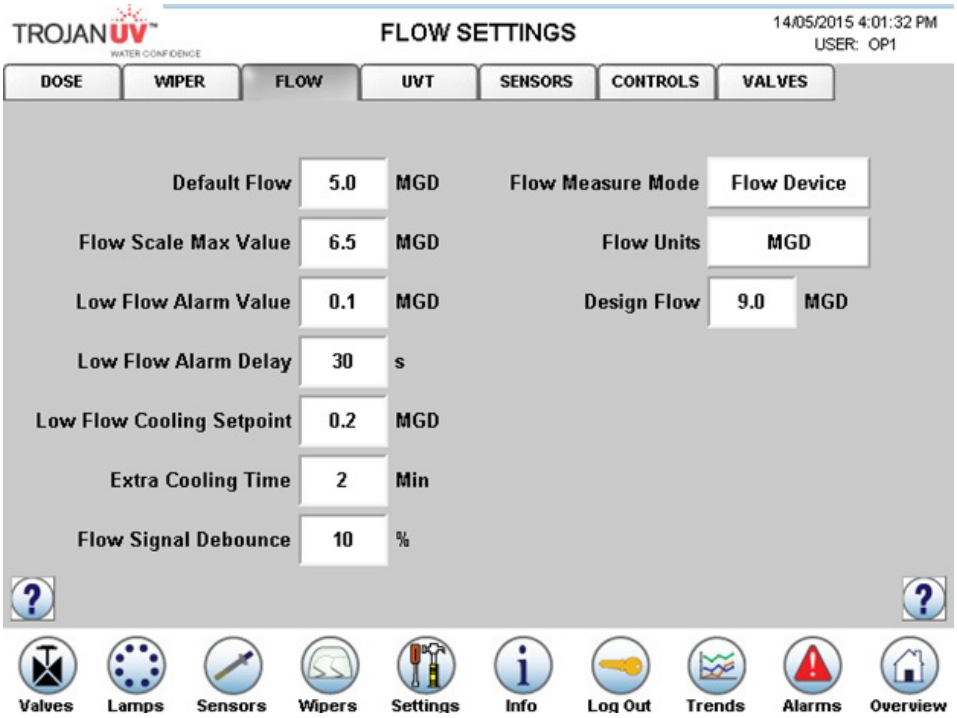


Figure 31 Flow Settings

Setting	Description
Default Flow	Sets Flow value used when Flow Measure Mode is selected as Manual.
Flow Scale Max Value	Sets the upper limit for scaling the flow signal analog input.
Low Flow Alarm Value	Sets the value at which a low flow alarm is generated.
Low Flow Alarm Value Delay	Sets the time that the flow rate must remain below the Low Flow Alarm Value to generate a low flow alarm.
Low Flow Cooling Setpoint	Sets the flow rate value at which extra cooling is required. The cooling valve will be opened when the flow rate is below this value to provide additional flow during periods of low flow.
Extra Cooling Time	Sets the time that the cooling valve remains open after the flow rate drops below the Low Flow Cooling setpoint.
Flow Signal Debounce (%)	Sets the Flow signal debounce percentage.
Flow Measure Mode control	Sets the flow measure mode control. • MANUAL – Value is entered manually on site. • FLOW DEVICE – Values monitored and received from the plant flow meter. • SCADA – Flow Valve written to CPP via Plant SCADA. The type of control the system is currently using will be displayed on the function's maintained selector (Not all options are available on all sites).

Setting	Description
Flow Units	Sets the flow units for the system. • MGD – Million of US Gallons per day • GPM – US Gallons per minute • MLD – Million of liters per day • l/s – Liters per second • m^3/Hour - Cubic meters per hour The type of Flow Units the system is currently using is the state displayed on the function's maintained selector.
Design Flow Field	Flow value used when sizing and designing the system.

8.2.6.5 Sensor Settings Screen

This screen allows to enter the Sensor Check Interval, Sensor Correction Factor, and Intensity Deviation Alarm.

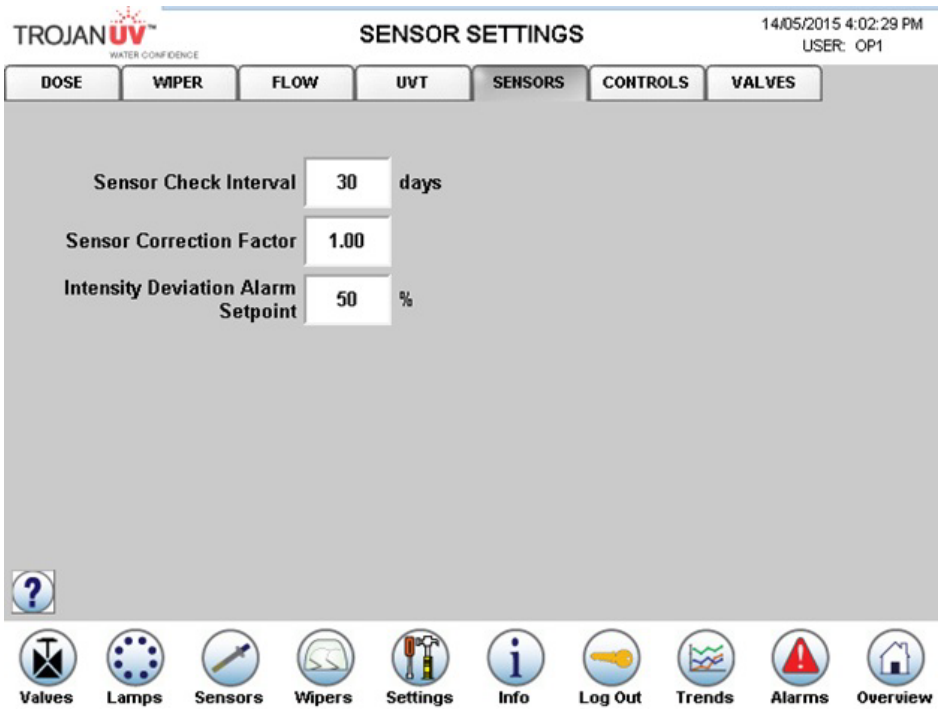


Figure 32 Sensor Settings

Setting	Description
Sensor Check Interval Time	Sets the interval between system Reference Sensor checks.
Sensor Correction Factor	This appears when off-spec Monitoring is required. A correction factor that may need to be temporarily applied during operation when duty sensor(s) fail a calibration check and can not be replaced. It allows the UV facility to remain in operation while problem is resolved.
Intensity Deviation Alarm Setpoint	The percent difference between the theocratical and actual UV intensities to trigger an alarm.

8.2.6.6 UVT Settings Screen

This screen allows to set the UVT Analyzer parameters and UVT Alarm Setpoints.

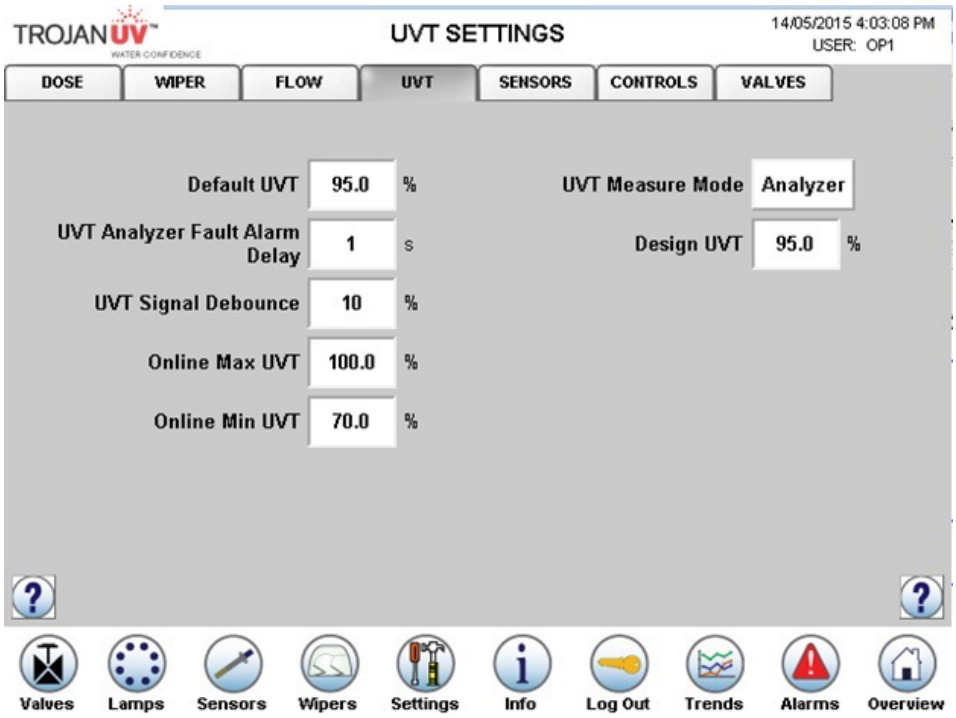


Figure 33 UVT Settings

Setting	Description
Default UVT	Sets percent transmittance value used when UVT Measure Mode is selected as Manual.
UVT Analyzer Fault Alarm Delay	Sets alarm delay time for UVT Analyzer related faults.
UVT Signal Debounce	Sets the percent transmittance signal debounce percentage.
Online Max UVT	Sets the upper limit for scaling the UVT signal analog input.
Online Min UVT	Sets the lower limit for scaling the UVT signal analog input.
Design UVT	UVT value used when sizing and designing the system.

8.2.6.7 Select UVT (Percent Transmittance) Source

Typically the RED pacing routine will use the Transmittance sensor (i.e., OPTIVIEW®) as the source of the UVT value. If the OPTIVIEW® unit has failed or is not used, a manually entered UVT value must be entered.

Procedure:

1. Press LOGIN menu button and enter the plant maintenance user name and password.
2. Access the UV Chamber Overview Summary screen. Refer to Section 8.2.4.
3. If the button states UVT is white, then touch the button to change it to yellow MANUAL UVT.
4. Enter desired manual UVT value using numeric touch pad. Refer to Section 8.2.4.

8.2.6.8 Control Settings Screen

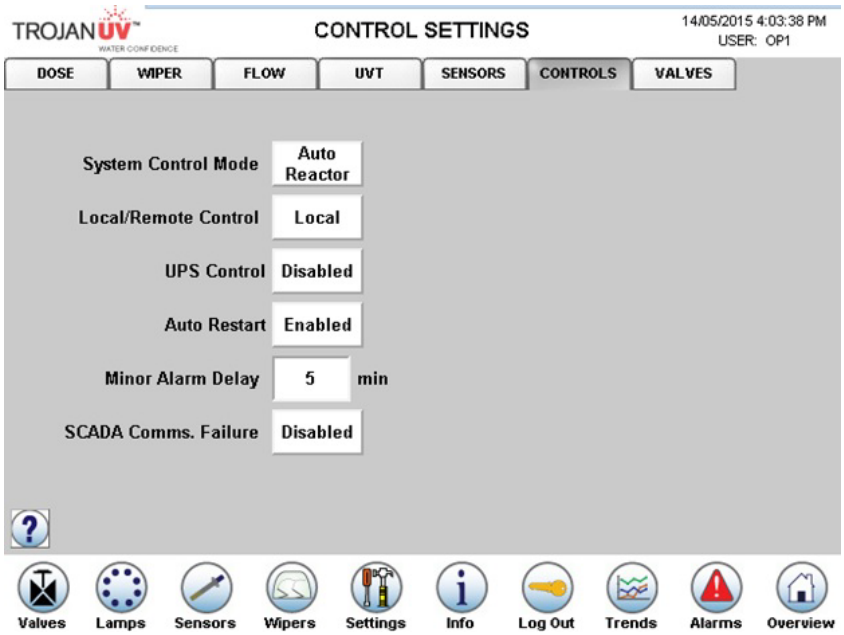


Figure 34 Control Settings

Setting	Description
System Control Mode	Sets the system mode of control (Manual or Auto). • MANUAL (in this mode, lamp power is controlled by the operator via the CPP operator interface), or. • AUTO (in this mode, the power is controlled by the controller based on maintaining the target RED while minimizing power consumption). The type of control the system is currently using is the state displayed on the function's maintained selector. The System Control Mode can either be Auto Reactor or Manual Reactor.
Local / Remote Control	Sets the mode for which the UV system is started. • LOCAL (in this mode the system can only be turned on or off via the CPP operator interface). • REMOTE HARDWIRED (in this mode the UV chamber will be controlled via a discrete input from the plant) or • REMOTE NETWORKED (in this mode the UV chamber will be controlled via a networked input from the plant SCADA). The type of control the system is currently using is the state displayed on the function's maintained selector. The system's mode of control can be Local or Remote.
UPS Control	Sets whether a UPS is present or not present in the CPP. • ENABLED (in the event of a power failure, this mode allows the system to monitor if power is present via a discrete input. The system will then ignore nuisance alarms or UV Chamber startup from occurring when power is not present). • DISABLED (when in this mode, in the event of a power failure, the system does not monitor if power is present via a discrete input). The type of control the system is currently using is the state displayed on the function's maintained selector.

Setting	Description
Auto Restart	Sets whether the Auto Restart function is enabled to restart the system when a power failure occurs during operation. The type of control the system is currently using is the state displayed on the function's maintained selector.
Minor Alarm Delay (min)	Sets the minor alarm delay for the system. The type of control the system is currently using is the state displayed on the function's maintained selector.
SCADA Comms fields	Sets whether the system is to be connected to a remote SCADA network and how the system will respond to a communication failure. • DISABLED (in this mode the system will not monitor communications with the SCADA system. No alarms related to SCADA communication will displayed in this mode. • USE MANUAL VALUES (in this mode the system monitors communication with SCADA via a "watchdog" network input. When a break in communication is detected, the system uses Manual Flow Rate, UVT and RED Setpoint values for RED pacing (if these inputs are selected as from "SCADA"). A SCADA Communication alarm is posted on the HMI. • SHUTDOWN REACTOR (in this mode the system monitors communication with SCADA via a "watchdog" network input. When a break in communication is detected, the system sets a critical alarm and the UV Chamber shutdowns. A SCADA Communication alarm is posted on the HMI.

8.2.6.9 Valve Settings Screen

This screen allows to enable / disable control valves, select the type of control of the valves, and adjust each valve alarm delay times.

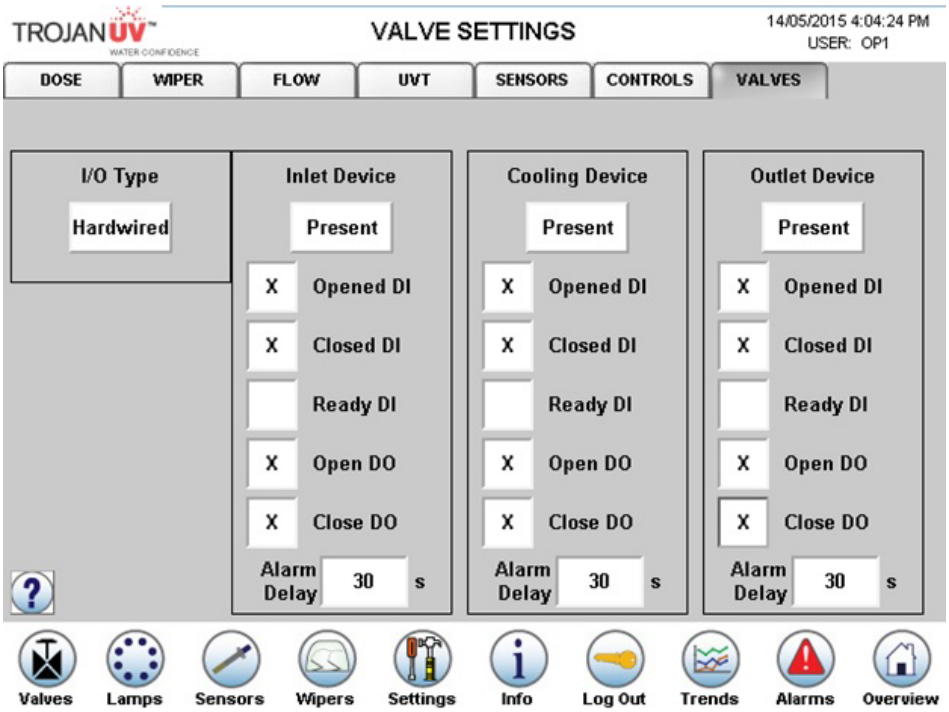


Figure 35 Valve Settings

Setting	Description
Valve Control	The Control Mode for either Inlet, Cooling or Outlet Device can either be Present or No Control. • PRESENT (in this mode, the CPP will control and monitor the status of the valves) • NO CONTROL (in this mode, the CPP will not be required to control or monitor the valves). The control type can either be Hardwired or Network. • HARDWIRED (in this mode, all valve inputs and outputs will be communicated via hardwired discrete signals). • NETWORK (in this mode, all valve inputs and outputs will be communicated via the SCADA network).
I/O Type	Sets whether valve status and commands will be communicated via hardwired signals or network signals.
Alarm Delay (seconds)	Sets valve I/O required by the site.

To Change	Procedure
Failure (Critical) Alarm Delay Time	**1** Touch the value in the Alarm Delay numeric input field to select input focus. A pop-up keypad will appear on the screen beside the field you wish to change. **2** Once the correct value is entered, press **ENTER** (↵). This will accept the change.
Status and Controls	**1** Touch the maintained selector next to the function's text. Once selected, an "X" will appear and non-selected function's will remain empty (no "X")

8.3 Reference Sensor Check

Perform reference sensor check according to procedure in document DC180601-002.

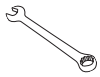
⚠ DANGER

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

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

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

9.1 Tools and Materials

Symbols	Description	Symbols	Description
	Phillips screwdriver		Lint free cloth (i.e. Kimwipes)
	Flat Screwdriver		Clean water
	T handle Allen wrench		Allen wrench
	Open end wrench		Adjustable wrench
	Torque Wrench		ActiClean® Gel bottle
	Bucket / Pail		Soap and water solution
	Isopropyl alcohol		

9.2 Maintenance Schedule

The manufacturer recommends scheduled complete internal inspections. Routine maintenance consists of partial disassembly, cleaning and visual evaluation of system components.

Table 4 describes the periodic maintenance tasks.

Table 4 Daily Visual Walk - about Inspection Checklist

System Component	Inspection Activity	Daily
CPP	Check Alarm Status Screen for new faults, record new alarms.	X
	Check the Alarm History screen to get an overview of past faults.	X
	Check Overview Screen to ensure dose targets are being achieved.	X

Table 5 Maintenance Schedule

Component	Maintenance Requirement	Weekly	Monthly	Semi Annually	Every # Years	5000 Hours of Runtime	As Needed
CPP	Clean the CPP enclosure. Refer to Section 9.11.1.						X
ActiClean® Cleaning System	Check the sensor sleeves for fouling: Remove a representative sample of sensor sleeves. If external fouling present, remove and clean all sensor sleeves. If internal fouling is present replace the sleeve. Refer to Section 9.8.3.		X				
	Remove outer service end cap. Initiate a wipe sequence. Listen for unusual noises or vibration.						X
	Recharge ActiClean® Gel. Refer to Section 9.10.2.			X			
	Replace Wiper Bearings and Seals. Refer to Section 10.2.3				1		
	Replace Pressure Membrane. Refer to Section 10.2.4				1		
	Rotate drive screw by hand: **1** Ensure main power is off before performing this procedure. **2** Drive screw should rotate back and forth easily.			X			
Lamp Sleeves and Sensor Sleeves	Check the sleeves for fouling: Remove a representative sample of sleeves. If external fouling present, remove and clean all sleeves. If internal fouling is present, replace sleeve. Refer to, Section 9.8.3, Section 9.9.1 and Section 9.9.2.			X			
UV Lamps	Change UV lamps. Refer to Section 9.7.2.					X	
UV Sensor	Perform a Reference Sensor check. Refer to Section 8.3.		X				
	Clean the UV Sensor. Refer to Section 9.8.2						X
UV Chamber	Check for evidence of water leaks, particularly on the outer face of the end plate.		X				

Note: *Monthly and Semi annual procedures may be required more frequently if either a low dose alarm occurs or if the UV Chamber has been turned off for a long period of time.*

9.3 Torque Chart

Bolt Size	Torque (N-m)	Torque
M4	1.4	12(in-lbs)
M5	2.6	23(in-lbs)
M6	5.6	50(in-lbs)
M8	11.3	100(in-lbs)
M10	22	195(in-lbs)
M12	50	37(ft-lbs)
M14	72	53(ft-lbs)
M16	108	80(ft-lbs)
M18	156	115(ft-lbs)
M20	217	160(ft-lbs)
M22	292	215(ft-lbs)

Bolt Size	Torque (N-m)	Torque
M24	362	267(ft-lbs)
M30	610	450(ft-lbs)

9.4 Depressurize and Drain a UV Chamber

The manufacturer recommends that the UV chamber be depressurized and drained before any maintenance, service or repair task is done. Failure to depressurize and drain the UV chamber can result in serious injury or death. Always follow all site-specific safety protocols and procedures. Refer to Section 2.

Prerequisites:

- Shutdown the UV system. Refer to Section 5.4 and Section 5.5.
- Apply lockout tag out devices as necessary. Refer to Section 4.
- The drainage or water bypass provisions are followed until UV system starts.

Materials:

Procedure:

1. Stand off to the side of the end plate. Open the drain valve, as the water level drops, the UV system will depressurize.
2. To verify that the UV chamber has been depressurized, open the pressure relief valve on the UV chamber. Refer to Figure 49.
   a. If water is discharging from the pressure relief valve then pressure has not been removed from the UV chamber.
3. To depressurize only, close the drain valve.
4. To depressurize and drain, keep drain valve open until the UV chamber is empty.
5. When service is complete, assemble the prerequisites in the reverse order of disassembly.

9.5 Pressurize a UV Chamber

Prerequisites:

- Shutdown the UV system. Refer to Section 5.4 and Section 5.5.
- Lockout tag out devices as necessary. Refer to Section 4.
- The drainage or water bypass provisions are followed until UV system starts.
- Remove the UV Lamps. Refer to Section 9.7.2.
- Inspect condition of the lamp sleeves, ensure no visible cracks or damage. Replace, if necessary.
- Close the drain valve.

Materials:

Procedure:

1. Slowly fill the UV chamber with water.
   a. Stand off to the side of the end plate and make sure the area is clear of all plant personnel.
   b. Pressurize the UV chamber.
   c. Check for leaks.
   d. Wait twenty minutes.
2. If leaks are found:
   a. Depressurize and drain the UV chamber. Refer to Section 9.4.
   b. Fix the leaks.
   c. Fill the UV chamber and do a pressure test. Check for leaks.
3. If leaks are not found, depressurize the UV Chamber. Refer to Section 9.4.
4. Install the UV Lamps. Refer to Section 9.7.2.

9.6 Service End Cap

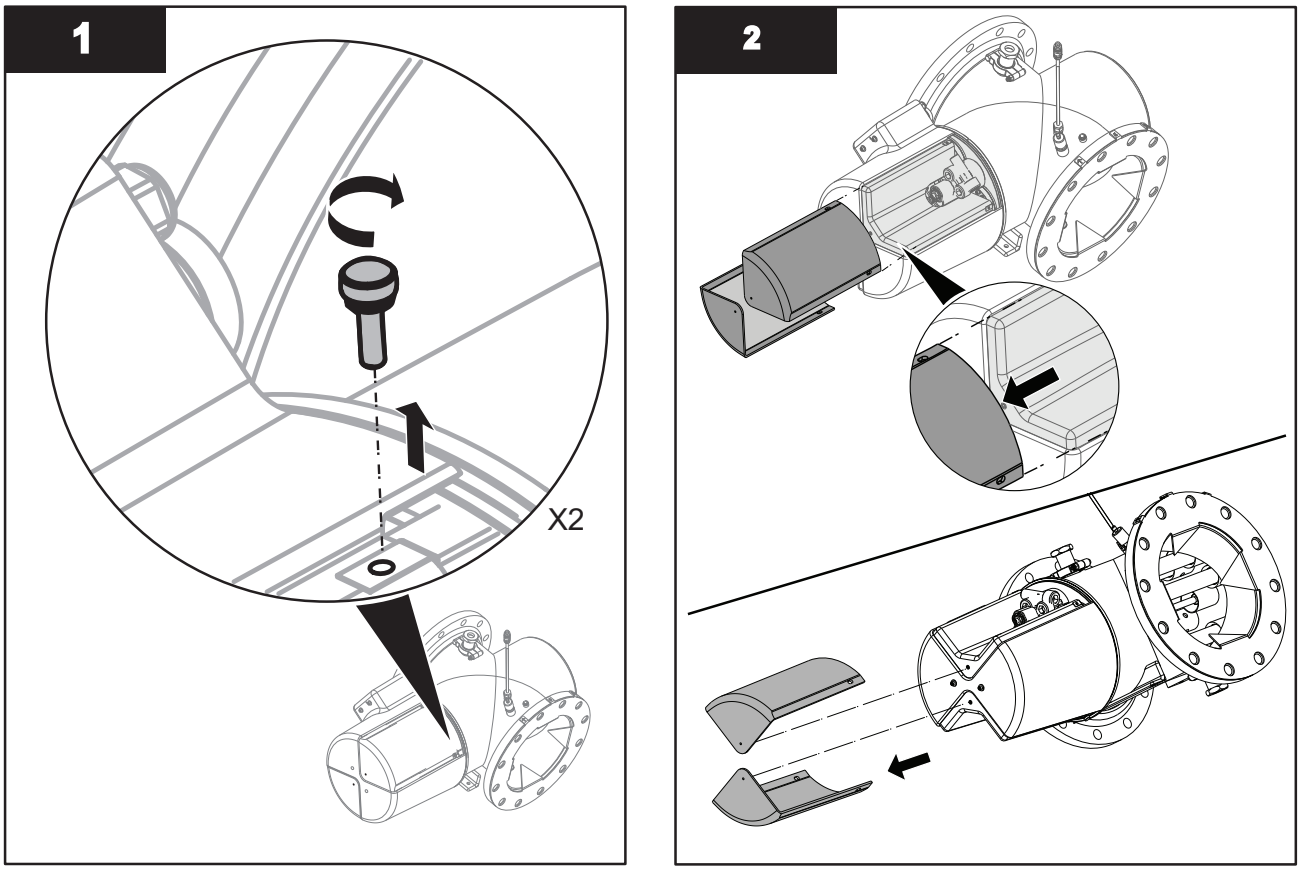
9.6.1 Remove and Replace Access Cover End Caps

Prerequisites:

- Shutdown the UV system. Refer to Section 5.4 and Section 5.5.
- Lockout tag out devices as necessary. Refer to Section 4.
- Depressurize the UV Chamber. Refer to Section 9.4.

Materials:

Procedure:



To install, assemble in reverse order of disassembly.

9.6.2 Remove and Replace Main Cover End Cap

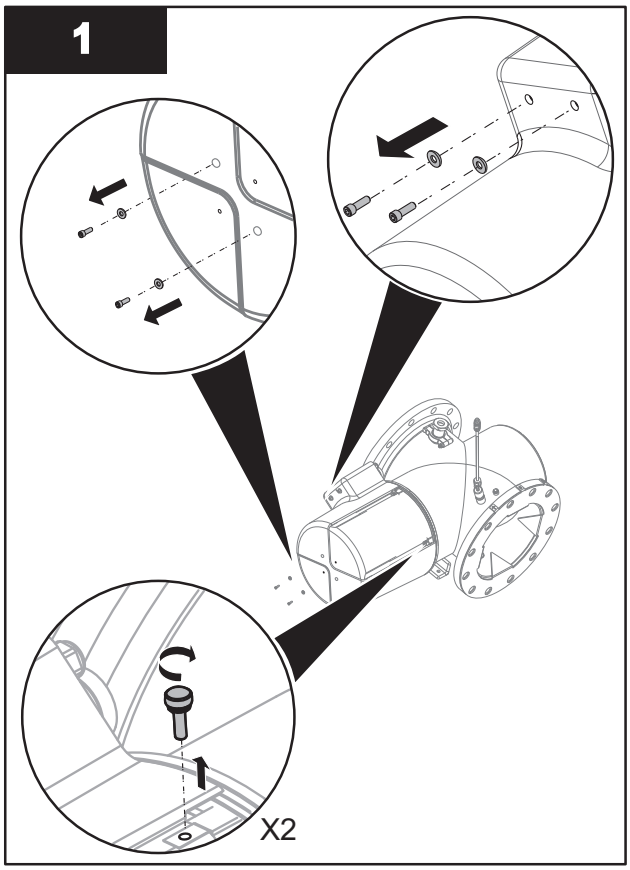
Prerequisites:

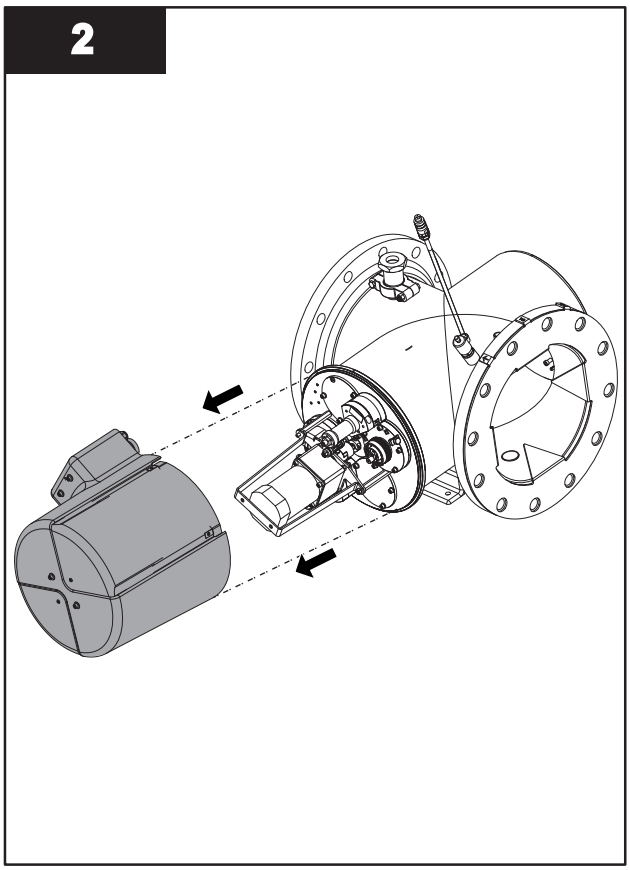
- Shutdown the UV system. Refer to Section 5.4 and Section 5.5.
- Lockout tag out devices as necessary. Refer to Section 4.
- Depressurize the UV Chamber. Refer to Section 9.4.

Tools:

Materials:

Procedure:





To install, assemble in reverse order of disassembly.

9.7 UV Lamp

UV lamps contain mercury (Section 2.)

9.7.1 Storage Requirements for Used UV Lamps

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

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

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

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

9.7.2 Remove and Replace UV Lamp

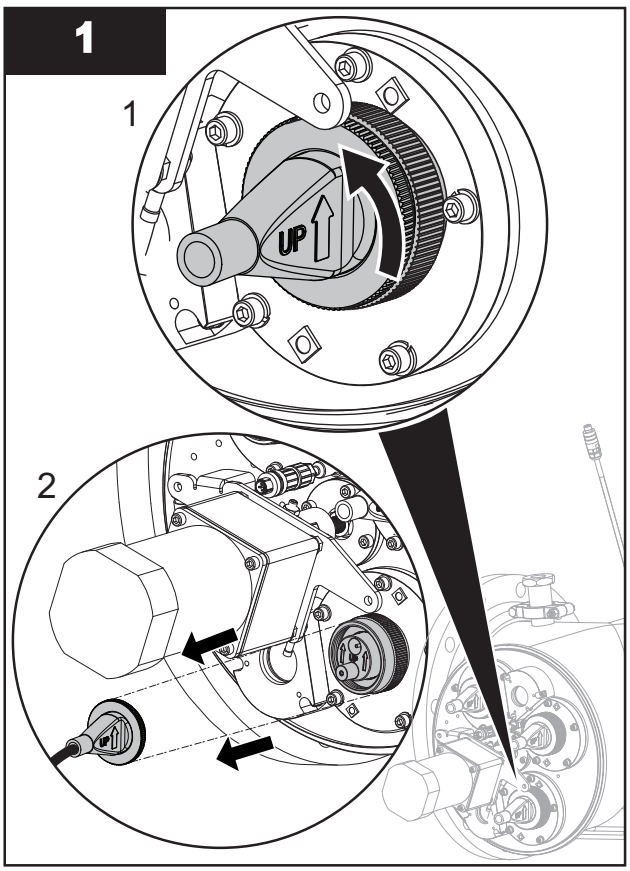
Prerequisites:

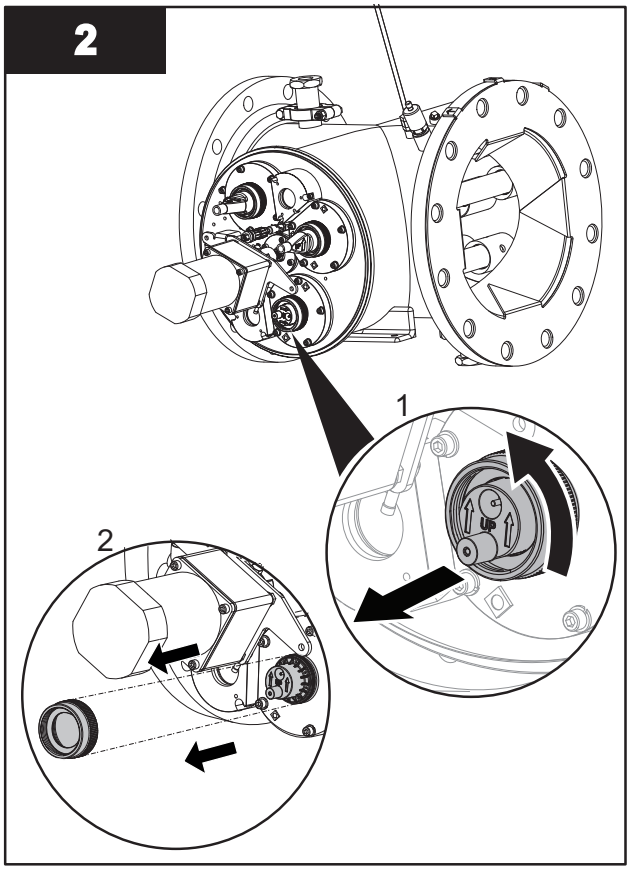
- Shutdown the UV system. Refer to Section 5.4 and Section 5.5.
- Lockout tag out devices as necessary. Refer to Section 4.
- Depressurize the UV Chamber. Refer to Section 9.4.
- Remove the main cover end cap. Refer to Section 9.6.2.

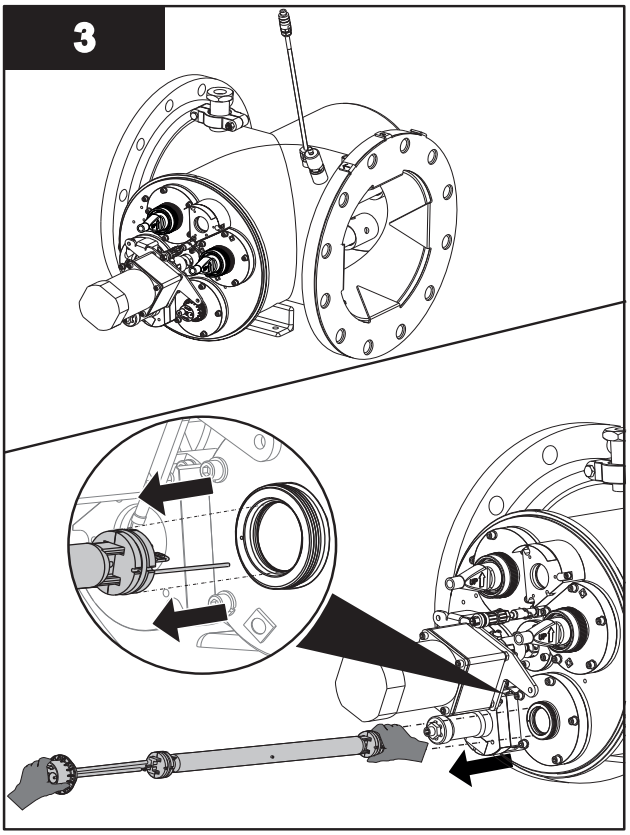
Tools:

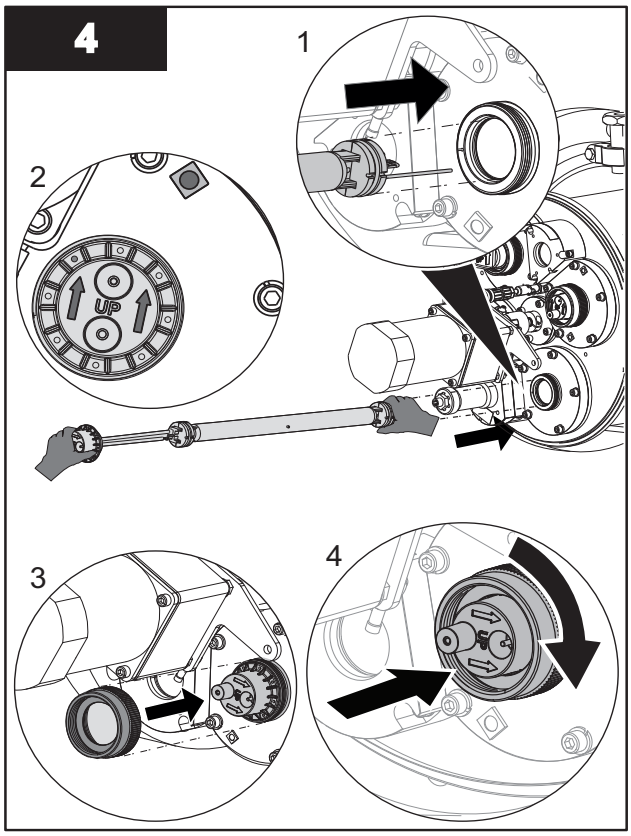
Materials:

Procedure:

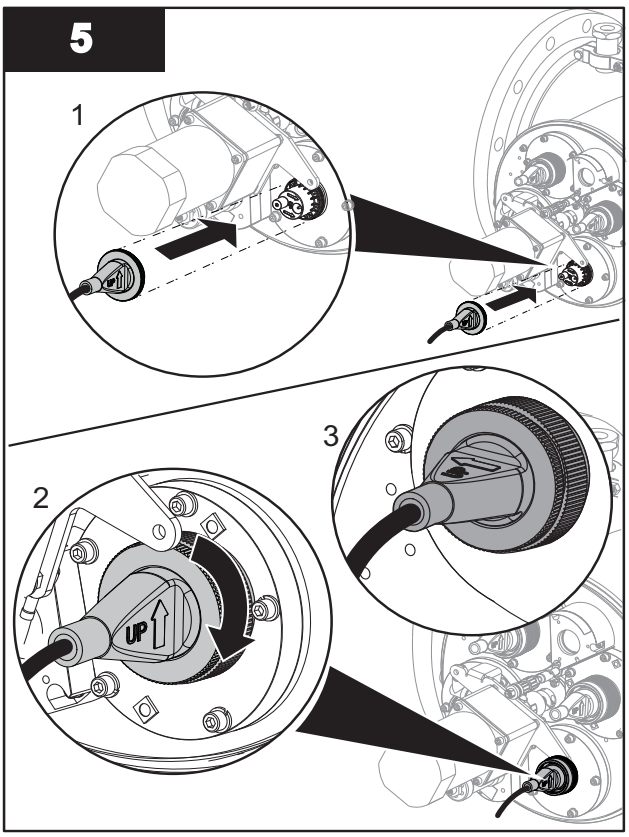








Note: *If there is any lag time between UV lamp removal and replacement, plug the lamp sleeve with lint free towelling. This keeps the inside of the lamp sleeve free from condensation and / or dirt.*



6. Reset Lamp Hours if a new UV Lamp is used. Refer to Section 8.2.5.9.

9.8 UV Sensor

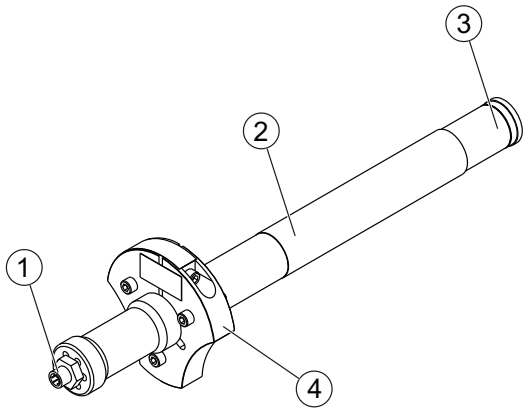


Figure 36 UV Sensor

1	UV Sensor Cable Connector	**3**	UV Sensor Window
2	Heat Shield	**4**	Alignment Pin

9.8.1 Remove and Replace the UV Sensor

Prerequisites:

- Depressurize the UV Chamber. Refer to Section 9.4.
- Remove the access cover end cap. Refer to Section 9.6.1.

Tools:

Materials:

Procedure:

1. Disconnect the UV sensor cable.
2. Remove the 3 (three) screws on the sensor plate. Pull the UV sensor straight out, not on an angle.
3. If not immediately replacing the sensor, place a lint free cloth in the end of the sensor sleeve port.
4. When service is complete, assemble in reverse order of disassembly.

9.8.2 Clean the UV Sensor

Prerequisites:

- Remove the UV sensor. Refer to Section 9.8.1

Materials:

Procedure:

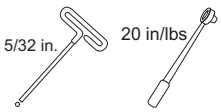
1. Dampen a lint free cloth with isopropyl alcohol.
2. Clean the sensor body.
3. Clean the quartz sleeve over the diode window. Verify it is contaminant free.
4. When service is complete, assemble in reverse order of disassembly.
   Note: *Make sure the UV sensor is clean and dry before re-installing.*

9.8.3 Remove and Replace the UV Sensor Sleeve

Prerequisites:

- Depressurize and drain the UV Chamber. Refer to Section 9.4.
- Remove the UV sensor. Refer to Section 9.8.1

Tools:



Materials:

Procedure:

1. Loosen the screws on the gland plate evenly. Pull the gland plate and sleeve straight out, not on an angle. Refer to Figure 37.
2. Inspect and clean the O-ring and the washer.
3. Inspect and clean the sleeve if required. Refer to Section 9.9.2.
4. Inspect for cracks or scratches, replace if required.

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

Notes: *1) Apply soapy water to lubricate the O-rings when installing.*
2) Torque gland plate bolts to 20in/lbs.

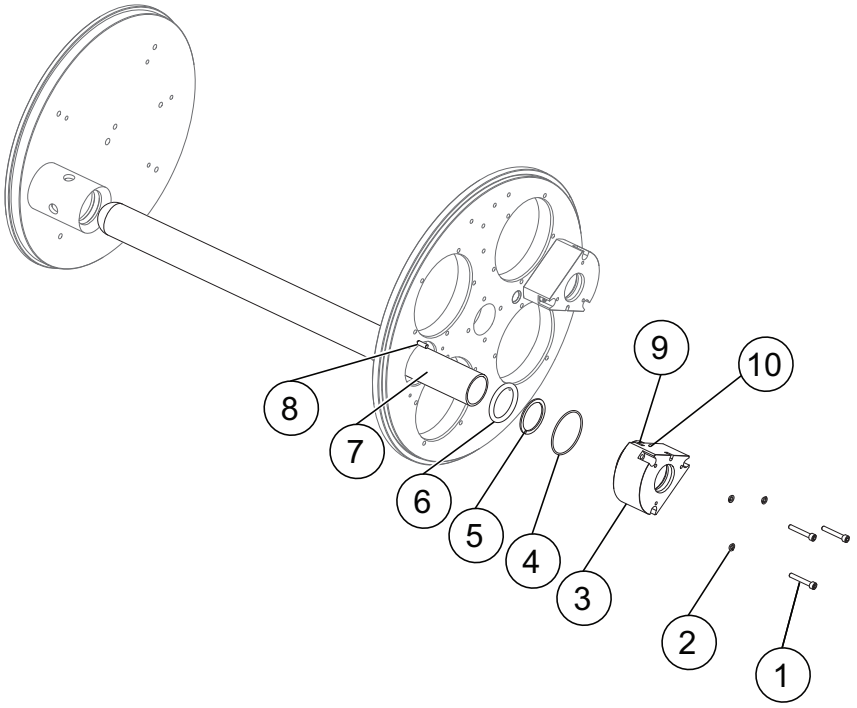


Figure 37 UV Sensor Sleeve Assembly

1	Screw	**6**	O-ring
2	Washer	**7**	UV Sensor Sleeve
3	Gland Plate	**8**	Alignment Pin
4	O-ring	**9**	Alignment Slot
5	Washer, Gland Plate	**10**	Support, Gland

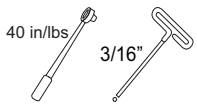
9.9 Lamp Sleeve

9.9.1 Remove and Replace Lamp Sleeve

Prerequisites:

- Depressurize and drain the UV Chamber. Refer to Section 9.4.
- Remove the UV lamp. Refer to Section 9.7.2.

Tools:



Materials:

Procedure:

1. Loosen screws gradually in a sequential star pattern. Remove screws and outer gland plate being careful not to lose the washer located in a small recess in the outer gland plate or the sleeve seal O-ring.
2. Remove the inner gland plate and O-ring.

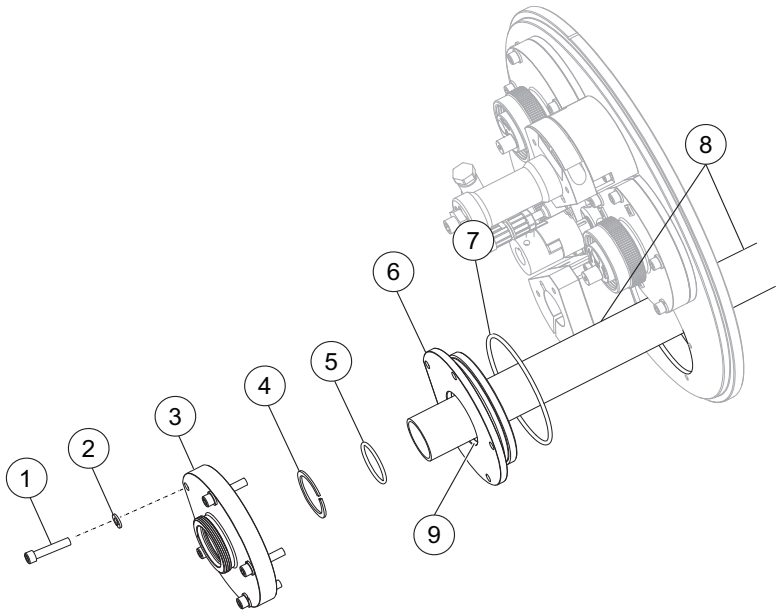


Figure 38 Lamp Sleeve Assembly

1	Gland Plate Screws	**6**	Inner Gland Plate
2	Lock Washer	**7**	Inner Gland Plate O-ring
3	Outer Gland Plate	**8**	Lamp Sleeve
4	Washer	**9**	Inner Gland Plate Groove
5	Sleeve O-ring		

3. Drain the ActiClean®Gel from the wiper collar. Refer to Section 9.10.1.
4. Remove the sleeve O-ring from the sleeve. It may be necessary to pull the sleeve out slightly to remove the sleeve seal.
5. Pull the lamp sleeve out straight from the UV Chamber, not on an angle.
6. Inspect the lamp sleeve for cleanliness.

   Note: *If required, manually clean the lamp sleeve. Refer to Section 9.9.2.*
7. Inspect the lamp sleeve for any cracks or breaks. Replace if cracks or breaks are visible.
8. Install the lamp sleeve into the UV Chamber. Keep the lamp sleeve straight and not on an angle.

   Notes: *1) There will be some resistance as the sleeve passes through the wiper collar. Push the sleeve in until you feel it seat against the sleeve cup. Approximately 1" (25 mm) of opened sleeve should be protruding from the front plate when the sleeve is in the correct position.*

   2) Visually inspect to ensure the lamp sleeve is in the holder on the opposite end of the sleeve.
9. Recharge wiper with ActiClean Gel. Refer to Section 9.10.2.

10. Spray soapy water onto the inner gland plate O-ring and face plate and install the inner gland plate.

    Note: *Considerable force will be required to reinstall. It is recommended to have the inner gland plate oriented close to its final position during installation.*

11. Wet the sleeve O-ring with water and place it over the lamp sleeve and into the groove in the inner gland plate. Leave approximately ¾” (19 mm) of the sleeve protruding from the inner gland plate.

    Note: *When replacing the lamp sleeve, ensure the lamp sleeve is in full contact with the O-ring.*

12. Inspect and re-install the washer into the groove of the outer gland plate.
13. Use the outer gland plate to push the lamp sleeve in the remainder of the way, until the inner and outer plates meet.

    Note: *Keep the mounting holes aligned between the inner and outer gland plates.*

14. Inspect the lock-washer and cap screws for fatigue or damage. Replace as needed. Ensure threaded holes in UV Chamber are clean.
15. Secure the inner and outer gland plates using a torque wrench.
16. Tighten screws gradually in a sequential star pattern.

    Note: *Incrementally tightening the screws reduces the chance of sleeve cracking.*

17. Verify open end of sleeve is seated against the washer in the outer gland plate.

9.9.2 Clean the Lamp Sleeves

Prerequisites:

- Remove the lamp sleeve. Refer to Section 9.9.1.

Materials:

Procedure:

1. Use a mild acidic solution and a lint-free cloth to wipe down the outside of the lamp sleeves to remove all solid particles.
2. Rinse the outside of the lamp sleeve thoroughly with clean water. Keep the inside of the lamp sleeve clean and dry. Moisture can cause deposits to form when the UV lamps are turned on.
3. Repeat steps above as required, until the lamp sleeve is clean.
4. When service is complete, assemble the prerequisites in the reverse order of the disassembly.

9.10 ActiClean® Cleaning System

The required maintenance consists of replacing the wipers, and recharging the wiper collars with ActiClean® Gel. The frequency of service depends upon the:

- Nature of the fouling agent
- Rate of fouling
- Frequency of cleaning

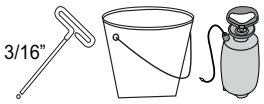
On average, rubber wipers should be inspected and, if necessary, replaced every six months or whenever lamp sleeves are checked. ActiClean® Gel should be recharged whenever lamp sleeves are checked or a minimum of every 6 months.

9.10.1 Flush / Drain the ActiClean® Gel

Prerequisites:

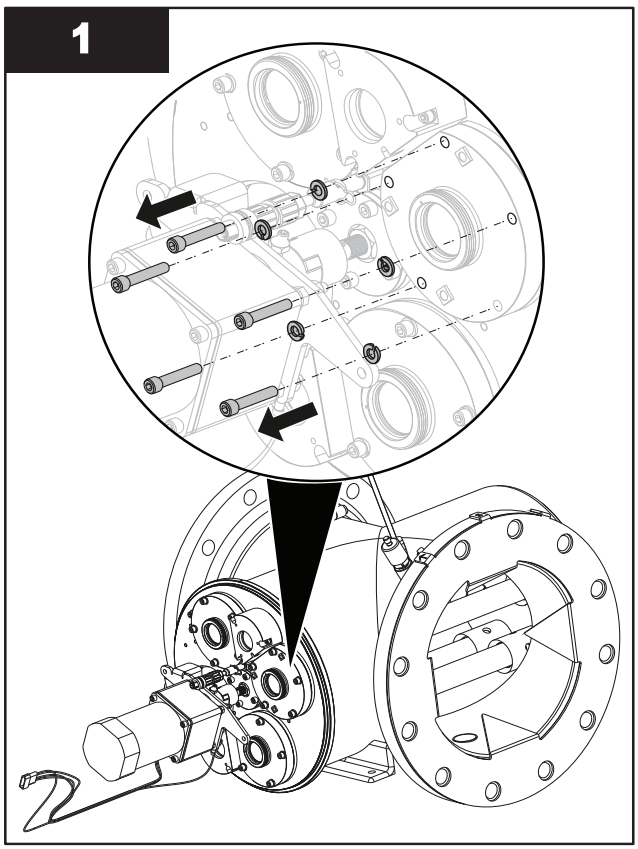
- Home the wiper. Refer to Section 8.2.5.1.
- Depressurize and drain the UV chamber. Refer to Section 9.4.
- Remove the UV lamp. Refer to Section 9.7.2.
- Remove the UV sensor. Refer to Section 9.8.1.
- DO NOT remove the lamp sleeve from the UV chamber.

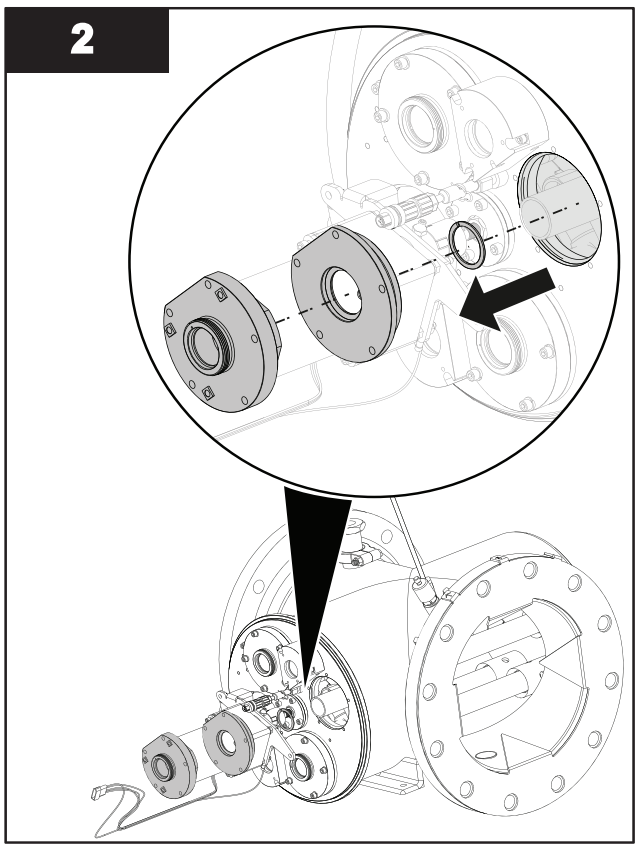
Tools:

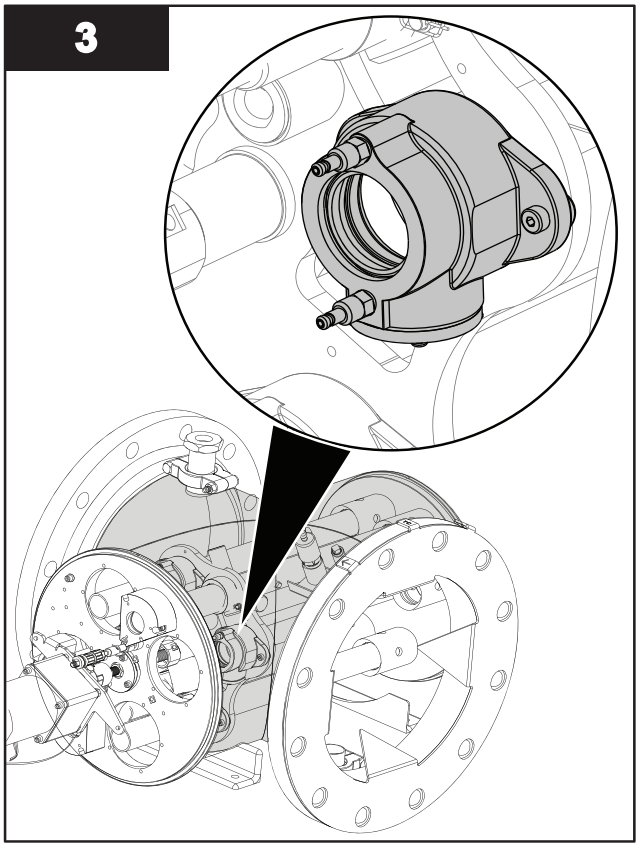


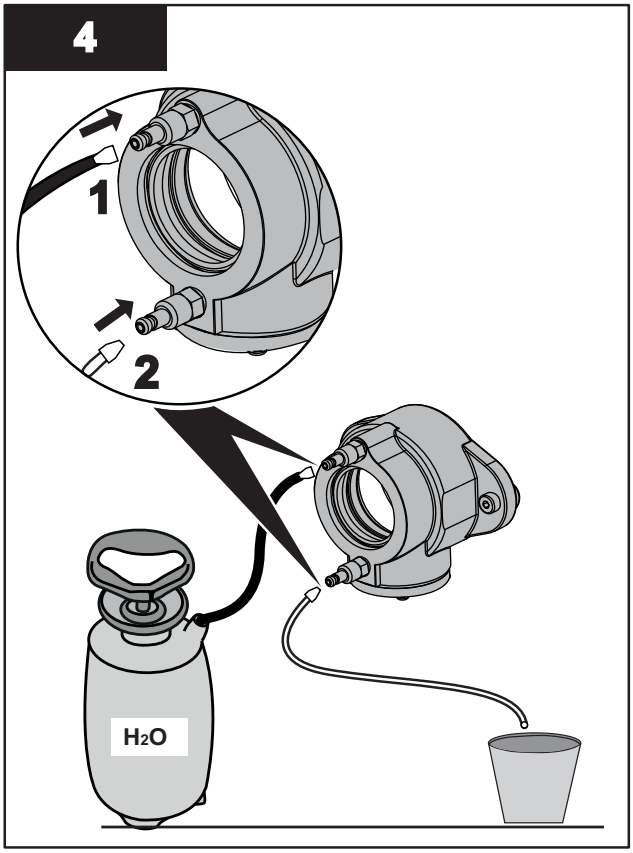
Materials:

Procedure:

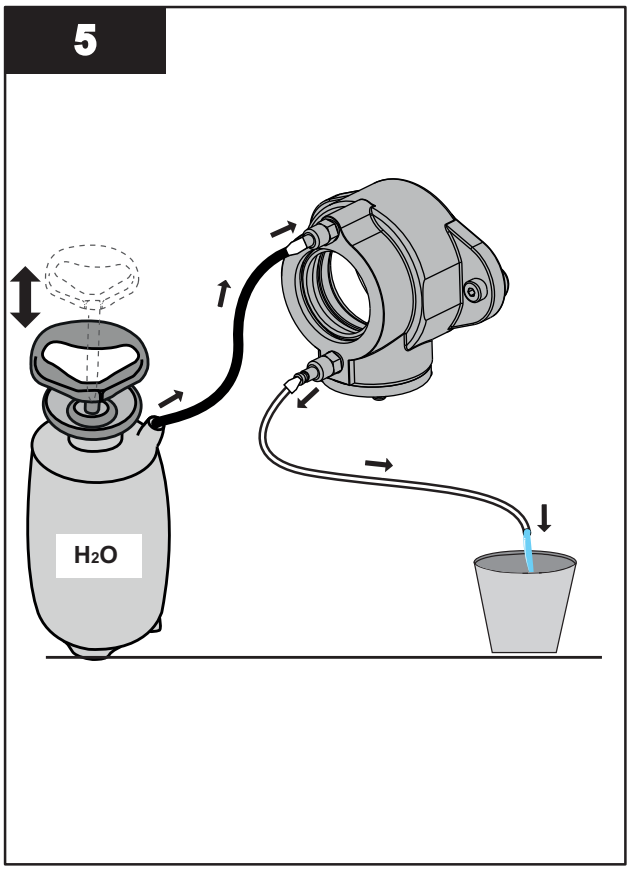


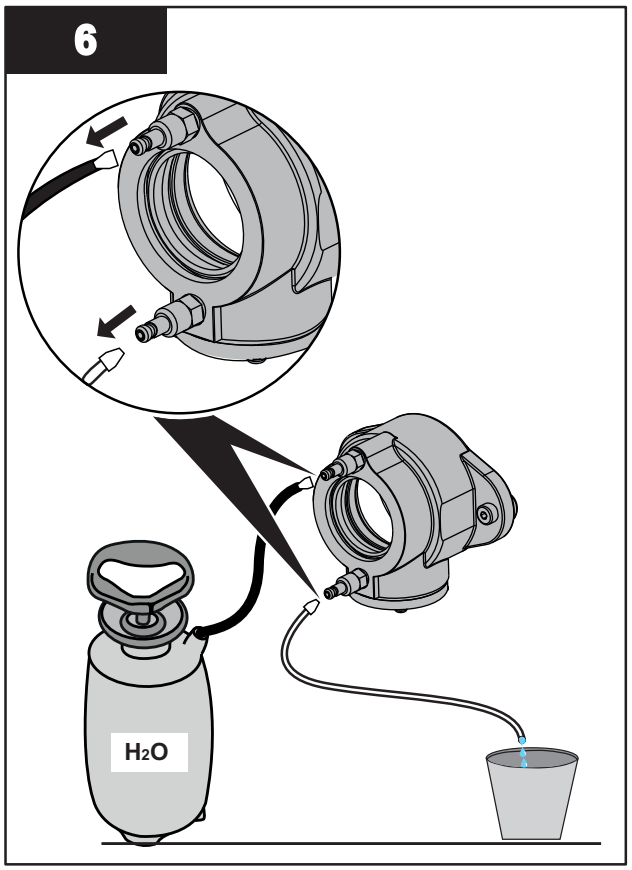






Note: *Lamp Sleeve not shown for clarity.*





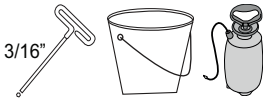
Note: *Lamp Sleeve not shown for clarity.*

9.10.2 Recharge ActiClean® Gel

Prerequisites:

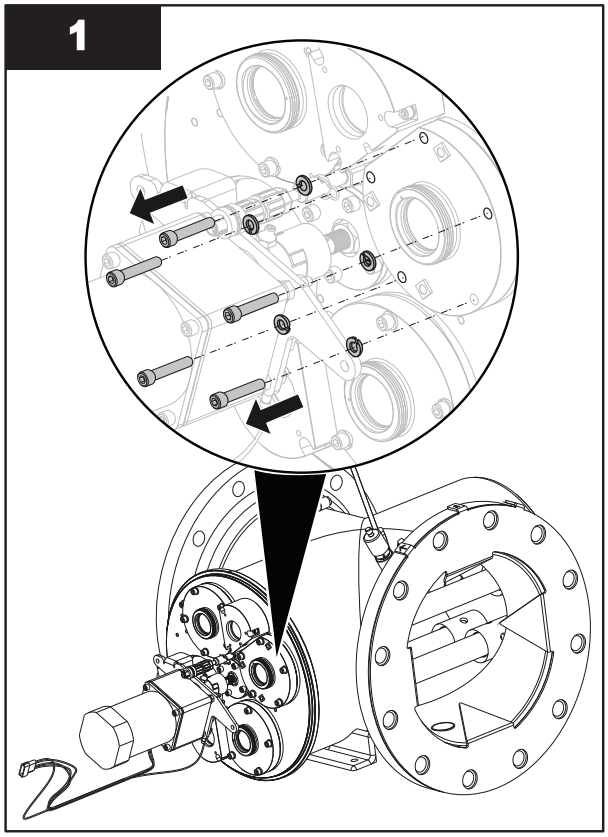
- Home the wiper. Refer to Section 8.2.5.1.
- Depressurize and drain the UV chamber. Refer to Section 9.4.
- Remove the UV lamp. Refer to Section 9.7.2.
- Remove the UV sensor. Refer to Section 9.8.1.
- DO NOT remove the lamp sleeve from the UV chamber.

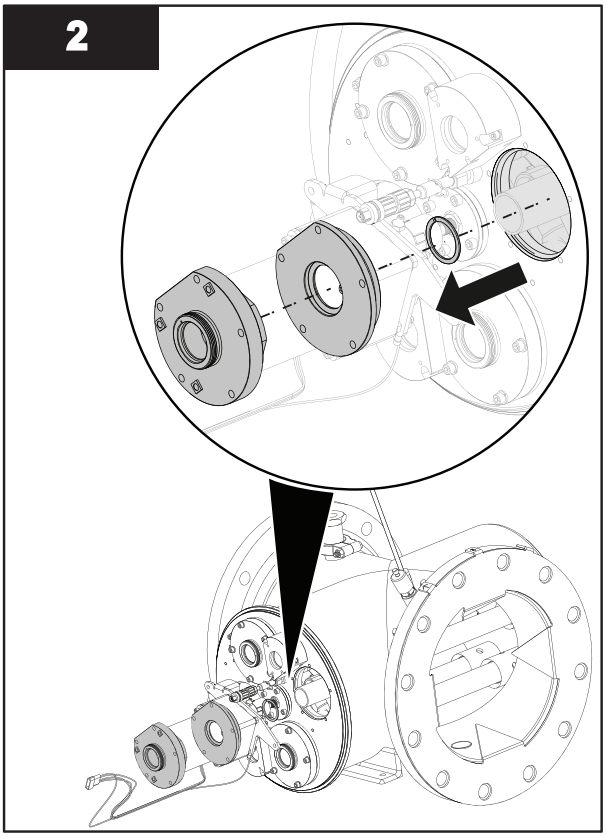
Tools:

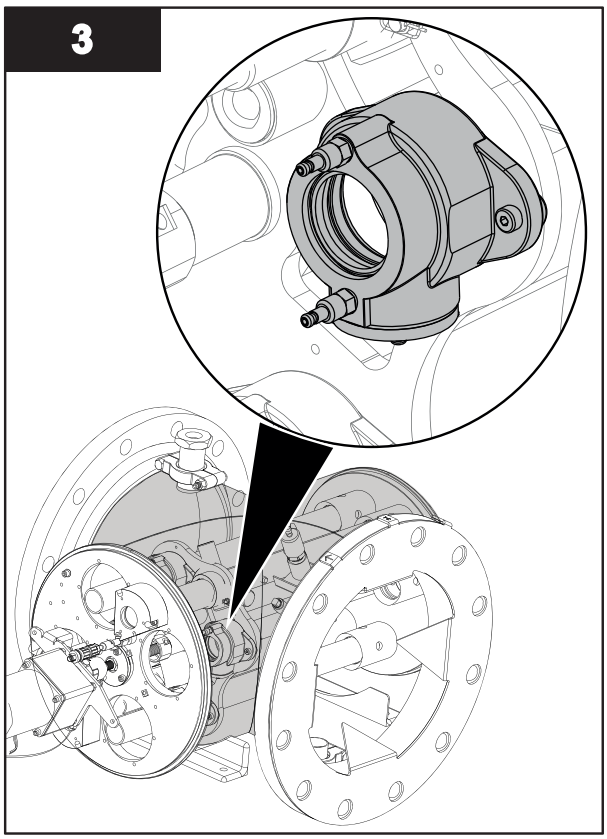


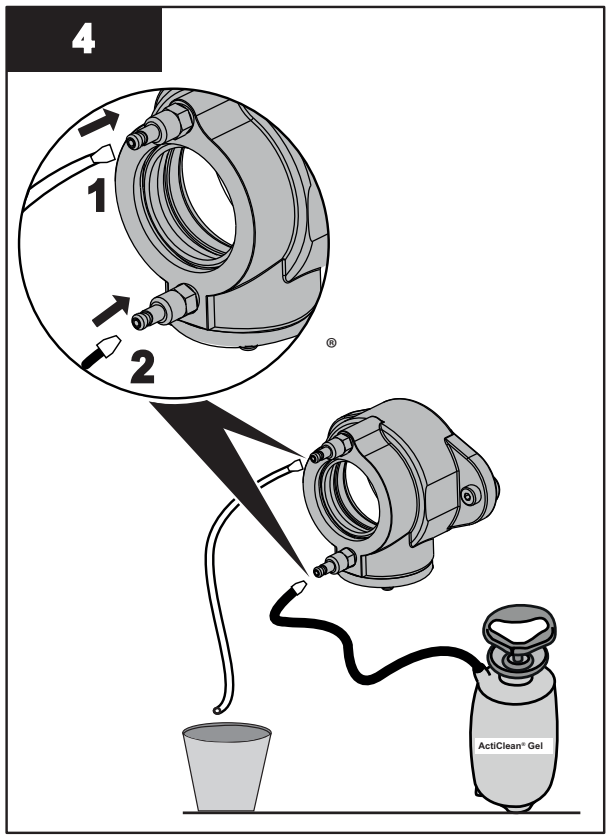
Materials:

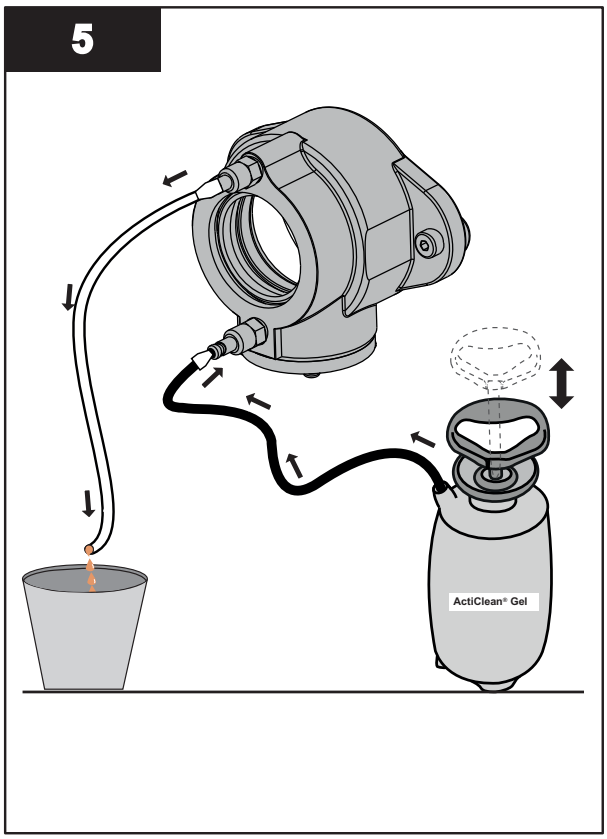
Procedure:

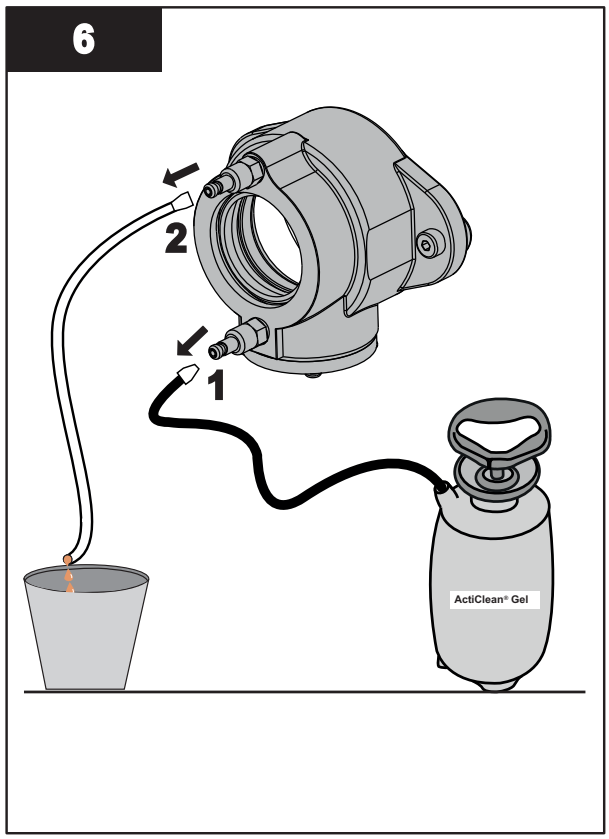












Notes: *1) The drain hose must be free of air at least for two pumps.*

2) Lamp Sleeve not shown for clarity.

3) New ActiClean Gel will appear lighter in color than old ActiClean Gel.

7. Repeat steps 1 - 4 for remaining wiper collars.

8. Install protective caps onto fill and reclaim wands after service is complete.
9. When service is complete, assemble prerequisites in reverse order of disassembly.

9.10.3 Remove and Replace Gear Motor Assembly

Remove the gear motor assembly as necessary to access UV lamps and lamp sleeves that are located behind the gear motor assembly.

Prerequisites:

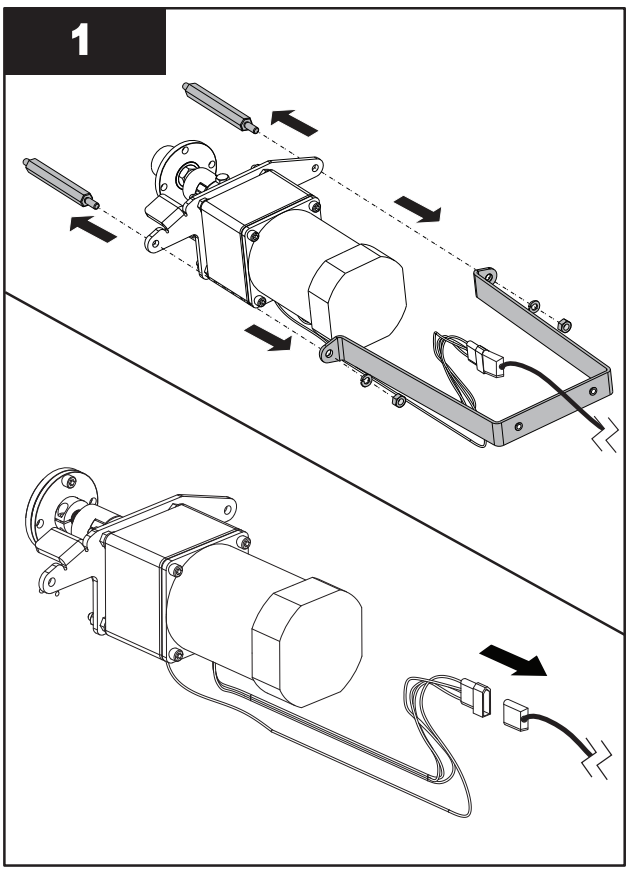
- Remove the service end cap. Refer to Section 9.6.

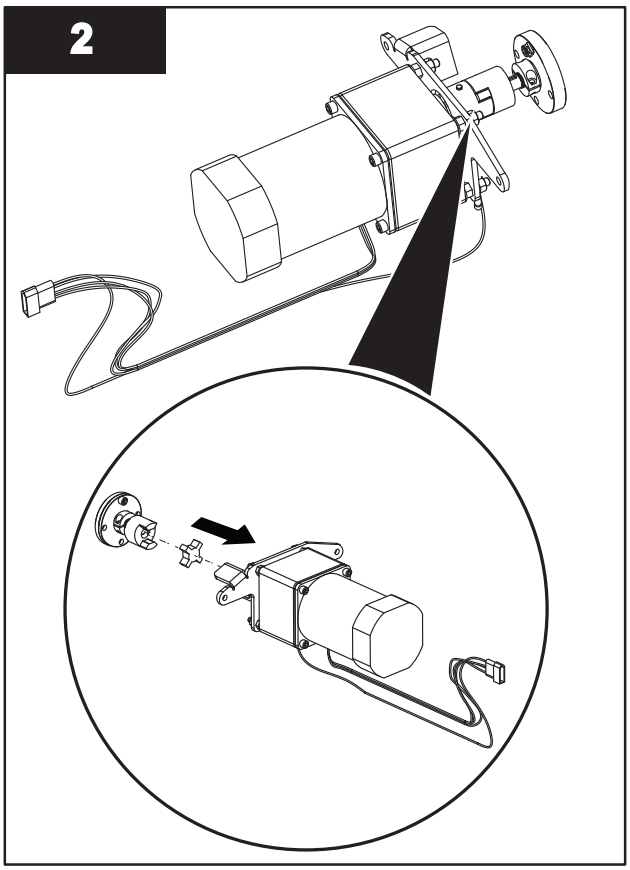
Tools:

Materials:

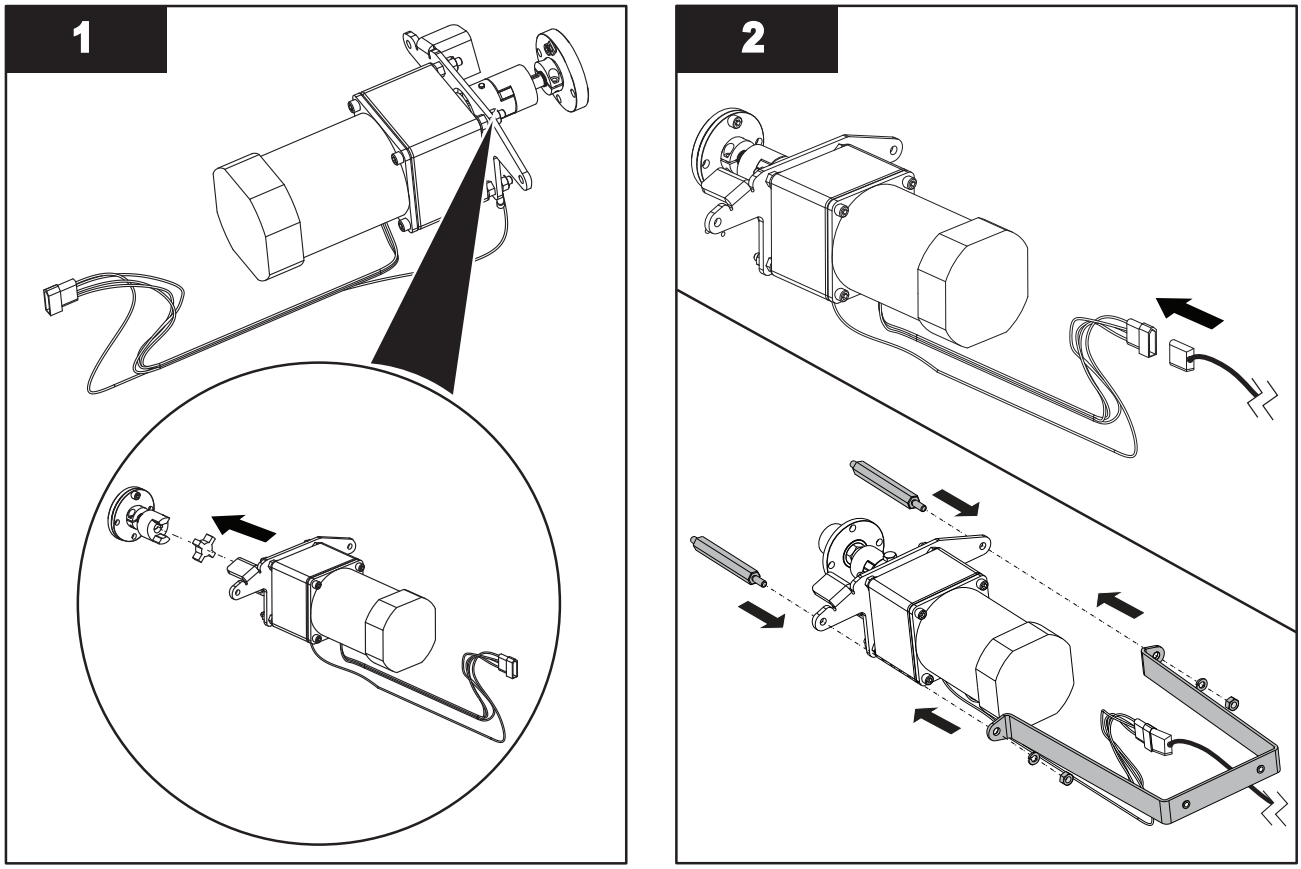
Procedure:

To Remove:





To Replace:



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

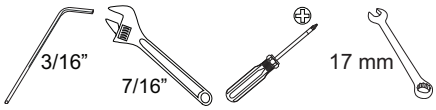
9.10.4 Remove and Replace the Gear Motor

Replace the gear motor when it can no longer turn the drive shaft to move the wiper cage.

Prerequisites:

- Remove gear motor assembly. Refer to Section 9.10.3

Tools:

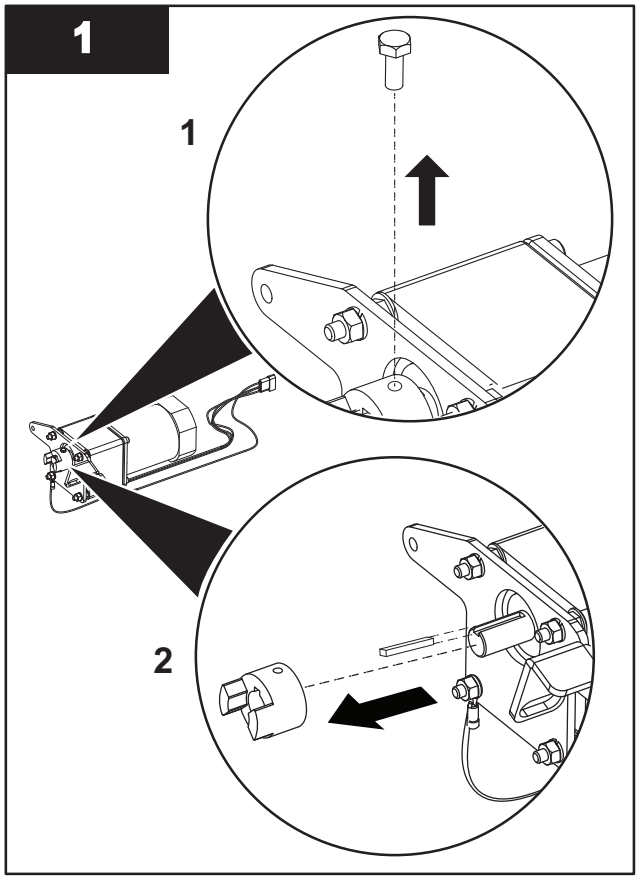


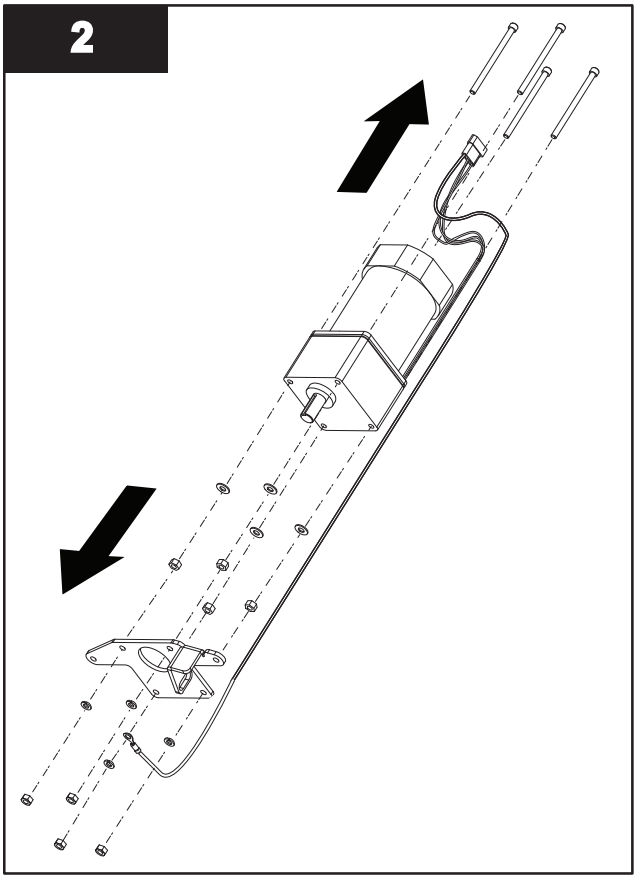
Materials:

- Gear motor

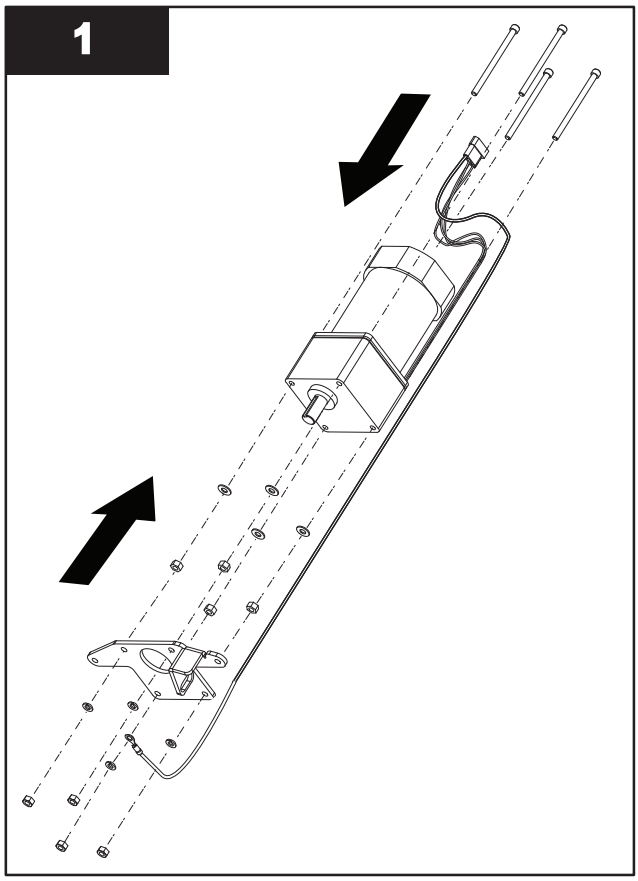
Procedure:

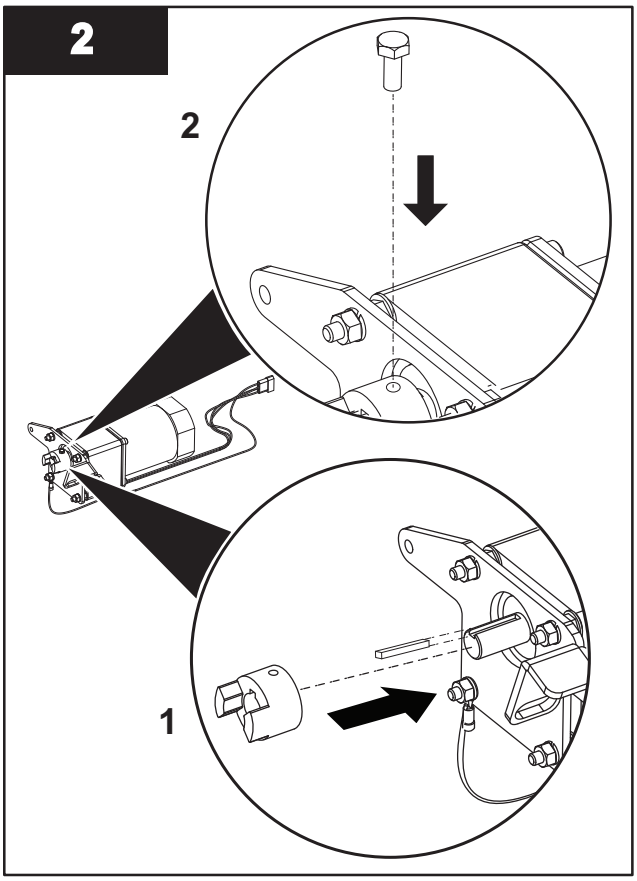
To Remove





To Install





2. Install a Gear Motor Assembly. Refer to Section 9.10.3.
3. When service is complete, assemble the prerequisites in the reverse order of the disassembly.

9.11 Control Power Panel

9.11.1 Clean the CPP

Prerequisites:

- Shutdown the UV system. Refer to Section 5.4 and Section 5.5.
- Lockout tag out devices as necessary. Refer to Section 4.

Materials:

Procedure:

1. Wash the CPP enclosure's exterior with a mild soap and solution.

   Note: *Do not use any corrosive cleansers on the CPP cabinet or Operator Interface.*

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

9.11.2 Remove and Replace Lamp Driver

Prerequisites:

- Shutdown the UV system. Refer to Section 5.4 and Section 5.5.
- Lockout tag out devices as necessary. Refer to Section 4.
- Wait 5 minutes to allow stored energy to dissipate.
- Open the CPP enclosure.
- Identify faulty lamp driver.

Tools:

Materials:

- Lamp Driver

Procedure:

1. Disconnect the two (2) output cable wires, the two (2) input wires, the ground wire and the communications cable. Refer to Figure 39.
2. Loosen the top three (3) screws on each lamp driver clamp. Do not remove the screws, loosen them enough to allow the lamp driver to be removed (about ½ turn).

3. Support the lamp driver with one hand, loosen the two (2) lower screws and slide the lamp driver up and out of the clamps.
4. Install new lamp driver.
5. When service is complete, assemble in reverse order of disassembly.

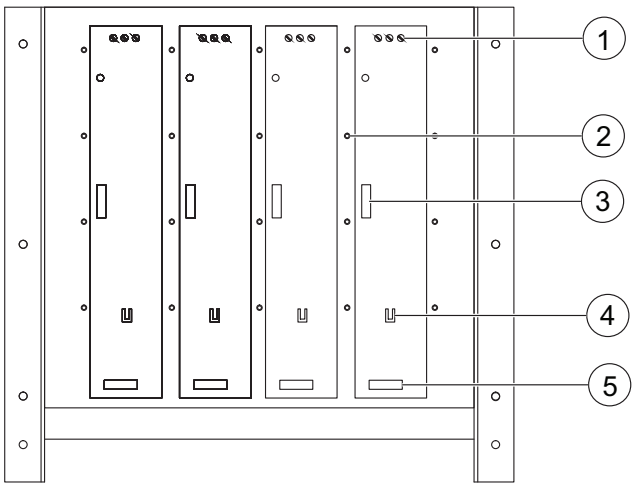


Figure 39 Lamp Driver

1	Lamp Driver Output Cable Wires	**4**	Ground Wire
2	Lamp Driver Clamp Screw (Typical of 4)	**5**	Lamp Driver Input Wires
3	Lamp Driver Communication Cable		

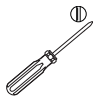
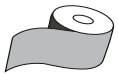
⚠ DANGER

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

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

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

10.1 Tools and Materials

Symbols	Description	Symbols	Description
	Wrench		T handle Allen wrench
	Flat screwdriver		Teflon® tape
	Phillips screwdriver		Allen wrench
	Cleaning brush		Spray bottle
	Loctite 243		Clean water

10.2 UV Chamber

10.2.1 Remove and Replace Lamp Sleeve Wiper Collar

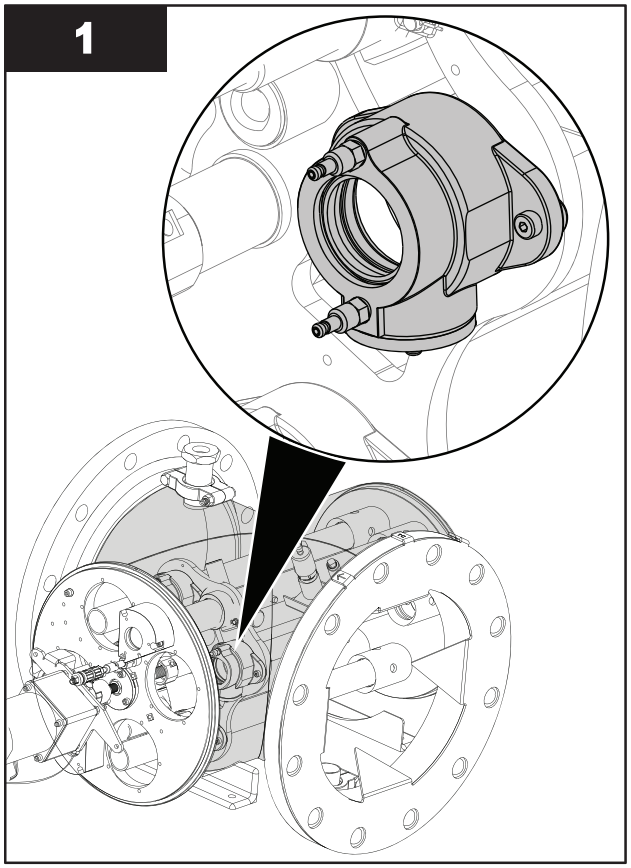
Prerequisites:

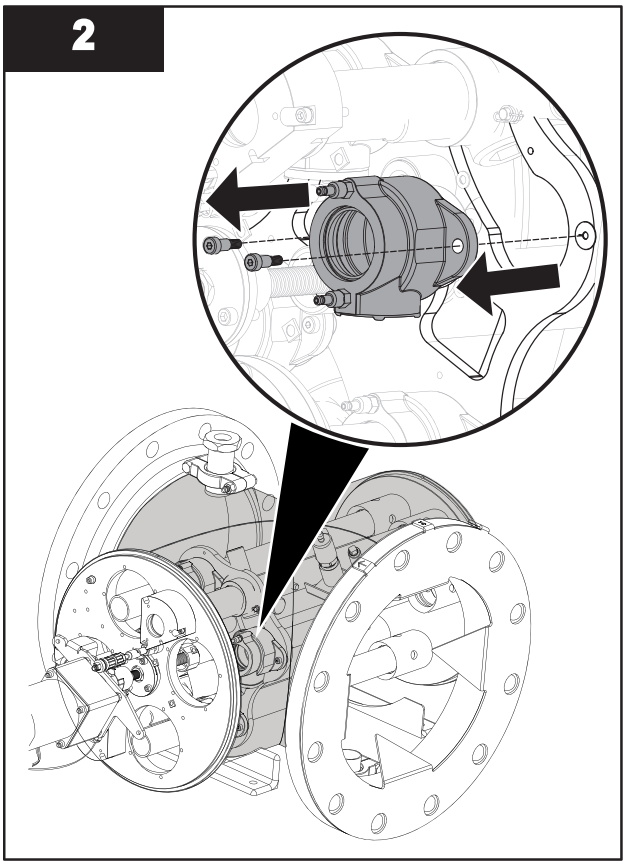
- Home the wiper. Refer to Section 8.2.5.1.
- Depressurize and drain the UV Chamber. Refer to Section 9.4.
- Remove the lamp sleeve. Refer to Section 9.9.1.

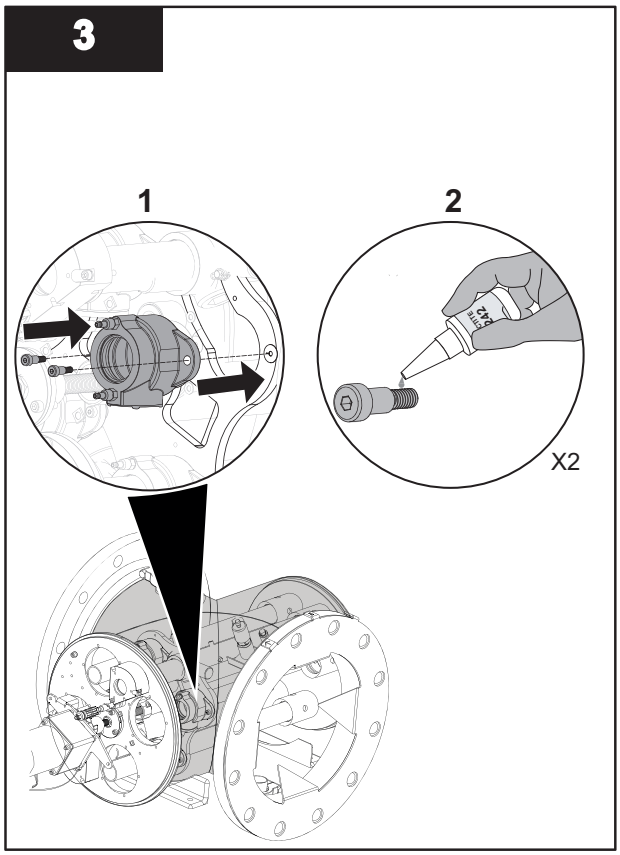
Tools:

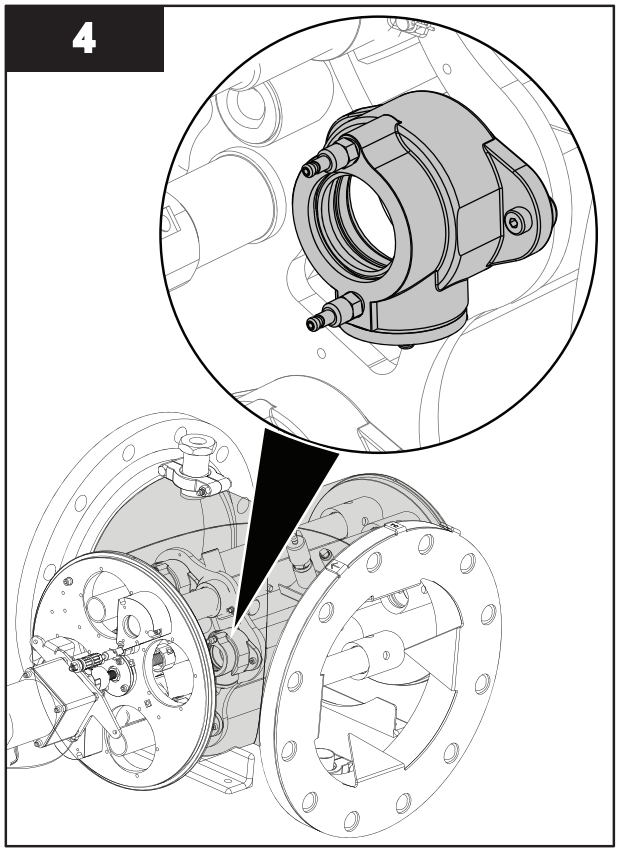
Materials:

Procedure:









10.2.2 Remove and Replace UV Sensor Sleeve Wiper Collar

Prerequisites:

- Home the wiper. Refer to Section 8.2.5.1.
- Depressurize and drain the UV Chamber. Refer to Section 9.4.
- Remove lamp sleeve wiper collar. Refer to Section 10.2.1.

  Note: *Remove UV Lamp, Lamp Sleeve and Lamp Sleeve Wiper collar closest to the UV Sensor Wiper Collar being serviced.*
- Flush / Drain the ActiClean Gel from Sensor Wiper Collar. Refer to Section 9.10.1.
- Remove the UV Sensor. Refer to Section 9.8.1.

Tools:

Materials:

Procedure:

1. Grasp the wiper collar and pull gently towards the front of the UV Chamber.
2. Push the spring loaded pin, located on the side of the wiper collar, slide the collar to the large opening at then end of the slot.
3. Remove the wiper collar through the lamp sleeve port.
4. Inspect the wiper bearings and O-rings, replace if required. Refer to Section 10.2.3.

10.2.3 Remove and Replace Wiper Collar Seals and Bearings

Prerequisites:

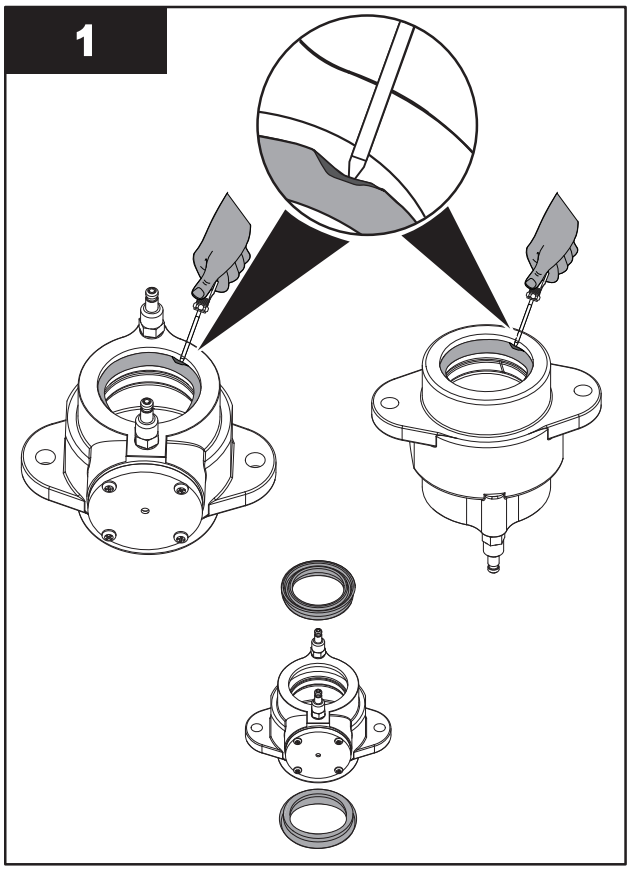
- Remove the wiper collar. Refer to Section 10.2.1 and Section 10.2.2.

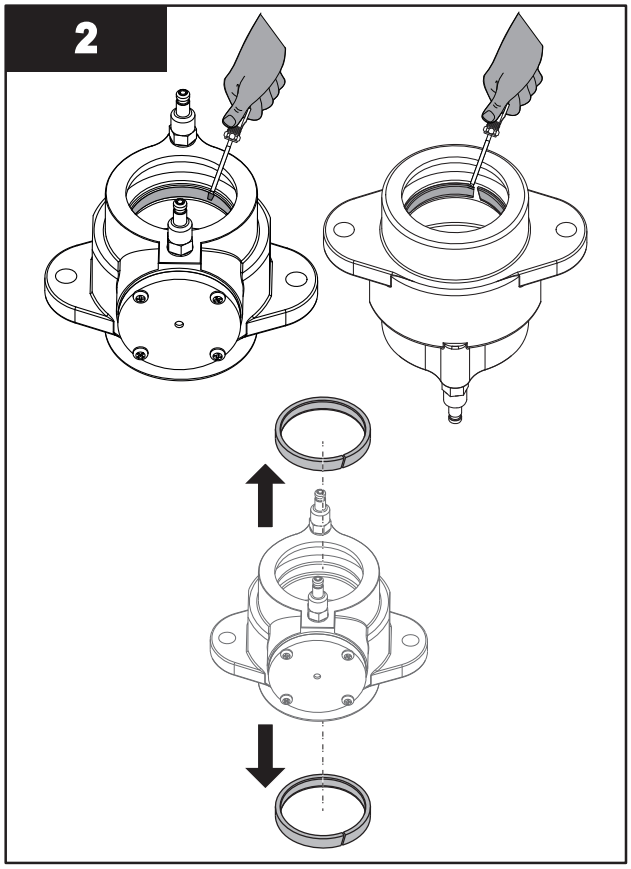
Tools:

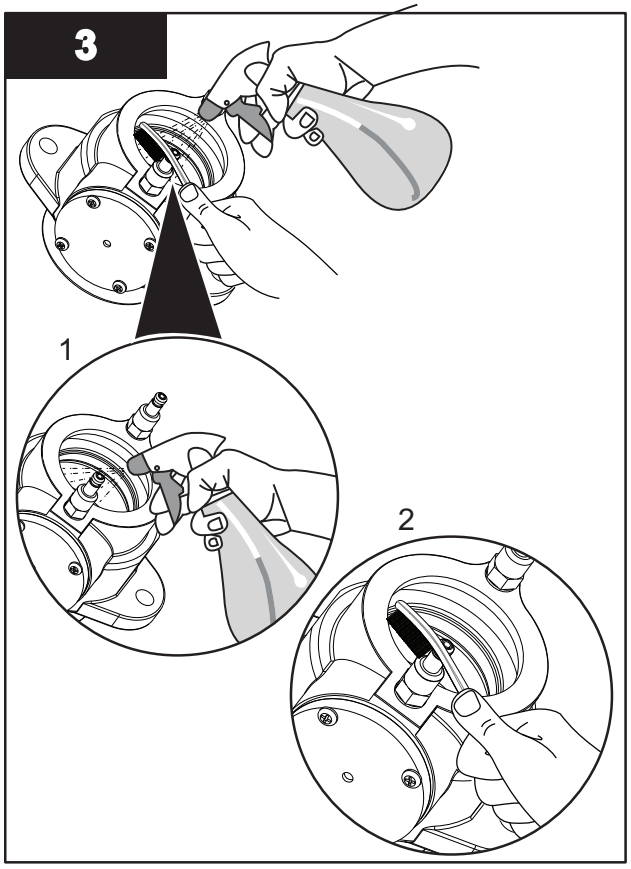
Materials:

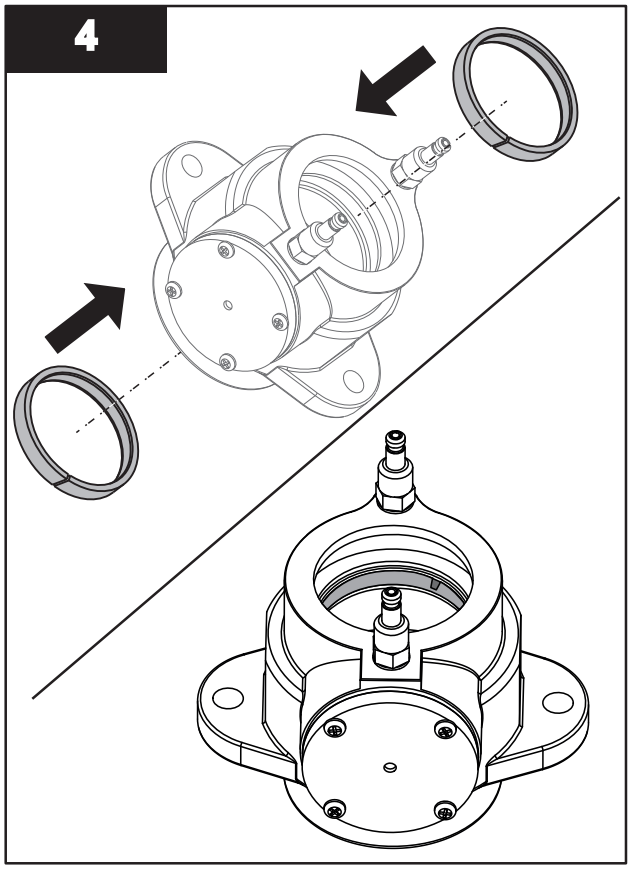
- Wiper Collar U-Cup Seal (if required)
- Wiper Collar Bearing (if required)

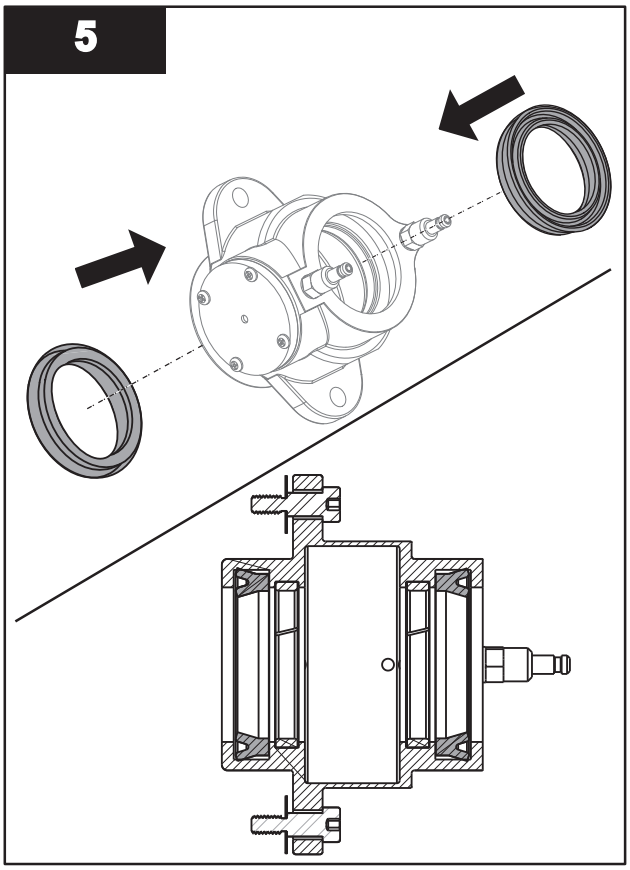
Procedure:











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

Note: *A regular inspection of the rubber wipers and sleeves is recommended for early detection of possible cleaning problems.*

10.2.4 Remove and Replace Pressure Membrane

Prerequisites:

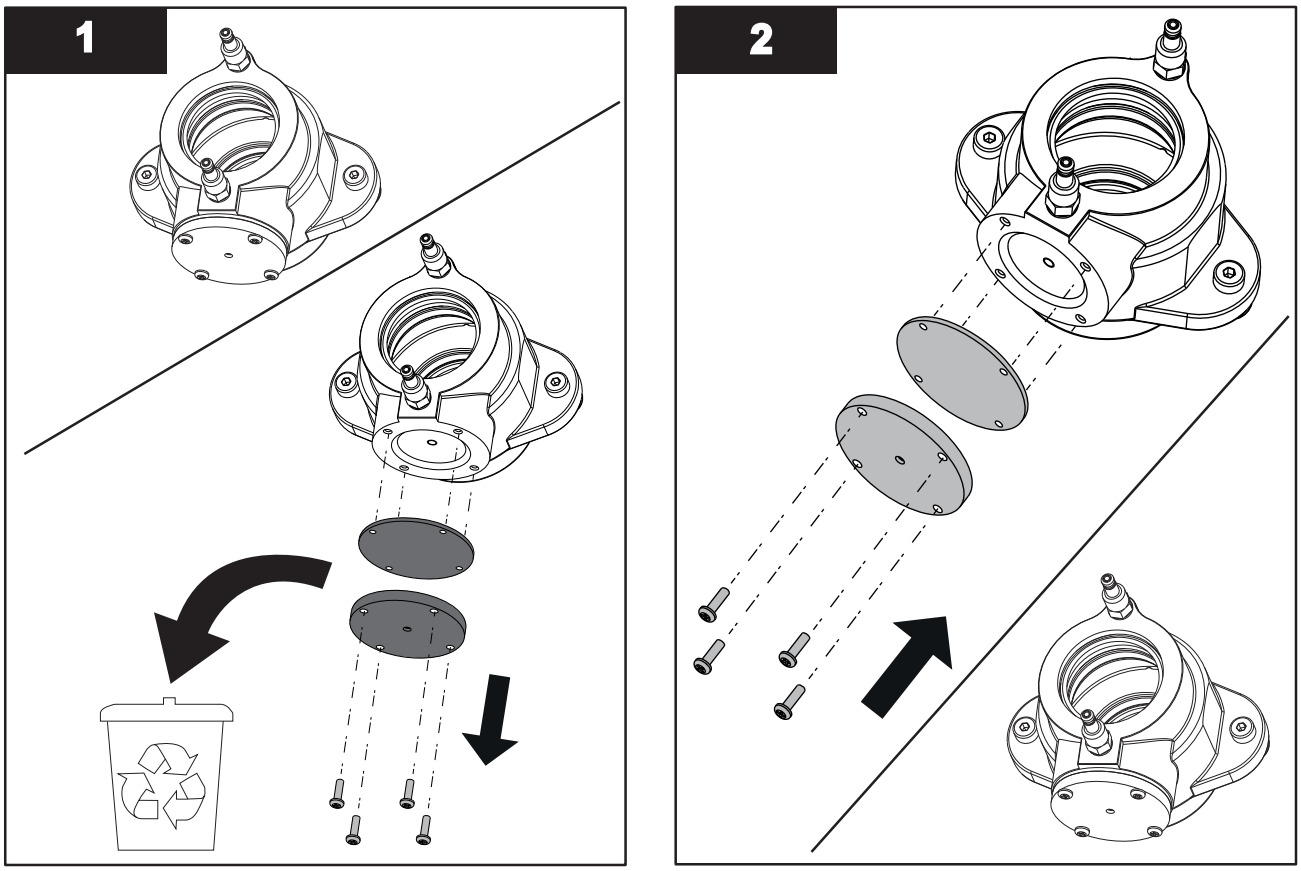
- Remove the wiper collar. Refer to Section 10.2.1.

Tools:

Materials:

- Pressure membrane

Procedure:



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

10.3 Temperature Switch

10.3.1 Remove and Replace Temperature Switch

Prerequisites:

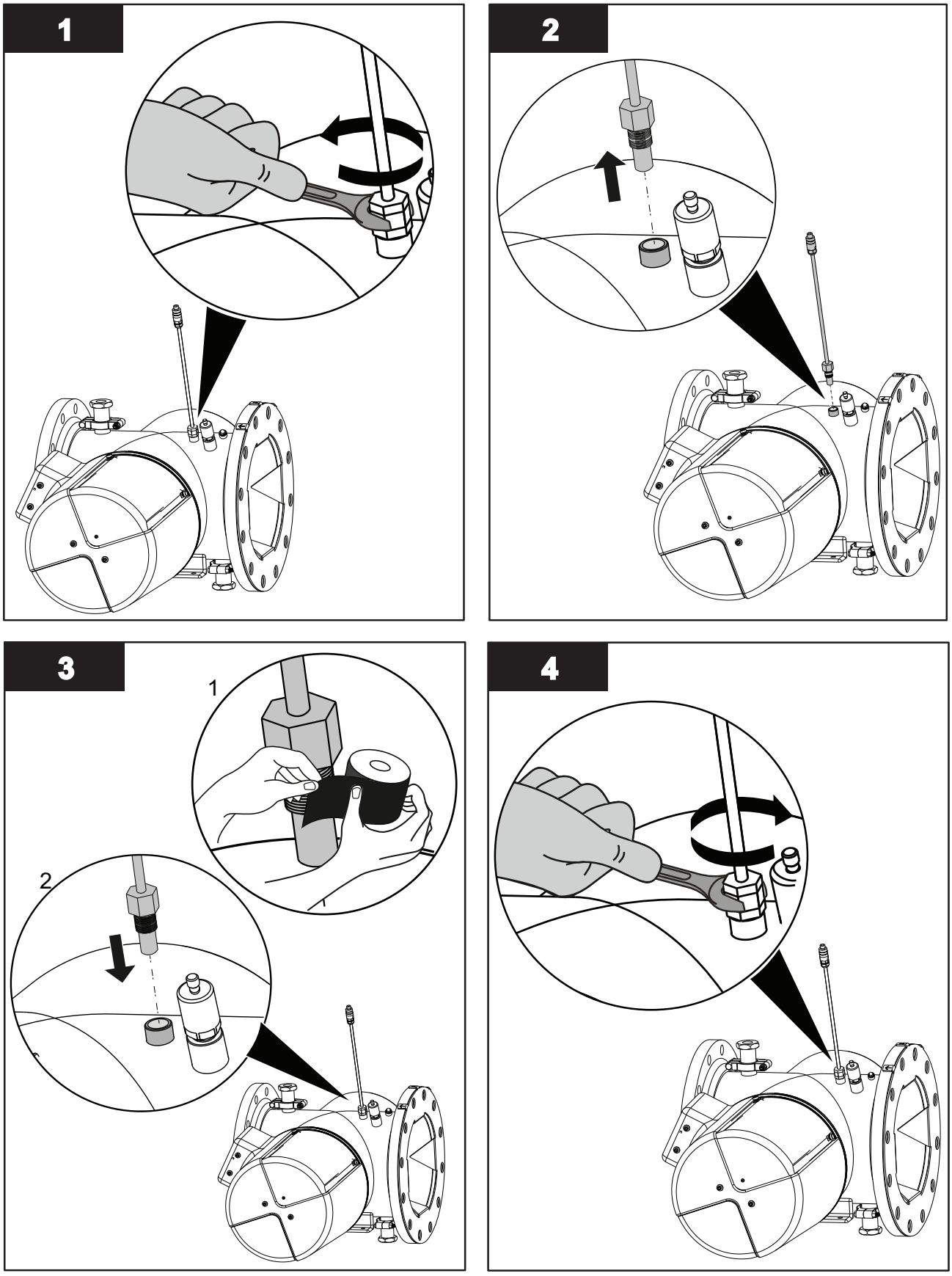
- Depressurize and drain the UV chamber. Refer to Section 9.4.

Tools:

Materials:

- Temperature switch

Procedure:



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

Note: *Do Not over tighten the coupling it may cause damage.*

10.4 Level Sensor

10.4.1 Remove and Replace Level Sensor

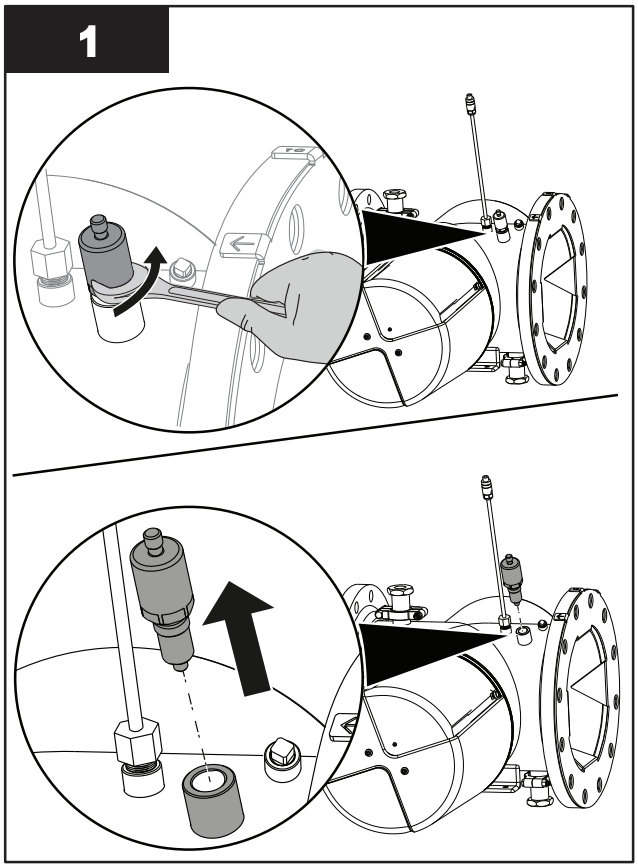
Prerequisites:

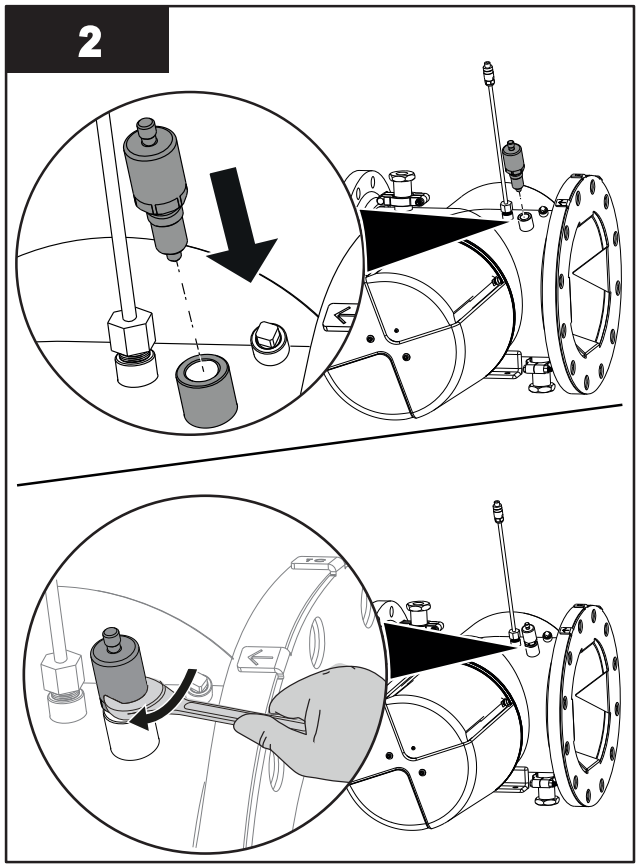
- Depressurize and drain the UV Chamber. Refer to Section 9.4.

Tools:

Materials:

Procedure:





Note: *Do Not over tighten the coupling it may cause damage.*

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

10.5 Reed Assembly

10.5.1 Remove and Replace a Reed Assembly

Prerequisites:

- Depressurize and drain the UV Chamber. Refer to Section 9.4.

Materials:

Procedure:

1. Disconnect the cable from the reed switch assembly.
2. Remove the hairpin from the reed switch tube.
3. Remove the reed switch from the UV Chamber.
4. When service is complete, assemble in reverse order of disassembly.

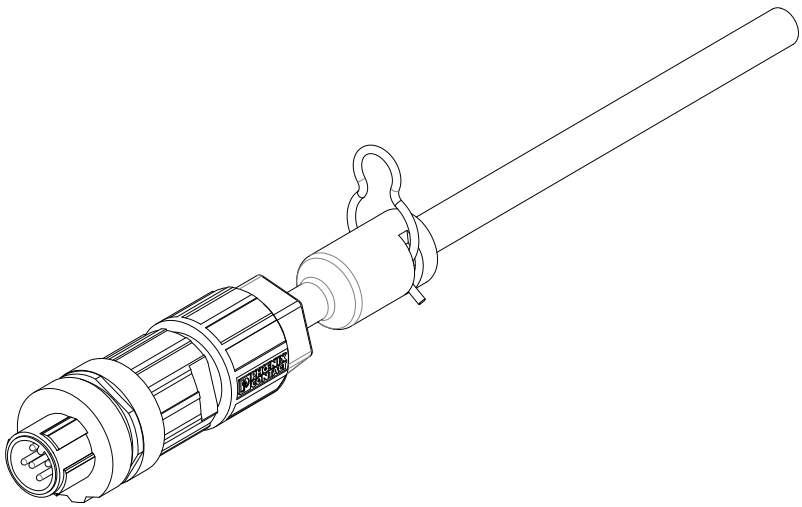


Figure 40 Reed Assembly

10.6 Control Power Panel

10.6.1 Programmable Logic Controller

10.6.1.1 PLC Program Reload

NOTICE
A PLC program restored in this manner will return to the shipped program status. Current lamp hours for each UV Chamber will need to be reentered on the Lamp Overview screen and any other configuration or programming changes made since the original system startup must be reentered on the appropriate System Setting.

Prerequisites:

- Shutdown the UV system. Refer to Section 5.

- Lockout tag out devices as necessary. Refer to Section 4.
- If UPS is present, put in service mode. Refer to Section 10.6.2.

Materials:

- Memory card (located in panel door pocket)

Procedure:

1. Install the memory card in the PLC processor.
2. Remove lockout and tag out. Wait 2 minutes. The PLC program is restored to factory settings.
3. If a UPS is present:
   a. Restore to non service mode.
   b. Power cycle the CPP.

10.6.2 Remove and Replace UPS Battery

Prerequisites:

- Shutdown the UV system. Refer to Section 5.
- Lockout tag out devices as necessary. Refer to Section 4.

Materials:

Procedure:

1. Place the UPS in Service Mode.

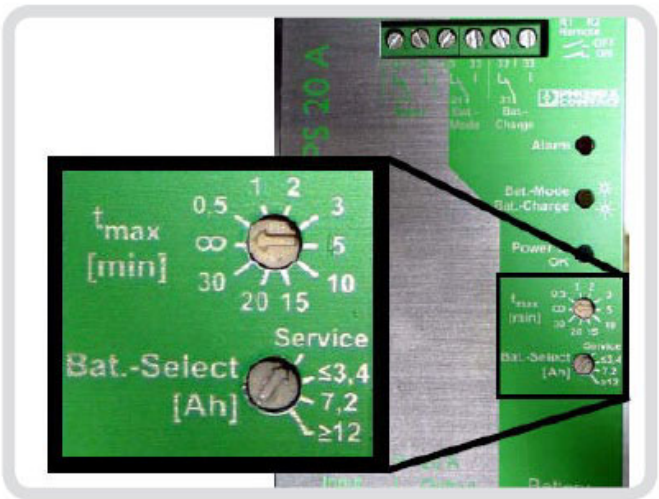


Figure 41 UPS in Service Mode

2. Check to ensure voltage at Terminal 3 has been removed.

3. Remove the fuse from the UPS Battery Module.

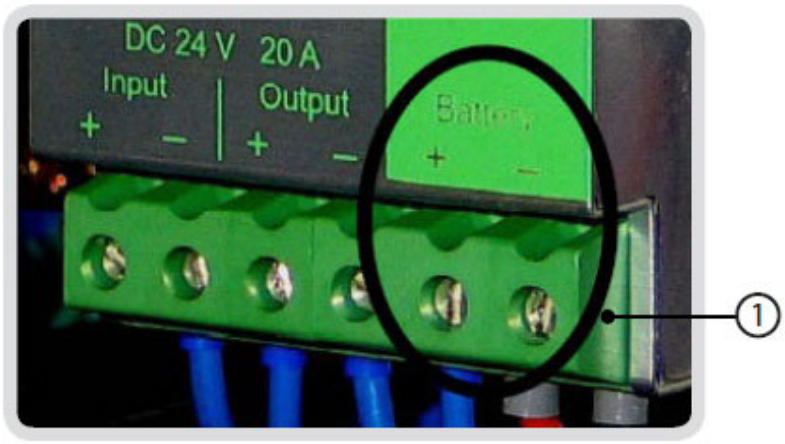


Figure 42 UPS - Battery Input Power Location

1	Battery Input Power

4. Remove and replace battery.

   Note: *Ensure that the "Bat. Select" Setting on the UPS module matches the Battery being replaced.*

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

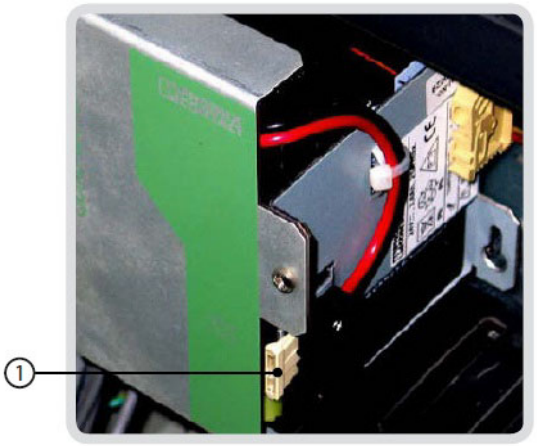


Figure 43 UPS - Battery Fuse Location

1	25 Amp Fuse

Section 11 Troubleshooting

DANGER

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

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NOTICE

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

11.1 Critical Alarms

Indicates that immediate attention is required. The UV system will partially or completely shut down until the fault is cleared. Alarms may be latched and require a reset from the HMI after the alarm condition is remedied.

Note: *A Ballast may also be referred to as a Lamp Driver.*

Note: *A Reactor may also be referred to as a UV Chamber.*

Alarm Location	Alarm / Condition	Description	Possible Cause	Possible Solution
System	Communications Board Timeout	PLC is not communicating with the Dosimeter™ board	Faulty or damaged wiring.	To be checked by an electrician: **1** Faulty or loose connections. **2** Continuity in the wire or cable
			Dosimeter Board failure	Contact your service provider
			Supply interruption	Follow plant protocols to check upstream protection devices.
	PLC Faulted	Major Controller fault has occurred	A programming error has occurred.	Reset the Major fault and attempt to place the PLC back into RUN mode.
			RUN / REM switch - Allan Bradley only	Set RUN / REM switch to RUN or REM position
	[1]Plant SCADA Communications Failure	Failed to receive a watchdog register change from SCADA system	The controller has not received a communication update from the SCADA system in the last 20 seconds.	Wait 20 seconds for power to be restored and CPP and SCADA system to re-boot.
			Faulty or damaged wiring.	To be checked by an electrician: **1** Faulty or loose connections. **2** Continuity in the wire or cable
			Faulty Communication Module	Check for proper operation of the communication module. Replace if required. Contact a Controls Technician.
			Faulty Protocol Converter (if applicable)	Check for proper operation of the Protocol Converter. Replace if required. Contact a Controls Technician.
			Faulty Ethernet Switch (if applicable)	Check for proper operation of the Ethernet Switch. Replace if required. Contact a Controls Technician.
			SCADA system issue	Contact the Plant SCADA Integrator.

Alarm Location	Alarm / Condition	Description	Possible Cause	Possible Solution
UV Chamber	Start Up Sequence Failed	A lamp failed to start	A critical alarm is active.	Resolve all active critical alarm conditions.
			A previously resolved alarm has not been acknowledged	Acknowledge all critical alarms.
			A UV Lamp or Lamp Driver alarm that has been cleared and acknowledged has not been reset at the Chamber Overview Screen.	Reset UV Lamp and Lamp Driver alarms on the Chamber Overview Screen at the CPP.
			Mains power to CPP to be cycled.	Cycle mains power to the CPP. If problem persists, contact your service provider
	Reactor Low Water Level	UV Chamber does not contain enough water to activate the level switch	Air pocket has developed inside the UV Chamber.	Bleed off any air that may have collected in the UV Chamber during operation. Restart UV Chamber. Contact your service provider.
			Faulty or damaged wiring.	To be checked by an electrician: **1** Faulty or loose connections. **2** Continuity in the wire or cable
			Faulty level sensor.	Check for proper operation of the level sensor. Replace if required (Section 10.4.1). Contact your service provider.
	Reactor High Temperature	UV Chamber high temperature switch tripped	Air pocket has developed inside the UV Chamber.	Bleed off any air that may have collected in the UV Chamber during operation. Restart UV Chamber. Contact your service provider.
			Faulty temperature sensor.	Check for proper operation of the temperature sensor. Replace if required. Contact your service provider.
			Insufficient flow through the UV Chamber.	Confirm water is flowing through the UV Chamber.
			Water Temperature is too high.	Ensure that the water temperature is below 50°C (122°F)
	Reactor Cover is Off	Protective cover on UV Chamber removed	Service end cap (i.e. reactor cover) not secured in place on the UV Chamber.	Secure the service end cap (i.e. reactor cover) in place on the UV Chamber.
			Faulty or damaged wiring.	To be checked by an electrician: **1** Faulty or loose connections. **2** Continuity in the wire or cable
			Faulty safety switch	Check safety switch is securely fastened in place. Replace if required.

Alarm Location	Alarm / Condition	Description	Possible Cause	Possible Solution
UV Chamber	E-Stop pressed	E-stop switch pushed – will mask out High Reactor Temperature and Dust Cap alarms	E-stop has been activated.	Reset E-stop when safe to do so.
			Faulty or damaged wiring.	To be checked by an electrician: **1** Faulty or loose connections. **2** Continuity in the wire or cable
			E-stop is faulty or damaged	Replace E-Stop.
			Faulty I/O module	I/O module signal function to be checked by an electrician or controls specialist.
Lamp and Driver	Multiple Ballast Alarm	The number of Lamp Drivers that are failed in the UV Chamber is greater than two	Refer to: Ballast Major Alarm (1 per ballast)	
	Multiple Lamp Alarm	The number of lamps that are failed in the UV Chamber is greater than two	Refer to: Lamp Major Alarm (1 per lamp)	
Wiper	Wiper Home Limit Switch Fault	Wiper home switch contacts are in the same state indicating the switch has failed	Faulty or damaged wiring.	To be checked by an electrician: **1** Faulty or loose connections. **2** Continuity in the wire or cable
			Limit Switch Plunger is stuck	Check for proper operation of the limit switch plunger. Clean if required. Replace if required. Contact your service provider.
			Faulty Limit Switch	Check for proper operation of the limit switch. Replace if required. Contact your service provider.
	Wiper Revolution Sensor Fault	Indicates a wiper has been commanded to move but is not triggering the revolution input sensor.	Faulty or damaged wiring.	To be checked by an electrician: **1** Faulty or loose connections. **2** Continuity in the wire or cable
			Faulty Revolution Sensor	Check for proper operation of the revolution sensor. Clean if required. Replace if required. Contact your service provider.

Alarm Location	Alarm / Condition	Description	Possible Cause	Possible Solution
Wiper	Wiper Extend Travel Time Exceeded	Wiper has not reached end of travel before configured travel time	Low Flow	Refer to Low Flow Rate. ***Note: DO NOT** operate the wiper when the UV Chamber is empty and the lamp sleeves are installed.*
			Incorrect Travel Time setpoints.	Contact your service provider
			Faulty or damaged wiring.	To be checked by an electrician: **1** Faulty or loose connections. **2** Continuity in the wire or cable
			Faulty Drive Motor	Check for proper operation of the Drive Motor. Replace if required. Contact your service provider.
			Broken Lamp Sleeve	Isolate and shut off the UV chamber immediately. Check for water inside the service end cap and inside lamp sleeves. If water is detected, this is likely a result of UV lamp or lamp sleeve break. Contact your service provider. Check all O-rings and seals used to seal UV Lamp and sensor sleeves and replace if damaged. Ensure the Sleeve Gland and sleeve nuts are adequately tightened.
			Broken UVI Sensor Sleeve	Isolate and shut off the UV Chamber immediately. Check for water inside the service end cap. If water is detected, this is likely a result of sleeve break. Contact your Service Provider. Check all O-rings and seals used to seal UV Lamp and sensor sleeves and replace if damaged. Ensure the Sleeve Gland and sleeve nuts are adequately tightened.
			Wiper Plate is obstructed	Inspect inside the UV Chamber for wiper plate obstructions. Clear obstructions.
	Wiper Retract Travel Time Exceeded	Wiper has not reached home position before configured travel time	Refer to Wiper Extend Travel Time Exceeded.	

Alarm Location	Alarm / Condition	Description	Possible Cause	Possible Solution
Flow Meter	Low Flow Rate	Flow is below preset setpoint for configured time	Supply interruption	Follow plant protocols to check upstream processes.
			Inlet Valve not fully opened	Check Inlet Valve for obstructions, remove obstructions as needed. Open Inlet Valve.
			Incorrect Flow Setpoints	Contact your service provider
			Faulty or damaged wiring.	To be checked by an electrician: **1** Faulty or loose connections. **2** Continuity in the wire or cable
			Faulty I/O module	I/O module signal function to be checked by an electrician or controls specialist.
			Faulty Flow Meter	Check for proper operation of the flow meter. Replace if required. Contact your service provider.
			Faulty Inlet Valve.	Check for proper operation of the valve. Replace if required. Contact your service provider.
	Flow Meter Signal Out of Range	4-20 mA flow signal input is below 3.5 mA or above 20.5 mA	Faulty or damaged wiring.	To be checked by an electrician: **1** Faulty or loose connections. **2** Continuity in the wire or cable
			Faulty I/O module	I/O module signal function to be checked by an electrician or controls specialist.
			Flow meter not calibrated correctly or faulted	Verify proper calibration and function of the flow meter.
			Faulty Flow Meter	Check for proper operation of the flow meter. Replace if required. Contact your service provider.

Alarm Location	Alarm / Condition	Description	Possible Cause	Possible Solution
Valves	Inlet Valve Fail to Open	Valve commanded to open but has not reached opened limit switch or has not left closed limit switch	Faulty or damaged wiring.	To be checked by an electrician: **1** Faulty or loose connections. **2** Continuity in the wire or cable
			Faulty I/O module	I/O module signal function to be checked by an electrician or controls specialist.
			Valve not fully opened	Check Valve for obstructions, remove obstructions as needed. Open Valve.
			Faulty Valve.	Check for proper operation of the valve. Replace if required. Contact your service provider.
	Inlet Valve Fail to Close	Valve commanded to close but has not reached closed limit switch or has not left opened limit switch	Faulty or damaged wiring.	To be checked by an electrician: **1** Faulty or loose connections. **2** Continuity in the wire or cable
			Faulty I/O module	I/O module signal function to be checked by an electrician or controls specialist.
			Valve not fully closed	Check Valve for obstructions, remove obstructions as needed. Close Valve.
			Faulty Valve.	Check for proper operation of the valve. Replace if required. Contact your service provider.
	Outlet Valve Fail to Open	Valve commanded to open but has not reached opened limit switch or has not left closed limit switch	Refer to Inlet Valve Fail to Open	
	Outlet Valve Fail to Close	Valve commanded to close but has not reached closed limit switch or has not left opened limit switch	Refer to Inlet Valve Fail to Close	
	Cooling Valve Fail to Open	Valve commanded to open but has not reached opened limit switch or has not left closed limit switch	Refer to Inlet Valve Fail to Open	
	Cooling Valve Fail to Close	Valve commanded to close but has not reached closed limit switch or has not left opened limit switch	Refer to Inlet Valve Fail to Close	

[1] Severity is Critical only when "SCADA Comms" setting is set to "Shutdown Reactor".

11.2 Major Alarms

Indicates that immediate attention is required, otherwise damage may occur or performance may be compromised. The UV system does not shutdown, however, control actions may be taken to achieve proper equipment operation.

Note: *A Ballast may also be referred to as a Lamp Driver.*

Note: *A Reactor may also be referred to as a UV Chamber.*

Alarm Location	Alarm / Condition	Description	Possible Cause	Possible Solution
Lamp and Driver	Lamp Major Alarm (1 per lamp)	A lamp that is required to operate is not running after warm-up time	Faulty UV Lamp	Swap the faulted UV Lamp with a known working UV Lamp. If the fault follows the UV Lamp, replace the UV Lamp. Refer to Section 9.7.2. Reset lamp hours. Refer to Section 8.2.5.9.
			Lamp plug not properly connected	Remove UV Lamp cable and reconnect
			Faulty or damaged wiring.	To be checked by an electrician: **1** Faulty or loose connections. **2** Continuity in the wire or cable
			Lamp Driver output or lamp cord not connected within the CPP.	Lamp Driver connection to be checked by an electrician.
			Faulty Lamp Driver	Refer to Ballast Major Alarm (1 per ballast)
			Broken Lamp Sleeve	Isolate and shut off the UV chamber immediately. Check for water inside the service end cap and inside lamp sleeves. If water is detected, this is likely a result of UV lamp or lamp sleeve break. Contact your service provider. Check all O-rings and seals used to seal UV Lamp and sensor sleeves and replace if damaged. Ensure the Sleeve Gland and sleeve nuts are adequately tightened.
			Short Circuit, water has infiltrated the sleeve	Isolate and shut off the UV chamber immediately. Check for water inside the service end cap (safety guard) and inside lamp sleeves. If water is detected, this is likely a result of UV lamp or lamp sleeve breakage - contact service provider. Check all O-rings and seals used to seal UV lamp and sensor sleeves and replace if damaged. Ensure the Sleeve Gland and sleeve nuts are adequately tightened.

Alarm Location	Alarm / Condition	Description	Possible Cause	Possible Solution
Lamp and Driver	Ballast Major Alarm (1 per ballast)	A lamp driver that is required to operate is not running after warm-up time	Faulty or damaged wiring.	To be checked by an electrician: **1** Faulty or loose connections. **2** Continuity in the wire or cable
			Lamp Driver is not seated into the backplane.	Lamp Driver seating to be checked by an electrician.
			Faulty Lamp Driver(s).	Replace all failed Lamp Drivers (Section 9.11.2).
			Incorrect Lamp Driver Address	Change Lamp Driver address to a correct Lamp Driver location in the Lamp Driver rack
	Ballast High Temperature (1 per ballast)	A Lamp Driver has exceeded the high temperature set point	Obstruction limiting air flow	Clean the lamp driver fan, remove obstructions.
			Faulty panel intake or exhaust fan	Clean or replace the filter.
			Faulty or damaged wiring.	To be checked by an electrician: **1** Faulty or loose connections. **2** Continuity in the wire or cable
			Faulty temperature switch	Check for proper operation of the temperature switch. Replace if required. Contact your service provider.
			Faulty panel intake or exhaust fan	Check for proper function of the fan. Replace if required.
			Incorrect Temperature Setpoint	Contact your service provider
			Site conditions are not within specified operating parameters (i.e. High Ambient Temperature).	Ensure site conditions are within specified operating parameters.
			Faulty Lamp Driver Fan	Replace the fan.
			Faulty Lamp Driver(s).	Replace all failed Lamp Drivers (Section 9.11.2).
Off Specification	Off Specification – Low Validated Dose	Indicates that the validated dose is below the required dose.	Refer to Low UV Dose Major	
	Off Specification – Low S/S0	Indicates that S/S0 (Relative Lamp Output) is below the validated limit.	Faulty UVI Sensor	Perform a reference sensor check. Replace UVI Sensor if faulty (Section 9.8.1). Resolve all UVI Sensor Alarms
	Off Specification– Low UVT	Indicates that the UV transmittance is below the validated limit.	UVT analyzer not calibrated correctly or faulted	Verify proper calibration and function of the UVT analyzer
	Off Specification – High Flow	Indicates that the Flow rate is above the validated limit.	High Flow	Ensure site conditions are within specified operating parameters.

Alarm Location	Alarm / Condition	Description	Possible Cause	Possible Solution
Off Specification	Off Specification – Low RED	Indicates that the Actual RED is below the Target RED	Refer to Low UV Dose Major	
	Off Specification – Reactor Off with Valves Open	Indicates that the UV Chamber is off and the valves do not have a closed status.	Faulty or damaged wiring.	To be checked by an electrician: **1** Faulty or loose connections. **2** Continuity in the wire or cable
			Faulty I/O module	I/O module signal function to be checked by an electrician or controls specialist.
			Valve not fully closed	Check Valve for obstructions, remove obstructions as needed. Close Valve.
			Faulty Valve.	Check for proper operation of the valve. Replace if required. Contact your service provider.
	Log Inactivation Not Possible	Indicates that the UV Chamber cannot treat the required log inactivation target	The selected target log inactivation value is higher than the validated limit	Set the log inactivation value that is within design parameters.
	Off Specification – Invalid BRED	Indicates that a valid RED bias term cannot be determined at the current operating conditions.	Low UVT, UVT is below validated range	Ensure UVT is within design parameters. Resolve upstream processes causing low UVT conditions.
			UVT analyzer not calibrated correctly or faulted	• UVT needs to be cleaned • UVT needs to be calibrated • UVT has active alarms
	Off Specification – Lamp Failed	Indicates that at least one lamp has failed	Lamp Issue	Refer to Lamp Major Alarm (1 per lamp)
	Off Specification – Sensor Failed	Indicates that at least one sensor has failed	Faulty UVI Sensor	Perform a reference sensor check. Replace UVI Sensor if faulty (Section 9.8.1). Resolve all UVI Sensor Alarms
			Broken UVI Sensor Sleeve	Isolate and shut off the UV Chamber immediately. Check for water inside the service end cap. If water is detected, this is a likely sleeve break. Contact your Service Provider. Check all O-rings and seals used to seal UV Lamp and sensor sleeves and replace if damaged. Ensure the Sleeve Gland and sleeve nuts are adequately tightened.

Alarm Location	Alarm / Condition	Description	Possible Cause	Possible Solution
Off Specification	Sensor Correction Factor Applied	Indicates a value greater than 1 is being used as a sensor correction factor	A UVI Sensor has failed a reference sensor check and a good UVI Sensor is not available to be installed in the UV Chamber. The user has input a sensor correction factor. ***Note:*** *This is to be used as a temporary countermeasure in situations where a good UVI Sensor is not immediately available.*	**1** Replace the failed UVI Sensor with a UVI Sensor that passes a reference sensor check (Section 9.8.1). **2** Remove the temporary sensor correction factor.
UVI Sensors	Sensor Signal Lost (1 alarm per sensor)	4-20 mA sensor signal input is below 3.5 mA	Faulty or damaged wiring.	To be checked by an electrician: **1** Faulty or loose connections. **2** Continuity in the wire or cable
			Broken UVI Sensor Sleeve	Isolate and shut off the UV Chamber immediately. Check for water inside the service end cap. If water is detected, this is a likely sleeve break. Contact your Service Provider. Check all O-rings and seals used to seal UV Lamp and sensor sleeves and replace if damaged. Ensure the Sleeve Gland and sleeve nuts are adequately tightened.
			Faulty UVI Sensor	Replace the UVI Sensor (Section 9.8.1).
UV Chamber	[1]Low UV Dose Major	Actual Dose is lower than the target Dose	Incorrect Dose setpoints	Contact your Service Provider.
			Low Lamp Power Level	Check the Lamp Power Level. If operating in manual mode, increase lamp power level to 100% or switch to automatic mode.
			Lamp Issue	Refer to Lamp Major Alarm (1 per lamp)
			Lamp Driver issue	Refer to Ballast Major Alarm (1 per ballast)
			Lamp Sleeve is fouled - Systems with Automatic Cleaning System	Initiate a wiping sequence to clean the Lamp Sleeves. Check ActiClean Gel in Wiper Collars. Fill collars with ActiClean Gel if required. Manually clean Lamp Sleeves in the Chamber if required (Section 9.9.2).

Alarm Location	Alarm / Condition	Description	Possible Cause	Possible Solution
UV Chamber	[1]Low UV Dose Major	Actual Dose is lower than the target Dose	Lamp Sleeve is fouled -Systems without Automatic Cleaning System.	Inspect one Lamp Sleeve for signs of fouling. If fouling is detected, remove and clean all Lamp Sleeves in the Chamber (Section 9.9.2).
			Low UVT, UVT is below validated range	Ensure UVT is within design parameters. Resolve upstream processes causing low UVT conditions.
			UVT analyzer not calibrated correctly or faulted	• UVT needs to be cleaned • UVT needs to be calibrated • UVT has active alarms
			High Flow	Ensure site conditions are within specified operating parameters.
			Faulty Flow Meter	Check for proper operation of the flow meter. Replace if required. Contact your service provider.
			Faulty UVI Sensor	Perform a reference sensor check. Replace UVI Sensor if faulty. Resolve all UVI Sensor Alarms
			Broken UVI Sensor Sleeve	Isolate and shut off the UV Chamber immediately. Check for water inside the service end cap. If water is detected, this is a likely sleeve break. Contact your Service Provider. Check all O-rings and seals used to seal UV Lamp and sensor sleeves and replace if damaged. Ensure the Sleeve Gland and sleeve nuts are adequately tightened.
			UVI Sensor Sleeve is fouled - Systems with Automatic Cleaning System	Refer to Lamp Sleeve is fouled - Systems with Automatic Cleaning System
			UVI Sensor Sleeve is fouled - Systems without Automatic Cleaning System.	Refer to Lamp Sleeve is fouled -Systems without Automatic Cleaning System.

Alarm Location	Alarm / Condition	Description	Possible Cause	Possible Solution
Flow Meter	Maximum Hydraulic Capacity Exceeded	Calculated flow rate is greater than the pre-set system hydraulic maximum capacity	High Flow	Ensure site conditions are within specified operating parameters.
			Faulty Flow Meter	Check for proper operation of the flow meter. Replace if required. Contact your Service Provider.
			Faulty or damaged wiring.	To be checked by an electrician: **1** Faulty or loose connections. **2** Continuity in the wire or cable
			Faulty I/O module	I/O module signal function to be checked by an electrician or controls specialist.

[1] Alarm exists only when Off-Spec monitoring is disabled.

11.3 Minor Alarms

Indicates that the UV system requires maintenance but it is operating in compliance. Alarms are not latched and no reset is required. No other actions will be taken.

Note: *A Ballast may also be referred to as a Lamp Driver.*

Note: *A Reactor may also be referred to as a UV Chamber.*

Alarm Location	Alarm / Condition	Description	Possible Cause	Possible Solution
System	UPS Low Battery or UPS Fault	UPS has a low battery output voltage or has an internal fault	Faulty battery	Replace the UPS battery (Section 10.6.2).
	PLC Battery Low	PLC Battery has a low output voltage	The PLC battery has been removed or has reached it's end of life.	Replace or reconnect the PLC battery.
	[1]Plant SCADA Communications Failure	Failed to receive a watchdog register change from SCADA system	Refer to Plant SCADA Communications Failure	
	Main Power is Disconnected	Main power is not present and system is running on UPS power	Utility interruption	Follow plant protocols for utility failures
			Supply interruption	Follow plant protocols to check upstream protection devices.
			Faulty or damaged wiring.	To be checked by an electrician: **1** Faulty or loose connections. **2** Continuity in the wire or cable
			24VDC Power Supply failure	Contact your service provider
			Faulty I/O module	I/O module signal function to be checked by an electrician or controls specialist.
	Main Power is Restored	Main power has been restored and the system is no longer running on UPS power	Power has recently been restored.	No action required.

Alarm Location	Alarm / Condition	Description	Possible Cause	Possible Solution
Lamp and Driver	Lamp End of Life Warning (1 per lamp)	A lamp has exceeded its rated end of life operating hours	Aged UV Lamp	Replace UV Lamp. Refer to Section 9.7.2. Reset lamp hours. Refer to Section 8.2.5.9.
UVT	UVT Analyzer Signal Out of Range	4-20 mA UVT signal input is below 3.5 mA or above 20.5 mA	Low UVT, UVT is below validated range	Ensure UVT is within design parameters. Resolve upstream processes causing low UVT conditions.
			UVT analyzer not calibrated correctly or faulted	• UVT needs to be cleaned • UVT needs to be calibrated • UVT has active alarms
			Faulty or damaged wiring.	To be checked by an electrician: **1** Faulty or loose connections. **2** Continuity in the wire or cable
			Faulty I/O module	I/O module signal function to be checked by an electrician or controls specialist.
			Faulty controller	Controller function to be checked by electrician or controls specialist.
	UVT Analyzer Fault	OPTIVIEW® meter failure mode signaled by discrete output	Utility interruption	Follow plant protocols for utility failures
			Faulty or damaged wiring.	To be checked by an electrician: **1** Faulty or loose connections. **2** Continuity in the wire or cable
			Faulty I/O module	I/O module signal function to be checked by an electrician or controls specialist.
			UVT Analyzer is warming up	Wait for UVT Analyzer to complete warmup.
			UVT Analyzer is offline	Change UVT Analyzer to online mode.
			Faulty controller	Controller function to be checked by electrician or controls specialist.
	UVT Analyzer Manual Value Used	UVT mode is selected as manual at the HMI	UV Transmittance is overridden and utilizing a manually entered value	Verify the manual value is correct. If value is not correct: **a** Update the manual value with a correct value OR **b** Clear the manual override, if no longer required

Alarm Location	Alarm / Condition	Description	Possible Cause	Possible Solution
UVT	UVT Less Than Design	Actual UVT is less than the design UVT	Low UVT, UVT is below validated range	Ensure UVT is within design parameters. Resolve upstream processes causing low UVT conditions.
			UVT analyzer not calibrated correctly or faulted	• UVT needs to be cleaned • UVT needs to be calibrated • UVT has active alarms
UVI Sensors	Sensor Saturated (1 alarm per sensor)	4-20 mA sensor signal input is above 20.5 mA	UV Chamber is operating in Manual Mode, above dose target.	Reduce UV Chamber power or operate system in automatic mode.
			High UVT - influent water UVT is higher than design value	This alarm doesn't affect the operation of the UV Chamber. The alarm will resolve when the UV Chamber power level lowers.
			Faulty UVI Sensor	Perform a reference sensor check. Replace UVI Sensor if faulty (Section 9.8.1). Resolve all UVI Sensor Alarms
	Sensor Reference Check Required (1 alarm per sensor)	The reference check interval time has expired	A reference sensor check is due.	Perform Reference Sensor Check.
	Reference Sensor Procedure Active	Reference Sensor procedure is active	A reference sensor check is active.	Complete and exit the Reference Sensor Check.
	Sensor UV Intensity Deviation (1 alarm per sensor)	Measured Intensity differs from Theoretical Intensity	UVI Sensor Sleeve is fouled - Systems with Automatic Cleaning System	Refer to Lamp Sleeve is fouled - Systems with Automatic Cleaning System
			UVI Sensor Sleeve is fouled -Systems without Automatic Cleaning System.	Refer to Lamp Sleeve is fouled -Systems without Automatic Cleaning System.
			Low UVT - UVT is below validated range	Ensure UVT is within design parameters. Resolve upstream processes causing low UVT conditions.
			UVT analyzer not calibrated correctly or faulted	• UVT needs to be cleaned • UVT needs to be calibrated • UVT has active alarms
			High UVT - influent water UVT is higher than design value	Ensure UVT is within design parameters.
			Faulty UVI Sensor	Perform a reference sensor check. Replace UVI Sensor if faulty (Section 9.8.1). Resolve all UVI Sensor Alarms

Alarm Location	Alarm / Condition	Description	Possible Cause	Possible Solution
Valves	Inlet Valve Not Ready	Valve is faulted or in Local Control Mode	Valve is in local control mode	Place Valve into remote control mode.
			Faulty or damaged wiring.	To be checked by an electrician: **1** Faulty or loose connections. **2** Continuity in the wire or cable
			Faulty I/O module	I/O module signal function to be checked by an electrician or controls specialist.
			Faulty Valve.	Check for proper operation of the valve. Replace if required. Contact your service provider.
	Inlet Valve in Manual	Manual Mode is selected at the HMI	Valve is in manual mode at HMI	Place Valve into automatic mode at HMI
			Faulty or damaged wiring.	To be checked by an electrician: **1** Faulty or loose connections. **2** Continuity in the wire or cable
			Faulty I/O module	I/O module signal function to be checked by an electrician or controls specialist.
			Faulty Valve.	Check for proper operation of the valve. Replace if required. Contact your service provider.
	Outlet Valve Not Ready	Valve is faulted or in Local Control Mode	Refer to Inlet Valve Not Ready	
	Outlet Valve in Manual	Manual Mode is selected at the HMI	Refer to Inlet Valve in Manual	
	Cooling Valve Not Ready	Valve is faulted or in Local Control Mode	Refer to Inlet Valve Not Ready	
	Cooling Valve in Manual	Manual mode is selected at the HMI	Refer to Inlet Valve in Manual	
Flow Meter	Flow Meter Manual Value Used	Manual Flow mode is selected at the HMI	Flow value is overridden and utilizing a manually entered value	Verify the manual value is correct. If value is not correct: **a** Update the manual value with a correct value OR **b** Clear the manual override, if no longer required
	Flow Greater than Design	Actual System flow is greater than system design flow	High Flow	Ensure site conditions are within specified operating parameters.

[1] Severity is Minor when "SCADA Comms" setting is set to "Use Manual Values".

Section 12 Replacement Parts

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

- Product name and model number (refer to the front of this manual)
- Part number and description of the replacement part or accessory.

If a replacement part is not listed, contact Trojan Technologies.

12.1 UV Lamp and Lamp Sleeve

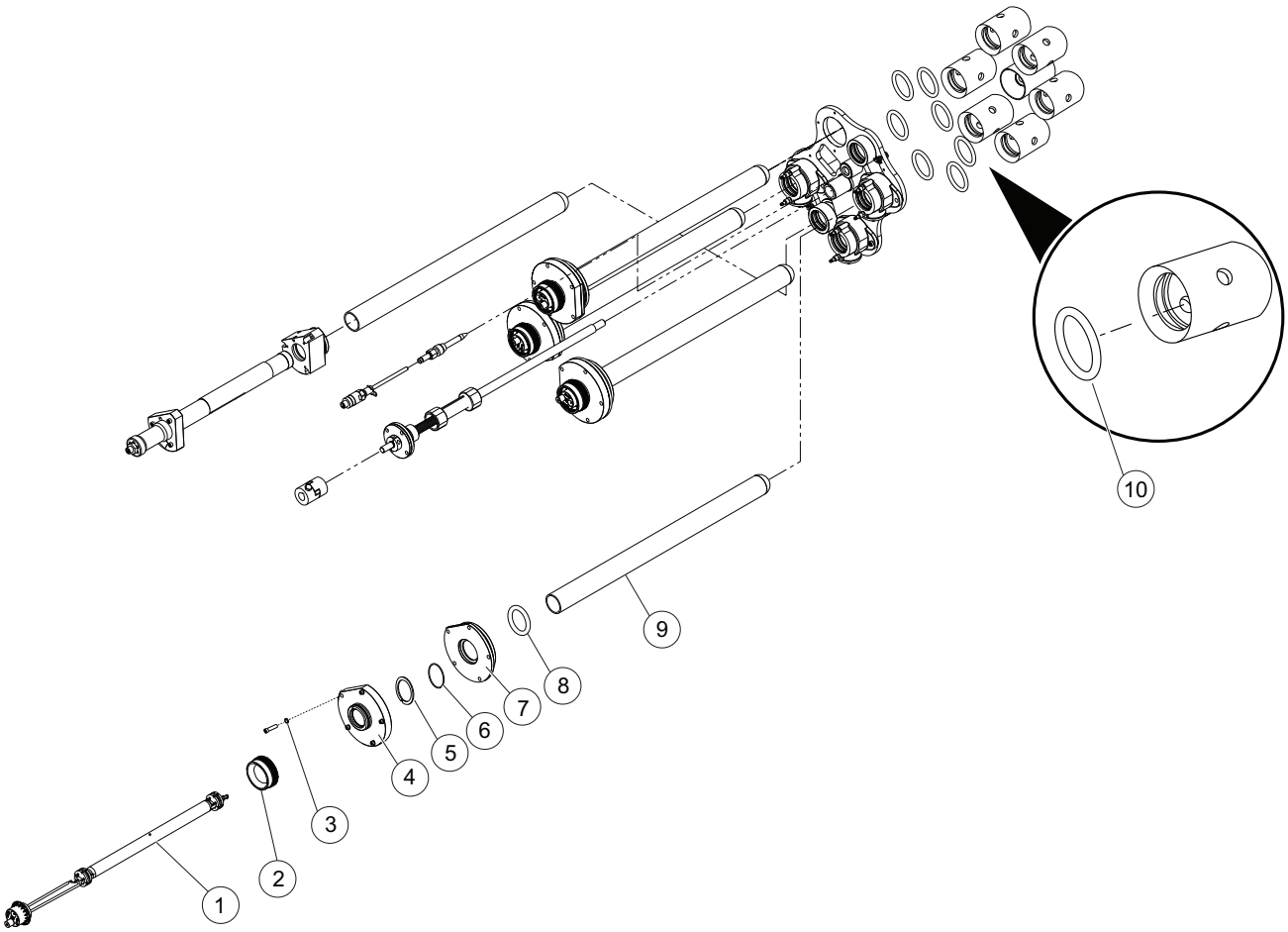


Figure 44 UV Lamp and Lamp Sleeve

Item	Description	Part Number
1	UV Lamp	820856*
2	Lamp Retaining Ring	820371
3	Washer, 1/4 Splitlock 316 SST	010035
4	Gland Plate	820839
5	Washer, Gland Plate	820317
6	Lamp Sleeve O-ring	002190-325F
7	Inner Gland (Access Port) Plate	820840
8	Gland Plate O-ring	002190-240F
9	Lamp Sleeve	820821-558
10	Sleeve Holder O-ring	002189

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

12.2 UV Sensor

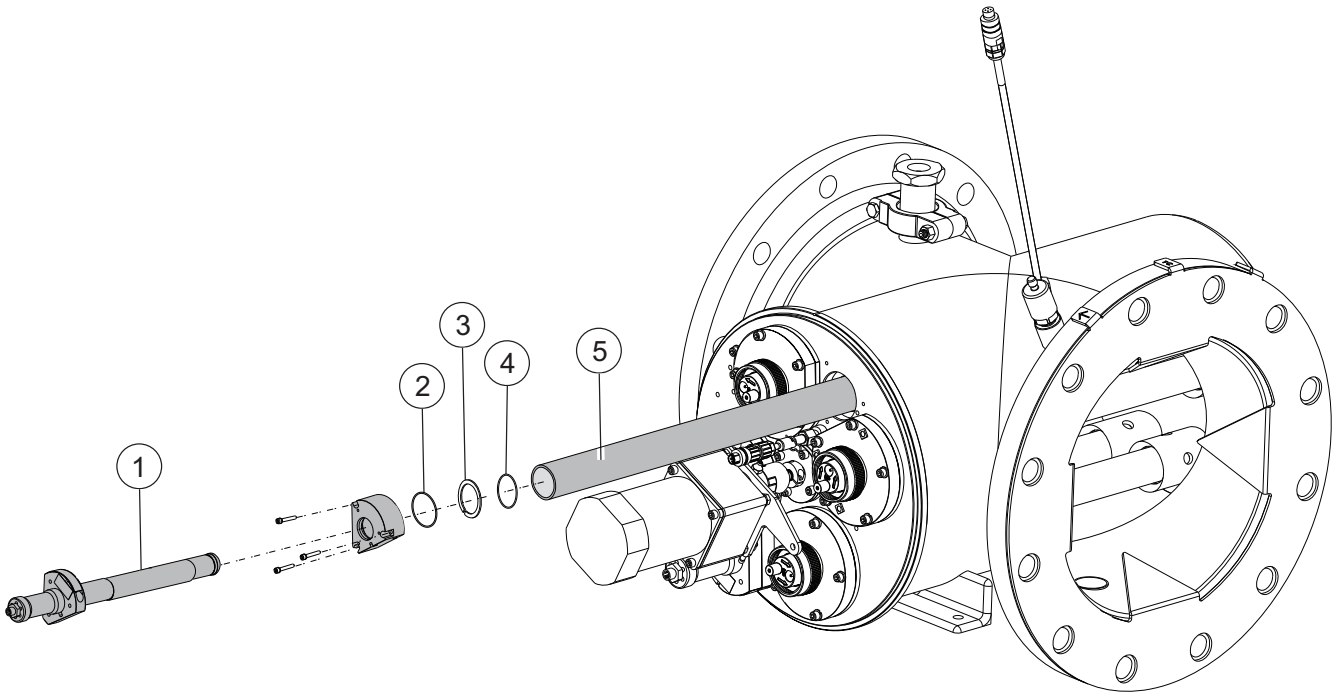


Figure 45 UV Sensor

Item	Description	Part Number
1	UV Sensor	
	Single	015362–S1–798S
	Double	015362–S2–798S
	Reference Sensor Kit	
	Single	015366-R1-798S
	Double	015366-R2-798S
2	O-Ring, 2 x 1/16	002190-033FT
3	Washer, Gland Plate	820317
4	Sleeve O-ring	002190-325F
5	UV Sensor sleeve	820821-558

12.3 ActiClean Cleaning System (ACS)

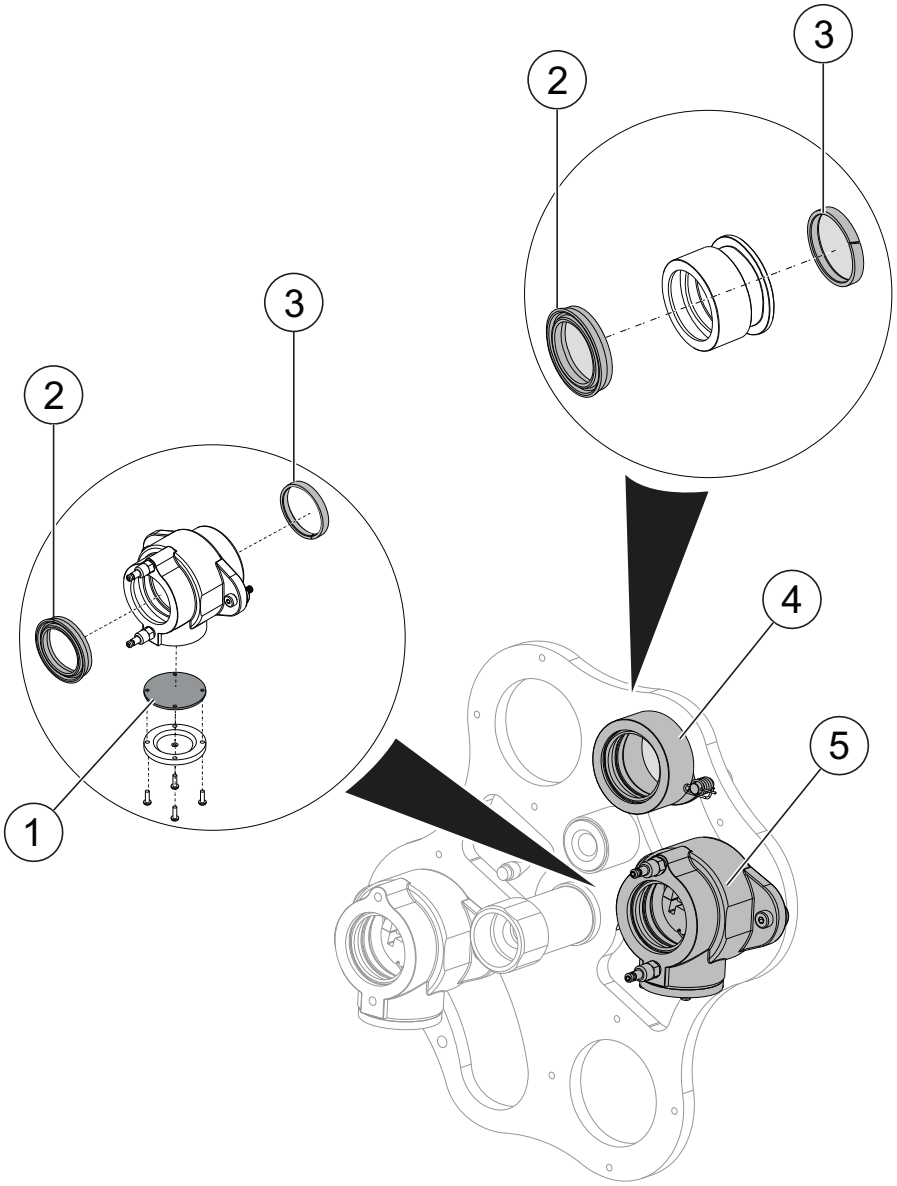


Figure 46 Wiper Collar

Item	Description	Part Number
1	Wiper Diaphragm	820028
2	Wiper Seal	820679
3	Wiper Bearing	820027
4	Sensor Wiper Maintenance Kit (includes seals, bearings etc.)	820896-857SC
5	Lamp Wiper Maintenance Kit (includes mounting hardware, seals, bearings etc.)	820896-857WC

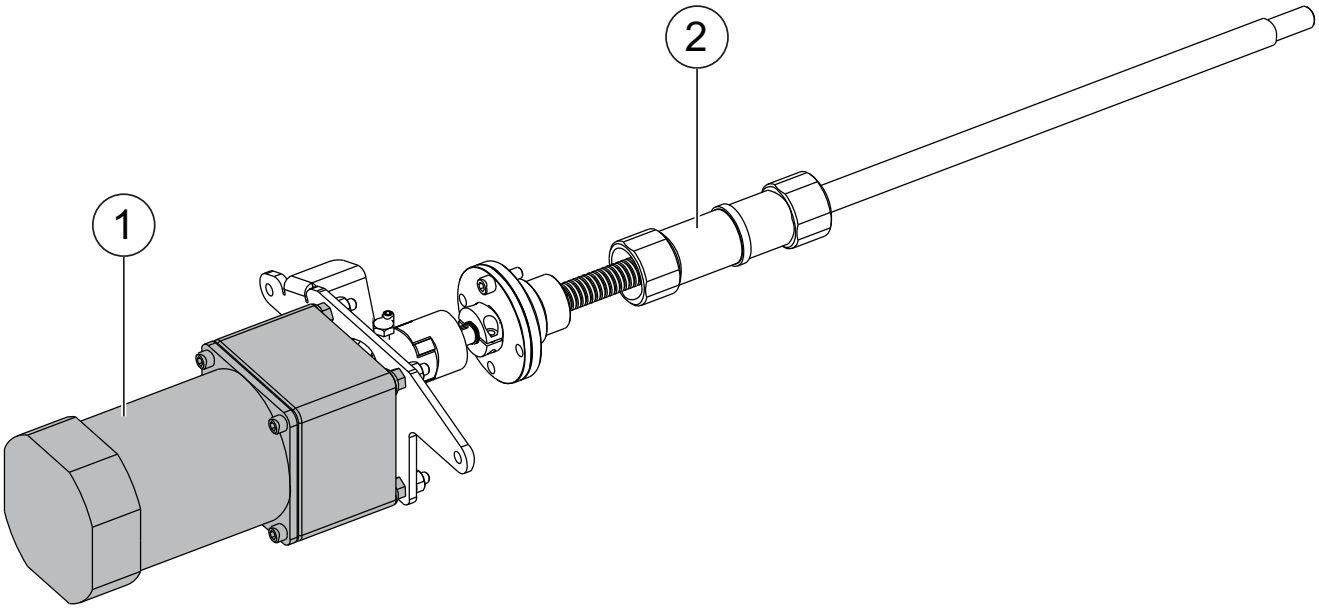


Figure 47 Wiper Drive Assembly

Item	Description	Part Number
	Wiper Motor	
1	60 Hz	820394-001
	50 Hz	820394-002
2	Drive Screw Assembly	821106

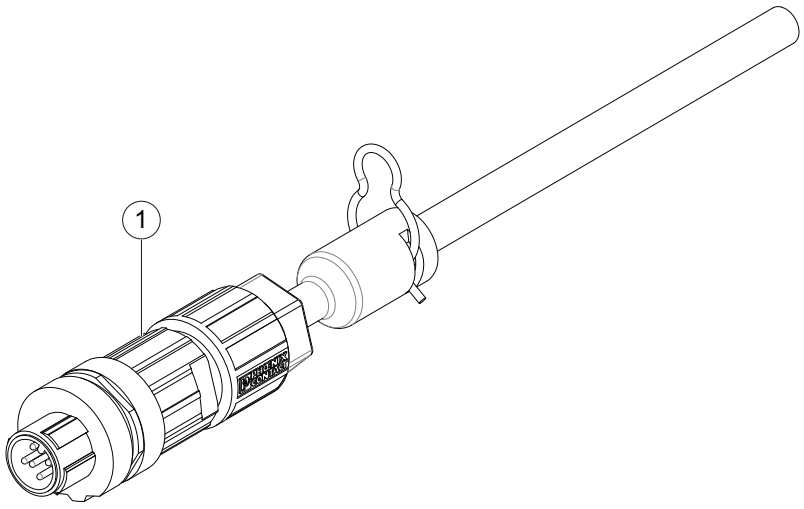


Figure 48 Reed Assembly

Item	Description	Part Number
1	Reed Switch Assembly	820552-124

12.4 UV Chamber

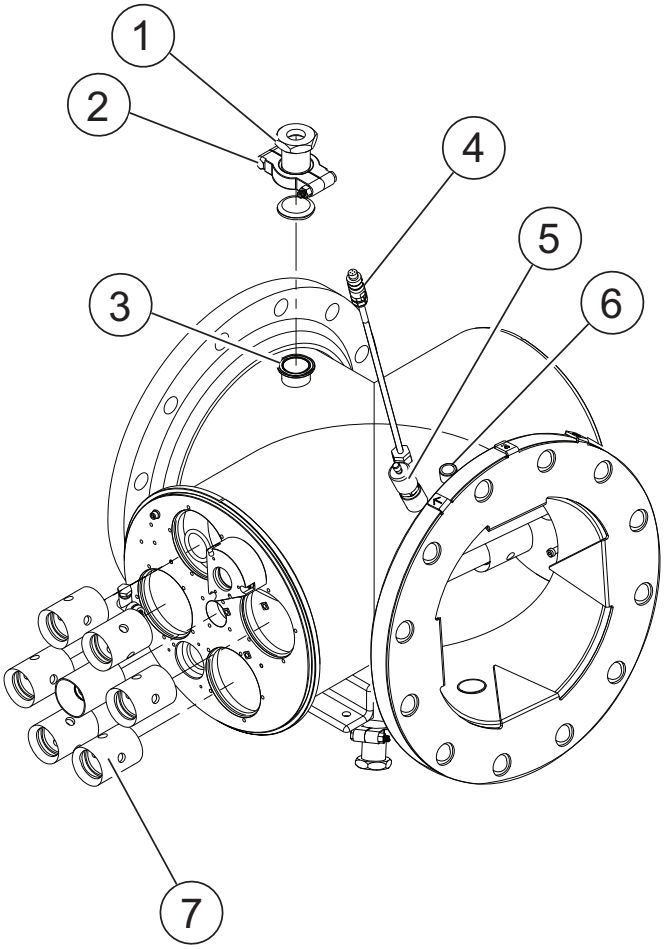


Figure 49 UV Chamber

Item	Description	Part Number
1	Adapter, Sanitary 1-1/2 x FNPT 3/4 1-1/2 x FNPT 1-1/2	 907544-24F12 907544-24F24
2	Sanitary Clamp 1.5 inch	013213-150
3	Gasket, 1-1/2	002285-015
4	Temperature Switch	820691-650
5	Level Sensor	915737
6	Pressure Relief Kit	798036
7	Lamp Sleeve Support	820377

12.5 Control Power Panel

Item	Description	Part Number
1	Lamp Driver Electronic	915109
2	CPP Fan Filter	916850-3182100

12.6 Miscellaneous

Item	Description	Part Number
1	Operator Kit	906015-320
	Face Shield	906002
2	Pump Assembly, ActiClean Gel	821176
3	Hose Assembly, Wiper Fill	821175
4	ActiClean Gel 1 Liter	820108
5	Limit Switch, End Cap	793590

INSTRUCTION

PRODUCT LINE:	TROJANUVSWIFT™ (Type xL12) TROJANUVSWIFT™ (Type xL24) TROJANUVSWIFT™ (Type xL30) TROJANUVSWIFT™ ECT (Type xL24) TROJANUVSWIFT™ ECT (Type xL30)	**INSTRUCTION NUMBER:**	DC180601-001 DC190601-001 DC200601-001 DC210601-001 DC220601-001
TOPIC:	INSTRUCTION, WATER LEVEL SENSOR SERVICE KIT BSP	**EDITION/REVISION:**	01-02

1. OVERVIEW

This service kit is designed to increase the accuracy of sensing the water level in the UV chamber as well as relieving a small amount of air. The kit contains an adapter, fittings, and automatic air vent to allow this new level sensor to be adapted to existing UV chambers in the field.

The stainless steel adapter block allows the new IFM LMT-100 water level sensor to be added to existing UV chambers with a ½" BSP coupling on the UV chamber. To ensure water level travels up to the new sensor, an auto air vent is installed in the adapter block to allow air to escape. This air vent also allows air to enter the UV chamber if the water level of the UV chamber drops, providing indication of low level. When the UV chamber is full, the sensor's orange LED will be ON. When the water level in the UV chamber drops, the sensor will indicate low level and the LED will turn OFF.

2. SAFETY PRECAUTIONS

⚠ DANGER

Arc Flash and Shock Hazard - Live Electrical Circuit Present. Hazardous Voltage.

- Failure to follow these instructions will result in electrical shock, injury or death from electrocution.
- Devices inside this equipment contain stored energy.
- NEVER work inside this equipment until at least 5 (five) minutes after disconnecting main power to allow stored energy to dissipate.
- Lockout tag out all sources of power before performing any inspection, repair, or maintenance. ***There may be more than one source of power!***

⚠ DANGER

Pressurized Device. Fluid Injection Hazard.

- Failure to depressurize hydraulic circuit before servicing will result in serious injury or death due to high pressure hydraulic fluid.
- Release hydraulic pressure before servicing.
- NEVER physically inspect, repair, or do maintenance unless hydraulic circuit has been depressurized by competent personnel.
- Protect hands, face, and body before disconnecting hydraulic or other lines.
- If accidental skin injection occurs, seek immediate medical attention.

⚠ CAUTION

Burn Hazard.

- Failure to follow these instructions may result in minor or moderate injury due to burns.
- NEVER touch hot surface.

NOTICE

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

3. ADAPTER BLOCK AND ¼" NPT SWIVEL INSTALLATION

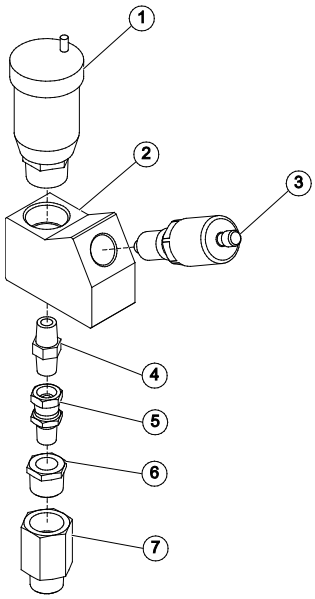


Figure 1: TrojanUVSwift Water Level Sensor Service Kit BSP

ITEM	DESCRIPTION	PART NO.
1	VENT, AUTOMATIC 150 PSI	901908
2	ADAPTER, WATER LEVEL SENSOR WITH AUTO VENT	900017
3	LEVEL SENSOR	915737
4	NIPPLE, HEX 1/4" NPT STAINLESS STEEL	907553
5	ADAPTER, SWIVEL 1/4 NPT STAINLESS STEEL	907735
6	BUSHING, NPT 1/4" X 1/2" 316 STAINLESS STEEL	013319G
7	ADAPTER 1/2" X 1/2" 316 STAINLESS STEEL	013350G
-	TEFLON TAPE	-
-	IFM LMT-100 LEVEL SENSOR WITH OPERATING INSTRUCTIONS	-
-	EA79 AUTO AIR VENT WITH OPERATING INSTRUCTIONS	-

INSTRUCTION

***Notes**:*

Adapter block, air vent, water level sensor, and nipple fitting come pre-assembled as one unit and the swivel fitting, bushing, and adapter as another unit.

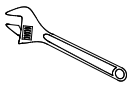
The automatic air vent supplied with this kit does not replace any air vent already equipped on the UV chamber. The adapter assembly requires a dedicated auto air vent to function properly. If you have an air vent already installed on the UV chamber, leave it in place.

* Procedure described is for 1 (one) UV chamber.

3.1 PREREQUISITES

- Shut down the UV system. Refer to the Operation and Maintenance manual.
- Drain and depressurize the UV chamber. Refer to the Operation and Maintenance manual.
- Apply lockout tag out devices as necessary. Refer to the Operation and Maintenance manual.

3.2 TOOLS NEEDED

- 1/8”, 5/8” (2), and adjustable wrenches 

3.3 MATERIALS NEEDED

- Safety glasses 
- Safety boots 
- Gloves 

3.4 PROCEDURE

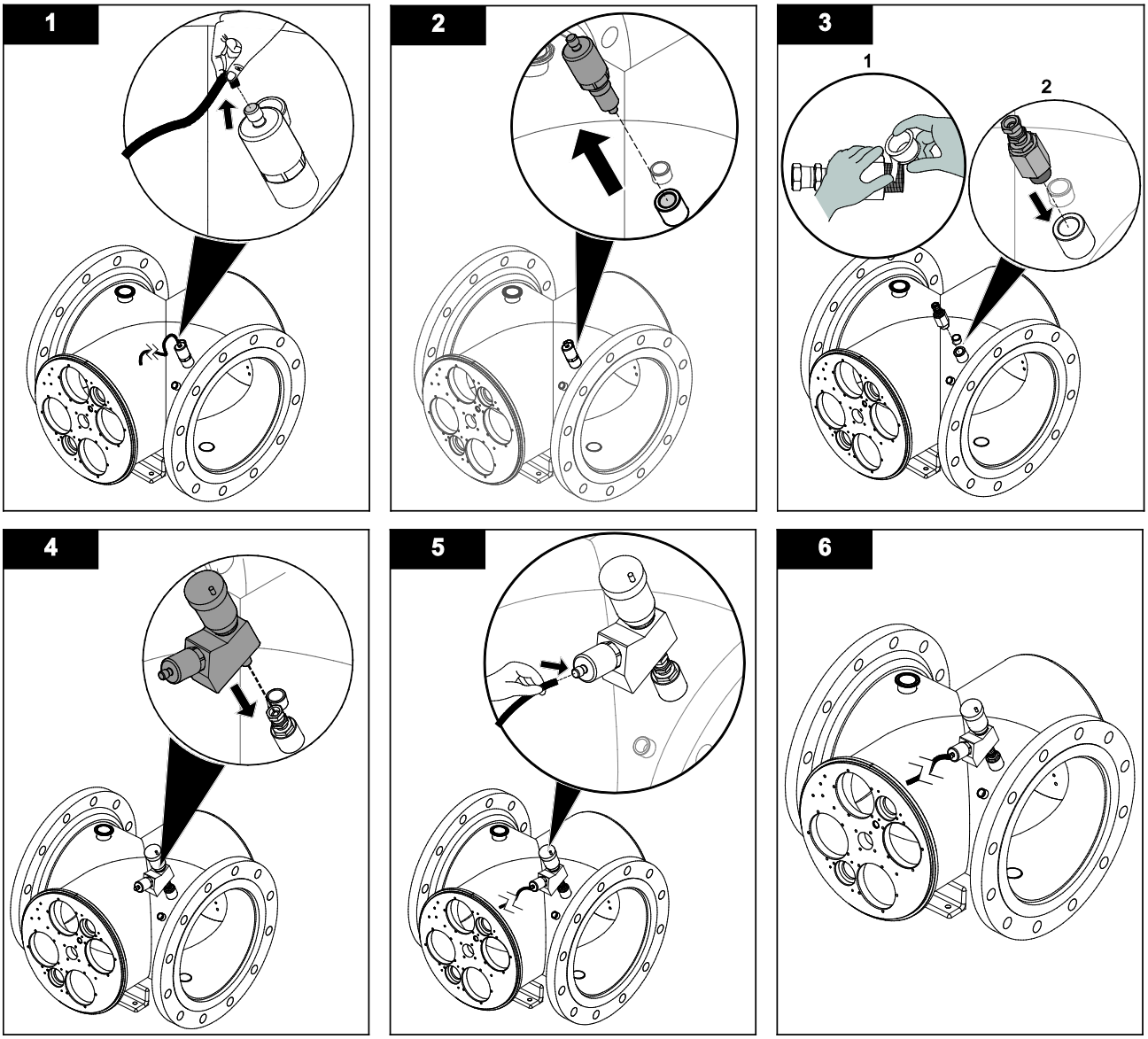
1. Disconnect the sensor wire from old water level sensor.
2. Remove old water level sensor from ½” BSP coupling on UV chamber.
3. Install ¼” NPT swivel fitting, ¼” NPT bushing, and ½” BSP Adapter into ½” BSP coupling where old water level sensor was removed.

   ***Note:** Ensure Teflon tape is applied.*
4. Install new water level sensor adapter block assembly into the ¼” NPT swivel on UV chamber. Position the adapter block so it does not interfere with any component, and fully tighten the swivel.

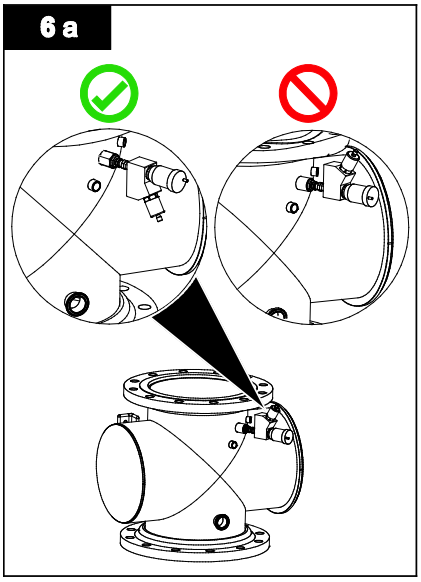
   ***Note:** On vertical UV chamber installations, ensure that the water level sensor is pointing down. Refer to illustration 6 a.*
5. Ensure all connections are tight and connect the sensor wire to the new water level sensor.
6. Set up the auto air vent by turning the body to the open position. Refer to the auto air vent manufacturer’s instructions for additional information.
7. Remove lockout tag out.

INSTRUCTION

8. Refill system and check for leaks. Listen to the auto air vent to ensure air is being removed. The LED light (located by the sensor wire connection) on the new level sensor should glow when level is correct. If the light does not glow, loosen the red cap on the auto air vent and test fill system again. Refer to the auto air vent manufacturer's instructions for additional information.
9. Start the UV chamber as per normal operating procedures when no leaks are present, and it is safe to start the UV chamber.



INSTRUCTION



4. ASSISTANCE/SUGGESTIONS

If you require technical assistance, please contact your local representative. If you require additional assistance, please contact the Technical Assistance Center (TAC) using the contact information below:

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

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INSTRUCTION

PRODUCT LINE:	TROJANUVSWIFT® xL12	**DOCUMENT NUMBER:**	DC180601-002
TOPIC:	INSTRUCTION, REFERENCE SENSOR PROCEDURE (GENERATION 2)	**EDITION/REVISION:**	02-04

1. OVERVIEW

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

Note: *The UV Reactor is referred to as a UV Chamber.*

The Reference Sensor is used to provide comparative values over time to demonstrate continued good (satisfactory) operation of the service sensor. The Reference Sensor is designed to be mounted into the same sensor port and sensor sleeve as the service UV Sensor.

The Reference Sensor uses the same type of material and is identical in calibration to the installed UV Sensor. The Reference Sensor is provided with its own protective case and is to be stored in a dry, warm, and clean environment.

The basic procedure steps are:

- Operator Login
- Control Mode set to 'Local'.
- System set to 'Manual' mode and Power to 100%
- Perform the Reference Sensor Procedure
- Reset UV Sensor counters to zero
- Set the System mode to 'Auto'
- For each UV Sensor, calculate its Calibration Ratio and record its status (PASS/FAIL) in the Reference Sensor Procedure Data Sheet.

2. SAFETY PRECAUTIONS

⚠ DANGER

Pressurized Device - Impalement Hazard.

- Failure to follow these instructions will result in serious injury or death due to forcible ejection of materials from UV chamber.
- ALWAYS follow lockout tag out procedures, as required by ***Operation and Maintenance Manual***.
- NEVER perform any physical inspection, repair, maintenance or service on UV chamber unless UV chamber has been isolated, depressurized and open to atmosphere. Where UV chambers are interconnected in series and vertically stacked, only the top UV chamber must be open to atmosphere.

  Exception: Performing Reference Sensor check in compliance with "Install or Remove a Reference Sensor" in Operation and Maintenance Manual.
- NEVER pressurize UV chamber without service end cap properly installed.
- NEVER stand in front of UV lamp section while UV chamber is undergoing a hydrostatic pressure test. Stand to the side of the UV chamber while looking for leaks.
- ***If a leak is observed, depressurize immediately, drain, repair and retest.***

⚠ CAUTION

UV Light Hazard.

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

NOTICE

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

***Note**: Dispose of contaminated parts/components as per country requirements.*

3. MATERIALS

	Desiccant Bag

- UVI Reference Sensor
- Kimwipes® (by others)
- Alcohol wipes (by others)

4. PROCEDURE

The Sensor Overview screen is accessible through the Lamp Overview screen on the CPP.

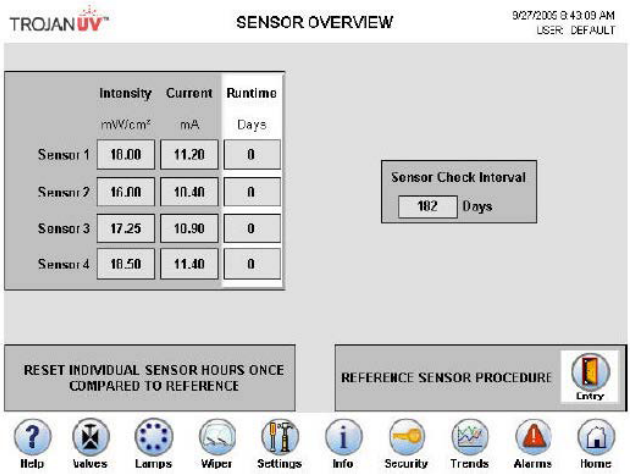

Figure 1 Sensor Overview Screen

1. Thoroughly clean the Reference Sensor with isopropyl alcohol and Kimwipes® if the quartz surface is contaminated.
2. Record the UV Chamber ID.
3. Set the Manual Power (%) to “100” at the UV Reactor Overview screen. Select the “Log In” button from the Toolbar.
4. You will be prompted to enter a password and then press “OK”.
5. Select the Settings button at the bottom of the screen, the Operator Settings screen should be displayed.
6. From the “CONTROL” tab, set
   a. System Control Mode to “Manual Reactor”
   b. Local / Remote Control to “Local”

7. At the “Sensor Overview” screen, select the “Reference Sensor Procedure ENTRY” button. At the “Ref Sensor Introduction” screen, select the “Help” button to display the “General Information” and “Equipment Required” help buttons. Refer to Figure 2. Read both screens to prepare for the procedure. Press “Return” to return to the “Ref Sensor Introduction” screen and press “PROCEED” when ready.

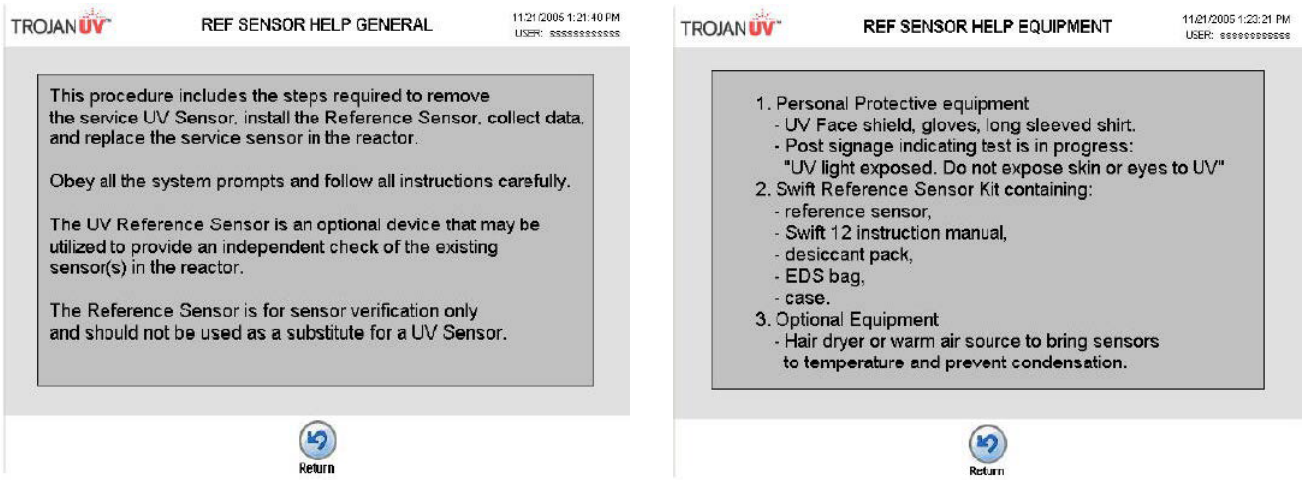

Figure 2 Reference Sensor Help General and Equipment Screen

8. Note the highlighted “Actual” conditions. The “Expected” conditions must be set before entry into the Reference Sensor procedure. “Actual” conditions must be the same as the “Expected” conditions to enter into the Reference Sensor procedure mode. Select “Exit” and proceed to correct the condition and return to beginning of the procedure.

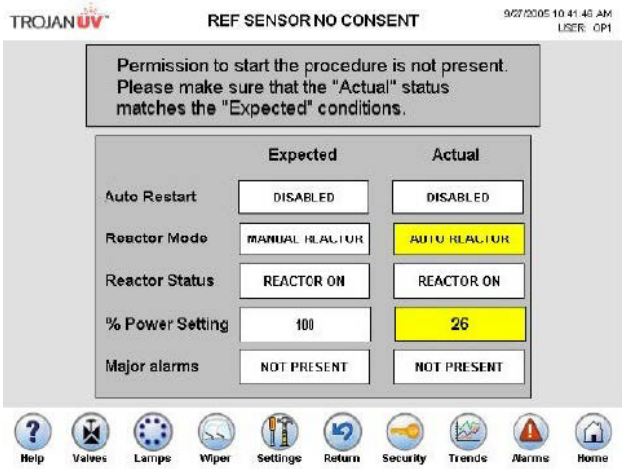

Figure 3 Reference Sensor No Consent Screen

If all consent conditions are met, the following screen will be displayed.

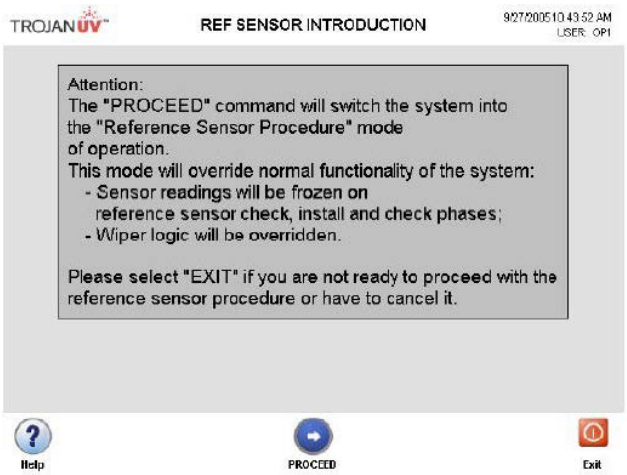

Figure 4 : Reference Sensor Introduction Screen

9. An alarm will display as “Reference Sensor Procedure Activated”. Select the “X” button.

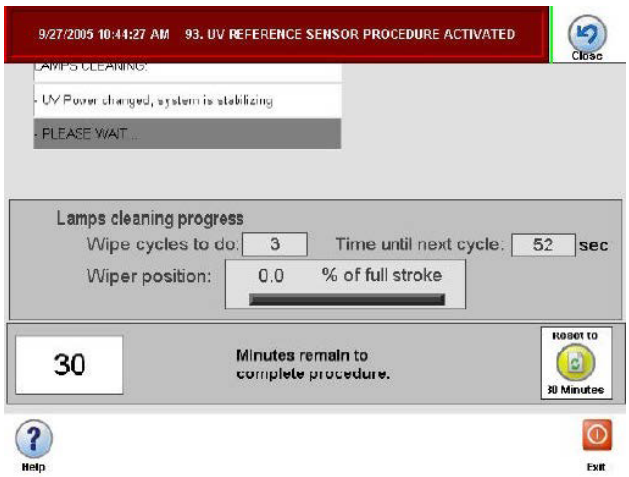

Figure 5 Reference Sensor Activated Screen

10. If a wiping system is present, the Wiper will perform three wipe cycles. The following screen will display.

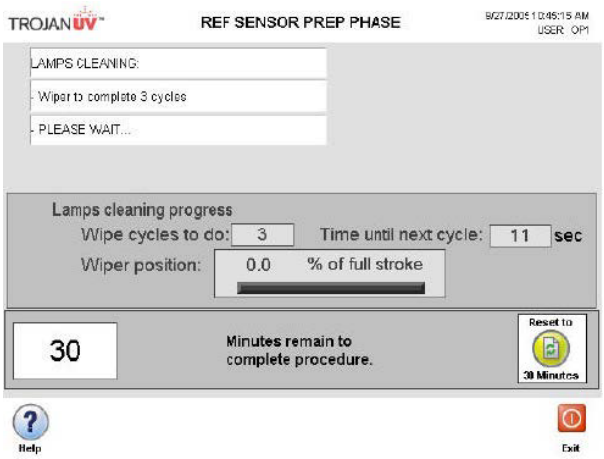

Figure 6 Reference Sensor Preparation Phase Screen

11. The sensor saturation check is performed. The “Sensor saturation cut-off level” can be set to either 18 or 19 mA by pressing the “Change” button (The recommended cut-off level is 18 mA to ensure optimal test conditions). During this step the system checks to ensure the sensor mA output signals are less than the cut-off level selected. Record the Sensor Saturation cut-off level selected, on the Reference Sensor Data Sheet.

Note: *If the “Dose Actual” value drops below the dose target value after power level changes have been made, the following screen will be displayed. Press “Exit”. The reset timer is disabled and the system power is automatically increased to 100% to achieve dose. If “Exit” is not pressed, the procedure will automatically exit after 2 minutes. If reducing the power level to the lowest setting does not correct the “sensor saturation condition”, the following screen will be displayed. Press “Exit”.*

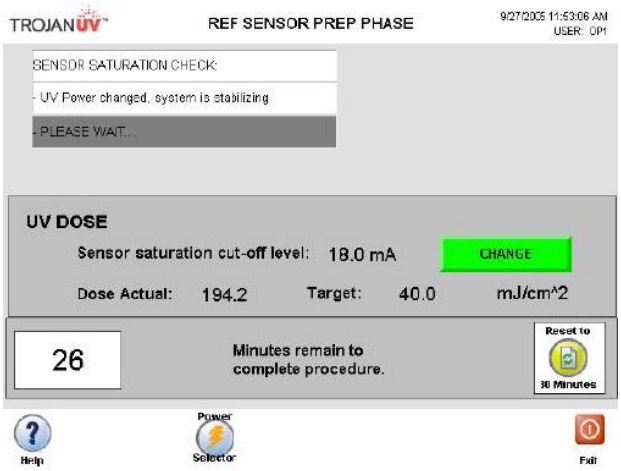

Figure 7 Reference Sensor Preparation Phase Screen

12. If sensor saturation is detected, the following prompt will be displayed. Press the “Reduce Power” button. Allow time between power level adjustments. Repeat until the condition is cleared. The following screen can be toggled between the “UV Dose” display (refer Figure 8) and the “Reactor Power Level Control” by pressing “Dose Display” on the bottom center of the following screen. At the following prompt press “Next”.

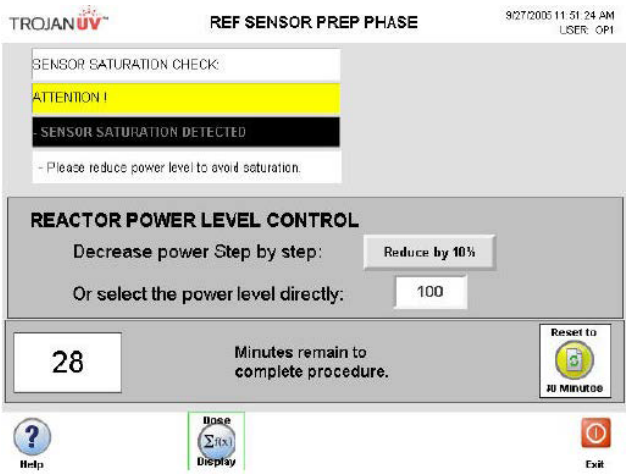

Figure 8 Reference Sensor Preparation Phase Screen

13. When the following screen is displayed, remove the Outer Service End Cap to expose the sensor ports. At the UV Chamber, disconnect one of the system sensor plugs from its sensor harness receptacle. Do not remove the sensor from the UV Chamber. Return to the CPP. Do not disconnect more than one sensor harness at a time.

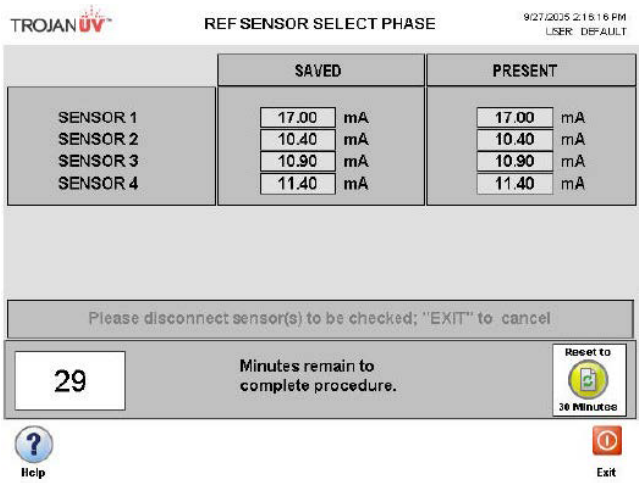

Figure 9 Reference Sensor Select Phase Screen

14. The disconnected sensor will be highlighted as displayed on the following screen. Select the “Next” button.

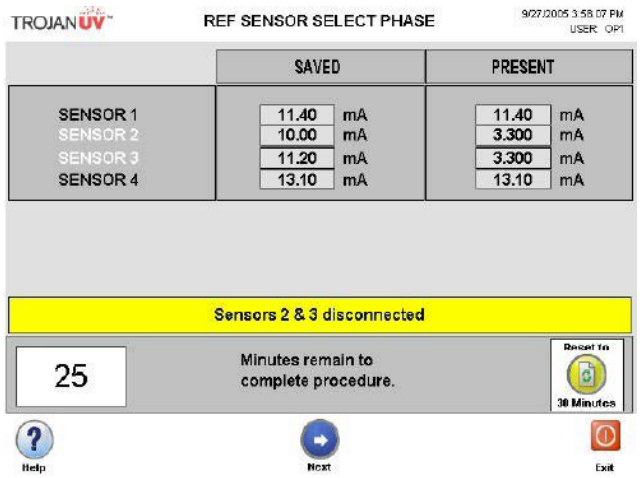

Figure 10 Reference Sensor Select Phase Screen

15. Record highlighted Sensor ID on the Reference Sensor Data Sheet. If a double sensor is disconnected, two sensors will be highlighted. Record each number on a separate line.

a. Record the 12 digit serial number of the disconnected sensor in the Reference Sensor Data Sheet. If the disconnected sensor is a double sensor, record the serial number for each sensor listed.

Note: *4L12 uses double sensors.*

b. Record the Reference Sensor serial number in the appropriate column of the Reference Sensor Data Sheet.

Note: *The Reference Sensor procedure completion time is set to 30 minutes. This can be reset at any time during the procedure by pressing “Reset to 30 Minutes”.*

16. Remove the service UV Sensor. Refer to the Operation and Maintenance Manual.

Note: *Place in a clean, dry, and warm environment, such as the Reference Sensor's protective case.*

17. Insert the Reference Sensor into the UV Chamber. Tighten the three screws and connect the Reference Sensor plug to the UV Chamber harness. Ensure that the Reference Sensor being inserted has the correct configuration with one 2L12 or two 4L12 sensors.

18. Select the “INSTALLED” button and at the prompt, wait 30 seconds.

    Note: *If the Reference Sensor plug is not connected properly to the sensor harness receptacle, the following screen will not appear, check the cable connection again to ensure it is tight.*

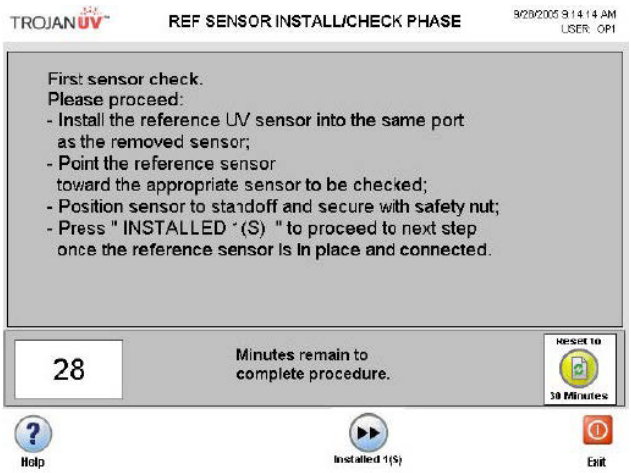

Figure 11 Reference Sensor Install / Check Phase Screen

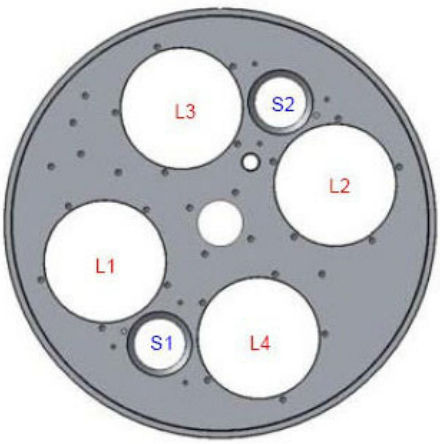

Figure 12 4L12 UV Lamp and Sensor Configuration Screen

Note: *Horizontal UV Chamber orientation is shown with left to right flow. For other UV Chamber orientations and flow directions, rotate the lamp / sensor pattern shown in Figure 58 until L1 is located at the inlet position.*

19. Record the “Saved” value for each sensor in the Duty Sensor Reading Column of the Reference Sensor Data Sheet. Record the displayed “Present” value for each sensor under test in the Reference Sensor Reading column of the Reference Sensor Data Sheet.

20. Return to the UV Chamber and disconnect the Reference Sensor plug from the sensor harness receptacle. Remove the Reference Sensor from the UV Chamber. Place in a clean, dry, warm environment, such as the Reference Sensor's protective case. Insert the Duty Sensor into the UV Chamber.

21. Connect the system sensor plug to the UV Chamber harness receptacle. Return to the CPP. Select “Next” to continue.

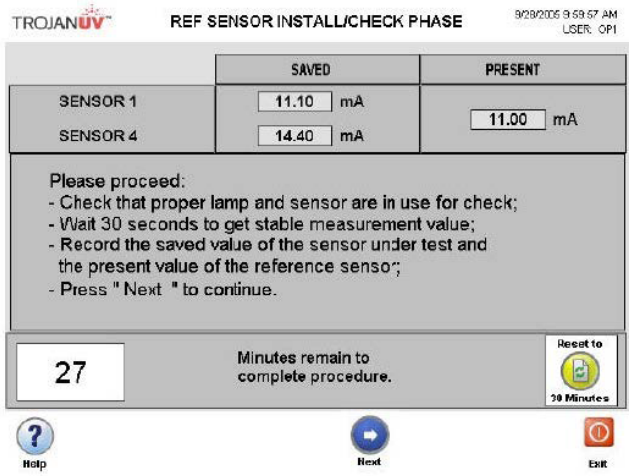

Figure 13 Reference Sensor Install / Check Phase Screen

22. For the sensors tested, complete the Calibration Ratio calculation column of the Reference Sensor Data Sheet and compare the value obtained to the allowable Calibration Ratio variation between the Reference and Duty sensors.

a. If the calculated Calibration Ratio is less than or equal to 1.2, enter “Pass” in the “Calibration Ratio $\leq$ 1.2" column of the Reference Sensor Data Sheet.

b. If the calculated Calibration Ratio is greater than 1.2, enter “Fail” in the “Calibration Ratio $\leq$ 1.2" column of the Reference Sensor Data Sheet. If all system sensors have been tested, press “Exit”.

c. If further Reference Sensor Tests are required, return to the UV Chamber and disconnect another UV Sensor from the UV Chamber. Return to the CPP. Repeat steps 13 to 22 for all system sensors.

23. Ensure all system sensors are assembled correctly within the UV Chamber and connected properly to their respective UV Chamber harness. Replace the UV Chamber cover and secure in place. Press “Done” when ready.

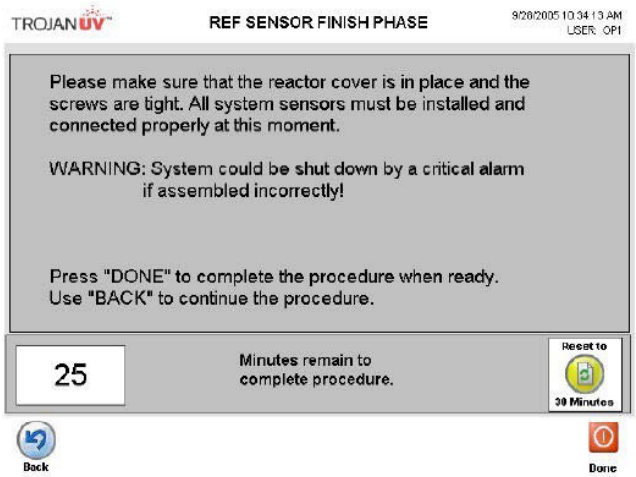

Figure 14 Reference Sensor Finish Phase Screen

24. Exiting from the Reference Sensor procedure returns to the UV Reactor Overview screen. From the UV Reactor Overview screen, select “Sensors”. If required, enter password and press “OK”.

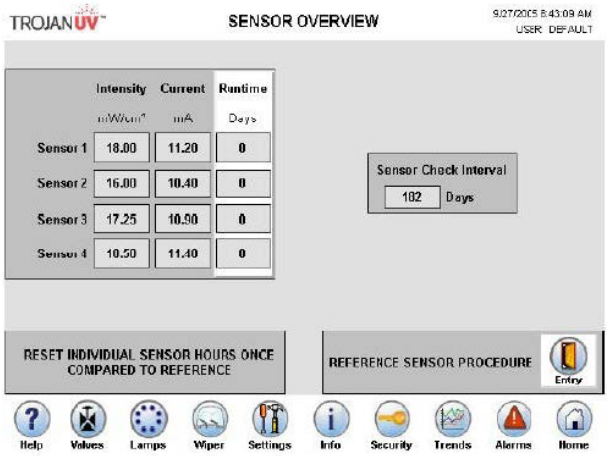

Figure 15 Reference Sensor Overview Screen

25. Reset the Reference Sensor Weeks Counters by pressing the Runtime Days value and then pressing “Reset” for each of the sensors tested.

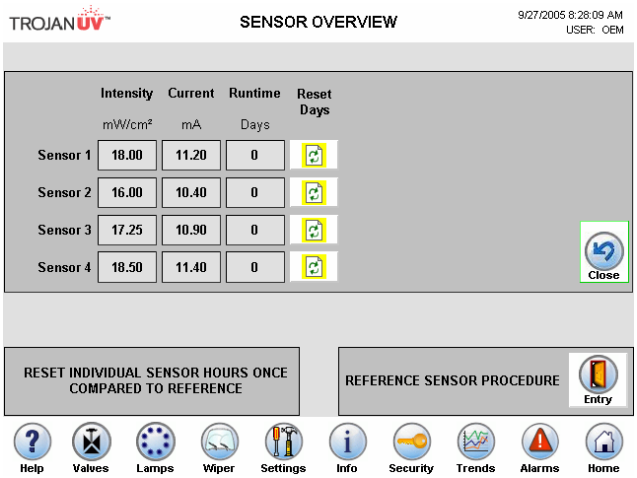

Figure 16 Sensor Operator Set Screen

26. Set the system control back to previous operating mode.

TrojanUV Reference Sensor Procedure Data Sheet

Based on the 2006 'EPA Disinfection Guidance Manual for the Final LT2ESWTR'.

TROJAN UV WATER CONFIDENCE™

Date: _____

Site: _____ **Operator:** _____

%UVT: _____ **Sensor Saturation Cut-Off Level:** _____ **mA**

Reactor ID	Sensor ID	Duty Sensor Serial No.	Reference Sensor Serial No.	Duty Sensor Reading (A) (mA)	Reference Sensor Reading (B) (mA)	Calibration Ratio (A – 4) / (B – 4)	Calibration Ratio ≤ 1.2 (Yes/No[1])

Note 1: [Extracted from 2006 EPA Guideline] If calibration ratio is greater than 1.2, verify that the reference UV sensor is accurate with a different reference UV sensor (i.e. verify that the duty UV sensor truly failed the calibration check) by inserting a second reference UV sensor and repeating the reference procedure. If a second reference UV sensor is unavailable, the sensor calibration can be checked against two duty sensors (as opposed to another reference sensor).

5. ASSISTANCE

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

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

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

PART H

CERTIFICATE

Certificate of Registration

QUALITY MANAGEMENT SYSTEM - ISO 9001:2015

This is to certify that:

Trojan Technologies
3020 Gore Road
London
Ontario
N5V 4T7
Canada

Holds Certificate No: **FM 63961**

and operates a Quality Management System which complies with the requirements of ISO 9001:2015 for the following scope:

Research, design, engineering, manufacturing, sales and service of ultraviolet (UV) water treatment solutions for municipal, industrial, light commercial and residential applications.

For and on behalf of BSI:

Carlos Pitanga, Chief Operating Officer Assurance – Americas

Original Registration Date: 1998-03-27
Latest Revision Date: 2021-07-06

Effective Date: 2021-07-11
Expiry Date: 2024-07-10

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Certificate of Registration

ENVIRONMENTAL MANAGEMENT SYSTEM - ISO 14001:2015

This is to certify that:

Trojan Technologies Group ULC
3020 Gore Road
London
Ontario
N5V 4T7
Canada

Holds Certificate No: **EMS 633149**

and operates an Environmental Management System which complies with the requirements of ISO 14001:2015 for the following scope:

The environmental management system for the control of risks associated with the engineering and assembly of ultraviolet (UV) light technologies for wastewater, industrial, and drinking water disinfection applications, and for the destruction of pollutants in liquid streams.

For and on behalf of BSI:

Carlos Pitanga, Chief Operating Officer Assurance – Americas

Original Registration Date: 2016-03-08
Effective Date: 2022-03-06
Latest Revision Date: 2022-02-17
Expiry Date: 2025-03-07

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