CITY OF PACIFICA, CALIFORNIA

UV DISINFECTION SYSTEM REPLACEMENT

CLIENT PROJECT NO. P034

APPENDICES
REFERENCE DOCUMENTS

BID SET

VOLUME 5 OF 5

MARCH 2024

CITY OF PACIFICA

UV DISINFECTION SYSTEM REPLACEMENT

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APPENDIX A

EXISTING UV4000PLUS SHOP DRAWINGS

REV	REVISION DESCRIPTION	LOG NO.	REV BY	CHK BY	APPROVAL AND DATE
A	DRAWING RELEASED	--	WJG		

NOTES:

BEFORE ANY HOSE CONNECTIONS ARE TO BE MADE, THE REACTOR MUST BE FILLED WITH COOLANT, AS IT IS SHIPPED EMPTY.

USE HOSE BARB # J ON OUTLET SIDE OF REACTOR AND HOSE BARB # A ON INLET SIDE OF REACTOR AS FILL HOLES.

ONCE REACTOR HAS BEEN FILLED, HOSE CONNECTION CAN BE MADE.

CONNECT CHANNEL INSERT JUMPER J TO J (10 ft required)

CONNECT HSC # A TO CHANNEL INSERT # A (8ft required)
CONNECT HSC # D TO CHANNEL INSERT # D (8ft required)
CONNECT HSC # E TO CHANNEL INSERT # E (8ft required)

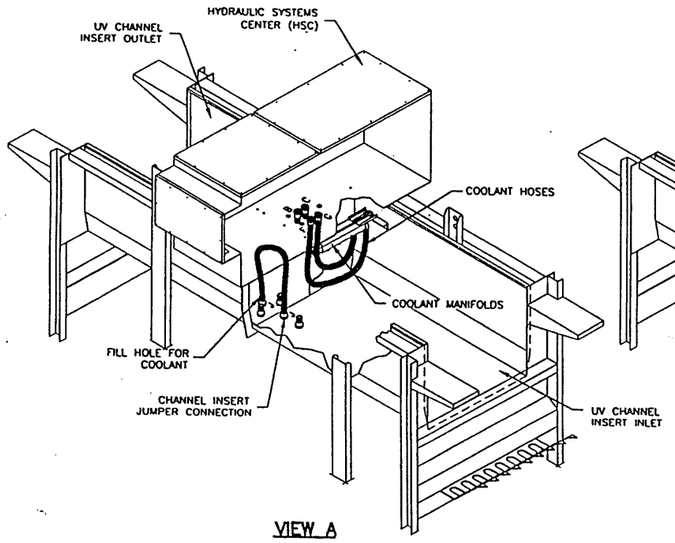
CONNECT HSC # B TO COOLANT SUPPLY MANIFOLD (same side as B: 6ft required)
CONNECT HSC # F TO COOLANT SUPPLY MANIFOLD (same side as F: 6ft required)

CONNECT HSC # C TO COOLANT RETURN MANIFOLD (same side as C: 6ft required)
CONNECT HSC # G TO COOLANT RETURN MANIFOLD (same side as G: 6ft required)

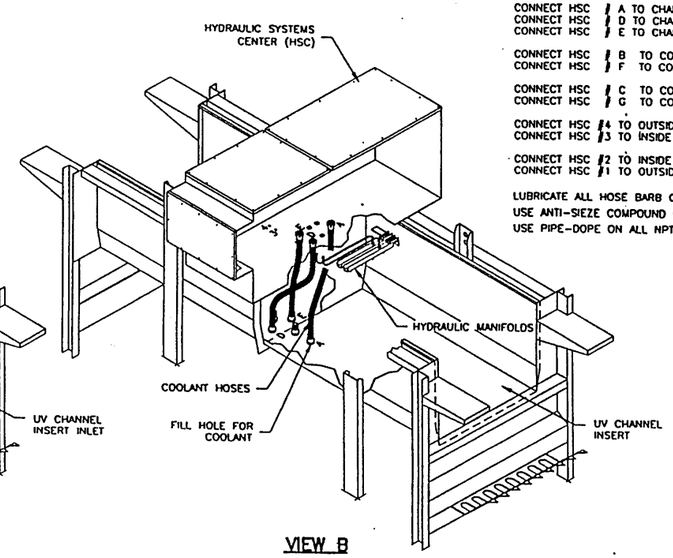
CONNECT HSC #4 TO OUTSIDE HYDRAULIC MANIFOLD (same side)
CONNECT HSC #3 TO INSIDE HYDRAULIC MANIFOLD (same side)

CONNECT HSC #2 TO INSIDE HYDRAULIC MANIFOLD (same side)
CONNECT HSC #1 TO OUTSIDE HYDRAULIC MANIFOLD (same side)

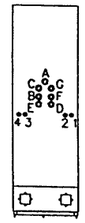
LUBRICATE ALL HOSE BARB CONNECTIONS.
USE ANTI-SIEZE COMPOUND ON ALL 1 1/4" HOSE CLAMP THREADS.
USE PIPE-DOPE ON ALL NPT THREADS.



VIEW A



VIEW B



PLAN VIEW OF HSC

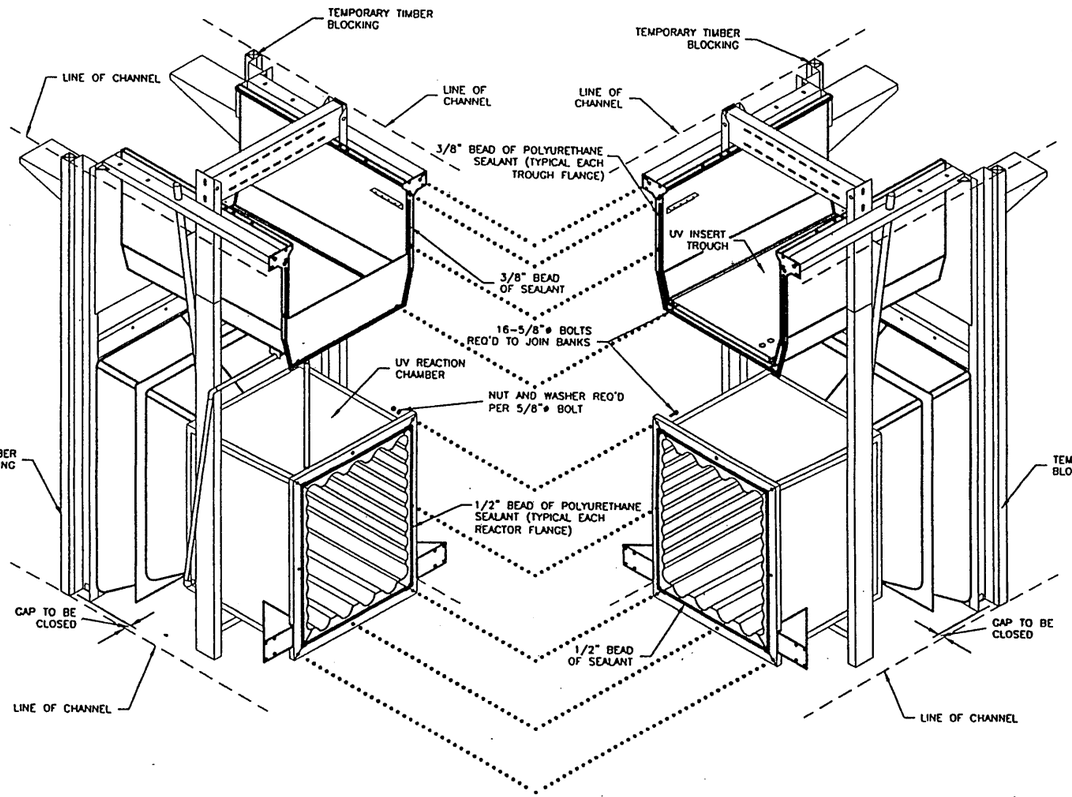
UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
TOLERANCES: 2 PL DEC ± N/A
3 PL DEC ± N/A
ANGLE ± N/A
REMOVE ALL BURRS
ALL CORNERS R 0.010 OR BREAK
▽ DENOTES CRITICAL DIMENSIONS

TROJAN TECHNOLOGIES INC.
LONDON, ONTARIO, CANADA

DESCRIPTION: HSC/CHANNEL INSERT CONNECTIONS

THIRD ANGLE PROJECTION
0 0.5 1.0
1.0" ON ORIGINAL DWG
SCALE: 1:36
PART NO. ------
REV A
SHEET 1 OF 1
SIZE B
DWG NO. 4M00126

REV	REVISION DESCRIPTION	LOG NO.	REV BY	CHK BY	APPROVAL AND DATE
A	DRAWING RELEASED	--	WJG		



NOTES:

1/ TO EACH FLANGE OF THE REACTOR, APPLY A CONTINUOUS 1/2" BEAD OF SEALANT NOT MORE THAN 5/8" FROM INNER EDGE.

2/ TO EACH FLANGE OF THE TROUGH, APPLY A CONTINUOUS 3/8" BEAD OF SEALANT TO THE INSIDE EDGE.

3/ SEALANT TO BE POLYURETHANE (3M #08694) - SEALANT HAS SET UP TIME OF 15-20 MIN.

4/ ONCE SEALANT IS IN PLACE, MOVE THE BANKS TOGETHER SUCH THAT THE FLANGES ARE FLUSH WITHIN ±0.063 INCHES.

5/ THE BANKS ARE UNSTABLE UNLESS JOINED TOGHTHER WHEN IN UPRIGHT POSITION.

6/ USE TEMPORARY TIMBERS TO CLOSE GAPS BETWEEN CONCRETE CHANNEL WALL AND OF THE REACTION CHAMBER. (TIMBERS TO REMOVED AFTER CONCRETE HAS BEEN POURED)

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
TOLERANCES: 2 PL DEC ± N/A
3 PL DEC ± N/A
ANGLE ± N/A
REMOVE ALL BURRS
ALL CORNERS R 0.010 OR BREAK
▽ DENOTES CRITICAL DIMENSIONS

TROJAN TECHNOLOGIES INC.
LONDON, ONTARIO, CANADA

DESCRIPTION: INSTALLATION REACTOR INSERT

THIRD ANGLE PROJECTION

0 0.5 1.0
1.0" ON ORIGINAL DWG

SCALE: 1:36

PART NO. ------

REV: A

SHEET 1 OF 1

SIZE B

DWG NO. 4M00127

REV	REVISION DESCRIPTION	LOG NO.	REV BY	CHK BY	APPROVAL AND DATE
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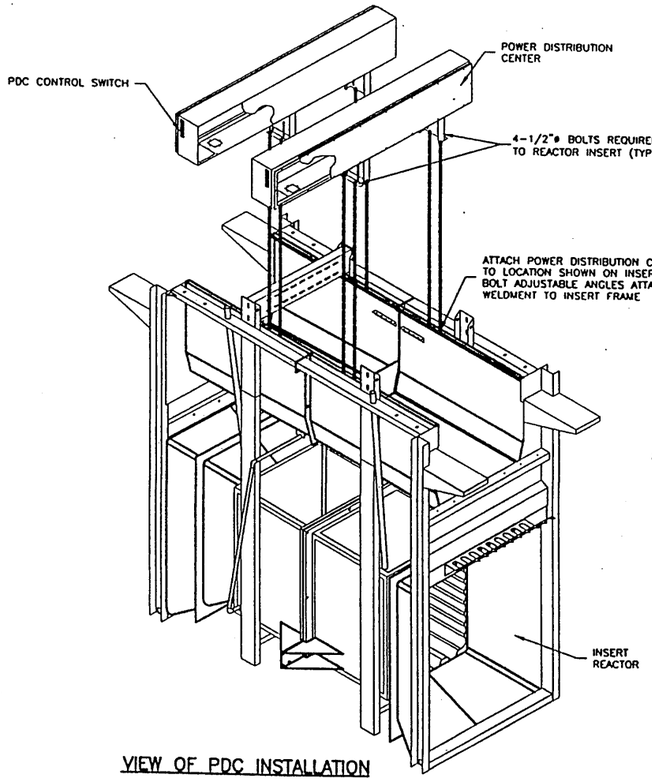


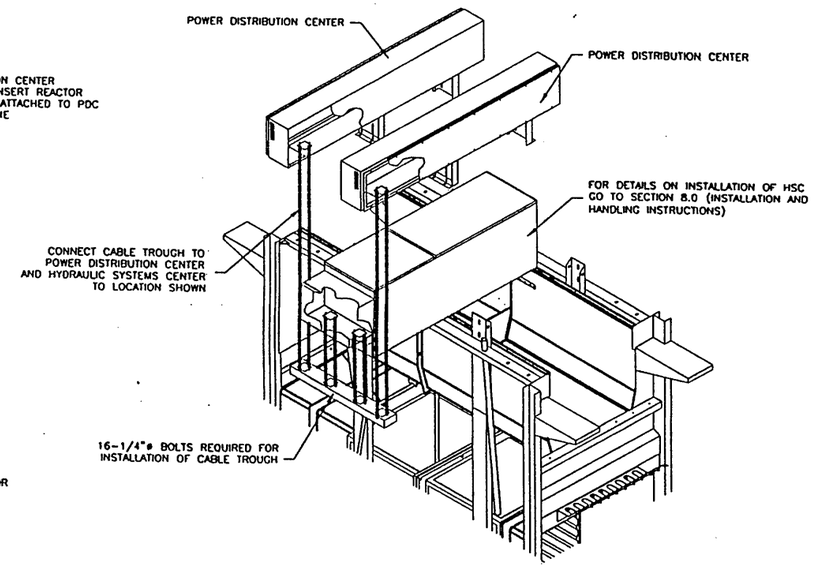
VIEW OF PDC INSTALLATION

NOTES

1/ POSITION POWER DISTRIBUTION CENTERS ON EITHER SIDE OF HSC. ENSURE POWER DISTRIBUTION NAMEPLATES CORROSPOND WITH NAMEPLATES IN INSERT.

2/ ADJUSTABLE ANGLES REQUIRED TO INSTALL POWER DISTRIBUTION CENTER ARE ATTACHED TO PDC WELDMENT BEFORE SHIPPING

3/ BEFORE CABLE TROUGH IS TO BE ATTACHED – POWER DISTRIBUTION CENTER AND HYDRAULIC SYSTEMS CENTER SHOULD BE IN FINAL RESTING POSITION



ASSEMBLY OF CABLE TROUGH TO HSC & PDC

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
TOLERANCES: 2 PL DEC ± N/A
3 PL DEC ± N/A
ANGLE ± N/A
REMOVE ALL BURRS
ALL CORNERS R 0.010 OR BREAK
▽ DENOTES CRITICAL DIMENSIONS

TROJAN TECHNOLOGIES INC.
LONDON, ONTARIO, CANADA

DESCRIPTION: INSTALLATION POWER DISTRIBUTION CENTER

THIRD ANGLE PROJECTION

0 0.5 1.0
1.0" ON ORIGINAL DWG

SCALE: 1:48

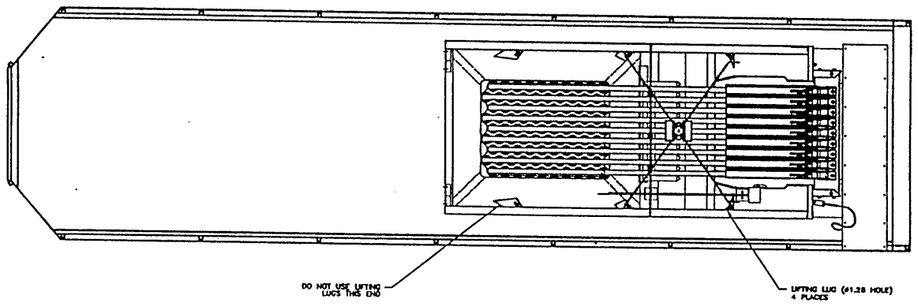
PART NO. ------

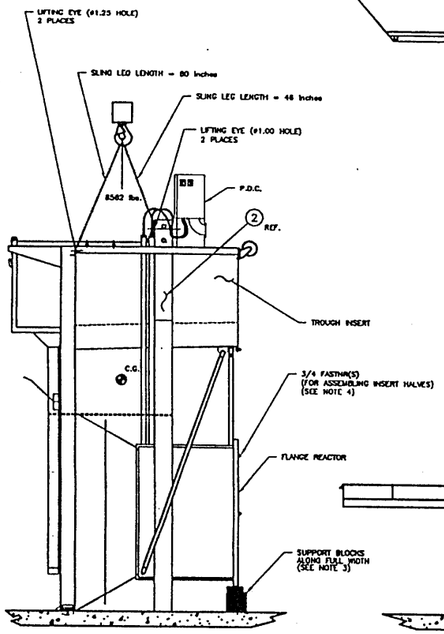
REV A

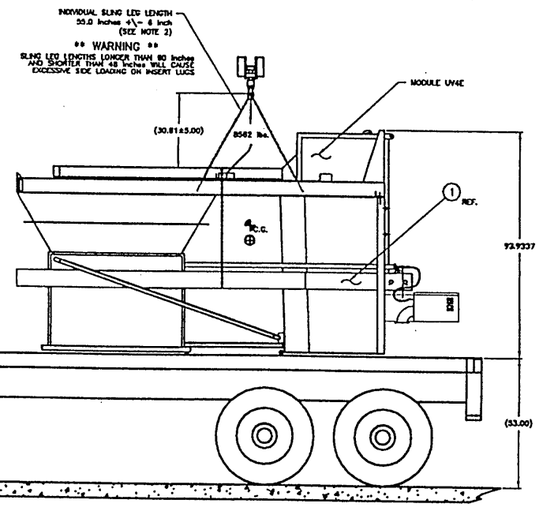
SHEET 1 OF 1

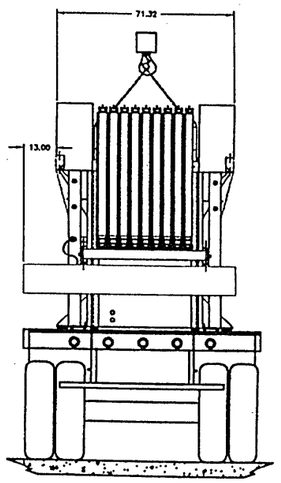
SIZE B

DWG NO. 4M00128









4M0081- TROJAN LIFTING DETAILS SHEET 1

TROJAN TECHNOLOGIES INC.
LONDON, ONTARIO, CANADA

CHAIN INSERT DB ASSY UMIE INSTL

4M0081

SECTION C – C

(REMOVED)

MODULES & PDC REMOVED FOR CLARITY

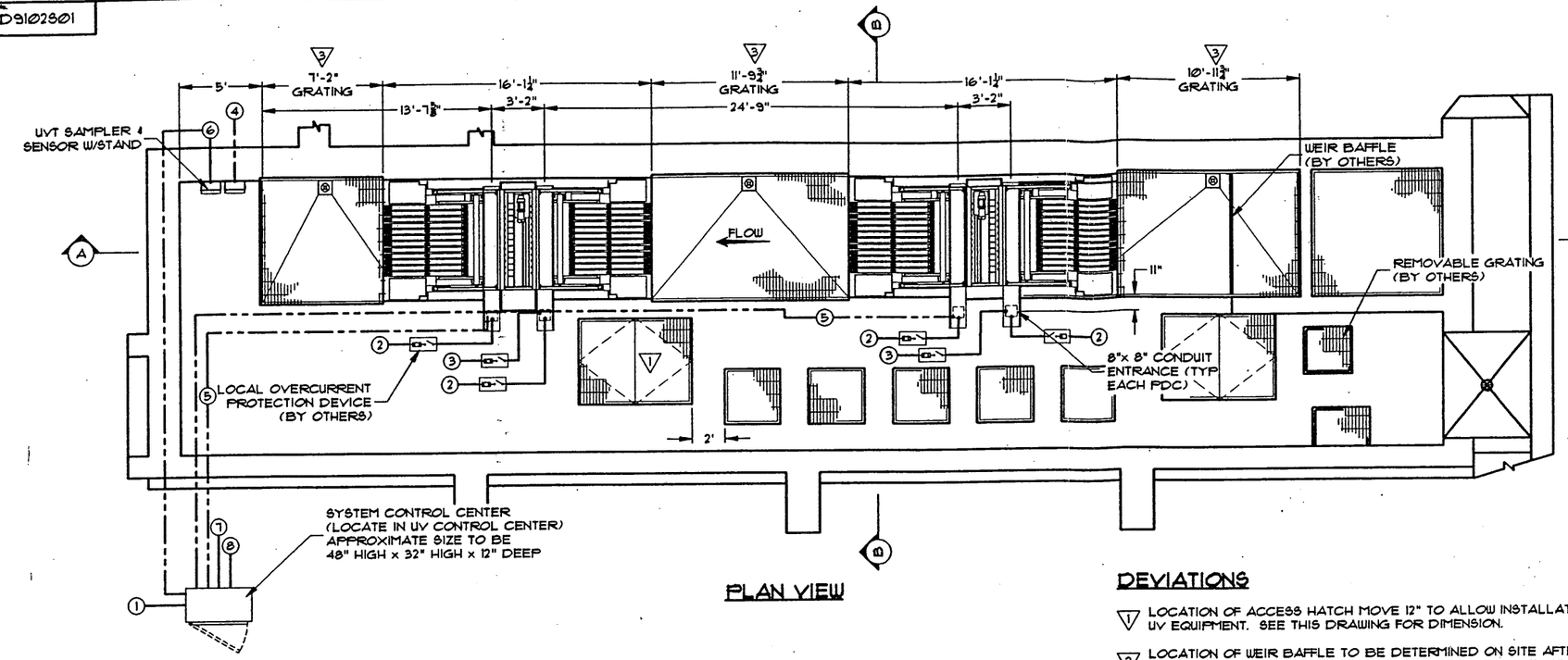
4M0091- TROJAN LIFTING DETAILS SHEET 2

TROJAN TECHNOLOGIES INC.

CHAIN INSERT DB ASSY UAME INSTL

A

DWG No. D9102S01



PLAN VIEW

UV4000 SYSTEM COMPONENT DESCRIPTIONS

DESCRIPTION	QTY
UV MODULES	48
POWER DISTRIBUTION CENTER	4
REACTION CHAMBER INSERT ASSEMBLY WITH INTEGRAL MODULE REMOVAL MECHANISM	2

GENERAL NOTES:

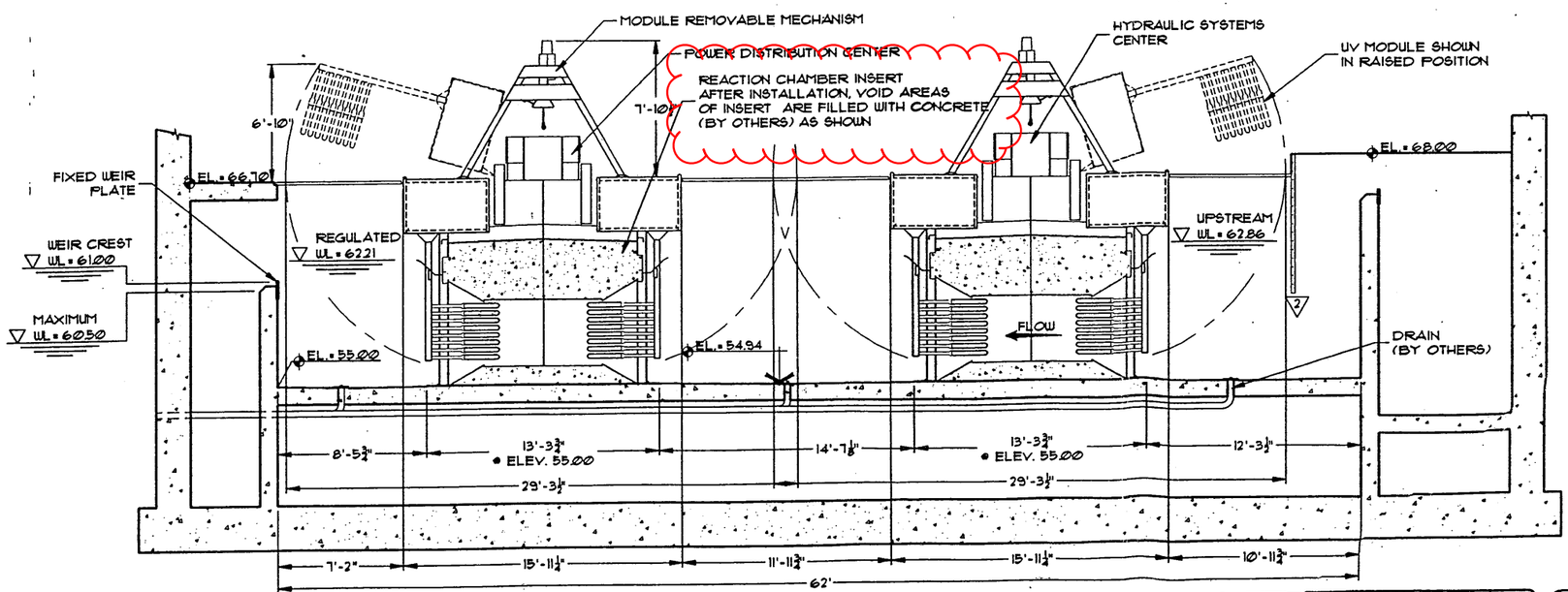
1. DO NOT SLOPE CHANNEL FLOOR
2. CHANNEL WIDTH AND DEPTH MUST BE KEPT WITHIN A TOLERANCE OF + OR - 1/4 in.
3. ANCHOR BOLTS ARE NOT SUPPLIED BY TROJAN TECHNOLOGIES INC.
4. SYSTEM CONDUIT, WIRING, DISTRIBUTION PANELS AND INTERCONNECTIONS BY OTHERS

UV4000 EQUIPMENT INTERCONNECTIONS

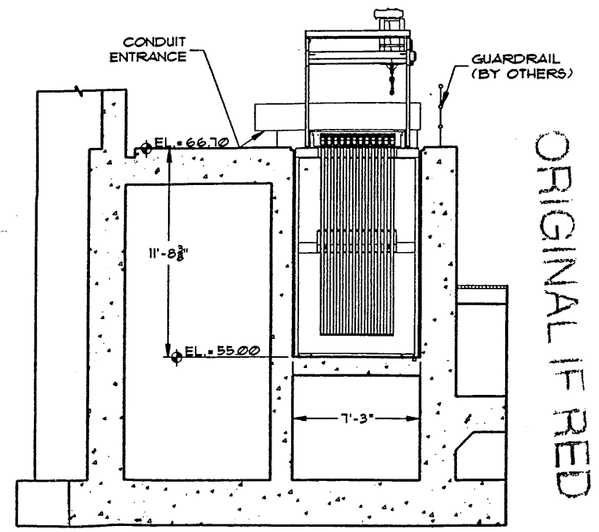
No.	DESCRIPTION	FROM	TO
1	SYSTEM CONTROL CENTER POWER SUPPLY 120V, 1 PHASE, 2 WIRE, 2000VA	DISTRIBUTION PANEL (3EA) -	SYSTEM CONTROL CENTER -
2	POWER DISTRIBUTION CENTER POWER 480V, 3 PHASE, 4 WIRE, 299 kVA FOR EACH OF (4) FOR TOTAL	DISTRIBUTION PANEL (SB-UV) -	POWER DISTRIBUTION CENTER (4)
3	MECHANICAL SYSTEMS POWER SUPPLY 120V, 1 PHASE, 2 WIRE, 5 kVA EACH OF (2) TWO TOTAL	DISTRIBUTION PANEL (NOT SHOWN) -	POWER DISTRIBUTION CENTER (2) -
4	UVT SAMPLER POWER SUPPLY 120V, 1 PHASE, 2 WIRE, 500VA -	DISTRIBUTION PANEL (NOT SHOWN) -	UV SAMPLER - -
5	SERIAL COMMUNICATION LINK 2 TWISTED, 18 Ga. INDIVIDUALLY SHIELDED PAIR (4 CONDUCTORS)	SYSTEM CONTROL CENTER & POWER DISTRIBUTION CENTER	POWER DISTRIBUTION CENTER(S) -
6	UVT SAMPLER 1 TWISTED, 18 Ga. SHIELDED PAIR (2 CONDUCTORS)	UV SAMPLER - -	SYSTEM CONTROL CENTER -
7	FLOW METER (BY OTHERS) 4-20 mA, DC ANALOG INPUT	FLOW METER PANEL (NOT SHOWN)	SYSTEM CONTROL CENTER
8	GRAPHICAL USER INTERFACE INTERCONNECT DATA HIGHWAY +	SYSTEM CONTROL CENTER -	SCADA PC -

DEVIATIONS

1. LOCATION OF ACCESS HATCH MOVE 12" TO ALLOW INSTALLATION OF UV EQUIPMENT. SEE THIS DRAWING FOR DIMENSION.
2. LOCATION OF WEIR BAFFLE TO BE DETERMINED ON SITE AFTER INSTALLATION OF UV EQUIPMENT. BAFFLE MUST NOT INTERFERE WITH RAISING THE UV MODULES.
3. REVISE BANK LOCATIONS AS SHOWN



SECTION A-A



SECTION B-B

ORIGINAL IF RED

REV	REVISION DESCRIPTION	ECN NUMBER	REV BY AND DATE	APPROVAL AND DATE
A	CHANGED BRANCHNECT 6 AND REMOVED BRANCHNECT 7		KJW 97/02/21	KJW 97/02/21
B	REVISED BANK LOCATIONS		KJW 97/06/18	

DESIGN CRITERIA

PEAK FLOW	20.00 US MGD
U.V TRANSMISSION AT 253.7 nm	55 %
SUSPENDED SOLIDS	5 mg / l
DISINFECTION STANDARD	2 TC / 100ml • 7 DAY MEDIAN

Trojan

TROJAN TECHNOLOGIES INC.
LONDON, ONTARIO, CANADA

DESCRIPTION: PACIFICA, CA

THIRD ANGLE PROJECTION

DESIGN BY	W.J.G	DATE 97/2/27
CHECKED BY	K.J.W	DATE 97/FEB/18
APPROVED BY		DATE 97/FEB/18

0 0.5 1.0
1.0 INCH ON ORIG. DWG

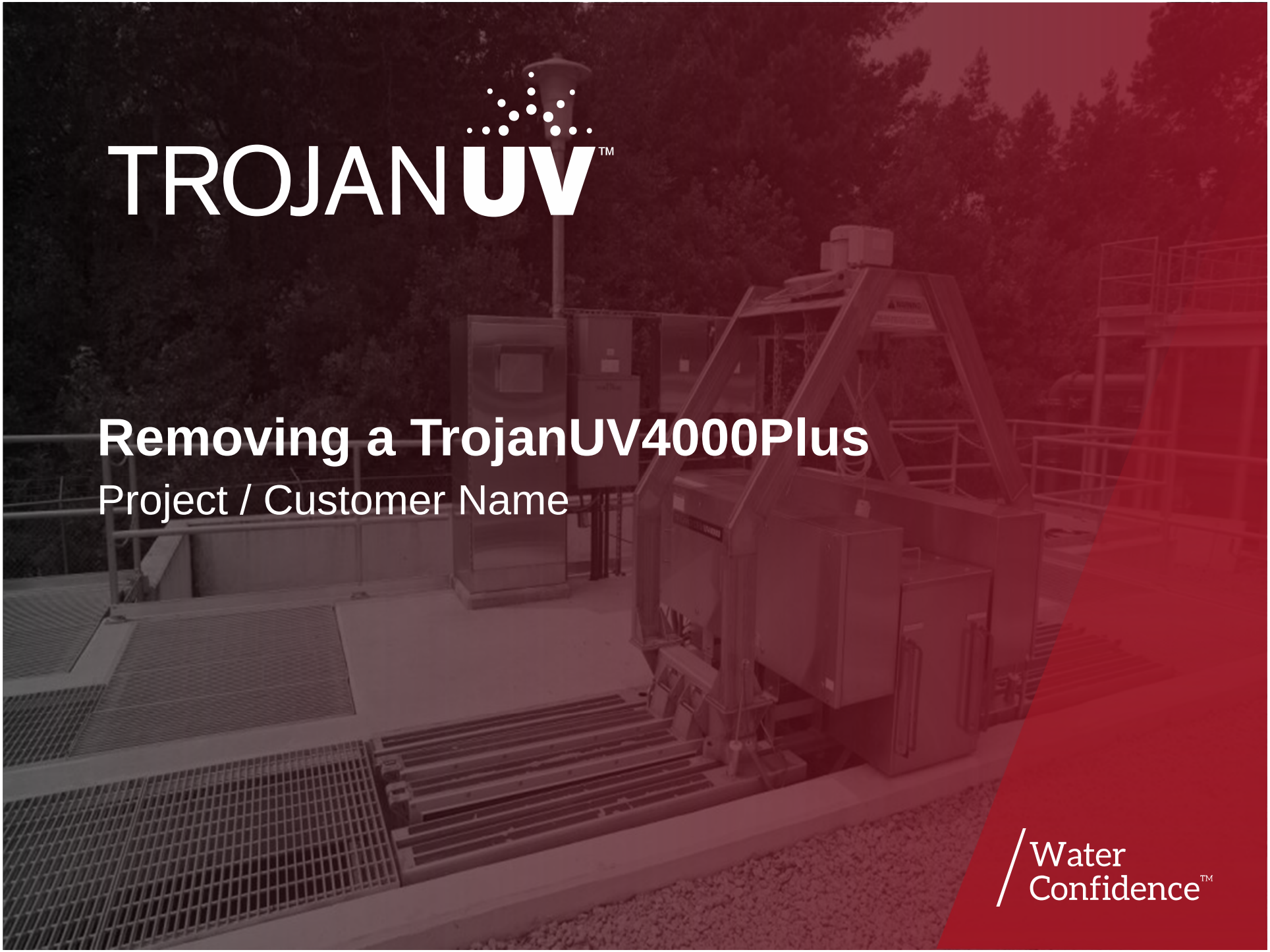
SCALE 1 : 48

DWG No. D9102S01

SHEET No. 1 OF 1

APPENDIX B

UV4000PLUS REMOVAL PROCEDURES



Removing a TrojanUV4000Plus

Project / Customer Name

Water Confidence™

MAKING THE UPGRADE

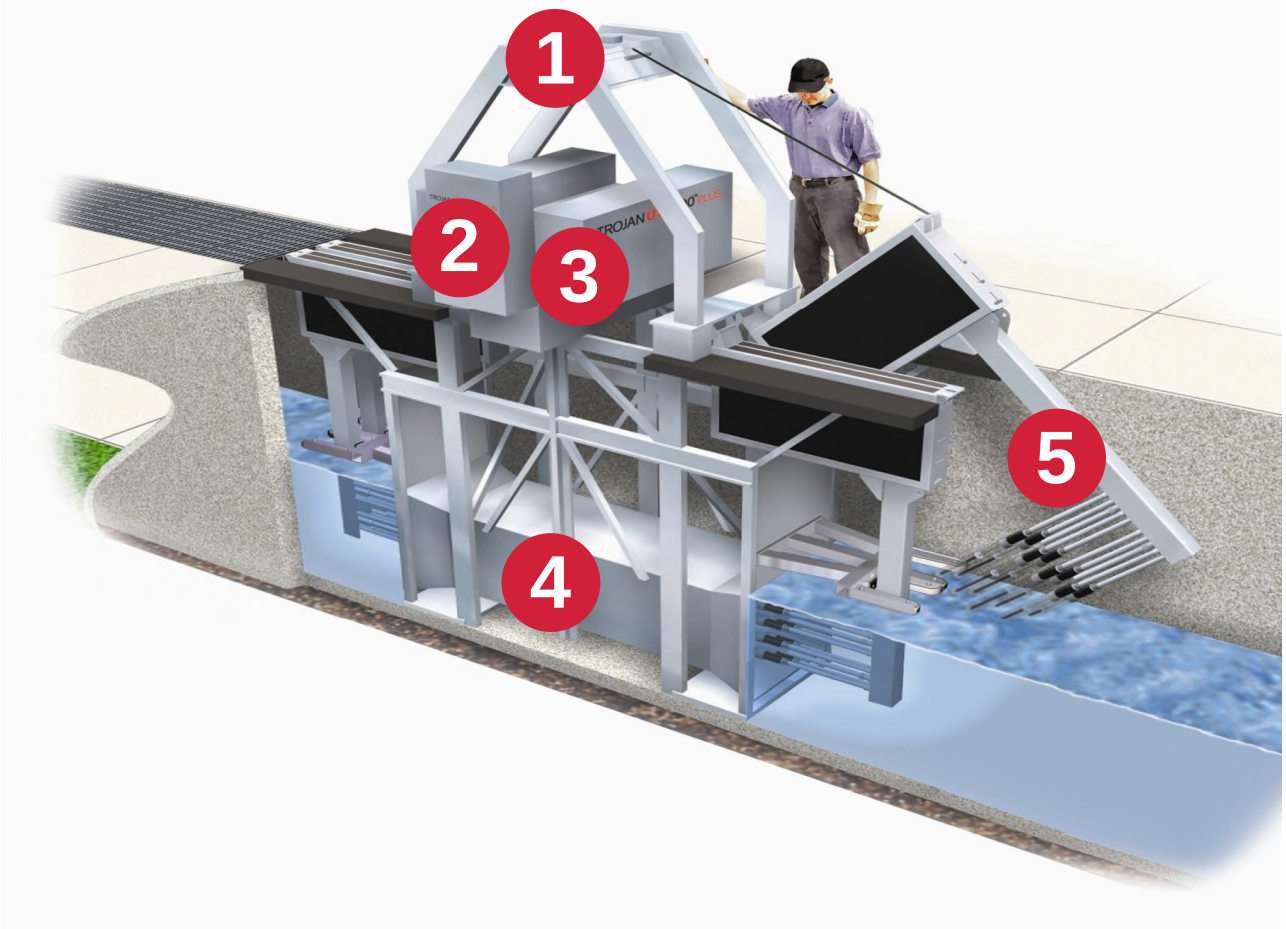
- Municipalities throughout the world are choosing TrojanUV systems for their disinfection upgrade and chlorine conversion projects
- Significant innovation has occurred in the 15 to 20 years since many UV systems have been placed in operation
- We have helped hundreds of municipalities replace and upgrade their UV disinfection system
- The following slides provide a quick step-by-step overview of how a TrojanUV4000Plus is removed from a channel

Then


Now

TROJANUV4000 CONFIGURATION

1. Module Removal Mechanism (MRM)
2. Hydraulic System Center (HSC)
3. Power Distribution Center (PDC)
4. Reactor Insert and Mounted Components
5. Module



STEP #1:
REMOVE MODULES

- Lift grating
- Lift modules using MRM
- Wash down modules
- Lower grating
- Remove lamps, sleeves and ballasts
- Disconnect all cables and hoses between PDC, HSC and modules
- Support module body using forklift truck and slings
- Remove entire module by removing module hinge nuts
- Estimated 5 hours / module

STEP #2:
REMOVE FLUIDS

- Remove coolant and hydraulic fluids from HSC power pack and coolant reservoir
- Store in suitable containers for disposal
- Estimated 2-3 hours per reactor

STEP #3:
REMOVE MRM

- Remove motor assembly
- Unbolt MRM from reactor
- Lift from reactor using forklift truck or crane
- Estimated 1 hour per MRM

STEP #4:
REMOVE PDC & HSC

- Unbolt PDCs from reactor
- Lift from reactor using forklift truck and slings
- Unbolt HSC from reactor
- Lift from reactor using forklift truck and slings
- Estimated 3 hours per reactor

STEP #5:
REMOVE BEAMS

- Beams that held the modules need to be removed
- One beam spans each bank (two beams per reactor)
- Estimated 1 hour per beam

STEP #6:
REMOVE REACTOR INSERT

- This is the most challenging step in the UV system removal process
- The SS reactor insert and beams are encased in concrete

Grouted Concrete

Reactor insert & coolant reservoir

STEP #6:
REMOVE REACTOR INSERT

- The concrete will need to be chipped out to gain access to the reactor insert(s)
- Approx. volume of concrete to be removed: 15-20 yd^3
- Methods include jack-hammering, concrete and SS saw-cutting
- Ensure that coolant from insert in fully pumped out before removal
- Time to remove inserts varies based on methods used and experience

MAKING THE UPGRADE

- TrojanUVSigna reactor (shown) does not require tight tolerances on channel floor or walls
- Designed to easily fit into existing TrojanUV4000 channels


TROJAN UV SIGNA™

APPENDIX C

UV PURE BY HALLETT CUT SHEETS

UV PURE®

Powerful UV disinfection for difficult water

Smart technology. High performance. Easy maintenance.

Up to **100** gpm per unit, multiplex systems available

35% minimum UV transmittance

uvpure.com

Count on Hallett for any application

Potable | Wastewater | Reuse | Rainwater

Safe water, always.™

Table of Contents

UV PURE®

Advanced UV disinfection for challenging water

UV Pure Technologies is a manufacturer of advanced ultraviolet water disinfection systems for commercial, industrial, municipal, residential, and decentralized applications, with worldwide installations in:

- **COMMERCIAL**
- **SYSTEM INTEGRATORS**
- **AGRI-FOOD**
- **AGRICULTURE**
- **MUNICIPAL**
- **PARKS & RECREATION**
- **HEALTHCARE**
- **RESIDENTIAL**
- **TRANSPORTATION**

Potable | Wastewater | Reuse | Rainwater

Hallett®

The company's range of Hallett™ products are proven for use in potable, wastewater, reuse, and rainwater disinfection systems for flows of up to 3,800 cubic metres per day (1 million gallons per day).

Hallett systems are certified to NSF/ANSI 55 Class A, NSF/ANSI/CAN 61 & 372, with performance validation to EPA & NWRI protocols for a wide range of operating conditions including low UV transmittance water. Non-certified Hallett systems are also available to achieve the same performance for applications that do not require formal certification.

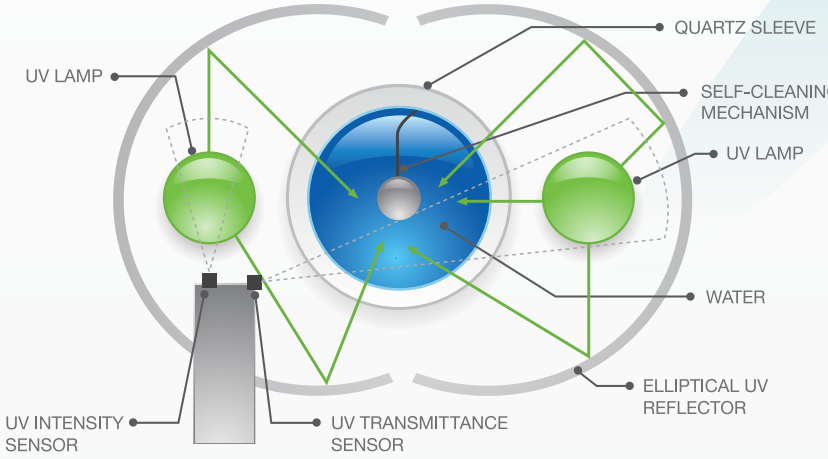
UV Pure™ systems feature patented Crossfire Technology® with an innovative dual-lamp elliptical reflector design, self-cleaning quartz sleeve, and smart sensors for on-board diagnostics and remote monitoring capabilities. Crossfire Technology was selected for water disinfection on the new Boeing 787 Dreamliner, and is trusted by water industry leaders including SUEZ (formerly GE Water), Evoqua (formerly Siemens Water), the Los Angeles Department of Water and Power, Veolia, and CH2M.

UV Pure has earned an Artemis Top 50 Clean Tech Company award, Going Green Global Top 200 award, two Frost & Sullivan Best Practices Awards, and a Canadian Drinking Water Association award for innovation.

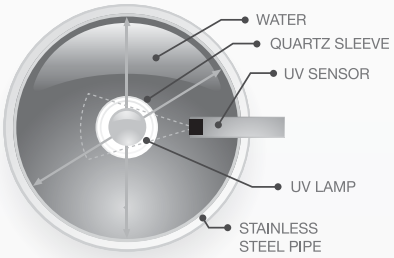
Powered by

CROSSFIRE® TECHNOLOGY

Crossfire Technology® targets pathogens from every angle - 360 degrees



Conventional System



- ✓ Self-cleaning system prevents quartz fouling
- ✓ Reliable high performance in low UVT conditions
- ✓ Safe, easy lamp changes
- ✓ Smart sensors for real-time monitoring

UV Pure's patented Crossfire Technology incorporates elliptical reflectors that redirect light energy from 360 degrees to overcome shadowing and deliver a sterilizing UV dose to harmful pathogens.

Dual smart UV sensors in every Hallett system continually monitor lamp output and water quality to ensure the highest level of disinfection is consistently achieved. The smart sensors practically eliminate nuisance alarms and make troubleshooting simple when the system is out of compliance.

Effective disinfection for up to 10x more difficult water with UV transmittance from 35-95%, hardness up to 855 mg/L, and iron up to 3 mg/L

UV PURE®

Safe water, always.™

Call Us: 1-888-407-9997

www.uvpure.com info@uvpure.com

Meet the New Hallett™
Questions & Answers

UV PURE®

Call Us: 1-888-407-9997

Questions	Answers

What's new about UV Pure's Hallett products?

UV Pure® has redesigned its next generation Hallett™ product series with all new features for even better reliability and operability. All of UV Pure's products are powered by Crossfire Technology® for industry-leading disinfection performance, even for challenging water quality conditions.

There are four new Hallett product lines to meet a wide range of UV water disinfection needs:

Potable | Wastewater | Reuse

- Hallett P for potable and drinking water applications
- Hallett R for reuse (gray water and rainwater) applications
- Hallett W for wastewater applications

What sizes are available for the new Hallett?

There are **three model sizes** for the new Hallett product lines that handle flows from 10-100 US gpm and UV transmittance (UVT) as low as 35%. The sizes are based on the nominal UV lamp length (in millimeters) for each unit:

- Hallett 500
- Hallett 750
- Hallett 1000 – all new

What is the new Hallett 1000?

The new Hallett 1000 is our largest model yet with a 2-inch connection for flows up to 100 US gpm. It is equipped with amalgam lamps that can be cycled 6-12 times per day, plus quadruple smart UV sensors. Use it for any application including potable water, wastewater, reuse water or rainwater.

What product certifications and validations are available for the new Hallett?

The new Hallett lineup includes models with ANSI/NSF certifications and third-party performance validation in accordance with the US EPA UV Disinfection Guidance Manual (UVDGM) and NWRI UV Disinfection Guidelines for Drinking Water and Water Reuse.

- UL 979 and CSA C22.2 No.68-09 – all Hallett models
- NSF/ANSI 55 Class A – Hallett PN Series
- NSF/ANSI/CAN 61 and NSF/ANSI 372 – all Hallett models
- EPA UVDGM validation – Hallett 1000
- NWRI validation – Hallett 1000

v.20210218

Questions	Answers

What new **features** does the next generation Hallett have?

All new Hallett models are equipped with:

- Color touchscreen interface
- Improved dual UV sensor array design with quad-sensor models available
- Better temperature management with built-in purge valve and available lamp heaters
- Optional 4-20 mA output with MODBUS connectivity
- Remote start capability
- Two dry contacts for warning and alarm signals
- Better message history that stores the last 99 messages with timestamp
- Optional data logging through USB port
- Built-in surge protection

What has **NOT changed** in the new Hallett systems?

New Hallett systems are still powered by UV Pure patented Crossfire Technology™ including:

- Automatic self-cleaning wipers and built-in purging that prevent fouling of the quartz sleeve by mineral scaling and biofilm, making Hallett up to 10 times more effective in difficult water applications than conventional UV systems
- Dual air-mounted lamps with forced air cooling that provide better UV chamber temperature control, helping to eliminate false lamp alarms
- Elliptical reflector design that captures and redirects UV energy from 360 degrees to minimize UV shadowing and prevent live transfer of bacteria and microorganisms
- Dual UV sensor array that provides real-time monitoring of UV lamp intensity, UV dose and net UVT while enabling superior on-board diagnostics for troubleshooting

All Hallett systems are still non-contact, meaning the operator is not exposed to contaminated water when performing routine maintenance like quartz inspections and lamp changes. In fact, the new Hallett design makes maintenance even easier.

With its small footprint and simple plug-and-play design, Hallett is quick to install and easy to start up, even in tight spaces.

What are the warranty terms for new Hallett systems?

We continue to offer one of the industry's leading warranty packages for UV Pure systems and parts:

- 12 months on sensors, temperature probes, and valves
- 12 months on LPHO lamps
- 16 months on amalgam lamps
- 36 months on electrical components, quartz sleeve, and reflectors
- 60 months for structural, hardware, and mechanical components

Are engineering drawings available for the new Hallett systems?

Yes, engineering drawings are available for single and multi-unit Hallett systems. For help with sizing or drawings, please contact your UV Pure sales professional or send a request to **info@uvpure.com.**

Product Line
Feature comparison
Effective August 1, 2019

Feature	Hallett 1st Generation	Hallett Upstream 2nd Generation	Hallett 3rd Generation	Hallett 3rd Generation
	H30, H13	H15xs, NC series	H500, H750 series	H1000 series
Crossfire Technology	Built in	Built in	Built in	Built in
>> Eliptical Reflectors, >> 360° Disinfection	Built in	Built in	Built in	Built in
>> Dual Lamps, >> Multiple Sensors	Built in	Built in	Built in	Built in
>> Self cleaning mechanism	Built in	Built in	Built in	Built in
User Interface	Single button	Four mechanical buttons	Touch screen Color	Touch screen Color
Operational alarms	Dual visual - audible	Dual visual - audible	Dual visual - audible	Dual visual - audible
Display - Liquid Crystal (LCD)	Optional	Built in	Touch screen Color	Touch screen Color
Communications	4-20 mA output	Not available	4-20 mA output Modbus	4-20 mA output Modbus
UV Intensity Warning Dry Contact	NA	NA	Built in	Built in
Remote Start/Stop	NA	NA	Built in	Built in
Built-in Surge Protection	Optional	Optional	Built in	Built in
Message History	NA	Last 50 messages	Last 99 messages	Last 99 messages
Data logging - local	NA	NA	Optional	Optional
Flow range (@ 40 mJ/cm^2, 95% UVT)	up to 51 USgpm 193 L/min	up to 51 USgpm 193 L/min	up to 51 USgpm 193 L/min	up to 100 USgpm 378 L/min
Minimum UVT required	45%	50%	50%	35%
Lamp Type	LPHO	LPHO	LPHO	Amalgam
Lamp Expected Life	9000 hours	9000 hours	9000 hours	9000 hours
Lamp Heaters	NA	NA	Available	Available
Time Needed for Lamp Change	5 minutes	< 5 minutes	< 2 minutes	< 2 minutes
Sensor Design	Analog technology	Digital technology	Digital technology NIST compliant	Digital technology NIST compliant
Dual Sensors	One per unit	One per unit	One per unit	One per lamp 2 per unit
Temperature Control	Convection cooling Optional purge valve	Forced air cooling Built-in purge valve	Improved forced air cooling Built-in purge valve	Improved forced air cooling Built-in purge valve
Performance Validation	Factory Tested	Factory Tested	Third party Validation (1)	US EPA UVDGM Validated
Drinking Water Performance Certification	NSF/ANSI 55 Class A	NSF/ANSI 55 Class A	NSF/ANSI 55 Class A	NWRI / Validation
Drinking Water System Components – Health Effects / Lead Free Compliance	NSF/ANSI/CAN 61 certified	NSF/ANSI/CAN 61 certified	NSF/ANSI/CAN 61 & 372 certified	NSF/ANSI/CAN 61 & 372 certified
Drinking Water and Water Reuse Performance Validation	Factory Tested	Factory Tested	Factory Tested	NWRI Validation

(1) Pending
(2) NA - Not available

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Hallett Models & Certifications

Product Line	Hallett P	Hallett W	Hallett R
Applications	Potable	Wastewater	Reuse & Rainwater
Hallett Models	1000, 750, 500, 750PN, 500PN	1000, 750, 500	1000, 750, 500
Certifications & Validations	All Models - NSF/ANSI/CAN 61 & 372		
	NSF/ANSI 55 Class A (PN models only)	EPA wastewater validated (1000 model only)	NWRI reuse validated (1000 model only)
	EPA UVDGM validated – 1000 model only		

Download UV Pure Technical Data Sheets at uvpure.com/downloads/

UV PURE®

Call Us: 1-888-407-9997

Technical Data Sheet
Hallett™ 1000P

www.uvpure.com

Potable Water Applications

Model	Hallett 1000P
Validation protocol	US EPA UVDGM IECEE CB + CE Mark

Operating Range

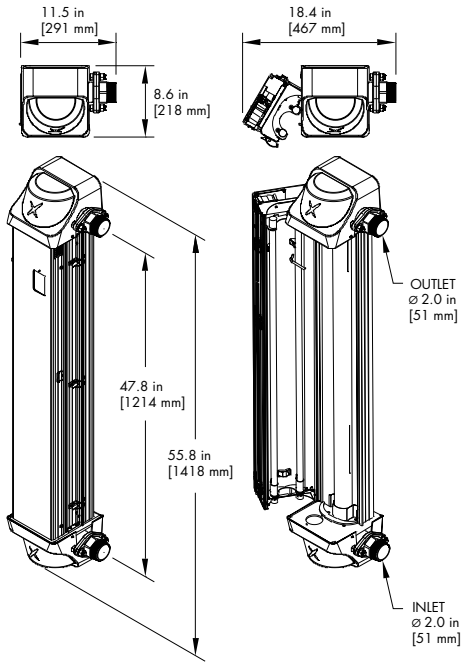
Flow (single unit)*	Up to 100 US gpm (378 Lpm)
UV dose	16 - 200 mJ/cm^2
UV Transmittance [UVT] (water)	50 - 95% UVT
Hardness (water)	Maximum 855 mg/L (50 gpg)
Iron (water)	Maximum 3 mg/L (3 ppm)
Temperature (air)	34 - 104°F (1 - 40°C)
Temperature (water)	34 - 95°F (1 - 35°C)
Water pressure	5 - 100 psig (34 - 690 kPa)
Relative humidity (air)	Maximum 70%

Features

Quartz sleeve cleaning	Built-in - automatic mechanical wiper
Wiper position switch	Built-in
Purge valve	Built-in
Cooling	Built-in - forced air
Flow restrictor	Optional - external
Shut-off valve	Optional - automatic solenoid

Electrical/Instrumentation

Voltage	120/230 V AC, 50/60 Hz
Power consumption (nominal)	403 W
Certifications	UL 979
UV lamps	Dual amalgam - air mounted
Lamp life (typical)	12,000 hours
Lamp cycles (recommended)	Maximum 6 to 12 cycling per 24 hours
Sensors	Quad UV - calibrated to NIST standards
Dry contacts	Built-in - 2 provided (warning and alarm)
Interface	Colour LCD resistive touchscreen display
Alarming	Indicator light and audible alarms
Remote start/stop	Built-in
Onboard diagnostics	Built-in
4-20mA Output & Modbus	Optional



Physical

Dimensions (H x W x D)	55.8 x 11.5 x 8.6 in (1418 x 291 x 218 mm)
Weight (dry)	52 lb (23.5 kg)
Weight (wet)	58.3 lb (26.4 kg)
Wetted parts	Meets NSF/ANSI/CAN 61 & NSF/ANSI 372 for water up to 73°F (23°C)
Body materials	Anodized aluminum and 316 Stainless Steel
Body configuration	Double door with side hinges
Inlet/outlet ports	2" MNPT Stainless Steel, optional - Stainless Steel hose
Ingress Protection rating	IP 51, optional - IP 66 for NEMA cabinet systems
Multiple units	Multiplex manifold and cabinets available
Warranty	5-year limited warranty for structural, hardware and mechanical components; 3-year limited warranty on electrical components and quartz sleeves; 16-month limited warranty on bulbs; and 1-year limited warranty on sensor probes

Contact a UV Pure representative to confirm product operating parameters for specific applications.

info@uvpure.com

**Maximum flow for single unit is 100 gpm (378 L/min) . Multiplex manifold and cabinet systems available for flows up to 1 MGD (3,800 m3/day) .*

v.20200917

MADE IN CANADA

UV Pure Technologies Inc.

ULTRAVIOLET WATER DISINFECTION SYSTEM

ORIGINAL INSTRUCTIONS

MODEL:
SERIAL #:
Installation Date:

TECHNOLOGY

Hallett 500PN & 750PN are NSF/ANSI 55 CLASS A CERTIFIED by NSF International

AS 3497
WM-032206 †††

NSF/ANSI/CAN 61 Section 8 for material safety only and NSF/ANSI 372. Not certified by WQA for contaminant reductions or structural integrity.

CERTIFIED ELECTRICAL SAFETY †

LR1382

IEC 60335 ††

SAVE THESE INSTRUCTIONS

Publication Number: GH44N
May 2023

† 120V versions of the product are certified by QPS
†† 230V versions of the product meet IEC 60335.1, IEC 60335-2-109 (National Differences: EU Group Differences, AU, NZ, SG) and are CE and ACMA (Australian Communications & Media Authority) compliant (NSW #CS11052N).
††† The Hallett 500PN and Hallett 750PN models are Watermark certified.

NOTICE

THANK YOU
By purchasing a UV system with Crossfire Technology, you can now be certain that your application is receiving world-class treatment.

UV Pure units are designed to deliver highly effective UV doses from 30 mJ/cm^2 up to 200mJ/cm^2 depending on the model.

UV Pure products conform to the applicable provisions of the Code of Federal Regulations (CFR) requirements including, Title 21, Chapter 1, Subchapter J, Radiological Health.

The EPA Establishment number is 075213-CAN-1

1. IMPORTANT INSTRUCTIONS AND SAFETY INFORMATION

When operating the Hallett unit, basic precautions should always be followed to reduce the risk of fire, electric shock, and injury to persons, including the following:

1. Read all the instructions before installing or operating the system.
2. Pay attention to all warning and caution statements, and also safety symbols throughout these instructions. Failure to do so may result in personal injury and/or damage to equipment.
3. This unit is not intended for use by persons (including children) with reduced physical, sensory or mental capabilities, or lack of experience and knowledge, unless they have been given supervision or instruction concerning use of the unit by a person responsible for their safety.
4. Do not contact moving parts.
5. Only use attachments or spare parts recommended or sold by UV Pure.
6. The unit is intended only for indoor use in a dry location.
7. Do not unplug the unit by pulling on cord. To unplug, grasp the plug, not the cord.
8. Unplug the unit from the outlet when not in use and before any servicing or cleaning.
9. The UV chamber contains an interlock to disable the UV lamps if the event the chamber is accessed when the power is on. Do not defeat its purpose or attempt to service without opening the panel completely.
10. Do not operate the unit with a damaged cord or plug, or after a significant malfunction or is dropped or damaged in any manner. Return the unit to the nearest authorized service facility for examination, repair, or electrical or mechanical adjustment. If the supply cord is damaged, it must be replaced by a special cord available from UV Pure.
11. Connect the unit only to a circuit that is protected by a ground-fault circuit-interrupter (GFCI). See Grounding Instructions.
12. If an extension cord is necessary, the cord should contain a ground and be rated for the same amperage as the unit or combined units.
13. Do not plug in the unit if water is present on the unit or if any nearby piping connections are leaking.
14. Service to the unit does not require the removal of the aluminum endplates and they must remain assembled.
15. In the event of an alarm or shut down of the UV unit and water continues to flow either accidentally or for emergency purposes, or if the UV system is bypassed, it is recommended that any water used for drinking be boiled.
16. Do not operate the unit dry.
17. Do not operate this unit at altitudes over 3000m.
18. If the unit is installed in a room storing chemicals or is exposed to unnatural substances such as hydrogen sulphide, the room must be ventilated.

Grounding Instructions

This UV unit must be grounded. In the event of a malfunction or breakdown, grounding will reduce the risk of electric shock by providing a path of least resistance for electric current. This unit is equipped with a cord having an appliance-grounding conductor and a grounding plug. The plug must be plugged into an appropriate outlet that is installed and grounded in accordance with all local codes and ordinances. The piping connected to the UV unit must also be properly grounded. Install a grounding lug or strap as required.

WARNING: For correct operation of this unit, it is essential to observe the manufacturer's instructions.

WARNING - Improper connection of the equipment-grounding conductor can result in a risk of electric shock. Check with a qualified electrician or service representative if you are in doubt whether the unit is properly grounded. Do not modify the plug provided with this unit; if it will not fit the outlet, have a proper outlet installed by a qualified technician.

WARNING: If connection is made to a potable water system, the system shall be protected against backflow.

Ground-Fault Circuit-Interrupter

To comply with National Electrical Code, NFPA 70, the circuit where the UV unit(s) is connected must be protected by a ground-fault circuit-interrupter (GFCI). UV Pure recommends the use of Hubbell GFCIs for 120Vac.

Safety Symbols

WARNING: **Potential Shock Hazard**
Shutdown and unplug the unit before servicing.

DANGER: Ultraviolet Radiation
Disconnect power before replacing lamps. The lamps in the unit emit ultraviolet (UV) light that can cause permanent damage to the skin & eyes. **Never look at the lamp when it is operating.** Do not plug the unit in unless it is properly installed and all the panels are closed and secured. Do not open a panel or perform any service unless the unit has been unplugged. Never look into the unit or place any exposed skin into the illuminated areas when it is operating. Do not operate a unit that has been damaged or missing any components or safety devices. If a part is missing from your unit, contact your dealer**.**

CAUTION: **Safety Alert**
Pay attention to warning or caution statements in the instructions.

CAUTION: **UV Lamps Contain Mercury**
The UV lamps are fragile and must be handled with care. If lamp breakage occurs, avoid inhalation or ingestion of debris and avoid exposure to skin and eyes. Do not use a vacuum cleaner or broom for cleanup. Follow local guidelines and regulations to remove and dispose of old UV lamps or mercury debris.

CAUTION: **Wear appropriate safety equipment**
Wear safety glasses when performing maintenance on the unit.
For non-potable applications, do not handle wetted parts with bare hands - use latex or vinyl gloves or equivalent.

CAUTION: **Quartz sleeves are fragile**
The quartz sleeve can break or chip if mishandled. Always handle it with care and keep it in a safe place if it is removed from the unit. Do not strike the quartz sleeve with any tool, since even the smallest chip can cause it to break under pressure.

2. ABOUT THE HALLETT

The Hallett system, manufactured by UV Pure Technologies, is the world's only ultraviolet water disinfection device with patented Crossfire Technology.

> Patented in US 6,707,048, Canada 2,463,503, Australia 2,002,333,084, Mexico 248805
> Patent Pending in Japan, UK, Europe, & Eurasia

UV Pure's UV systems employ revolutionary Crossfire Technology that is self-cleaning, self-monitoring, and fail-safe. The Hallett system with Crossfire Technology is designed to eliminate the potential risks associated with conventional single lamp UV systems.

Committed to exceeding UV disinfection standards, UV Pure has turned conventional technology inside-out by flowing the water inside the quartz sleeve and including two lamps mounted in air, dual or quad smart sensors, software-designed reflectors and an optional fail-safe solenoid valve.

Crossfire Technology delivers a high UV dose for disinfection: Crossfire Technology incorporates *two* proprietary high-output UV lamps, with software-designed reflectors, that target pathogens with radiation from 360º. Amalgam UV lamp technology has been introduced into the largest units to not only provide higher UV output, but also increased stability over a wider range of operating temperatures. In addition, the amalgam lamps can be cycled more often than conventional low pressure high output (LPHO) UV lamps – See Product Specifications Tables.

Crossfire Technology is capable of treating low UVT water: The Ultraviolet Transmittance (UVT) of water impacts the amount of treatment since UV light is absorbed rather than being available for disinfection. With a shorter path length for the UV light to travel, Crossfire Technology outperforms conventional UV systems and can treat potable applications as low as 50% UVT and also reuse and waste water in low UVT applications.

Crossfire Technology is engineered to be risk-free and fail-safe: Crossfire Technology uses dual or quad smart UV sensors mounted in air, which are designed to not foul and are more reliable indicators of system performance than ordinary systems. The lamps are fan-cooled and maintain consistent levels of UV output for maximum delivery of UV dose. Computerized alarms and an optional auto shutoff fail-safe valve are designed so that only treated water will pass through the unit.

Crossfire Technology is self-cleaning: Crossfire Technology uses a stainless steel wiper to clean the inside of the quartz sleeve eliminating fouling and the need for a water softener making abrasive quartz sleeve cleaning a thing of the past – saving money and the environment. The wiper is automated to cycle for 5 minutes every 4 hours. The cycle begins 5 minutes after power is applied. Self-cleaning not available on the NC models.

Crossfire Technology is virtually maintenance-free: Crossfire technology utilizes two lamps mounted in air, outside the quartz sleeve so maintaining a UV Pure unit is as easy as changing a light bulb with no system draining required. The UV lamps require replacement after 12 or 16 months of operation depending on the lamp type and notification of lamp replacement is given via a warning one month in advance.

Crossfire Technology is easy to install: The units are provided with either 1” or 2” male NPT connections. Optional stainless steel flexible hoses with Female Iron Pipe (FIP) connections are available for purchase for quick and simple installation.

The Hallett has a smart display: The operator interface is a colour touchscreen designed to allow unprecedented access to information such as lamp lifetime, real-time message history and UV dose display. A real-time clock is now available for improved troubleshooting and fault resolution.

The Hallett has a built-in purge valve: The purge valve eliminates the need to shut down the unit in the event of no water flow for hours, or even days (as long as a pressurized water supply is present). It is designed to prevent buildup of metals and minerals on internal components. The purge valve also eliminates nuisance alarms from changing water transmittance conditions. The purge valve is not available on some models.

The Hallett has remote status indication: The units come standard with warning and run contacts to remotely signal a control panel. In addition, the units can be started & stopped via external device.

The Hallett has a built-in surge protection: The power distribution circuit board contains filters and surge protection devices to increase the reliability of the on-board electronics and ballasts for the UV lamp.

The Hallett offers new interfaces: The Hallett units are available with a pair of 4-20mA outputs for UV Intensity, Net UV Transmittance, or UV Dose through an optional add-on device. Modbus, a smart electronic communication protocol, will also be available when the 4-20mA option is purchased.

The Hallett offers data logging: The Hallett units are available with an optional USB drive to continuously record performance on a daily basis.

3. PRODUCT SPECIFICATIONS

Specifications & Features common to all units

Operating Pressure[1]	5-100 psig (34-690 kPa)
Water Temperature Range (Hallett 1000XX)[2]	34-95° F (1-35° C) [5]
Water Temperature Range (Hallett 400-750XX)[2]	34-104° F (1-40° C) [5]
Air Temperature Range[2]	34-104° F (1-40° C)
Maximum Relative Humidity[3]	70%
Voltage Input	120Vac 50/60Hz for North America. 230 or 240 Vac 50/60Hz for International. **See power input label on left side of unit near power cord.**
Manifold materials	316 Stainless Steel
External Contact	2 available - Standard
Remote Start/Stop	Standard
Data Logging to USB Drive	Optional on all units
Automatic Solenoid Shutoff Valve	Optional on all units
Wetted Parts[4]	Meets NSF/ANSI/CAN 61 & NSF/ANSI 372

[1] Purging requires pressure to work properly. The optional shutoff valve requires min. 8psig (55kPa) to operate.
[2] In extreme conditions, high air temperatures may require lower water temperatures for proper operation and vice versa.
[3] For continuous flow potable applications, it is recommended to dehumidify the room where the UV unit is located.
[4] The Hallett 400NC does not meet NSF/ANSI/CAN 61 or 372
[5] Certified by WQA to 73° F or 23° C

Flow restrictors are devices that limit the water flow through the UV unit despite the demand or the amount of supply pressure. A flow restrictor is mandatory for an NSF/ANSI 55 Class A system but optional for other units.

Warning: Removal of this device may allow the water flow to exceed the validated performance of the system which therefore may not provide the necessary UV dose for effective treatment.

Potable Water

Hallett Models	Hallett 1000P	Hallett 750PN	Hallett 750P	Hallett 500PN	Hallett 500P
Max. Flow Rate[1]	100 gpm 378 L/min 22.7 m^3/hr	27.4 gpm 104 L/min 6.2 m^3/hr	30 gpm 114 L/min 6.8 m^3/hr	16.5 gpm 62 L/min 3.8 m^3/hr	23 gpm 87 L/min 5.2 m^3/hr
Performance Certifications[2]	USEPA UVDGM 2006	NSF/ANSI 55 Class A	3rd Party	NSF/ANSI 55 Class A	3rd Party
Min. UVT[3]	95%	75%	50-75%	75%	50-75%
Flow Restrictor	Optional	Yes	Optional	Yes	Optional
Pressure Drop	4.4 psig (30 kPa)	22.7 psig[4] (156 kPa)	7.4 psig (51 kPa)	22.7 psig[4] (156 kPa)	4.2 psig (29 kPa)
Lamp Type	Amalgam	LPHO	LPHO	LPHO	LPHO
Lamp Life[5]	16 months	12 months	12 months	12 months	12 months
Cycles/day[6]	6-12	2 (I.S.) 6-12 (P.H.)	2 (I.S.) 6-12 (P.H.)	2 (I.S.) 6-12 (P.H.)	2 (I.S.) 6-12 (P.H.)
UV Sensor	Quad	Dual	Dual	Dual	Dual
Built-in Purge Valve	Standard	Standard	Standard	Standard	Standard
Automatic Quartz Sleeve Cleaning Device	Standard	Standard	Standard	Standard	Standard
Wiper Position Switch	Standard	Standard	Standard	Standard	Standard
Lamp Heaters	No	Standard	Standard	Standard	Standard
4-20mA Output	Optional	Optional	Optional	Optional	Optional
Modbus connectivity	Optional	Optional	Optional	Optional	Optional
Power Draw	403W	222W	222W	196W	196W
Inlet & Outlet Port size	2" MNPT	1" MNPT	1" MNPT	1" MNPT	1" MNPT
Nominal Dimensions (H x W x D)	56x11x9" (142x29x 22cm)	40x10x9" (103x24x 22cm)	40x10x9" (103x24x 22cm)	36x10x9" (93x24x 22cm)	36x10x9" (93x24x 22cm)

1 Based on UV Dose of 40mJ/cm^2 at alarm setpoint.
2 NSF/ANSI 55 Class A certifications substantiated by NSF International only. Third party validations are pending.
3 The Hallett 1000P can operate over a wide range of UVTs with the UV dose EPA validated between 16-200mJ/cm^2. Consult UV Pure to correctly configure the unit. The Hallett 750P and 500P can be configured to high or low UVT applications by service technicians.
4 The flow restrictor adds significant pressure drop so the value presented is at 75% of maximum flow capacity.
5 Amalgam lamp lifetime is 12,000hrs/500 days and LPHO lifetime is 9000hrs/375 days
6 Instant Start (I.S.) LPHO limited to 2 cycles/day; Preheat (P.H.) models have 6-12 cycles/day. Exceeding the recommended daily cycles will accelerate the age of the UV lamps. LPHO lamps perform more reliably when operated 24/7.

Reuse and Waste Water

Hallett Models	Hallett 1000X[1]	Hallett 750W	Hallett 750R	Hallett 500W	Hallett 500R
Default Flow Rate[2]	70 gpm 265 L/min 15.9 m^3/hr	18 gpm 68 L/min 4.1 m^3/hr	13 gpm 49 L/min 3 m^3/hr	14 gpm 53 L/min 3.2 m^3/hr	10 gpm 38 L/min 2.3 m^3/hr
Performance Certifications[3]	NWRI / EPA	3rd Party	3rd Party	3rd Party	3rd Party
Min. UVT[2]	77%	50%	50%	50%	50%
Flow Restrictor	Optional	Optional	Optional	Optional	Optional
Pressure Drop[4]	2.6 psig (18 kPa)	2.8 psig (19 kPa)	1.4 psig (10 kPa)	1.6 psig (11 kPa)	0.8 psig (6 kPa)
Lamp Type	Amalgam	LPHO	LPHO	LPHO	LPHO
Lamp Life[5]	16 months	12 months	12 months	12 months	12 months
Cycles/day[6]	6-12	2 (I.S.) 6-12 (P.H.)	2 (I.S.) 6-12 (P.H.)	2 (I.S.) 6-12 (P.H.)	2 (I.S.) 6-12 (P.H.)
UV Sensor	Quad	Dual	Dual	Dual	Dual
Built-in Purge Valve	Standard	Standard	Standard	Standard	Standard
Automatic Quartz Sleeve Cleaning Device	Standard	Standard	Standard	Standard	Standard
Wiper Position Switch	Standard	Standard	Standard	Standard	Standard
Lamp Heaters	No	Standard	Standard	Standard	Standard
4-20mA Output	Optional	Optional	Optional	Optional	Optional
Modbus connectivity	Optional	Optional	Optional	Optional	Optional
Power Draw	403W	222W	222W	196W	196W
Inlet & Outlet Port size	2" MNPT	1" MNPT	1" MNPT	1" MNPT	1" MNPT
Nominal Dimensions (H x W x D)	56x11x9" (142x29x 22cm)	40x10x9" (103x24x 22cm)	40x10x9" (103x24x 22cm)	36x10x9" (93x24x 22cm)	36x10x9" (93x24x 22cm)

1 The suffix X will be either R for Reuse or W for Waste water.
2 The maximum flow of the unit will depend on various parameters such as UVT, TSS, and level of UV dose required. The Hallett 1000X is capable of specific flow and UVT configurations. The peak flow & min. UVT for the unit is indicated in the proposal document prepared by UV Pure. The Hallett 750W, 750R, 500W and 500R can be configured to high or low UVT applications by service technicians.
3 The Hallett 1000X is NWRI validated between 19-150mJ/cm^2. Third party validations are pending.
4 Values presented are without the flow restrictor. The flow restrictor adds significant pressure drop.
5 Amalgam lamp lifetime is 12,000hrs/500 days and LPHO lifetime is 9000hrs/375 days
6 Instant Start (I.S.) LPHO limited to 2 cycles/day; Preheat (P.H.) models have 6-12 cycles/day. Exceeding the recommended daily cycles will accelerate the age of the UV lamps. LPHO lamps perform more reliably when operated 24/7.

Unregulated Water Applications

Hallett Models[1]	**Hallett 1000NC**	**Hallett 750NC**	**Hallett 500NC**	**Hallett 400NC**[7]
Max. Flow Rate[2]	90 gpm 341 L/min 20.4 m^3/hr	34 gpm 129 L/min 7.7 m^3/hr	29 gpm 110 L/min 6.6 m^3/hr	21 gpm 79 L/min 4.8 m^3/hr
Performance Certifications[3]	3rd Party	3rd Party	3rd Party	3rd Party
Flow Restrictor	Optional	Optional	Optional	Optional
Pressure Drop[4]	1.9 psig (13 kPa)	6.6 psig (46 kPa)	4.6 psig (32 kPa)	2.3 psig (16 kPa)
Lamp Type	Amalgam	LPHO	LPHO	LPHO
Lamp Life[5]	16 months	12 months	12 months	12 months
Cycles/day[6]	6-12	2 (I.S.) 6-12 (P.H.)	2 (I.S.) 6-12 (P.H.)	2 (I.S.) 6-12 (P.H.)
UV Sensor	Dual	Dual	Dual	Dual
Built-in Purge Valve	Yes	No	No	No
Automatic Quartz Sleeve Cleaning Device	No	No	No	No
Wiper Position Switch	No	No	No	No
Lamp Heaters	No	No	No	No
4-20mA Output	No	No	No	No
Modbus connectivity	No	No	No	No
Power Draw	403W	222W	196W	162W
Inlet & Outlet Port size	2" MNPT	1" MNPT	1" MNPT	1" MNPT
Nominal Dimensions (H x W x D)	56x11x9" (142x29x 22cm)	40x10x9" (103x24x 22cm)	36x10x9" (93x24x 22cm)	32x10x9" (82x24x 22cm)

1 The NC Hallett models require pretreatment for high hardness or iron levels. Review sales literature for pre-conditioning requirements.
2 The max. flow is based on UV Dose of 40mJ/cm^2 at alarm setpoint at UVT of 85%. The max. flow and min. UVT values can be modified to suit applications.
3 Third party validations are pending.
4 Values presented are without the flow restrictor. The flow restrictor adds significant pressure drop.
5 Amalgam lamp lifetime is 12,000hrs/500 days and LPHO lifetime is 9000hrs/375 days
6 Instant Start (I.S.) LPHO limited to 2 cycles/day; Preheat (P.H.) models have 6-12 cycles/day. Exceeding the recommended daily cycles will accelerate the age of the UV lamps. LPHO lamps perform more reliably when operated 24/7.
7 The Hallett 400NC does not meet NSF/ANSI/CAN 61 or 372

4. INSTALLATION INSTRUCTIONS

Before Beginning Installation

Water Conditions - Pre-treatment Parameters

Note this section is designed to ensure the optimal performance of your Hallett system. Please review the following pre-treatment parameters prior to installation. If any specifications are of concern or unclear please contact your water treatment dealer or specialist. Note some of the information below is technical in nature and you may want to contact your water treatment specialist to review the parameters.

IMPORTANT - Should any of the following water parameters exceed the recommended limits; the system will not be serviceable under warranty. **DO NOT INSTALL THE UNIT** until you have confirmed the unit's capabilities matches the application – see Product Specifications Tables.

Water Parameters for Treating <u>Potable</u> Water:
The minimum water requirements are:

- **UV Transmittance (UVT)** – see Product Specification Tables. It is recommended for the water to be tested for UV transmittance in any applications using cisterns, surface water or ground water under the influence of surface water.
- **Total Dissolved solids (TDS)** - must be less than or equal to 1000 mg/L (mg/L=ppm)
- **Level of turbidity** - or cloudiness - of less than or equal to 1 NTU (nephelometric turbidity unit). In a point of entry application, a 5 micron sediment filter is recommended before the unit to reduce turbidity (the presence of a filter will also simplify disinfection of plumbing – see *Disinfecting the Plumbing* section). For surface waters, a dual gradient pre-filter (75x25 or 50x5) is recommended.

Water Parameters for Treating <u>Waste & Reuse</u> Water:
The minimum water requirements are:

- **UV Transmittance** (**UVT)** – The minimum UVT level is 50% or as indicated in the proposal document prepared by UV Pure.
  Total Suspended Solids (TSS) - The amount of suspended solids affect treatment by blocking UV light. The maximum TSS level is 20 mg/L or as indicated in the proposal document prepared by UV Pure.

Parts Included

- UV system complete with integral wall brackets (1)
- Ultraviolet lamps (2) – installed within the unit
- Instruction manual (1)
- Power cord (1) (located within packaging)
- 20 feet of flexible hose to connect purge valve to drain (if applicable)
- Flow Restrictor (only for NSF/ANSI 55 Class A units, optional for other units)

Optional - Automatic shutoff solenoid valve
- Stainless flexible hoses (useful for installation & maintenance)
- Pre-treatment sediment and or carbon filter designed to remove water particles, odor or trace chemicals for improved taste.
- Strain Relief Kit for external wiring # GD21

UNIT (MODEL)	Ø NPT MALE	A inches [mm]	B inches [mm]	C inches [mm]	D inches [mm]	E inches [mm]
Hallett 1000XX	2"	55.8" [1418]	47.8" [1214]	11.5" [291]	18.4" [467]	45.9" [1166]
Hallett 750XX	1"	40.4" [1026]	33.5" [850]	9.6" [244]	16.5" [420]	30.5" [774]
Hallett 500XX	1"	36.5" [926]	29.5" [750]	9.6" [244]	16.5" [420]	26.5" [674]
Hallett 400XX	1"	32.4" [823]	25.4" [646]	9.6" [244]	16.5" [420]	22.4" [570]

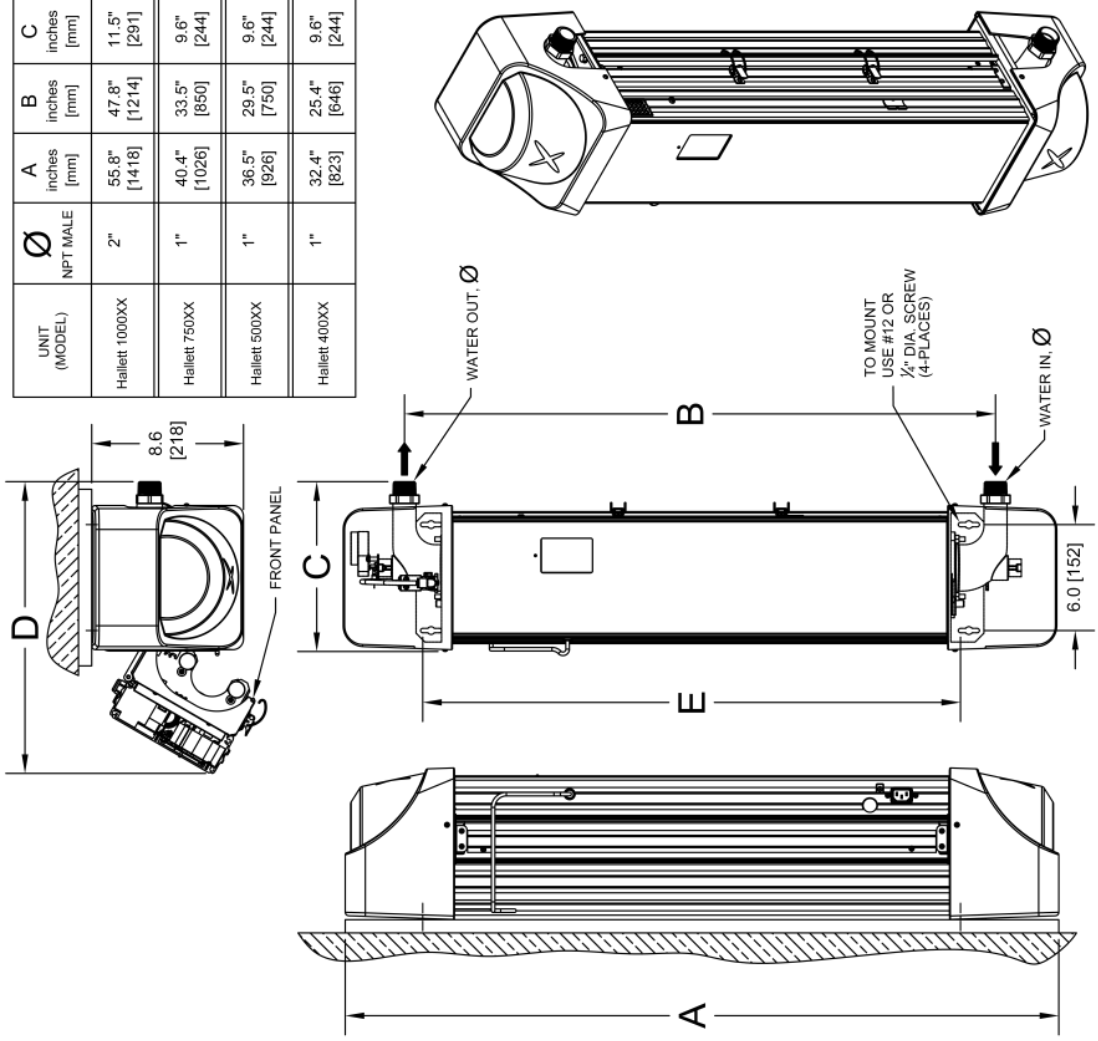


Figure 4.1

Other Materials Needed

The UV Pure unit requires four #12 to 1/4" diameter fasteners (not provided) to mount to a wall. Pipe insulation is recommended for any overhead piping to prevent condensation from dripping onto unit. The unit also requires a drain for the purge valve discharge line.

Warning – Use metal piping such as copper or stainless steel at the **outlet** of the UV unit since water temperatures can reach 176°F (80°C) if the UV unit operates without water flow or the ability to purge. **DO NOT USE PVC**.

These fittings, pipe insulation, and any piping compatible with the plumbing should be on hand before you begin installation. See Figure 4.2 and make a list of all necessary components including solder, paste and thread sealant. Bypass piping and valves that isolate the unit are optional, (but recommended) as is a drain valve for draining the unit.

Tools Needed

- pipe cutter, torch and other typical plumbing tools for modifying piping
- Wrench for tightening hose connections
- Phillips screwdriver
- Slotted screwdriver

Location

Warning - The unit must be positioned vertically on a solid wall **(the performance of the system will be adversely affected if mounted horizontally or is subjected to vibrations).** The installation of the unit (see Figures 4.1 through 4.4) should be done in compliance with all applicable federal, state/provincial, and local regulations. For units in Australia & New Zealand, installation to be in accordance with the Plumbing Code of Australia (PCA). We recommend that the unit be installed by a qualified service technician. Failure to install the system properly may result in property damage (leaks/flooding) or personal injury (electrical shock) and will void warranty.

In a potable water application, the UV Pure unit should be installed downstream of (after) any pre-treatment devices such as filters, water softeners etc and also any pressure tanks. However, it must be installed **before any branches** in the piping so that **all** the water is disinfected before splitting and distributing throughout the home or facility. The unit **must be before** any chlorine injection system or this will void warranty.

Time Required

Please note that full installation of the Hallett requires shutting off the main water supply for a number of hours. If disinfection is necessary, all pipes must be treated and flushed. Once the unit is plugged in, the new UV lamps may take from a few moments to several hours to reach full power depending on the type of lamps. Having a Dose Alarm is normal with a new system (or with newly installed lamps) until the lamps have reached full power.

Summary of Installation:

Unpack and install Hallett on a wall
Prepare connections to inlet and outlet ports
Install purge valve discharge line to a suitable drain line
Install optional shutoff solenoid valve
Install optional bypass & drain plumbing
Check for leaks

Install insulation to overhead piping
Connect system power cord from unit to GFCI

Assembling the Unit

Step 1: Unpack the unit, being careful to remove all packaging material. Inspect the unit for damage particularly the quartz sleeve – See the *Accessing UV Chamber* section. Check if UV lamps are fully inserted. Write model number, serial number, & installation date on front on the Instruction Manual.

Step 2: The UV unit has keyhole slots for convenient mounting – use all four mounts. **Do not mount the unit directly to an outside wall; mount on plywood or shims – See Figure 4.1.** Remove the top and bottom covers of the unit to make the mounting holes accessible. Mounting hole templates are provided to simplify installation.

Step 3: The unit can be connected directly to the water mains or using the optional Stainless flexible hoses purchased through UV Pure. Use only new hoses; old hoses should be discarded. If hoses are being used, connect them now to both the top and bottom of the unit. Make sure that the sealing washer is inside the hose end before making the connection. Hold the stainless manifold with a wrench then tighten the hose securely.

Connecting the Pipes

Warning - Water must flow into the inlet at the bottom of the unit. The outlet is located at the top of the unit. For 1" systems, hold the stainless manifolds with a wrench when tightening mating connections. For 2" systems, the pump flange should be removed and threaded into mating connection then reconnected to UV unit. Do not damage sealing surfaces.

Caution: Always shut off the water supply and relieve the water pressure before beginning any plumbing modifications.

Step 1: See Figure 4.2 on how to arrange the piping and optional devices such as the solenoid valve, bypass line, sample ports and drain. If the pressure tank is downstream of the unit, a purge valve relocation kit is required (# GE3).

Step 2: The optional solenoid valve ensures that should the system fail, due to power loss, low UVT or low UV lamp output, the system will fail in safe mode and shut down the water flow. It is recommended to install the solenoid valve just after the UV unit provided that a flood detection device exists at the site – this allows the unit to purge during alarm situations. If a flood detection device is not present, install the solenoid valve ahead of the UV unit. The direction of flow through the solenoid valve is important – verify flow direction with label on the valve. Water will not flow backwards through the valve. Keep the coil of the valve pointing upward (to prevent water from dripping on it). The valve requires minimum 69kPa (10psig) to fully open.

The optional solenoid valve is normally closed and must be powered to open.

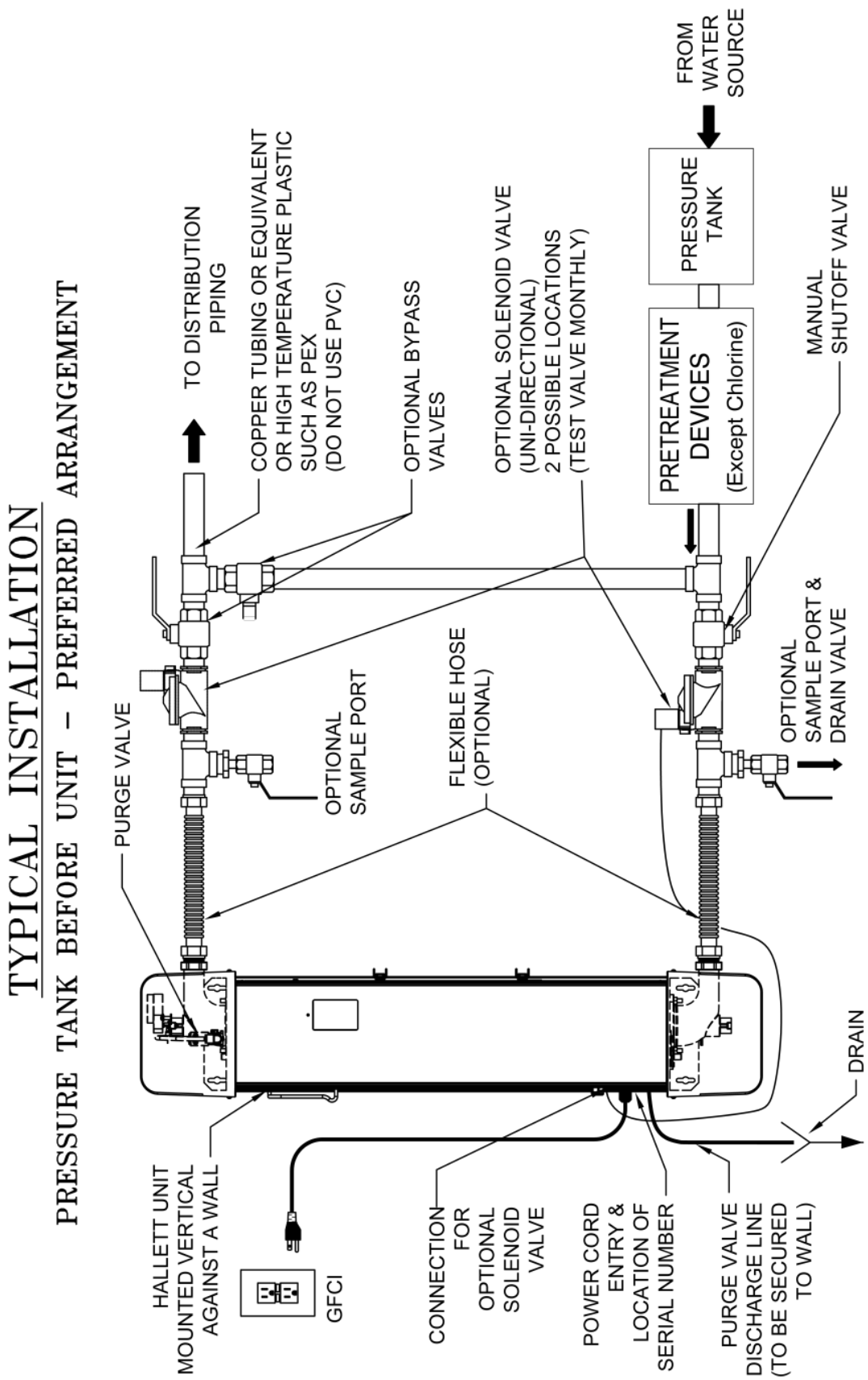


Figure 4.2

Some of the solenoid valves offered have a manual override (white lever) that can be used to force the valve open. In any regulated sites such as municipal applications, the manual override should not be used. For normal operation,

always leave valve in automatic position. In the *Advanced Settings* menu, item 2.7.3, toggle the valve to be “Installed” and a monthly reminder will appear to test valve. Please test valve monthly.

Step 3: Connect the purge valve to a drain using the tubing provided – see Figure 4.3. Note that an air gap is typically required between tubing and drain - follow local plumbing regulations. The tubing can be placed down the back side of the unit. The tubing should be secured to the wall or floor to prevent it from moving during the purging cycle. **During startup of the unit, it is strongly recommended to test the purge valve to confirm connections are free of leaks and the water discharges to drain.**

Step 4: Caution: do not allow the inside of the unit to get wet. Before opening the water supply, double check all connections and taps. Slowly turn on the water supply, vent out trapped air and check for leaks. If leaks exist, investigate the cause and repair before plugging in the unit.

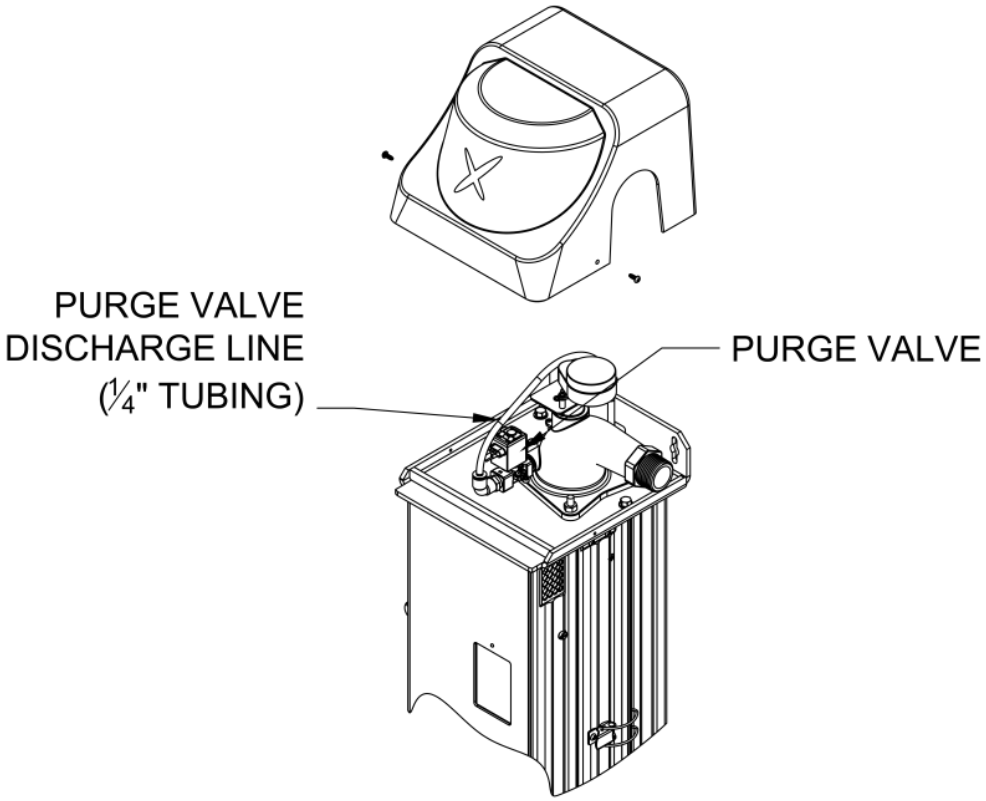


Figure 4.3

Step 5: Once the system is checked for leaks under full system pressure, install pipe insulation to any overhead piping to prevent condensation from falling onto or into the unit.

Important: after the unit has been operating for a few hours, check all connections for leaks (specifically at flexible hoses if purchased). **Repeat this procedure periodically.**

Parallel Installation

When more than one unit is installed in parallel (flow split between units), the

units must be installed with manual shutoff valves both upstream and downstream of each unit. This allows one unit to be serviced without interrupting the flow to the other units. Another requirement is the installation of a check valve downstream of the UV unit (after the UV unit). This will prevent the backflow of water to a unit.

Installation is now complete.

Control Interfaces

WARNING: Shutdown and unplug the unit before installing any external wiring.

External wiring can be introduced through a port in the left side of the unit – see Figure 4.4. By default, a plug is installed into this port in a standard unit and a strain relief (Kit # GD21) can be purchased if connection to remote devices is required. For External Contacts and Remote Start/Stop, 20 gauge wire is recommended and if the 4-20mA option is used, 20 gauge wire with foil and drain wire. Install wires onto spring cage terminals provided.

External Contacts

All Hallett systems provide two “dry” contacts for remote alarms or autodialers – the word “dry” indicates no voltage present at the contact. The first contact labeled RUN is a “System Run” condition – when closed, the unit is treating; if the contact is open, the unit is in alarm, has lost power, or perhaps the wire has been cut. The second contact labeled WARNING is to indicate the existence of an abnormal condition such as high water temperature. When this contact is open, the system is normal; when this contact is closed, a warning condition exists. Both contacts are meant for control purposes only, not to drive devices. The maximum rating of the contact is 24 Vac or Vdc, 2A.

Remote Start/Stop

All Hallett systems have remote start/stop capability which allows them to remain idle without operating the UV lamps. When a signal is given (voltage applied), UV lamps are energized. This is convenient for locations requiring periodic disinfection such as pump houses. The voltage rating range of the contact is 5-24 Vdc or Vac, 0.5W max. The remote start/stop is disabled by default and can be enabled in the Advanced Settings menu.

Caution: Avoid continuously starting and stopping the unit within a 24 hr period, as this will accelerate the aging of the UV lamps and will not be covered under warranty. See Product Specification Tables for permissible lamp cycles.

4-20mA & Modbus Option

A 4-20mA option is available with two continuous analog output signals and one input signal. The output signals can be UV Dose, or UV Intensity, or UV Transmittance. The input signal is flow (on 1000 models only). Modbus capability will also be available when the 4-20mA option is purchased. For more details, refer to document GD31 which is supplemental to this manual.

Data Logging on USB Option

Data logging capability is an available option on all Hallett units. A small USB drive is used to record system performance every 30 seconds. The USB drive has the capacity to store up to 4 years' worth of daily records. For more details, refer to document GD34 which is supplemental to this manual.

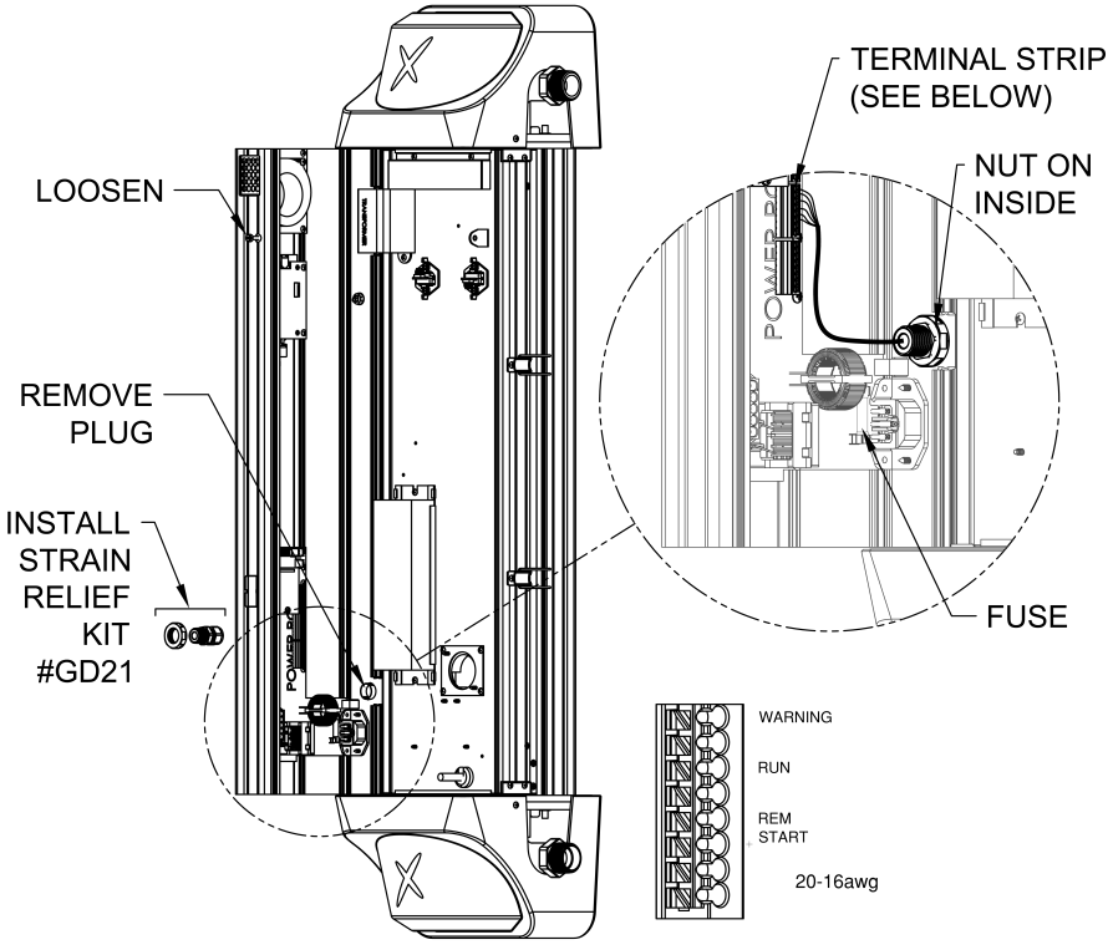


Figure 4.4

5. Operating Instructions

The Hallett applies advanced Crossfire Technology yet is simple to operate. The automatic quartz sleeve cleaning technology available on most models has been designed to reduce, and in most cases, eliminate the periodic shutdowns necessary to inspect the cleanliness of the quartz sleeve. The only required maintenance is the replacement of the two UV lamps.

The unit should be operated with both top and bottom plastic covers installed.

Unit Functions

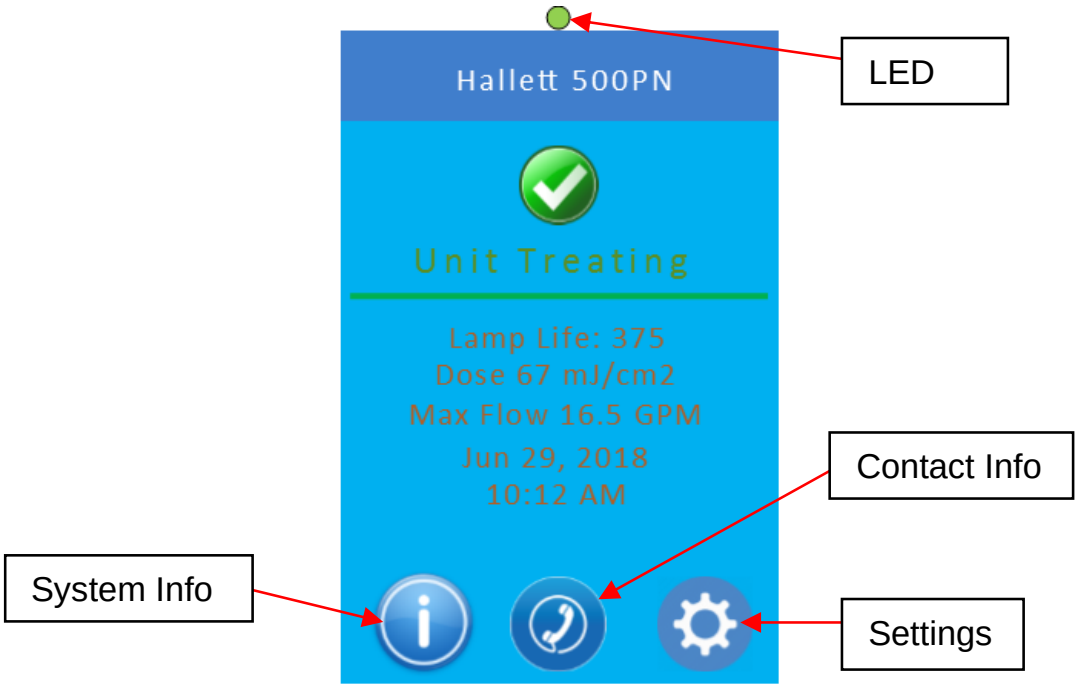


Figure 5.1

The user interface consists of a color touchscreen and a single multi-color LED. See Figure 5.1. The LED will always be illuminated when the UV unit is plugged in and powered up. The touchscreen enters sleep mode after 10 minutes and requires the user to touch it to wake it up. The touchscreen will change colors if any significant event occurs such as warnings or alarms. See the section on *Navigating the Menus* for a complete layout of the screens.

Indicating LED

Green Light – an illuminated green light indicates the unit is treating normally. A slow flashing green light means the UV lamps are not yet at full power or the unit is in standby mode awaiting a remote start. A fast flashing green light means the wiper is cycling.

Red Light – an illuminated red light indicates either a warning or an alarm has occurred. A warning is a condition that, if not addressed, could impact the unit's performance. Warnings should be addressed as soon as possible. Warnings are accompanied with a flashing red LED, a single beep, a message, and a yellow screen. An alarm is a condition that has significantly impacted the unit's performance and it must be addressed immediately. Alarms are accompanied with a solid red LED, continuous beeping, a message, and a red screen.

Audio Alarm

The audio alarm or beeper, will alert the operator to any conditions out of the ordinary. A single beep will sound if a warning occurs; continuous beeping will sound if an alarm occurs. The audio alarm may be disabled temporarily or permanently in the Settings Menu, item 2.3. The sound level of a unit operating normally is less than 70db(A). However, sound levels can exceed 85 db(A) with the audio alarm on.

Navigating the Menus

0 Home

- 0.1 Model name
- 0.2 Treatment Status
- 0.3 Lamp Life
- 0.4 UV Dose
- 0.5 Max Flow or Flow Signal (Optional)
- 0.6 Date & Time

0A Contact Info

Text: Company, Phone, Installation date

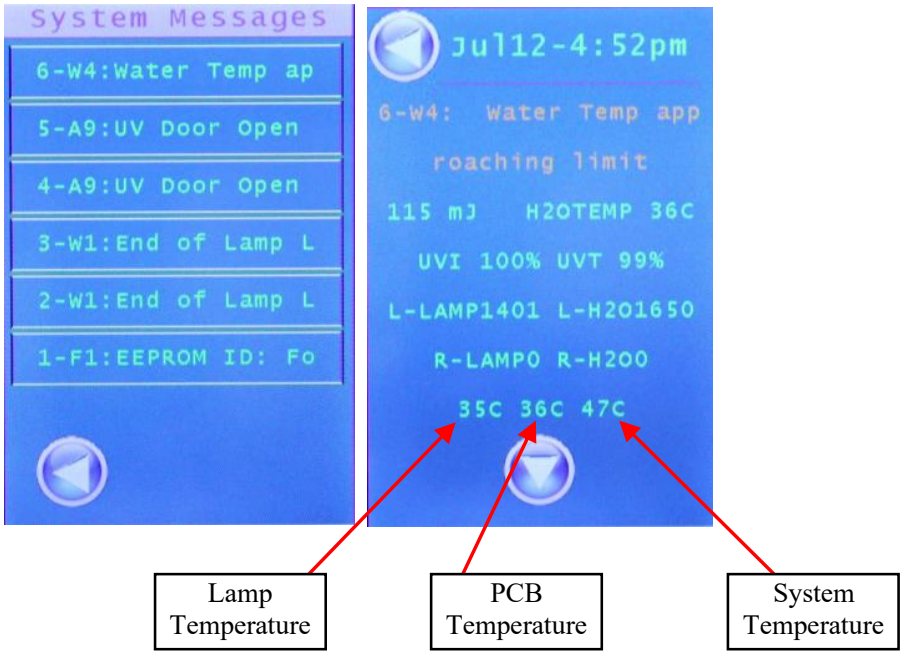
1 System Info

- 1.1 UVT
- 1.2 UVI
- 1.3 Left Lamp UV
- 1.4 Left Water UV
- 1.5 Right Lamp UV (If available)
- 1.6 Right Water UV (If available)
- 1.7 PCB Temp
- 1.8 Sys Temp
- 1.9 Water Temp
- 1.10 Lamp Temp
- 1.11 Wiper Countdown
- 1.12 Daily Starts
- 1.13 Firmware Version
- 1.14 Total Starts
- 1.15 Power-ups
- 1.16 Life-time counter
- 1.17 CH1 - Analog Output
- 1.18 CH2 - Analog Output

2 Settings

- 2.1 Date & Time
- 2.2 Power Down
- 2.3 Audible Alarm
- 2.4 Units (Imperial/Metric)
- 2.5 Reset Lamp Counter
- 2.6 Message History (Last 100 messages)
  - 2.6.1 {Message 1}
    - 2.6.1.1 UV Dose
    - 2.6.1.2 Water Temp
    - 2.6.1.3 Estimated UVI
    - 2.6.1.4 Estimated UVT
    - 2.6.1.5 Left Lamp UV
    - 2.6.1.6 Left Water
    - 2.6.1.7 Right Lamp UV
    - 2.6.1.8 Right Water
    - 2.6.1.9 Lamp Temp
    - 2.6.2.0 PCB Temp
    - 2.6.2.1 System Temp
  - 2.6.2 {Message 2}
  - 2.6.3 ...

Typical message screens shown below:



Starting the Unit

Plugging in the Hallett for the first time

Step 1: Ensure that all external wiring is complete (see *Control Interface*s section) and all the panels of the unit are closed before connecting the power cord.

Step 2: Plug the female end of the power cord into the power entry module located on the left side of the front panel. Plug the male end of the power cord into a ground-fault circuit-interrupter (GFCI).

Caution: Avoid continuously starting and stopping the unit within a 24 hr period, as this will accelerate the aging of the UV lamps and will not be covered under warranty. See Product Specification Table for permissible lamp cycles.

Caution: Do not operate unit dry. There must be water in the treatment chamber to prevent damage to internal components.

In the event of a lack of water or water supply being turned off, shutdown the unit until the water supply can be restored. In the event of a power failure, the unit will shut down and the optional solenoid valve will close, preventing water from flowing. When the power returns, the unit will automatically restart and perform a self-test. If no faults are detected, the unit will return to normal operation and the optional solenoid valve will open. Note that even during a brownout, the supply voltage may drop low enough to cause the unit to shut down. If the unit does not automatically restart as described above, shutdown and unplug the unit and plug it in again.

Step 3: Once the unit is plugged in, the LED illuminates, an audible tone is issued and the display becomes active to confirm all three devices are functional. The unit then performs a self-diagnostic. The user/installer should enter the date of installation in the Settings Menu, and treatment parameters if required.

Step 4: When the UV Lamps have started, (lamp ignition for amalgam lamps may take up to 30 seconds) the unit will wait at 10 - 15 minutes depending on the model to allow the lamps to stabilize before transitioning into Treating mode. This will occur every time the UV lamps are powered up. During this warm up, the green LED will flash, the unit will display the countdown to startup, and the optional shutoff valve will remain closed. **New LPHO lamps may take from a few moments to several hours to reach full power. Continue to operate the unit until the lamps reach full power – this may last 24 hours. It is recommended for new LPHO lamps to be operated initially 3-4 hours as a burn-in to achieve lamp stability.** When the warm up process is complete, a solid green light appears and the message “Unit Treating” will be displayed. The optional solenoid valve will be allowed to open only if treatment levels are adequate, otherwise it will remain closed.

This is the normal operating mode of the unit.

During normal operation if a power outage occurs, upon return of the power, the unit will start up automatically and perform a diagnostic check. After a 10-15 minute stabilization period, the unit will begin treating if treatment levels are adequate, otherwise an alarm will be issued if the unit is not treating. Alternate max flows are available on some models – see document GH43.

Test the wiper motor and purge valve - see Advanced Settings menu, items 2.7.1.2 and 2.7.1.3.

Flushing Instructions

Flushing the system is required after installation or after any disassembly and cleaning. Flushing may also be required to remove colored or contaminated water from the unit. Most filters (if installed) also require flushing prior to use – follow the manufacturer's recommendations.

The system may be flushed in two ways. It can be done manually by disassembling the unit and filling and draining the unit by hand (see *In-place Cleaning* section). Flushing may also be done while the unit is operating. Plug in the unit and open a tap closest to the unit and have the water flow for a minimum of 15 minutes.

Shutting Down of Unit and Seasonal Use

To shut the unit down, initiate the Power Down procedure located as the second item in the Settings Menu. When this procedure is complete, simply unplug the unit.

The Hallett can operate for extended periods of time without water usage **as long as pressurized water is present to allow for purging.** The unit may be shutdown in the case of seasonal residences or during a vacation. If the possibility of freezing exists, the unit and any valves and filters must be drained. (See *Draining the Unit* section.)

Disinfecting the Plumbing

Disinfection of the household or facility plumbing should be performed after the Hallett has been installed and is operating. This procedure should also be done if the unit is not functioning normally; if a bypass has been used; or if there has been a high background bacteria count in a water sample. UV Pure has found that disinfecting the plumbing is the best way to treat any potential bacteria or contaminants in the distribution system prior to system use.

Please note that this procedure is ineffective against protozoa that can be found in surface water or shallow wells under the influence of surface water. Under these circumstances, it is important to perform the disinfecting procedure and then operate the Hallett. UV Pure has found that this procedure does not work with sediments or heavy biofilm and encrustations, which must be removed mechanically.

UV Pure recommends sanitizing the household or facility plumbing by adding

50 ppm chlorine from bleach for 12 hours and then flushing. This can be achieved by doing the following:

Step 1: Shutdown and unplug the unit.

Step 2: Shut off the water supply and relieve the water pressure by opening a tap.

Step 3: Remove the filter from its housing and fill the housing with bleach

Step 4: Re-mount the housing (but not the filter) and plug in the unit to turn it on.

Step 5: Once the unit is operating, turn on the water supply and have the water flow to all taps (hot and cold), toilets, the washing machine and other water-using appliances – the bleach must fill every inch of plumbing. The Dose Alarm may arise due to low UVT after the introduction of bleach. If this occurs, use the manual override on the optional solenoid valve to keep valve open during procedure. **Return override to auto position afterward.**

Step 6: When you detect the odor of chlorine at each spot, turn off the water and let the bleach remain in the lines for at least 12 hours and **turn off** the UV unit during this time.

Caution: Do not allow corrosive chemicals to remain in the unit for more than 12 hours – Do not operate unit during this time period as heating the water will increase corrosive nature of chemicals.

Step 7: After the waiting period is over, plug in the unit. Once stable, flush every line for at least five minutes or until the odor of chlorine is gone. See local regulations for proper disposal of chlorine residual, especially in the case of discharge into a septic system.

Step 8: Now that the disinfection procedure is complete you will need to return the filter to its housing. Shut off the water supply, relieve water pressure by opening a tap, and return the filter to the housing. Allow a few days after a disinfection procedure before getting a sample since residual chlorine may affect the results.

Have the water tested by a local recognized testing agency prior to any water consumption. UV Pure partners with water testing organizations in select locations throughout North America. Contact UV Pure for potential water testing partners: 1-888-407-9997. The testing should be performed on a regular basis as required by local regulations.

Automatic Quartz Sleeve Cleaning Device (available on most models)

The self-cleaning feature of the Hallett system involves a wiper turning inside the quartz sleeve. The wiper operates soon after power up of the lamps and then every 4 hours it will cycle for 5 minutes. The wiper can be enabled anytime in the Advanced Settings menu, item 2.2.1.2. The LED will flash

quickly during a wiper cycle.

Built in Purge Valve (available on most models)

The Hallett contains a flushing or purge valve that cycles water through the unit during long periods of no water usage. The unit monitors water usage by measuring the rise in water temperature within the treatment chamber. During periods of no water flow, the purge valve on the small units can expel 1 gallon (4 liters) of water every 60-90 minutes; the largest unit can expel up to 4 gallons (15 liters). If the largest unit fails to purge and the water temperature exceeds 113°F (45°C), the unit will shutdown to prevent overheating.

6. TROUBLESHOOTING

The Hallett will operate unattended until a fault arises.

If an **alarm** occurs, the solenoid valve (optional) will close, preventing water from flowing; the LED turns red; the audio alarm will beep continuously; the touchscreen turns red and displays a message; the RUN contact will open to indicate the unit is no longer treating. The fault should be corrected to return the unit to normal operation and have the water flow again.

If a **warning** occurs, the solenoid valve (optional) remains open; the LED flashes red; the audio alarm will beep once; the screen turns yellow and displays a message; the warning contact will close to indicate the unit is still treating but in an abnormal state. The warning should be addressed as soon as possible and if left unattended, could turn into an alarm.

The Message History, available in the Settings menu, item 2.6, is very useful in troubleshooting since it contains up to 100 messages/events with associated recorded data such as times, UVI, UVT, UV sensor values, and temperatures.

In the event of an alarm, in many cases, a physical inspection of the unit with the power off should be done to try to identify a cause. A slow water leak for instance, near the top of the unit could stain lamps or reflectors and may not be uncovered without a full system inspection.

Dose Alarm

The Dose Alarm occurs when there is insufficient UV dose to treat the maximum flow rate prescribed by the unit. The Dose Alarm could be a result of low UV intensity or low UV Transmittance (UVT) or a combination of both. Review both values in the System Info Menu to determine which is causing the alarm and take corrective action. It is highly recommended to have a UVT sample taken to confirm system prediction.

The Advanced Settings menu under Force Outputs conveniently provides the ability to manually turn on and off devices to confirm their operation. Devices return back to their automatic position after 10 minutes.

Cycling the power is also useful to occasionally reset the software.

Troubleshooting Guide

System Status	Possible Cause	Corrective Action
No Power (LED is off, touchscreen is off)	Ground-fault circuit-interrupter (GFCI) tripped.	Check for water leaks. Reset GFCI.
	Fuse Blown.	Check for water leaks. Replace fuse (see Fig. 4.4 for fuse location)
	Touchscreen pcb not connected to power pcb.	Ensure ribbon cable is connected at both ends.
	Circuit Board is damaged.	Confirm if Power pcb has any illuminated LEDs. If so replace Touchscreen pcb (LCD).
UV Lamps not starting (occurs after 6 unsuccessful attempts)	UV Chamber interlock not engaged.	Check that each latch is correctly positioned and secure UV chamber door.
	# of lamp starts have exceeded specification.	Review Total Lamp starts in System Info Menu. Replace lamps but reduce future lamp cycles.
	UV lamp failure	Replace lamps
	UV Ballast Failure	Replace ballast
	Over temperature condition.	Either the system, pcb or water temperature has occurred. Allow to cool off and investigate cause by reviewing Message History.
UV Lamps on but UVI is low	Lamps are warming up after a power interruption.	Allow lamps up to 15 minutes to reach full power
	New LPHO lamps installed.	First time LPHO lamps are turned on it may take 3 to 4 hours to reach full power. After this initial “burn-in”, warmup time will be a few minutes.
	The UV output of the lamps have diminished.	Lamps have exceeded their lifetime. Replace lamps.
		# of lamp starts have exceeded specification. Replace lamps but reduce future lamp cycles.
	UV sensor requires recalibration/replacement.	Install reference sensor to confirm status of unit sensor.
	UV Lamps operating outside of recommended temperature conditions.	Check if UV blower is operating correctly.
		For cold water applications, increase room temperature or install LPHO lamp heater kit.
Water Temperature High Warning & Alarm	Warning issued when water temperature within the UV chamber exceeds 95°F (35°C) for H1000XX and 104°F (40°C) for H400-H750XX. Alarm issued when water temperature within the UV chamber exceeds 113°F (45°C) – UV Lamps are turned off (applies to Hallett 1000XX models)	Check if sufficient water pressure to operate purge valve. Check for blockage in purge discharge tubing. Check for debris in purge valve.
System Temperature High Warning & Alarm	The system temperature has exceeded a safe operating level causing the UV lamps to be turned off.	Check if water flow has been turned off. Check if operating temperatures have exceeded specifications. Check if both system blowers are operating correctly.
Circuit Board Temperature High Alarm	The temperature within the electrical chamber has exceeded a safe operating level causing the UV lamps to be turned off.	Check if operating temperatures have exceeded specifications. Check if the pcb blower is operating.
Wiper Not Turning Warning	The system has failed to detect wiper motion during the routine wiper cycle.	Check wiper motor operation
		Check wiper position switch & cam.

7. MAINTENANCE

The disinfection of water will occur as long as the unit is properly maintained with genuine parts in accordance with the instructions set out in this manual. Operating a malfunctioning unit or defeating any system sensors may jeopardize the safety of the water. Online videos are available to help with typical maintenance tasks. Simple tasks such as quartz inspections and lamp replacements can be done by end-user. More in-depth activities such as quartz replacement, should be done by authorized service representatives.

Test Shutoff Valve Monthly
The optional solenoid shutoff valve should be tested monthly to confirm it opens and closes. Unplug valve from unit to confirm water stops flowing. Plug the valve in again to confirm water continues to flow.

Clean Air Filter Periodically
The Hallett contains a washable air filter in the located at the air inlet port (See Figure 7.1). Periodically check and clean the filter to ensure blower operation is not impeded.

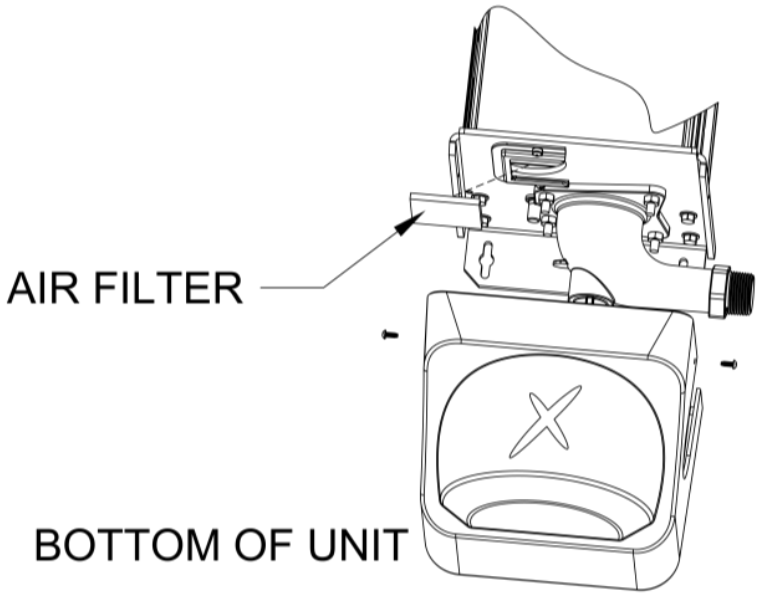


Figure 7.1

UV Sensor Maintenance
Refer to document GH72 for maintaining the UV sensor.

Optional UVT & Flow Meter Maintenance
Refer to supplementary manual included with these devices.

Accessing the UV Chamber

The UV chamber can easily be opened for lamp replacement or quartz sleeve inspection without having to drain the unit and without any tools.

Caution: Always shutdown and unplug the unit before accessing the UV chamber.

Step 1: Shutdown and unplug the unit then wait 5 minutes before opening the UV chamber to allow the lamps to cool. The lamps heat up after continuous use and can burn your skin if touched.

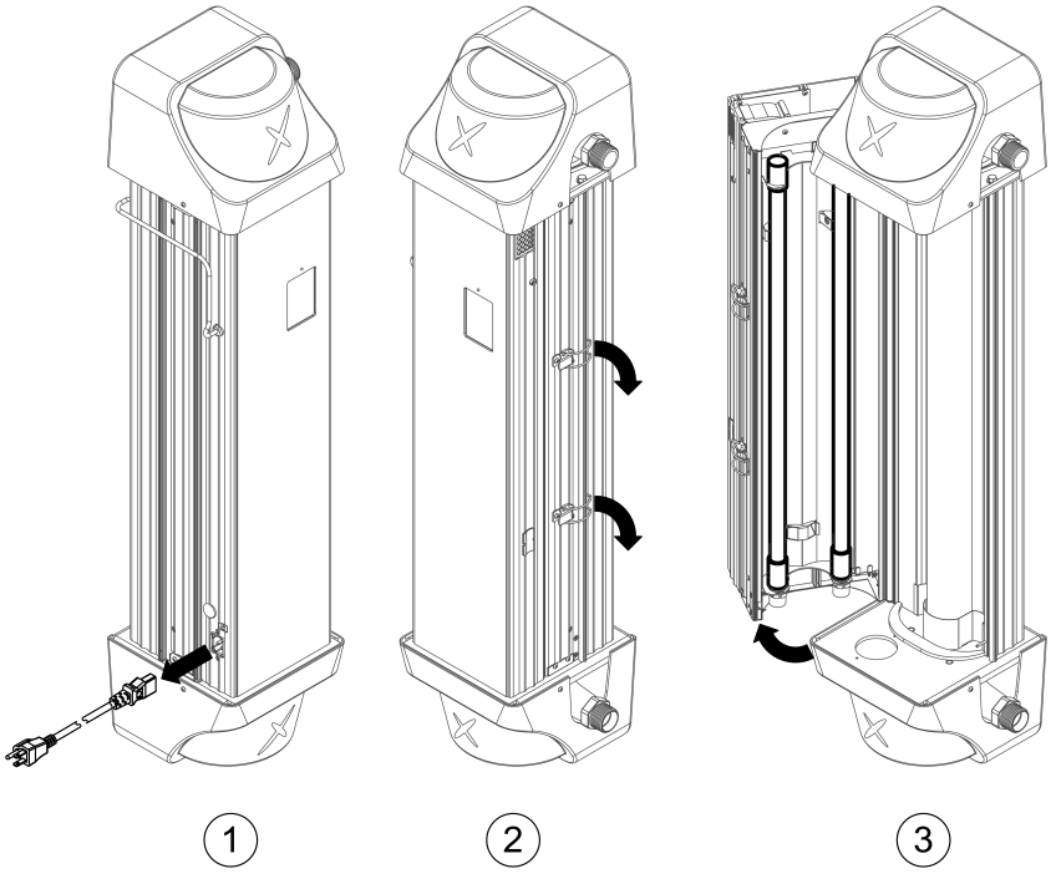


Figure 7.2

Step 2: See Figure 7.2. Open the UV Chamber by undoing the over-the-center latch (may be more than 1). Note where the latch wire engages the extrusion feature – it must be re-latched in same manner.

Step 3: Slowly swing the door completely to the left to reveal the two UV lamps installed in the front half of the UV chamber. Note that the quartz sleeve can be easily inspected.

Step 4: To close the UV chamber, slowly swing the door back towards the back half of the UV chamber. Close all over-the-center latches ensuring the wire correctly grabs the extrusion feature.

Step 5: Plug the unit in again.

Replacing and Cleaning UV Lamps

The Hallett contains two ultraviolet (UV) lamps that emit high-intensity UV light in the germicidal range, providing effective disinfection of the water flowing through the unit. The lamps in the unit will decay over time and they should be replaced every 12 or 16 months for optimum performance – see

Product Specification Tables for lamp lifetimes. Note that lamps will only decay while in operation. Shutting down the system for seasonal use will extend lamp life.

The unit has an internal timer to keep track of the lifetime of the lamps. The Hallett will issue a warning when the end of lamp lifetime approaches and it will warn again when the lamp lifetime is exceeded. The amount of life remaining on the lamps is measured in days and can be seen in the Home menu.

The lamps can be replaced in a few minutes. See Figures 7.3-7.5.

Caution: Do not allow water to flow until new lamps have been installed and reach full power.

Never touch the bulb (quartz portion) of a lamp with your fingers. Handle the lamp by its ends only. If the surface of the lamp becomes dusty or dirty, use a clean lint-free cloth and some rubbing alcohol to remove the dirt. For more difficult stains such as water spots, use a scale remover to remove the stain and then rubbing alcohol afterwards.

Tools Needed

- Slotted screwdriver

NOTE: Resetting the Lamp Lifetime counter will clear the Message History, Lamp Starts counter and Power Ups counter. If this information is required, review it first before proceeding to Step 1.

Step 1: Open the UV chamber as described in *Accessing UV Chamber* section.

Step 2: Use a slotted screwdriver and pry the lamps up between lamp base and ceramic socket, see Figure 7.3

When the bottom pins have disengaged the socket, lift the lamp up, then swing the lamp base away from socket. Lower the lamp to disengage it from the top lamp holder. With the lamp free from the unit, carefully place it aside and remove the other lamp.

Dispose of the old lamps in the same way as you would dispose of ordinary fluorescent tubes. Note that old lamps should be disposed of at a household waste management depot or transfer station; contact your local recycling and waste management authority for proper disposal procedures in your area.

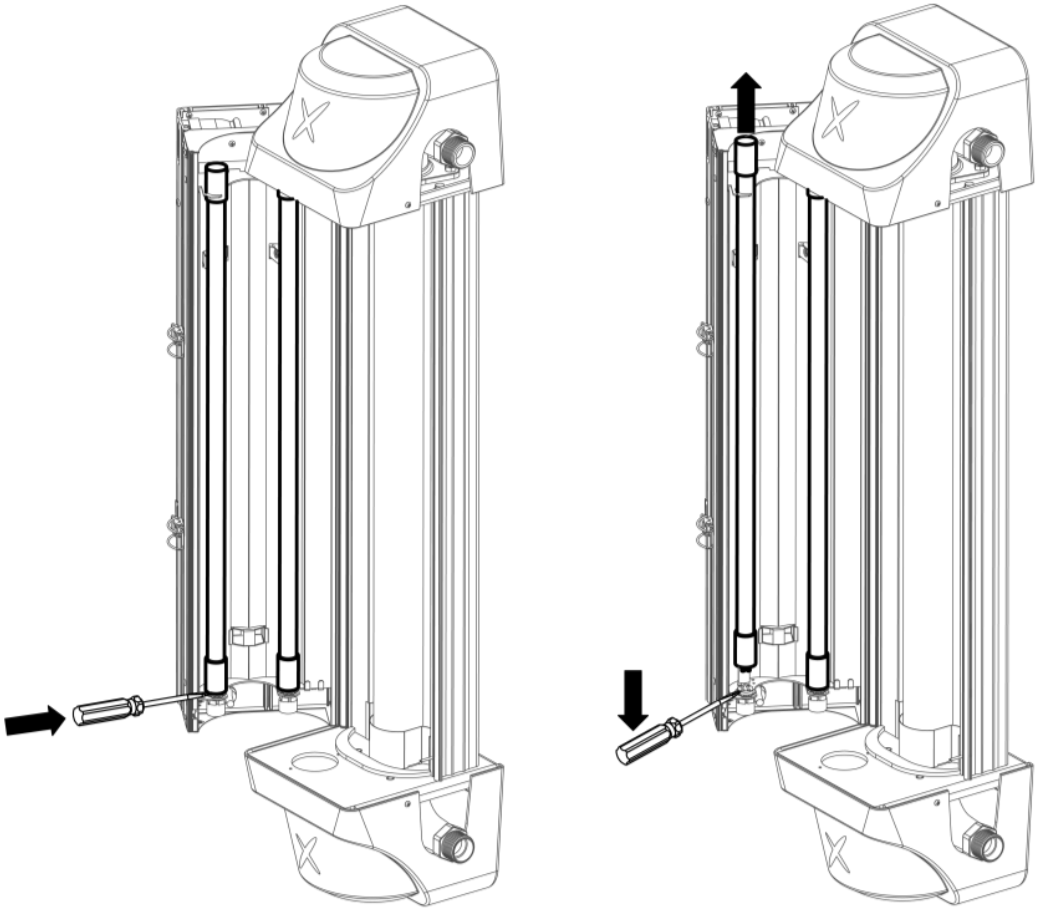


Figure 7.3

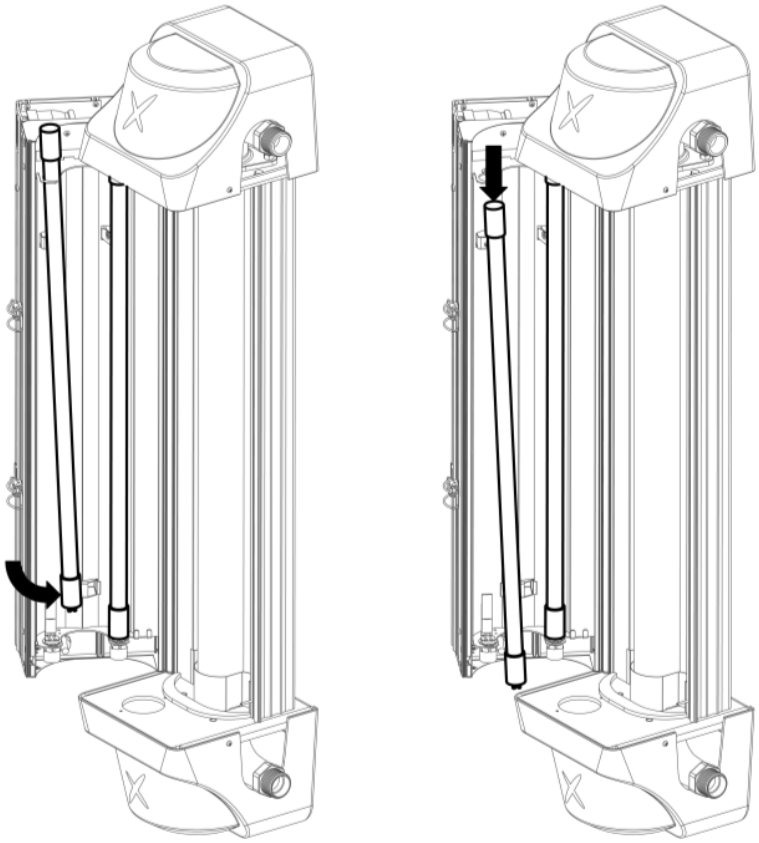


Figure 7.4

Step 3: Install the new lamps into the unit, one at a time being careful not to touch the bulb. Insert the top end of the lamp through the top lamp holder then swing lamp base in over the socket. For a LPHO lamp, rotate it until the "Stop Sign" symbol printed on the top ceramic is towards the left. See Figure 7.5. For an amalgam lamp, rotate it until the wires running down the lamp are facing the back of the unit – a check mark has been added to the top ceramic on same side as the wires. The proper orientation of the LPHO and amalgam lamp has the lamp wires opposite the UV sensors.

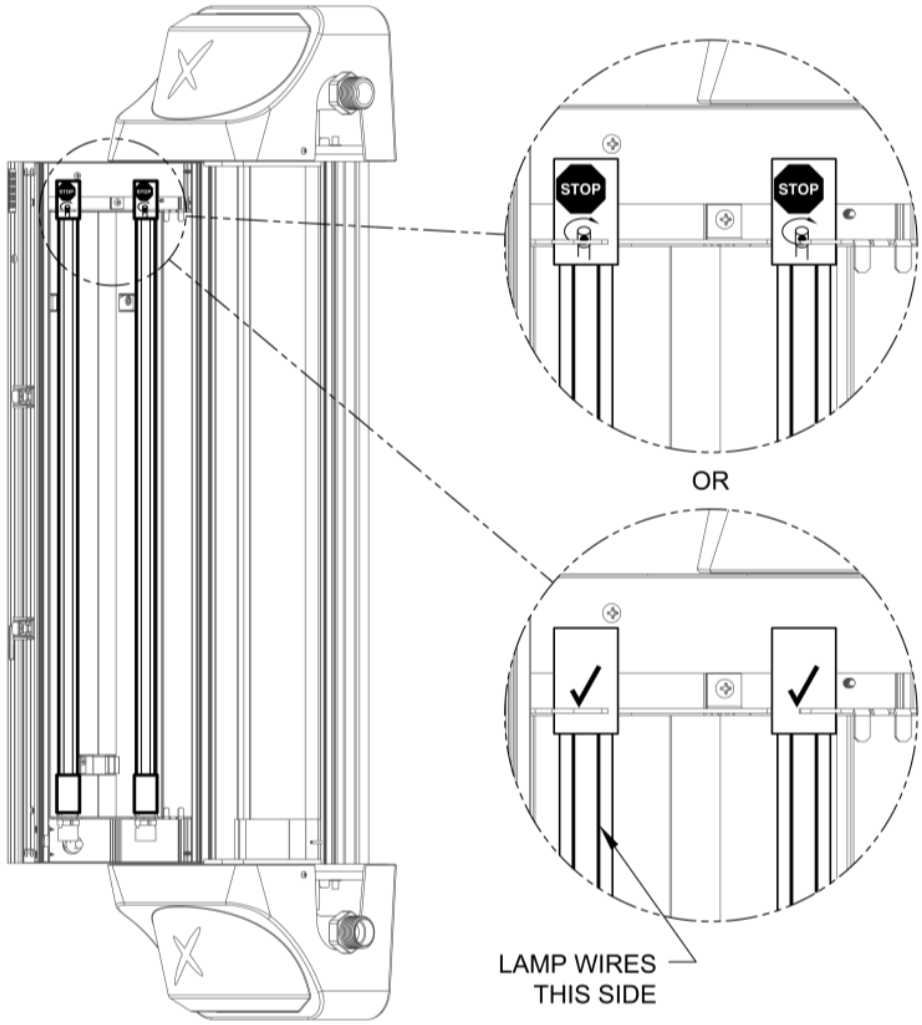


Figure 7.5

After the lamp has been rotated correctly, allow the 4 pins of the lamp to engage into the socket, push **firmly down** on the top of the lamp while holding socket. Do not twist the lamps when they are inserted. **Observe the base of the lamp to confirm the pins are fully seated into the socket.** Repeat for other lamp.

Step 4: Close the UV Chamber and secure door.

Step 5: Record the date of the lamp replacement in your Service Record Sheet.

Step 6: Plug in the unit. The lamp lifetime counter can be reset in the Settings menu, item 2.5 (375 days for LPHO lamps, 500 days for amalgam

lamps). **New LPHO lamps may take from a few moments to several hours to reach full power. Continue to operate the unit until the lamps reach full power.** The UV intensity value can be observed to confirm output levels. It is recommended for new LPHO lamps to be operated initially 3-4 hours as a burn-in to achieve lamp stability.

Draining the Unit

The Hallett does not normally require draining for routine operation or lamp replacement. Draining is necessary to disassemble the system, to protect against freezing, or to remove poor-quality water.

Tools Needed

- Pipe wrench

Step 1: Shut off the water supply and relieve the pressure.

Step 2: Shutdown and unplug the unit.

Step 3: Place a bucket under the unit to collect the water.

Step 4: Open a tap downstream of the unit to vent.

Step 5: If you have installed an optional drain valve, open the drain valve. If you do not have an optional drain valve, disconnect the flexible hose or piping at the bottom port to allow the system to drain for a few minutes. Note that the water will not flow backwards through the optional automatic valve.

Step 6: When draining is complete, close the drain valve or reconnect the flexible hose or pipe connections.

Step 7: Close any taps that were previously opened.

Cleaning the Unit

UV Pure has designed the automatic quartz sleeve cleaning device within the Hallett systems to virtually eliminate the disassembly and cleaning of the quartz sleeve - the quartz sleeve will remain clear and transparent as glass. If a component of the cleaning device fails, such as the wiper motor, or in extreme water cases with unique water chemistry, the quartz sleeve may become fouled and require manual cleaning. In this situation the Dose Alarm will arise and alert you to the unsatisfactory conditions. Follow the steps below to inspect the quartz sleeve and disassemble the unit for cleaning.

Determining the Need for Cleaning

Step 1: Shutdown and unplug the unit.

Step 2: Open the UV chamber as described in *Accessing UV Chamber* section.

Step 3: Examine the quartz sleeve both inside and out – See Figure 7.2. If

it is clean, no disassembly is required and the unit can be closed. Restart the unit by plugging it in.

Step 4: If the quartz sleeve is dirty on the outside, proceed to wipe it down with a clean lint-free cloth and rubbing alcohol to remove the dirt. If the quartz sleeve is dirty on the inside, proceed with in-place cleaning or disassembly.

In-place cleaning

This procedure will clean the quartz sleeve without its removal from the unit. This is a quick and easy procedure that works well in most cases.

Tools Needed

- slotted screwdriver
- Philips screwdriver
- Pipe wrench

Step 1: Fill a bucket or container with 1 gallon (4 liters) of clean water - this will be required later to clean the quartz sleeve. A squeeze bottle is useful for applying water or cleaning solution to the inside of the quartz sleeve.

Step 2: Shutdown and unplug the unit.

Step 3: Shut off the water supply and relieve the pressure.

Step 4: Open the UV Chamber as described in *Accessing UV Chamber* section.

Step 5: Place another bucket under the unit and drain the unit until there is about 1” (3cm) of water left in the quartz sleeve (see *Draining the Unit* section).

Step 6: Disconnect the fitting at the top outlet port of the UV unit. If the stainless flexible hose was installed, disconnect the hose opposite from the UV unit then bend the open end upwards – this will make the next step easier.

Step 7: Add about 2 oz. (60cc) of cleaning solution to the top hose/manifold. The cleaning solution can be a citric acid, vinegar or other non-hazardous solutions. **Any solution used should be thoroughly rinsed out afterwards.** Fill the rest of the quartz sleeve with water.

Step 8: Let the cleaning solution remain in the quartz sleeve for at least 10-20 minutes.

Step 9: Manually turning the wiper may greatly assist the cleaning process. To do this, remove the top plastic cover then remove the motor and turn the wiper shaft with a slotted screwdriver (counterclockwise while looking at the shaft). If the optional wiper positioner switch is installed, leave the trigger cam in place.

Step 10: Drain the unit and inspect the quartz sleeve. If clean, flush the unit with clean water. If fouling remains, repeat procedure or proceed to disassembling the unit.

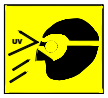
Step 9: Once the unit is clean, reassemble the system including the motor, plastic cover, top port connection(s) and UV chamber door.

Step 10: Slowly open the water supply and check for leaks.

Step 11: Restart the unit by plugging it in.

Disassembling the Unit

NOTE: This procedure is not recommended for untrained users - please contact your certified water specialist to assist should disassembly be required.



Tools Needed

- slotted screwdriver
- Philips screwdriver
- Pipe wrench
- 7/16” (11mm) wrench or nut driver
- Bottle clean brush with long handle

Step 1: Fill a bucket or container with 1 gallon (4 liters) of clean water - this will be required later to clean the quartz sleeve. A squeeze bottle is useful for applying water or cleaning solution to the inside of the quartz sleeve.

Step 2: Shutdown and unplug the unit.

Step 3: Shut off the water supply and relieve the pressure.

Step 4: Place another bucket under the unit and drain the unit completely (see *Draining the Unit* section). Note that piping connections to the inlet and outlet ports will have to be removed in order to disassemble the unit’s stainless manifolds. Perform these disconnections now.

Step 5: Open the UV Chamber as described in *Accessing UV Chamber* section. It may be necessary to have the UV chamber door held open for this procedure.

Step 6: Remove top plastic cover.

Step 7: Disconnect wires to wiper motor, purge valve, and water temperature sensor (thermistor).

Step 8: Remove the wiper motor by removing the two screws holding it to the plate.

Step 9: Remove the motor mounting plate from the top manifold by removing the two screws and nuts. Removing this plate will allow top manifold to come

free from the wire bundle.

Caution: Do not damage the sealing surfaces of the manifolds or the shaft adapter for the wiper - handle these parts with care to prevent water leaks. The wiper assembly must also be handled with care to prevent damage to cleaning edges. **The wiper blades are sharp, handle them with care.**

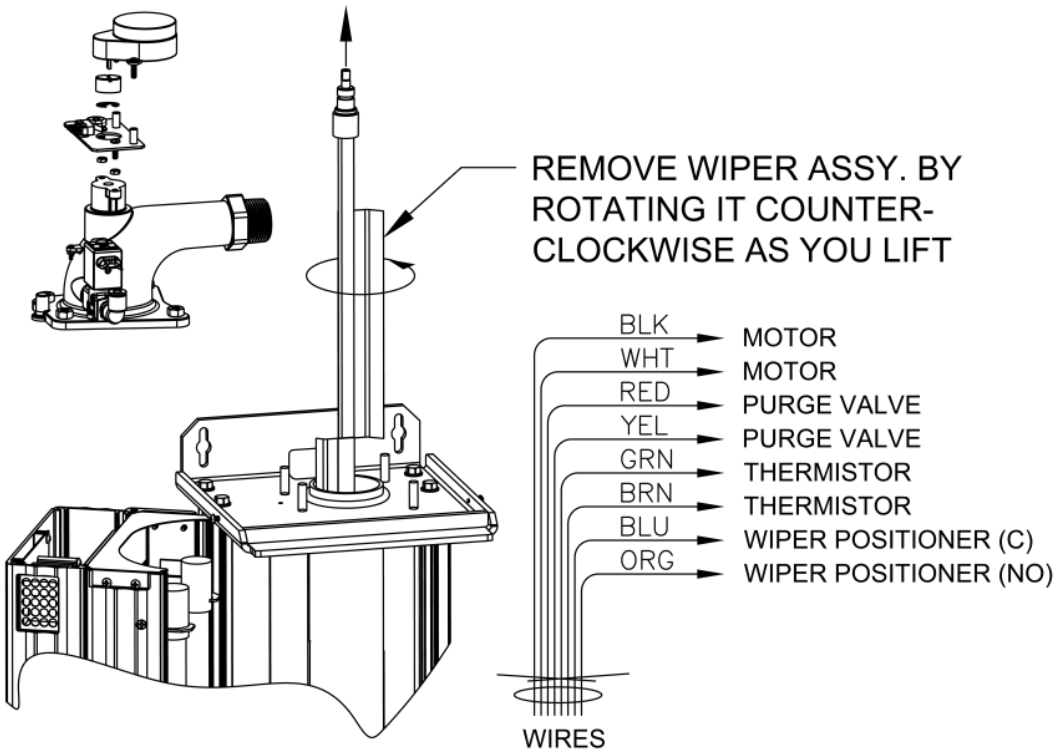


Figure 7.6

Step 10: Remove the retaining ring (E-ring) holding the wiper shaft.

Step 11: Use the 7/16” (11mm) wrench or nut driver to remove the four nuts of the top manifold in an alternating pattern (top left, bottom right, bottom left, then top right). The bottom manifold does not require removal to clean the quartz sleeve, so leave it in place. This will support the quartz sleeve during cleaning and simplify the overall process.

Step 12: Press down on the wiper shaft and remove the top manifold (Figure 7.6) by lifting it straight up to disengage the wiper shaft. The shaft adapter should remain on the top of the wiper shaft. Note the orientation of the slot to the wiper blades – the slot is aligned to the wiper blades.

Step 13: Remove the wiper assembly by carefully lifting it up and out of the quartz sleeve. Rotating it counter-clockwise as you lift will help. Prevent the shaft adapter from falling off the wiper assembly. Note that the shaft adapter sits on the top end of the wiper shaft - the top end of the shaft has a hole, the bottom end of the shaft does not.

Cleaning/Removing the Quartz Sleeve

Step 1: Use a bottle cleaning brush with a long handle to scrub the inside of the quartz sleeve. Scrub and flush it with water repeatedly to clean the quartz sleeve. Use a squeeze bottle to apply water or solution to the quartz sleeve to keep the area tidy. **Note: Keep the rest of the unit free from moisture.** Examine the quartz sleeve.

Step 2: If the quartz sleeve is still dirty, use a scale remover such as CLR or Lime Away and apply it to the inside of the quartz sleeve. Citric acid, available at a drug store, can also be used. **Always flush with clean water afterwards.**

Step 3: Once the quartz sleeve is clean, reassemble the unit (see Figure 7.8). Replace any seals that appear to have been damaged.

Step 4: If the quartz sleeve is still not clean, it requires replacement. This is done by removing the bottom manifold (see Figure 7.7). Replacing a quartz sleeve is easier when the unit is placed on a horizontal surface – removing the unit from the wall to work on a bench is recommended, especially for the Hallett 1000 models.

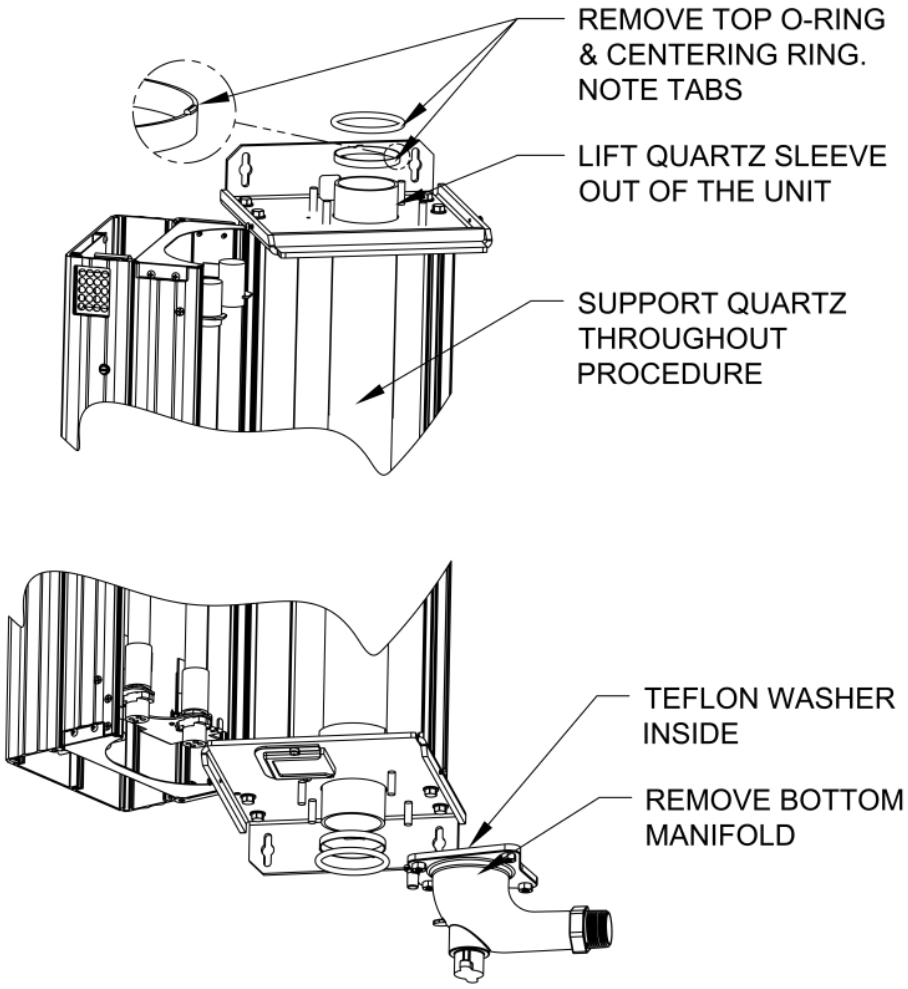


Figure 7.7

Step 5: Remove the bottom plastic cover and then the bottom manifold by undoing the four nuts in an alternating pattern (top left, bottom right, bottom left, then top right). Do not allow the Teflon washer at the lower cavity of the bottom manifold to fall out – the wiper shaft sits on this washer. Support the quartz sleeve as you remove this item.

Step 6: Remove the quartz sleeve by removing the top and bottom O rings and then the quartz centering rings. Lift the quartz sleeve out of the unit.

Step 7: Install the new quartz sleeve into the unit and center it vertically. **Be careful not to chip the ends.** Support the quartz sleeve for the next two actions.

Step 8: Install the quartz centering rings (small tabs face outwards) and then the top and bottom O rings, keeping the quartz sleeve centered vertically in the unit.

Step 9: Replace the bottom manifold (see Fig. 7.7) by installing the four nuts in an alternating pattern (top left, bottom right, bottom left, then top right). Check again for Teflon washer.

Reassembling the Unit

Step 1: Replace the wiper assembly carefully in the quartz sleeve -wetting the inside of the quartz sleeve with water will also make the task easier. Turn the wiper assembly counter-clockwise (looking from the top) as it is being inserted into the quartz sleeve – this will make the task easier and align the wiper blades properly. Ensure the bottom of the wiper is correctly seated into bottom manifold.

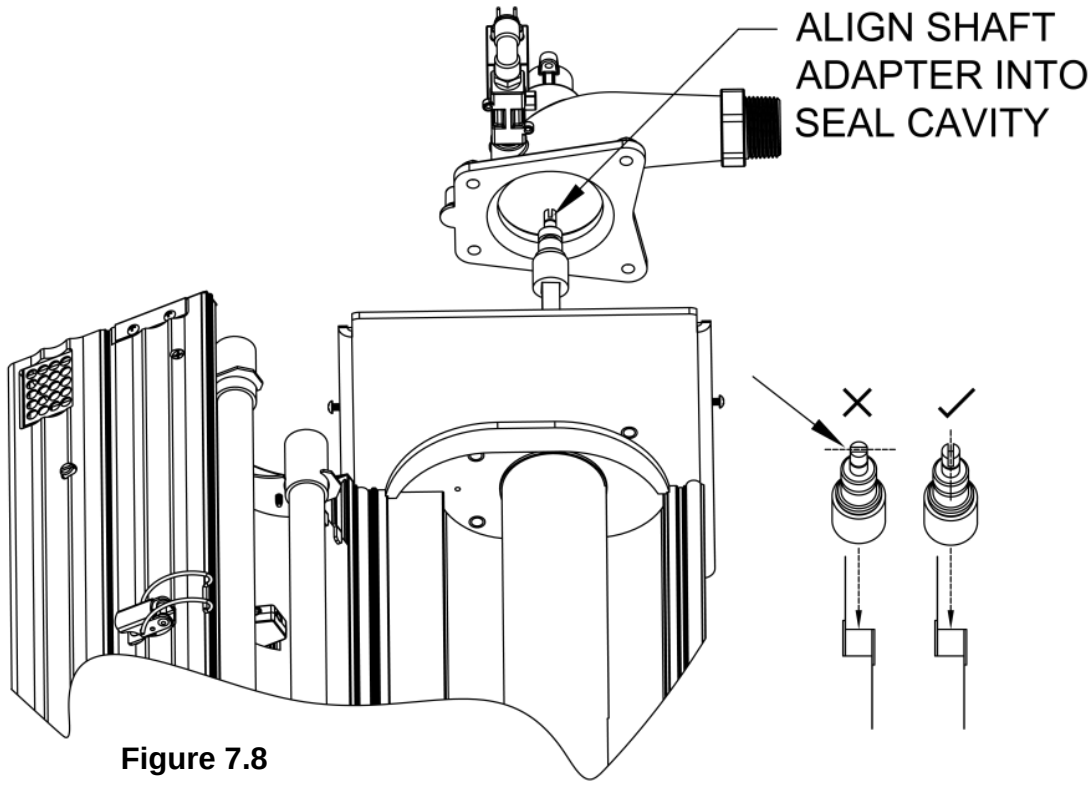


Figure 7.8

Step 2: Ensure the quartz O-ring seal is in place around the quartz sleeve and then replace the top manifold by aligning the shaft adapter into the seal cavity of the top manifold (see Figure 7.8).

Step 3: Tighten the nuts in an alternating pattern. Once top manifold is secure, replace the retaining ring on the wiper shaft. Rotate the wiper assembly CCW to have the top wiper blade facing the back of the unit.

Step 4: Reconnect both top and bottom piping connections. Close the UV Chamber door.

Step 5: Close any taps and slowly open the water supply. Inspect for leaks. Repair any leaks if necessary before plugging in the unit.

Step 6: Reinstall the motor mounting plate by using the trigger cam to center the plate (center hole to be concentric with wiper shaft). With the wiper blade opposite the UV sensor facing the back, the trigger cam should have the dimple in the 10 o'clock position. Install the wiper motor, then reconnect all the wires.

Step 7: Reinstall the top and bottom plastic covers.

Step 8: Plug in the unit. Check operation of wiper motor, purge valve and water temperature switch.

Step 9: Make an entry in the service record to establish a cleaning schedule.

Replacement Parts

Use only genuine parts from UV Pure Technologies when servicing your Hallett disinfection system. Failure to use genuine replacement parts will void the factory warranty, and any laboratory validation and/or certification for water safety and system operating performance. Figures 7.9A-B shows a complete list of original factory parts.

Replacement parts and service are available from your Installer, a Certified Service Dealer (CSD), or directly from UV Pure Technologies on our e-commerce site: www.uvpure.com . A complete list of Certified Service Dealers and their coverage areas is available on UV Pure's website: www.uvpure.com.

Manufactured by: **UV Pure Technologies Inc.**
455 Milner Avenue, Unit 1
Toronto, Ontario, Canada, M1B 2K4
416-208-9884, 1-888-407-9997
FAX 416-208-5808
e-mail inquires: info@uvpure.com www.uvpure.com

Date of Purchase:
Dealer Name:
Model:
Serial Number:
(S/N located on the left side of the front panel below power cord entry)

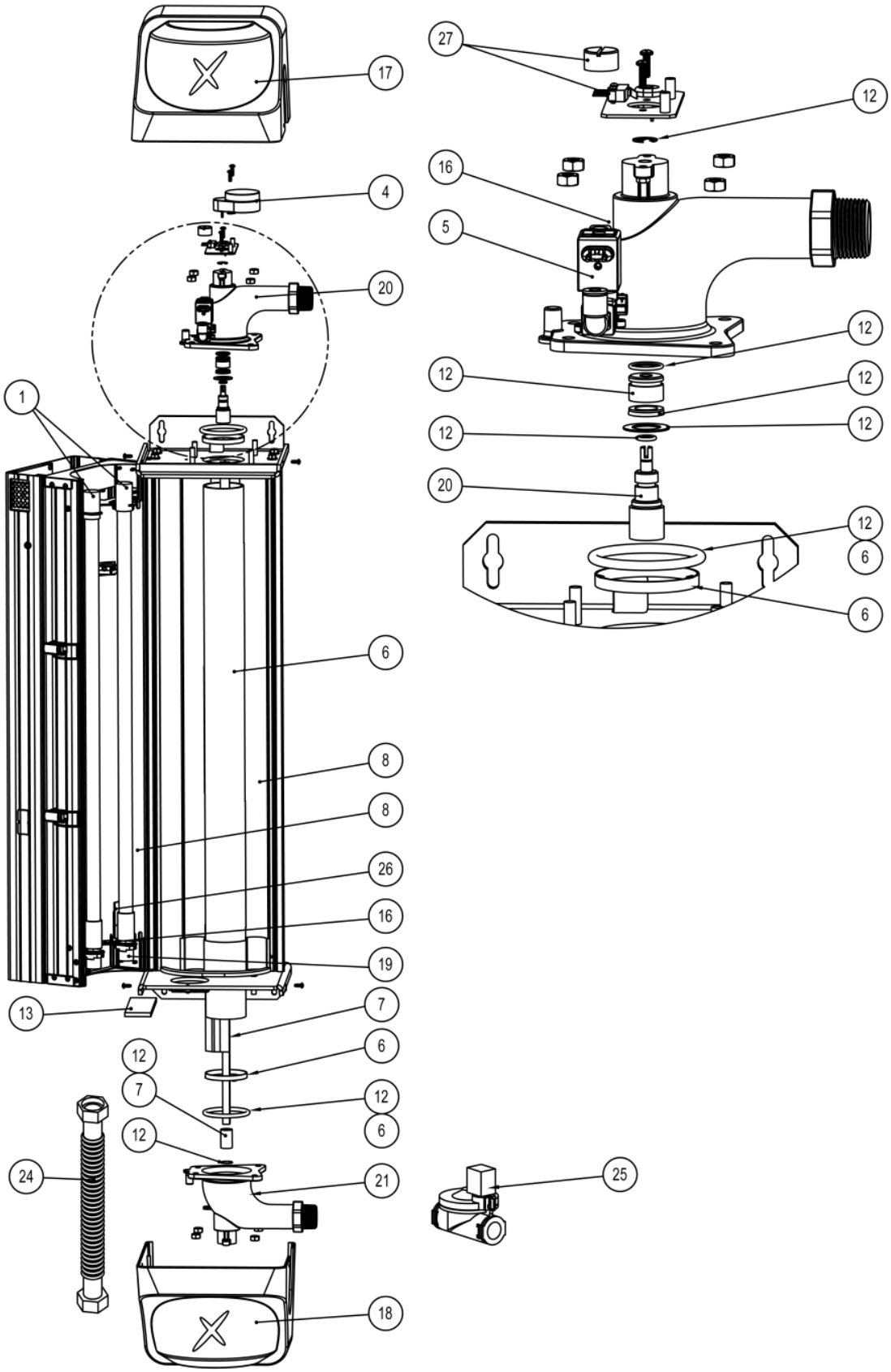

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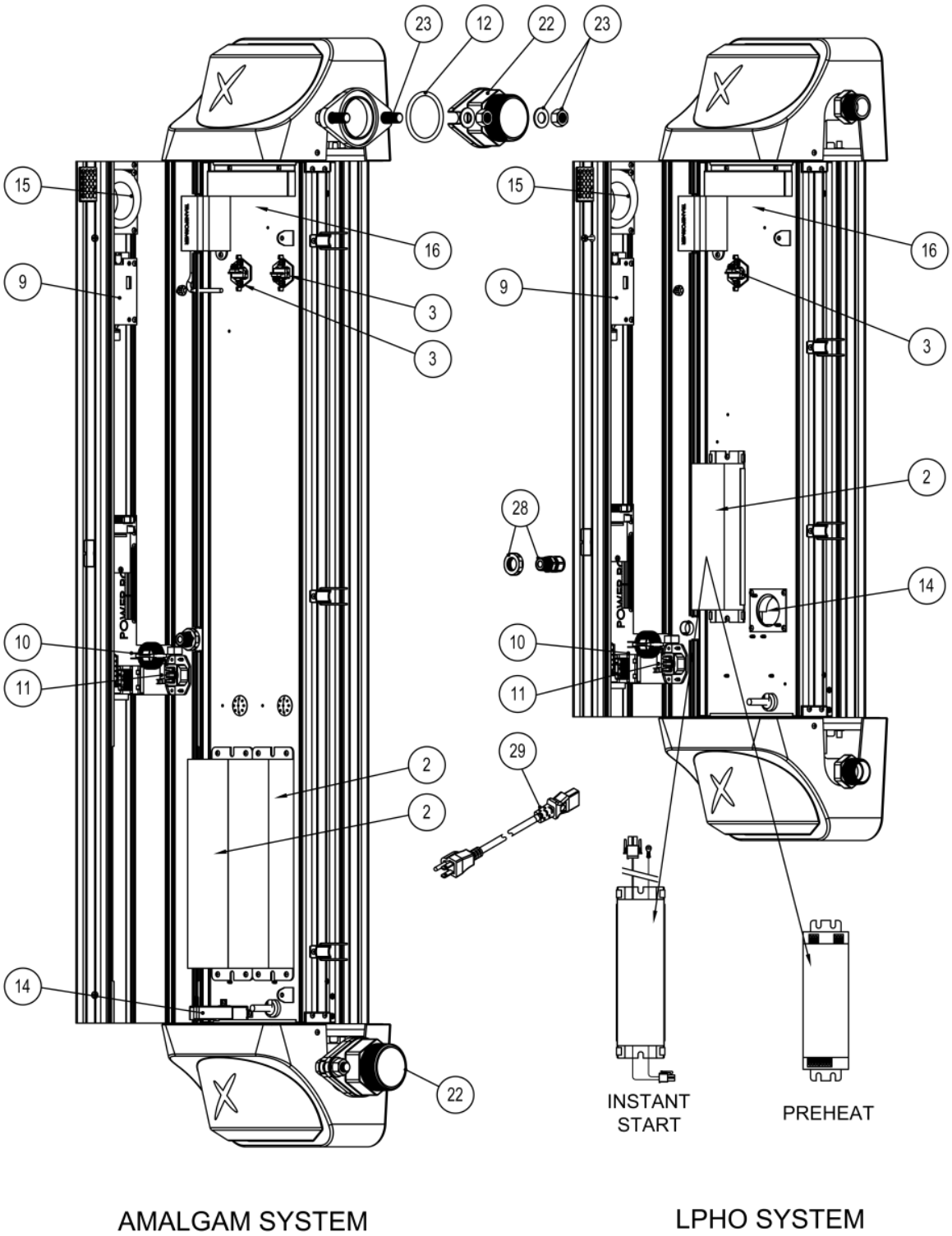
Figure 7.9A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PREHEAT
AMALGAM SYSTEM
LPHO SYSTEM

Figure 7.9B

Hallett Spare Parts List

Item No.	Part Name	Model			
		Hallett 1000XX	Hallett 750XX	Hallett 500XX	Hallett 400XX
1	UV Lamps (Shipped in pairs)	**GC19**			
			C300065 (single lamp p/n is C300064)		
				E300210 (single lamp p/n is E300209)	
					E300165
2	Electronic Ballast	GD37 (2 per unit)	GD40 (for 120V instant start systems) (1 per unit) GD41 (for preheat & 230V systems) (1 per unit)		
3	UV Sensor Kit	GD1 (some units have 2 - see Product Spec. Table)			
4	Wiper Motor Kit	R400005			
5	Purge Valve Kit	H400000			
6	Quartz Sleeve Replacement Kit (includes 2 O rings)	GDQ-XL	GDQ-L	GDQ-M	GDQ-S
7	Wiper Assembly Kit	GDW-XL	GDW-L	GDW-M	GDW-S
8	Reflector Kit (shipped & sold in pairs)	GDR-XL	GDR-L	GDR-M	GDR-S
9	Circuit Board - LCD	Contact UV Pure			
10	Circuit Board – Power	GD3 (for 120V systems) GD3-230 (for 230V systems)			
11	Fuse Pack (5 pcs)	GD4 (for 120Vac systems, fuse is 6A, 250V 3AG) GD50-230 (for 230Vac systems, fuse is 3.15A, 250V 5x20mm IEC)			
12	Seal Kit (complete)	GD5 (2" Port)	GD6 (1" port)		
13	Air Filter	GD7			
14	UV Chamber Blower Kit	GD8			
15	Circuit Board Blower Kit	GD9			
16	Temperature Sensor (Thermistor) Kit	GD10 (3 per unit)			
17	Top Plastic Cap	GD11			
18	Bottom Plastic Cap	GD12			
19	Lamp Socket Wire Harness	GD42 (2 per unit)	GD43 (for 120V instant start systems) (1 per unit) GD44 (for preheat & 230V systems) (2 per unit)		
20	Top SS Manifold/ Thermistor/Purge Valve Kit	GD13 (2 inch)	GD14 (1 inch)		
21	Bottom SS Manifold	GD15 (2 inch)	GD16 (1 inch)		
22	2" NPT Adapter (1 pc.)	GC25			
23	Fastener Kit for 2" Adapter (2 per unit)	GD22			
24	Optional Flexible SS Hose	GD17 (2" hose)	R400007 (1" hose)		
25	Optional Solenoid shut-off Valve – Nylon		550229 (1" ports)		
	Optional Solenoid shut-off Valve – Brass	550231	550195 (1" ports)		
26	Heaters for LPHO Lamps		GD18		
27	Wiper Position Switch Kit	GD19			

28	Optional Strain Relief Kit	GD21	
29	Power Cord	150013 - for 120V North America 150161 - for 230V Europe; 150135-for 230V Aus/NZ	
-	Purge Valve Relocation Kit	GE3 (equivalent to H500001)	
-	10gpm Flow R. Kit		GD24
-	13.2gpm Flow R. Kit		GD25
-	15gpm Flow R. Kit		GD26
-	18.5gpm Flow R. Kit		GD27
-	20gpm Flow R. Kit		GD28
-	25gpm Flow R. Kit		GD29
-	26.4gpm Flow R. Kit		GD30

8. SERVICE RECORD SHEET

Record lamp replacement dates and events in the space provided below.

Date (MMM/DD/YYYY)	**Action**
	System Installed

9. UV PURE TECHNOLOGIES LIMITED WARRANTY

Limited Warranty for UV Pure Technologies'® water disinfection systems purchased in Canada, the United States, Australia and New Zealand.

What this warranty covers:

Defects in materials and workmanship in systems manufactured by UV Pure Technologies Inc. (UV Pure) including Hallett® systems, replacement UV lamps and other original equipment manufacturer components such as manifolds or NEMA cabinets sold or certified by UV Pure Technologies Inc.

What the period of coverage is for UV Pure Parts:

Five-year Limited Warranty for structural, hardware, and mechanical components. Specifically, this includes the following UV Pure Parts: system casing (machined and extruded aluminum parts, stainless steel parts, and plastic molded components), stainless steel manifolds, NEMA cabinets, welded steel skids and structural components, and stainless steel self-cleaning mechanism.

Three-year Limited Warranty for electrical components, reflectors, and quartz sleeve. Specifically, this includes the following UV Pure Parts: wiper motor, air blowers, circuit boards, ballast and micro-processor with digital display, wiring harnesses, lamp sockets, reflectors, and quartz sleeves.

One-year Limited Warranty sensor probes and purge valves, Specifically this includes the following UV Pure Parts: UV sensors and the circuit board they are mounted in, temperature probes, and purge valves.

12-month Limited Warranty for all replacement LPHO lamps (coverage applies up to two years from the date of manufacture of the lamps).

16-month Limited Warranty for all replacement amalgam lamps

Ninety-day Limited Warranty or Balance of Original Warranty for replacement Parts. Specifically this includes any UV Pure Parts replaced or repaired under this Limited Warranty. This warranty period is for the balance of the original warranty or for 90 days from the date the Part is repaired and/or returned to the first end-user whichever is longer. An exception is all replacement lamps that are covered for 12 or 16 months from date of replacement depending on lamp type.

Who is covered:

This Limited Warranty extends to you only if you are the FIRST END-USER PURCHASER and with respect to the ORIGINAL INSTALLATION; the **warranty period shall commence upon the Date of Purchase**.

What we will do to correct problems covered by this Limited Warranty:

During the warranty period, as set out above, UV Pure will repair or replace Products or Parts, at its sole discretion and cost, with the exception of shipping and handling charges. UV Pure may require that certain failed part be returned to UV Pure within 45 days for analysis and to facilitate continuous improvement; for example, circuit boards and sensors that fail must be returned to UV Pure. Replacement parts or systems may be functionally equivalent reconditioned/refurbished/pre-owned or new products or parts at UV Pure's sole discretion. UV Pure may provide software updates, at its discretion, but is under no obligation to do so. Based on an agreement between UV Pure and its service providers, Certified Service Dealers, this warranty will be honoured by either UV Pure or a Certified Service Dealer.

In North America, based on an agreement between UV Pure and its service providers, Certified Service Dealers, this warranty will be honoured by either UV Pure or a Certified Service Dealer.

Outside North America UV Pure has appointed Distributors that will honour this warranty and that provide service directly or via local Certified Service Dealers.

How to get help:

Call a Certified Service Dealer (CSD) or UV Pure's Customer Service toll free line: 1-888-407-9997. A complete list of Certified Service Dealers and their coverage areas is available on UV Pure's website: www.uvpure.com. Or, email UV Pure's Customer Service Center: info@uvpure.com.

What this Limited Warranty does NOT cover:

Maintain your original PROOF OF PURCHASE. UV Pure or its Certified Service Dealers reserve the right to deny warranty coverage if you cannot provide proof of original purchase including date of purchase, who you purchased the Product or Part from, and serial number.

USE OF REPLACEMENT UV LAMPS THAT ARE NOT ORIGINAL UV PURE EQUIPMENT WILL VOID THIS WARRANTY.

USE OF REPLACEMENT UV LAMPS THAT ARE NOT ORIGINAL UV PURE EQUIPMENT WILL INVALIDATE CERTIFICATION TO OR BY EPA, NSF, MENV, NWRI AND OTHER VALIDATION PROTOCOLS AND CERTIFYING BODIES.

All UV lamps lose power over their usable lifetime; original equipment UV Pure lamps are engineered and tested to ensure that all of our systems achieve the

minimum power for disinfection specified, at the end of lamp life. Lamps that are not made by, or that are not approved by UV Pure may not meet those same high standards. Of course UV Pure performs rigorous testing of its systems and original equipment components to its own high quality control standards, and external testing and certification protocols are performed with original equipment UV Pure lamps. NON-ORIGINAL EQUIPMENT UV LAMPS have not been approved by certifying bodies, thereby invalidating those tests and certifications. If you have a question as to whether UV Pure lamps are original equipment, please call our Toll Free Customer Service line at: 1-888-407-9997.

UV Pure may source and supply equipment that is manufactured and warrantied by other companies (the Original Equipment Manufacturer) and **offered as options** in conjunction with UV Pure's Products and Parts. For example: heaters or AC units used in NEMA cabinets, solenoid shut-off valves, stainless flexible hoses, filter housings and inserts, UPS power supplies, and on-line instrumentation or web-enabling communications equipment. **Warranties for those components are solely the responsibility of the Original Equipment Manufacturer, and NOT UV Pure.** UV Pure uses reasonable efforts to ensure that OEM options are of the highest quality possible and consistent with UV Pure's high standards.

UV Pure is not responsible for Parts or Products that are improperly installed, used and/or not maintained as set out in the Product Manual or as expressly advised by UV Pure. This Limited Warranty does not cover damage caused by accidents, acts of God, minor scratches or imperfections and normal wear and tear. This Limited Warranty is void if the Product is improperly installed, used in conditions that exceed UV Pure's specifications as set out in the Manual or Product Specifications, or if there is water damage due to improper installation or poorly or improperly tightened plumbing connections. This Limited Warranty is void if the Product or Parts have been altered or modified in any way by anyone other than a UV Pure technician or a Certified Service Dealer. Warranty coverage may be void if the Product is operated in combination with ancillary or peripheral equipment not approved by UV Pure for use with the Products.

This Limited Warranty excludes the cost of labour in removing and/or reinstalling any defective Product or Part. In the event that a Product is returned to UV Pure for repair or replacement under the terms of this Limited Warranty, the Product must be returned in its original shipping container and packaging. UV Pure will not be liable for damage to the Product during shipping otherwise.

UV Pure does not assume any liability for personal injury or property damage caused by the use or misuse of any Product or Part. UV Pure is not liable for special, incidental, indirect or consequential damages. UV Pure's liability is limited to repair or replacement of the defective Part or Product and this liability shall terminate upon the expiration of the applicable warranty period as set out above.

This Limited Warranty may be amended or changed at any time, at UV Pure's sole discretion, without notice.

UV Pure offers inspection and refurbishing for older systems.

To assist our customers, UV Pure's certified technicians can provide inspection, recommendations, cost estimates, and complete refurbishing of older systems that may be out of warranty.

TO THE EXTENT PERMITTED BY APPLICABLE CONSUMER PROTECTION LAWS, ANY WARRANTIES PROVIDED FOR HEREIN ARE IN LIEU OF ANY OTHER WARRANTY, AND ALL OTHER WARRANTIES ARE HEREBY DISCLAIMED, WHETHER EXPRESS OR IMPLIED.

10. NSF STATEMENT

The Hallett 500PN and Hallett 750PN systems are Tested and Certified by NSF International against NSF/ANSI Standard 55 for Disinfection Performance, Class A.

Who is the NSF? The NSF is the global gold standard accepted by environmental regulatory agents worldwide for water treatment and disinfection.

This Class A system conforms to NSF/ANSI 55 for the disinfection of microbiologically contaminated water that meets all other public health standards. This system is not intended to convert wastewater or raw sewage to drinking water. The system is intended to be installed on visually clear water.

NSF/ANSI 55 defines wastewater to include human and/or animal body waste, toilet paper, and any other material intended to be deposited in a receptacle designed to receive urine and/or feces (black waste); and other waste materials deposited in plumbing fixtures (grey waste).

If this system is used for the treatment of untreated surface waters or ground water under the direct influence of surface water, a device found to be in conformance for cyst reduction under the appropriate NSF/ANSI Standard shall be installed upstream of the system.

UV Pure Technologies Inc.
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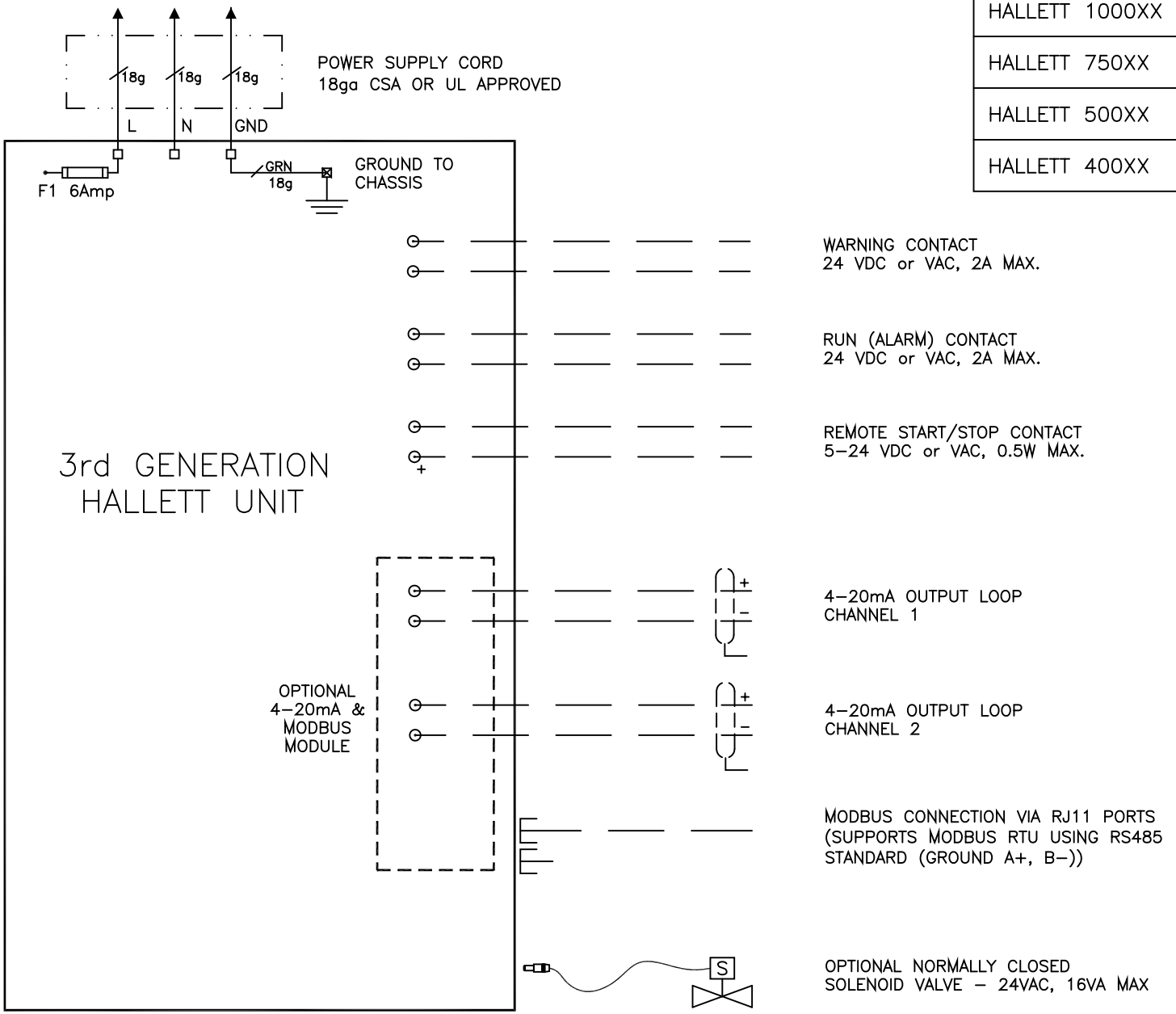
Toronto, Ontario
M1B 2K4
www.uvpure.com

120Vac, 15A, 1PH, 60 Hz, SUPPLY (GROUND–FAULT CIRCUIT INTERRUPTER)
SEE TABLE FOR POWER DRAW

MODEL	MAX POWER
HALLETT 1000XX	403W
HALLETT 750XX	222W
HALLETT 500XX	196W
HALLETT 400XX	162W



REVISIONS

REV	DESCRIPTION	DATE	APPV'D
A	ECO 489 – S.P.	24 MAR 20	
B			
C			
D			
E			

NOTES

1. FUSE F1 IS 6A 250VAC 3AG OR EQUIVALENT

2– EXTERNAL WIRING TO ENTER THROUGH PROVIDED HOLE IN SIDE WALL. STRAIN RELIEF KIT GD21 AVAILABLE.

3–UNLESS SPECIFIED, EXTERNAL WIRING CONNECTED TO SPRING CAGE TERMINALS, 20–16 AWG.

4–WIRING FOR ANALOG LOOPS SHOULD BE SHIELDED. EACH LOOP REQUIRES SEPARATE POWER SUPPLY OR ISOLATION. SEE DOCUMENT GH27.

5–FOR MODBUS INFORMATION SEE DOCUMENT GH57.

6–OPTIONAL SHUTOFF VALVE CONNECTED VIA BARREL CONNECTOR.

FINISH

MATERIAL

DIMENSIONS IN INCHES (unless otherwise specified)

TOLERANCES (unless otherwise specified)

ANGULAR	±0°30'	DECIMAL 2 PLACES	±.010
FRACTIONAL	±1/32	DECIMAL 3 PLACES	±.005
DECIMAL 1 PLACE	±.015	DECIMAL 4 PLACES	±.0005

UV PURE TECHNOLOGIES INC.
455 MILNER AVE., UNIT 1
TORONTO, ONTARIO
M1B 2K4

	NAME	SIGN.	DATE
DRAFT.	S.P.		18 OCT 19
DESIGN.			
CHECK			
APPR.			

TITLE: ELECTRICAL SCHEMATIC
GEN3 HALLETT UNITS

SHEET No.	SHEET 1 OF 1	SCALE NONE
DWG. No.	GA38	REV. A1

Configuring 4-20mA Device
For Hallett 500, 750 and 1000 Systems

4-20mA loop Installation

Two 4-20mA output loops are available on the Hallett 500, 750 and 1000 series of units. The 4-20mA option is normally purchased at the time of order of the UV unit. The hardware consisting of an Analog-Modbus (AM) module circuit board will be installed onto J4 connector of the Power Circuit Board – See Figure 1 below. Also included is the strain relief kit GD21 that will be installed into the front panel.

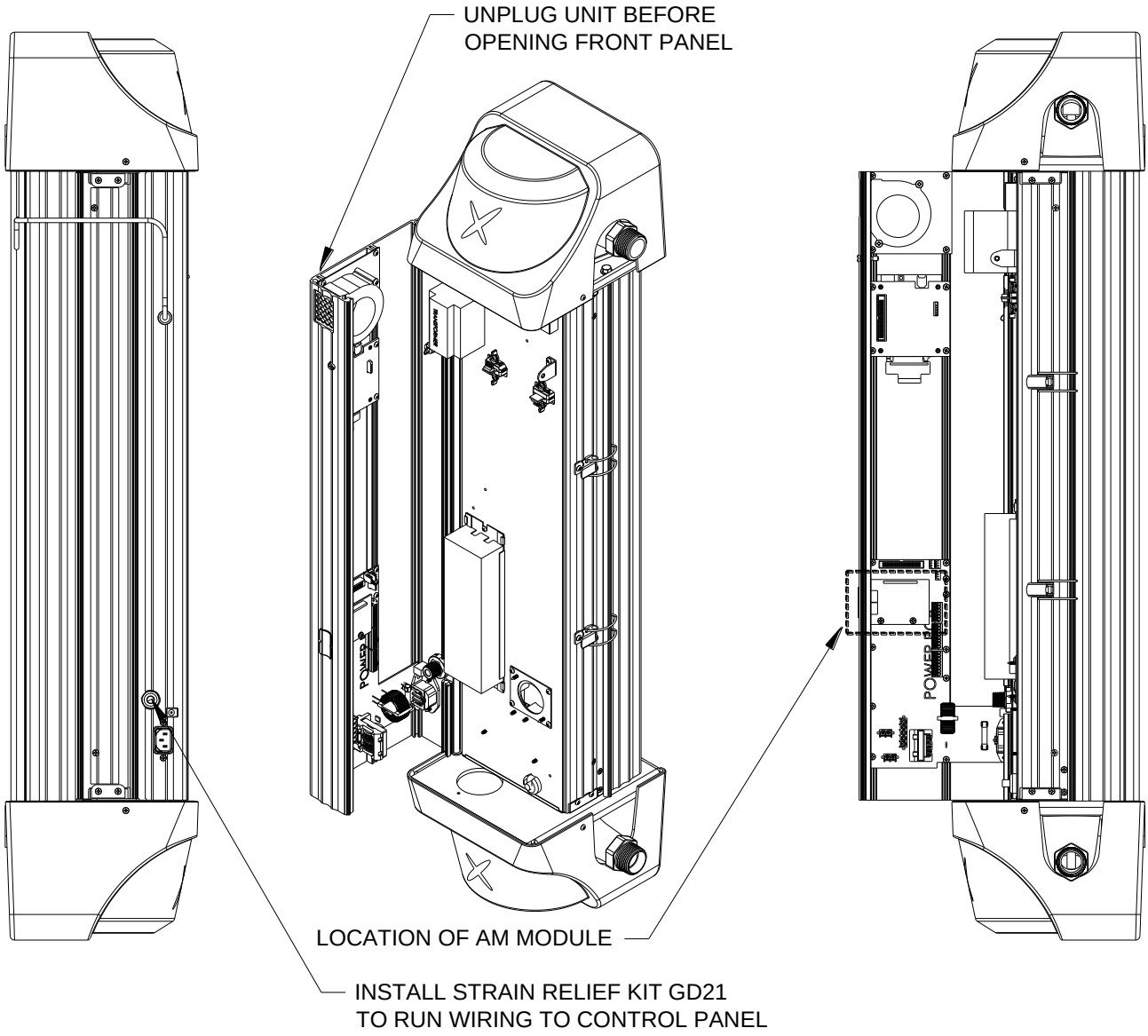


Figure 1

Wiring to the AM module can be 16-20 awg but it is recommended to use shielded pair with a drain wire (drain wire to be grounded in customer panel). Loop voltage (by customer) can be 5-24Vdc – the loops are isolated so one power supply can be shared between loops. Highlighted in the orange box in Figure 2 is where the 4-20 mA output spring cage terminals are located.

Figure 2

From the bottom, the first two terminals are for Channel 1 and the two after are for Channel 2. On the side you will find text denoting the position of the terminals. O/P1 for 4-20mA Output Channel 1 and O/P2 for 4-20mA Output Channel 2.

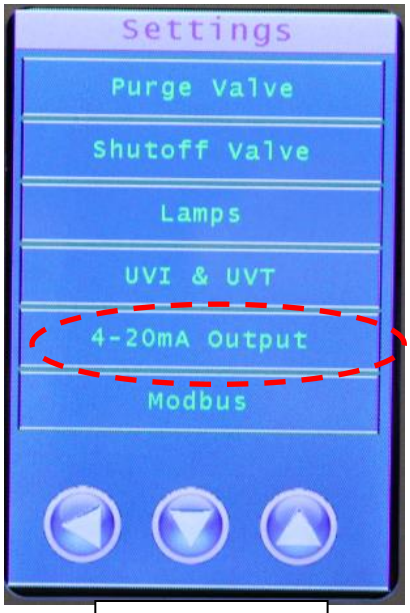
4-20mA loop Operation

Calibration of the 2 analog 4-20mA loops has already been done by the factory. However, the 2 channels can be configured for any 2 of the 3 parameters: Ultraviolet Intensity (UVI); Ultraviolet Transmittance (UVT); UV Dose. Configuration of the channels is done in a password protected area of the Settings Menu – password available to service provides/technicians only.

Once the password has been entered, additional buttons on the menu screens are revealed – see Figure 3.

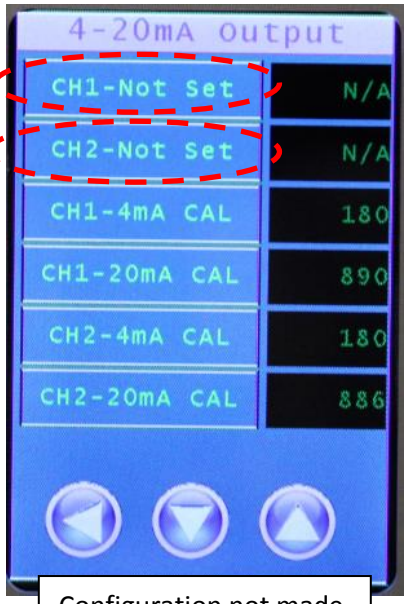
If no selections have been made for the 4-20mA loops, the channels will display the text “CH1-Not Set: N/A” and “CH2-Not Set : N/A”. Click on the channel buttons to configure or re-configure the channel. Once the channels have been configured, the parameter will be displayed on the button and the mA value will be calculated and displayed on the right – See Figure 4.

Settings Page 2

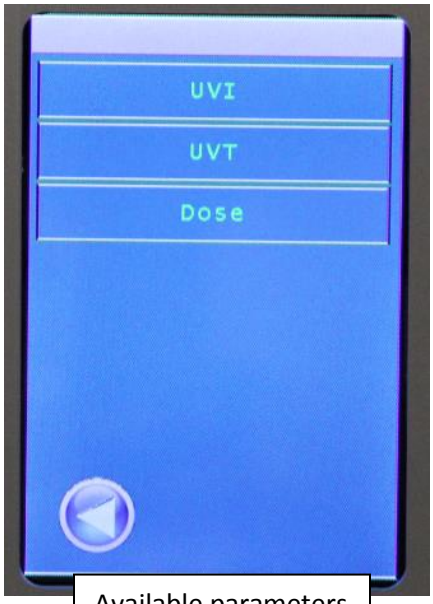


Settings Page 3

Figure 3



Configuration not made



Available parameters

Configurations made

Figure 4

The bottom 4 buttons on the page in Figure 4 is for calibration. Changing these values will alter the zero and span mA values and should only be done be trained personnel. Calibrations cannot be performed if the channels have not been configured.

Basic users can view the mA values without a password on the third information page menu – see Figure 5

Figure 5

Basic users can also force the 4-20mA signal to 4 or 20mA in the second page in the Forced Outputs menus – see Figure 6. Forcing the channel OFF, sets the value to 4mA. Forcing the channel ON, sets the value to 20mA.

Figure 6

APPENDIX D

PRE-PROCUREMENT CONTRACT DOCUMENTS

CITY OF PACIFICA

UV REPLACEMENT PROJECT

CLIENT PROJECT NO. P034

CONTRACT DOCUMENTS

UV PRE-PURCHASE SUBMITTAL

FEBRUARY 2023

Digitally signed by Paul V. Friedlander
Contact Info: Carollo Engineers, Inc.
Date: 2023.02.17 09:59:54 -08'00'

REGISTERED PROFESSIONAL ENGINEER
PAUL V. FRIEDLANDER
No. 55565
CIVIL
STATE OF CALIFORNIA

Digitally signed by Bryan A. Burnitt
Contact Info: Carollo Engineers, Inc.
Date: 2023.02.17 10:02:37 -08'00'

REGISTERED PROFESSIONAL ENGINEER
BRYAN A. BURNITT
No. 83046
CIVIL
STATE OF CALIFORNIA

2795 MITCHELL DRIVE • WALNUT CREEK, CALIFORNIA 94598-1601 • P. 925.932.1710

CITY OF PACIFICA

UV REPLACEMENT PROJECT

TABLE OF CONTENTS

VOLUME 1 OF 1

DIVISION 00 - PROCUREMENT AND CONTRACTING REQUIREMENTS

DIVISION 01 - GENERAL REQUIREMENTS

DIVISION 40 - PROCESS INTEGRATION

DIVISION 46 - WATER AND WASTEWATER EQUIPMENT

DOCUMENT 00_11_17

ADVERTISEMENT FOR BIDS AND LEGAL NOTICE - PROCUREMENT

CITY OF PACIFICA

700 Coast Highway

Pacifica, CA 94044

For procurement of **UV Disinfection Replacement Equipment - Project P034**

BID OPENING

Bids shall be submitted electronically on or before **3:00 p.m.**, local time, **March 15, 2023**, for Project No. **P034** to the City's e-Procurement Portal:
https://secure.procurenow.com/portal/cityofpacifica

The City is accepting electronic bid submissions. Bidders shall create a FREE account with ProcureNow by signing up at https://secure.procurenow.com/signup

Once you have completed account registration, browse back to:
https://secure.procurenow.com/portal/cityofpacifica

Click on "Submit Response" for this project, and follow the instructions to submit the electronic bid. The Documents will be available for download **February 17, 2023**.

The last day that questions will be accepted is **March 6, 2021**. Bid opening will be conducted remotely via Zoom Meeting whose link will be provided in ProcureNow.

Bids may be withdrawn through the City's e-Procurement Portal, the responding firm may "unsubmit" their proposal in ProcureNow. After withdrawing a previously submitted proposal, the responding firm may submit another proposal at any time up to the deadline for submitting proposals prior to the bid opening, but no bidder may withdraw his or her bid for a period of thirty (30) days after the opening thereof.

A Bidder's Package may be viewed in, and an electronic copy can be obtained on, the City's e-Procurement Portal whose address is listed above.

Bidders shall submit all inquiries regarding this bid via the City's e-Procurement Portal whose address is listed above. Please note the deadline for submitting inquiries. All answers to inquiries will be posted on the City's e-Procurement Portal. Bidders may also click "Follow" on this bid to receive an email notification when answers are posted. It is the responsibility of the bidder to check the website for answers to inquiries.

It is sole responsibility of the bidder to see that their bid is complete, all information requested has been submitted, and that their bid is submitted in the proper time. Any proposal submitted after the scheduled closing time will be rejected.

The bid opening whose date and time are listed above will be read aloud and conducted remotely via Zoom Meeting whose information will be included in ProcureNow.

DESCRIPTION OF THE GOOD AND SERVICES

The Goods and Services are generally described as follows:

Permanent replacement Ultraviolet (UV) disinfection equipment temporary bypass UV disinfection system and associated operational equipment. Services include but are not limited

to shop drawing submittals, testing, installation support, startup-up, and training related to all provided equipment.

- Provide Design Assistance (Shop drawings, design workshops, and design support, as specified in the Technical Specifications).
- Furnish UV Disinfection System and actuated gates, as specified in the Technical Specifications.
- Furnish Spare parts and special tools, as specified in the Technical Specifications.
- Furnish Freight, as specified in the Technical Specifications.
- Provide Supervision of installation, testing, training, commissioning, warranty, and follow-up support services.

BIDDING DOCUMENTS

All Bids must be in accordance with the Bidding Documents on file with on the City's eProcurement System as stated above.

BID SECURITY

Each Bid must also be accompanied by security in the form of a Bidder's Bond issued by a corporate surety, a certified check, or cashier's check payable to the City of Pacifica for an amount not less than five percent of the Total Bid Price.

The successful Bidder shall be required to execute a Performance Bond, issued by a corporate surety, in conformance with the requirements set forth in the Contract Documents, for not less than one hundred percent of the Contract Price.

Pursuant to California Code of Civil Procedures Section 995.311, the City will verify all bonds for this Project are issued and executed by a California admitted surety**.**

OWNER'S RIGHTS

Owner reserves the right to reject any or all Bids, including without limitation the rights to reject any or all nonconforming, nonresponsive, or conditional Bids, and to reject the Bid of any Bidder if Owner believes that it would not be in the best interest of Owner to make an award to that Bidder. Owner also reserves the right to waive formalities.

If the Contract is to be awarded, Owner will give the Successful Bidder a Notice of Award within the number of days set forth in the Bid Form.

BY ORDER OF_____

Date _____, 20__

CITY OF PACIFICA
700 Coast Highway
Pacifica, CA 94044

By _____

Kevin Woodhouse, City Manager

BID OPENING:

END OF DOCUMENT

DOCUMENT 00_21_14

INSTRUCTIONS TO BIDDERS - PROCUREMENT

ARTICLE 1 - DEFINED TERMS

1.01 Terms used in these Instructions to Bidders will have the meanings indicated in Document 00_72_01 - General Conditions - Procurement and Document 00_73_01 - Supplementary Conditions - Procurement. Additional terms used in these Instructions to Bidders have the meanings indicated below.

A. Issuing Office—The office from which the Procurement Bidding Documents are to be issued and where the bidding procedures are to be administered.

ARTICLE 2 - PROCUREMENT BIDDING DOCUMENTS

2.01 Bidder may obtain complete sets of the Procurement Bidding Documents, in the number and for the deposit sum, if any, stated in the advertisement or invitation to bid, from the Issuing Office. The deposit will be refunded to each document holder of record who returns a complete set of Procurement Bidding Documents in good condition within 30 days after opening of Bids. Bidders must obtain a complete set of the Procurement Contract Documents as listed in the Procurement Agreement.

2.02 Bidder must use a complete set of the Procurement Bidding Documents in preparing the Bid; neither Buyer nor Engineer assumes any responsibility for errors or misinterpretations resulting from the use of incomplete sets of Procurement Bidding Documents.

2.03 Buyer and Engineer make copies of Procurement Bidding Documents available on the above terms only for obtaining Bids for furnishing Goods and Special Services, and do not authorize or confer a license for any other use.

ARTICLE 3 - QUALIFICATIONS OF BIDDERS

3.01 Buyer may at any time conduct such investigations as Buyer deems necessary to establish the responsibility, qualifications, and financial ability of Bidder, and after the opening of Bids may require a Bidder to submit documentation of its qualifications, including but not limited to financial data and documentation of previous experience providing goods and services comparable to the specified Goods and Special Services.

3.02 Bidder is to carefully review those portions of the Bid Form requiring Bidder's representations and certifications.

ARTICLE 4 - SITE VISIT; PRE-BID CONFERENCE

4.01 Buyer recommends that Bidder visit the Point of Destination and the site where the Goods are to be installed and Special Services will be provided, taking into account observable local and site conditions that may affect the delivery, cost, progress, and furnishing of the Goods and Special Services. Arrangements for such a visit may be made through the City.

4.02 A pre-bid conference will not be held for this procurement.

4.03 Interpretations or clarifications considered necessary by Engineer in response to questions will be issued by Addenda delivered to all parties recorded by Engineer as having received the Procurement Bidding Documents. Only answers in the Addenda will be binding. Oral statements, interpretations, and clarifications may not be relied upon in the preparation of a Bid and will not be binding or legally effective.

ARTICLE 5 - INTERPRETATIONS AND ADDENDA

5.01 All questions about the meaning or intent of the Procurement Bidding Documents are to be submitted via the City's eProcurement System as described in Section 00_11_17 Advertisement for Bids and Legal Notice – Procurement.

5.02 Interpretations or clarifications considered necessary by Engineer in response to such written questions will be issued by Addenda mailed or delivered to all parties recorded as having received the Procurement Bidding Documents. Questions received less than the date specified in Section 00_11_17 will not be answered. Only answers in the Addenda will be binding. Oral statements, interpretations, and clarifications may not be relied upon in the preparation of a Bid and will not be binding or legally effective.

5.03 Addenda may be issued to clarify, correct, or change the Procurement Bidding Documents as deemed advisable by Buyer or Engineer. Addenda will be issued via the City's eProcurement System as described in Section 00_11_17.

ARTICLE 6 - BID SECURITY

6.01 A Bid must be accompanied by Bid security made payable to Buyer in an amount of 5 percent of Bidder's maximum Bid price (determined by adding the base bid and all alternates) and in the form of a Bid bond issued by a surety meeting the requirements.

A. Issue the Bid bond as specified in Document 00_43_30 - Bid Bond (Penal Sum Form).

6.02 The Bid security of the apparent Successful Bidder will be retained until Buyer (Project Owner) awards the Procurement Contract to such Bidder, and such Bidder has executed the Procurement Contract, furnished the required contract security, and met the other conditions of the Notice of Award, whereupon the Bid security will be released.

A. If the Successful Bidder fails to execute and deliver the Procurement Contract and furnish the required contract security within 15 days after the Notice of Award, Buyer (Project Owner) may consider Bidder to be in default and annul the Notice of Award, and the Bid security of that Bidder will be forfeited, in whole in the case of a penal sum bid bond, and to the extent of Buyer's damages in the case of a damages-form bond. Such forfeiture will be Buyer's exclusive remedy if Bidder defaults.

6.03 The Bid security of other Bidders that Buyer believes to have a reasonable chance of receiving the award may be retained by Buyer until the earlier of 7 days after the Effective Date of the Procurement Contract or 61 days after the Bid opening, whereupon Bid security furnished by such Bidders will be released.

6.04 Bid security of other Bidders that Buyer believes do not have a reasonable chance of receiving the award will be released within 7 days after the Bid opening.

ARTICLE 7 - PROCUREMENT CONTRACT TIMES

7.01 See applicable provisions in the Procurement Agreement.

ARTICLE 8 - LIQUIDATED DAMAGES

8.01 Any provisions for liquidated damages, such as those for Seller's failure to attain a specified Milestone such as the delivery of the Goods, are set forth in the Procurement Agreement.

ARTICLE 9 - CONFIDENTIALITY OF BID INFORMATION

9.01 Confidential information is information in the Bid, or in documents submitted by Bidder with the Bid or submitted subsequent to the opening of Bids in support of the Bid, that Bidder clearly and prominently labels in writing to be a trade secret, proprietary, or confidential. Bids will be opened and accompanying documents, if any, will be maintained in a manner that endeavors to avoid disclosing confidential information to third parties, to the extent allowed by Laws and Regulations.

9.02 Bidder shall clearly and prominently mark confidential information with the word "CONFIDENTIAL" on each page or sheet or on the cover of bound documents. Place "CONFIDENTIAL" stamps or watermarks so that they do not obscure any of the required information on the document, either in the original or in a way that would obscure any of the required information in a photocopy of the document.

9.03 If Buyer is requested to disclose confidential information, becomes legally compelled to disclose confidential information, or is required by a regulatory body, governing agency, or controlling authority to disclose confidential information, or make any other disclosure

that is prohibited or otherwise constrained by these Procurement Bidding Requirements, Buyer will provide Bidder with prompt notice so Bidder may seek a protective order or other appropriate remedy. Bidder will be solely responsible for submitting to the regulatory body, governing agency, or controlling authority any arguments, briefs, memoranda, motions, authorities, or other information in opposition to disclosure.

9.04 Buyer's obligations with respect to confidential information are nullified by the following exceptions:

A. Confidential information becomes a part of the public domain through publication or otherwise, through no fault of the Buyer;

B. Buyer can demonstrate through suitable documentation that the confidential information was already in the Buyer's possession, and not previously marked as confidential, or was otherwise publicly available prior to the date of Bid submittal;

C. The confidential information is subsequently and independently disclosed to the Buyer by a third party who has a lawful right to disclose such information;

D. Buyer concludes in good faith that the information is not confidential, or that disclosure is required or justified; or

E. Buyer is required to disclose the confidential information by court order or by applicable Laws and Regulations.

9.05 Notwithstanding any other provision of the Procurement Bidding Documents, it is stipulated and agreed that by accepting a Bid, Buyer has not and does not waive its legal immunity (if any) from suit or liability.

ARTICLE 10 - "OR EQUAL" ITEMS

10.01 The Procurement Contract, if awarded, will be based on material and equipment specified in the Procurement Bidding Documents without consideration of possible "or-equal" items. Whenever it is specified or described in the Procurement Bidding Documents that an "or-equal" item of material or equipment may be furnished or used by Seller if acceptable to Engineer, application for such acceptance will not be considered by Engineer until after the Effective Date of the Procurement Contract.

A. The procedure for submittal of any such application by Seller and consideration by Engineer is set forth in Document 00_72_01 - General Conditions - Procurement and may be supplemented in the Procurement Specifications.

ARTICLE 11 - PREPARATION OF BID

11.01 The Bid Form is included with the Procurement Bidding Documents. Additional copies of Procurement Bidding Documents may be obtained from the Issuing Office.

11.02 All blanks on the Bid Form must be completed and the Bid Form must be signed by an individual authorized to act on behalf of the Bidder. Alterations must be initialed by an

individual authorized to act on behalf of the Bidder. A Bid price must be indicated for each item in the Bid Form. In the case of optional alternates, the words “No Bid” may be entered.

11.03 Bidder must acknowledge all Addenda by filling in the number and date of each Addendum in the Bid Form and sign where indicated to verify that the Addenda were received. A Bid that does not acknowledge receipt of all Addenda may be considered non-responsive.

11.04 Bidder shall:

A. Sign the Bid Form as indicated in the Bid Form.

B. Include evidence of authority to sign.

C. Provide information on the individual to be contacted for any communications regarding the Bid.

D. Provide evidence of the Bidder’s authority and qualification to do business in the locality of the Project, to the extent required, or indicate the ability to obtain such authority and qualification prior to award of the Procurement Contract.

11.05 The responsibilities of each Bidder submitting a Bid are described in the Bidder’s representations and certifications set forth in Article 6 of the Bid Form.

ARTICLE 12 - BASIS OF BID; COMPARISON OF BIDS

12.01 Series of Lump Sums - **Bid Schedule “A”**

A. Bidder shall submit a Bid for each lump sum item as set forth on Bid Schedule “A” and shall compute and enter the total of all lump sum items in the space provided on the Bid Schedule.

B. Discrepancies between the indicated sum of any column of figures and the arithmetically correct sum will be resolved in favor of the arithmetically correct sum.

C. The bidders shall be scored according to the weighted Scoring Matrix below. This Procurement Contract will be awarded to the responsible Bidder with the apparent high Score determined based on the total of all the Scoring Matrix items.

12.02 Operation and Maintenance Expense - **Bid Schedule ”B”**

A. The comparison of Bidders’ data will include an evaluation of the operation and maintenance expense during the anticipated useful life of the equipment.

B. Bidder shall complete the items set forth on Bid Schedule ”B” and shall compute values based on the instructions therein.

C. Discrepancies between the indicated sum of any column of figures and the arithmetically correct sum will be resolved in favor of the arithmetically correct sum.

D. Values related to the evaluation of the operation and maintenance expense include the following:
   1. Anticipated useful life 30 years.
   2. Annual service 8,760 hours.
      a. 85 percent of hours at the average discharge disinfection flow rate and dose.
      b. 10 percent of hours at the average reuse disinfection flow rate and dose.
      c. 5 percent of hours at peak duty with all lamps on full power.
   3. Average energy costs at a power cost of 22¢/kWh.
   4. Discount rate at 4.75 percent annually.
   5. Inflation Rate at 2.5 percent annually.
   6. Maintenance labor rate at $100/labor hour.

E. The Engineer will review information provided by the Bidder in Bid Schedule “B”. The Engineer and Owner reserve the right to correct inaccurate values with written justification based on experience with similar installations of proposed equipment.

F. The bidders shall be scored according to the weighted Scoring Matrix below. This Procurement Contract will be awarded to the responsible Bidder with the apparent high Score determined based on the total of all the Scoring Matrix items.

12.03 Maintenance and Cleaning

A. Bidder shall include detailed maintenance and cleaning instructions and schedule for the UV equipment proposed. At minimum including:
   1. Lamp-bank cleaning descriptions, the estimated labor hours per lamp-bank cleaning, and the recommended lamp-bank cleaning frequency based on the conditions described in the technical specifications.
   2. Proposed equipment installation shop drawings identifying any obstructions near or on the bottom of the channel with a description of how to remove or address these obstructions during channel cleaning.

B. The Bidder may include references for owners with installations similar to the proposed equipment for the Owner and/or Engineer to contact during the evaluation.

C. Owner maintenance staff and the Engineer will review information provided by all Bidders to develop a comparison of the complexity and labor hours required to maintain and clean the proposed equipment.

D. The bidders shall be scored according to the weighted Scoring Matrix below. This Procurement Contract will be awarded to the responsible Bidder with the apparent high Score determined based on the total of all the Scoring Matrix items.

12.04 Scoring Matrix

ITEM	EVALUATION CRITERION	SCORE
Series of Lump Sums – Bid Schedule “A”	The lowest sum for Bid Schedule ”A” will receive Full Score. All other Bidder scores will be determined according to the following calculation ROUNDED DOWN to the nearest whole number: [SCORE] = [FULL SCORE] * {1 – ([BID]-[LOW BID])/[LOW BID]}	_____ /40
Operation and Maintenance Expense – Bid Schedule ”B”	The 30-year Operation and Maintenance life cycle cost will be calculated by the Engineer based on the information provided in this section and Bid Schedule “B”. The lowest calculated life cycle cost will receive Full Score. All other Bidder scores will be determined using the same calculation in Series of Lump Sums – Bid Schedule “A”.	_____ /40
Maintenance and Cleaning	The proposal requiring the fewest maintenance hours and having no critical maintenance flaw(s) as determined by the operations staff will receive Full Score. Complexity of access or maintenance determined by the City staff = score reduction based ratio type formula (see Capital Cost Calculation). City staff will determine additional maintenance man-hours and/or material costs above baseline expectations or current O&M. Inability to remove the UV Modules from the channels for cleaning will receive No Score.	_____ /20

ARTICLE 13 - SUBMITTAL OF BID

13.01 Bidder shall refer to the advertisement or invitation to bid for specific identification of the date, time, and place where Bids are to be submitted.

13.02 Bidder must submit one separate unbound copy of the completed Bid Form, and, if required, the Bid Security and the other documents required to be submitted under the terms of the Bid Form.

13.03 A Bid must be submitted no later than the date and time prescribed and at the place indicated in the advertisement or invitation to bid. Submit the Bid in an envelope plainly marked with the Project title (and, if applicable, the designated portion of the Project for which the Bid is submitted) and the name and address of Bidder. Enclose the Bid security and other documents required to be submitted with the Bid as listed in the Bid Form. If a Bid is sent by mail or other delivery system, the sealed envelope containing the Bid shall be enclosed in a separate package plainly marked on the outside with the notation “BID ENCLOSED.”

ARTICLE 14 - MODIFICATION OR WITHDRAWAL OF BID

14.01 A Bid may be modified or withdrawn by a document duly signed in the same manner that a Bid must be signed and delivered to the place where Bids are to be submitted prior to the date and time for the opening of Bids.

14.02 If, within 24 hours after Bids are opened, any Bidder files a duly signed, written notice with Buyer and promptly thereafter demonstrates to the reasonable satisfaction of Buyer that there was a material and substantial mistake in the preparation of its Bid, that Bidder may withdraw its Bid and the bid security will be returned.

ARTICLE 15 - OPENING OF BIDS

15.01 An abstract of the amounts of the Base Bids and Alternate Bids (if any) will be made available to Bidders after Bids have been opened and reviewed by the Buyer.

ARTICLE 16 - BIDS TO REMAIN SUBJECT TO ACCEPTANCE

16.01 All Bids will remain subject to acceptance for the period stated in Document 00_41_63 - Bid Form - Procurement, but Buyer may, in its sole discretion, release any Bid and return the bid security prior to the end of this period.

ARTICLE 17 - EVALUATION OF BIDS AND AWARD OF PROCUREMENT CONTRACT

17.01 Buyer reserves the right to reject any and all Bids, including without limitation, nonconforming, nonresponsive, unbalanced, or conditional Bids.

17.02 Buyer also reserves the right to waive all informalities not involving price, time, or changes in the Goods and Special Services.

17.03 Buyer will reject the Bid of any Bidder that Buyer finds, after reasonable inquiry and evaluation, to not be responsible.

17.04 In evaluating Bids, Buyer will consider whether the Bids comply with the prescribed requirements, and such alternatives, unit prices, and other data as may be requested in Document 00_41_63 - Bid Form – Procurement or prior to the Notice of Award.

17.05 If Buyer awards the Procurement Contract, such award will be to the responsible Bidder submitting the lowest responsive Bid.

ARTICLE 18 - BONDS AND INSURANCE

18.01 When the Successful Bidder delivers the signed Procurement Agreement to Buyer, it must be accompanied by required such bonds and acceptable evidence of insurance.

ARTICLE 19 - SIGNING OF PROCUREMENT AGREEMENT

19.01 When Buyer issues a Notice of Award to the Successful Bidder, it will be accompanied by 2 unsigned counterparts of the Procurement Agreement along with the other Procurement Contract Documents identified in the Procurement Agreement.

A. Within 15 days, Successful Bidder must execute and deliver the required number of counterparts of the Procurement Agreement and any bonds and acceptable evidence of insurance, together with printed and electronic copies of the Procurement Contract Documents. The Successful Bidder may send electronic copies initially, however signed originals are required to be delivered to the Buyer within the noted time period. In the event of a discrepancy between the terms for the electronic version and the signed original version, the signed original version shall take precedence.

B. Within 10 days, Buyer will deliver one fully executed counterpart of the Procurement Agreement to Successful Bidder, together with printed and electronic copies of the Procurement Contract Documents.

ARTICLE 20 - SALES AND USE TAXES

20.01 Seller shall include sales tax of 9.875% to all applicable bid items.

ARTICLE 21 - PROCUREMENT CONTRACT TO BE ASSIGNED

21.01 Bidder's attention is directed to the provisions of Article 5 of the Procurement Agreement which provide for the assignment of the Procurement Contract to a construction contractor designated by the Buyer to construct the Pacifica UV Disinfection System Replacement Project.

A. Successful Bidder (Seller) will be required to perform the Procurement Contract after it has been assigned to the construction contractor (Contractor Assignee) in accordance with the provisions in the Procurement Contract:
   1. The assignment will be as specified in Document 00_54_34 - Assignment of Procurement Contract and Document 00_60_09 - Surety's Agreement to Assignment.

B. Timing of the assignment is addressed in the Procurement Agreement. Forms documenting the assignment of the Procurement Contract and for the agreement of the Seller's surety to such assignment are included as attachments to the Procurement Agreement.

END OF DOCUMENT

DOCUMENT 00_41_63

BID FORM - PROCUREMENT

The terms used in this Bid with initial capital letters have the meanings stated in Document 00_21_14 - Instructions to Bidders - Procurement, Document 00_72_01 - General Conditions - Procurement, and Document 00_73_01 - Supplementary Conditions - Procurement.

ARTICLE 1 - BUYER AND BIDDER

1.01 This Bid is submitted to:

CITY OF PACIFICA

700 Coast Highway

Pacifica, CA 94044

1.02 The undersigned Bidder proposes and agrees, if this Bid is accepted, to enter into a Procurement Contract with Buyer in the form included in the Procurement Bidding Documents, and to furnish the Goods and Special Services as specified or indicated in the Procurement Bidding Documents, for the prices and within the times indicated in this Bid, and in accordance with the other terms and conditions of the Procurement Bidding Documents.

ARTICLE 2 - BASIS OF BID

The undersigned Bidder proposes and agrees to contract with the Owner, including subsidiary obligations as defined in the Contract Documents for the prices indicated in the BID SCHEDULES below.

Bidder is required to submit Bid Schedule “A”.

Bidder is required to submit Bid Schedule “B”.

The undersigned Bidder understands and agrees that the Total Bid Price is determined by the sum total of all respective bid item amounts in the applicable Bid Schedules A. In the event the addition of the bid item extended amounts does not equal the Total Bid Price the corrected addition of all bid item extended amounts will govern and the Owner will correct the respective total(s) accordingly.

Bid prices shall include everything necessary for the completion of the work stipulated in the Contract Documents, including but not limited to providing the materials, equipment, tools, plant and other facilities, and management, labor and services. Bid prices shall include a 9.875% sales tax and all other applicable federal, state, and local taxes and tariffs.

BID SCHEDULES

BID SCHEDULE "A": EQUIPMENT COSTS

Equipment Costs		
Item No.	**Description**	**Write Price in <u>Figures</u>**
A-1.	Design Assistance (Shop drawings, design workshops, and design support, as specified in the Technical Specifications) for the Lump Sum:	$_____
A-2.	UV Disinfection System, as specified in the Technical Specifications for the Lump Sum:	$_____
A-3.	Spare parts and special tools, as specified in the Technical Specifications for the Lump Sum:	$_____
A-4.	Freight, as specified in the Technical Specifications for the Lump Sum:	$_____
A-5.	Supervision of installation, testing, training, commissioning, warranty, and follow-up support services (Technical Specifications Sections 46_66_85, 40_61_05 and 40_05_59.20 and associate equipment) for the Lump Sum:	$_____
A-6.	Temporary UV Disinfection System: including design assistance shop drawings, spare parts and special tools, freight, installation, startup, testing, training, and follow-up support services while system is on site (Technical Specifications Section 46_66_75 and associate equipment) for the Lump Sum:	$_____
A-7 Total Equipment Price Schedule "A" (Sum of Items # A-1 - A-6) for the Lump-Sum price of (WRITTEN IN WORDS): _____ _____		$_____

END OF BID SCHEDULE "A"

BID SCHEDULE "B": OPERATION AND MAINTENANCE EXPENSE

Item		Description	Price ($)
Operation and Maintenance Costs			
B-1.	**Annual cost for electricity: Item #B-1a multiplied by the unit power cost ($0.22/kWh) and then multiplied by 365 days per year.**		$
	a	Average Power Consumption (APC) for all equipment supplied by Bidder, expressed in kilowatt-hours/day, for the average discharge flow and average UV transmittance conditions.(1) (2)	kWh/day
B-2.	**Annual lamp replacement costs: Item #B-2c multiplied by Item #B-2d.**		$
	a	Number of Lamps in Service at average discharge flow rate of 4 mgd and average UV transmittance of 62 percent. Include a 25 percent safety factor. (Calculated number of lamps multiplied by 1.25)	
	b	Guaranteed Lamp Life, expressed in hours, for the conditions in Item #B-2.	Hours
	c	Number of Lamps Replaced Per Year: Item #B-2a divided by Item #B-2b and multiplied by 8,760 hours in a year. Round up to the next whole number.	
	d	Lamp Material Cost: Guaranteed not-to-exceed replacement cost for one (1) UV lamp, expressed in dollars.	$
B-3.	**Annual ballast replacement costs: Item #B-3a divided by Item #B-3c and then multiplied by Item #B-3b.**		$
	a	Total number of installed ballasts/lamp drivers.	
	b	Ballast/Lamp Driver Replacement Cost: Guaranteed not-to-exceed replacement cost for one (1) ballast/lamp driver, expressed in dollars.	$
	c	Guaranteed Ballast/Lamp Driver Life, expressed in years.	Years
B-4.	**Annual sleeve replacement costs: Item #B-4a divided by Item #B-4c and then multiplied by Item #B-4b.**		$
	a	Total number of installed quartz sleeves.	
	b	Quartz Sleeve Replacement Cost: Guaranteed not-to-exceed replacement cost of one (1) quartz sleeve, expressed in dollars.	$
	c	Guaranteed Quartz Sleeve Life, expressed in years.	Years
B-5.	**Annual UV sensor replacement costs: Item #B-5a divided by Item #B-5c and then multiplied by Item #B-5b.**		$
	a	Total number of installed UV intensity sensors.	
	b	UV Intensity Sensor Replacement Cost: Guaranteed not-to- exceed replacement cost of one (1) UV intensity sensor, expressed in dollars.	$
	c	Guaranteed UV Sensor Life, expressed in years.	Years
B-6.	**Cost for duty/reference UV sensor calibration: Item #B-6b multiplied by Item #B-6c.**		$
	a	Total number of duty/reference UV sensors that require calibration.	
	b	Average number of calibrations required per year.	
	c	Cost of calibration per UV sensor, expressed in dollars.	$
B-7.	**Annual cost for cleaning system consumables (Cleaning Solution, etc.).**		$

Item	Description		Price ($)
B-8.	**Annual wiper replacement cost: Item #B-8a divided by Item #B-8c and then multiplied by Item #B-8b.**		$
	a	Total number of installed cleaning wipers.	
	b	Wiper Replacement Cost: Guaranteed not-to-exceed replacement cost of one (1) wiper, expressed in dollars.	$
	c	Guaranteed wiper life, expressed in years.	Years
B-9.	**Total Annual Operational and Maintenance Cost (Sum of Items #B-1 to #B-8).**		$

Notes:

(1) The Average Power Consumption (APC) calculation shall assume that the system will operate at conditions specified in Section 46_66_85 of the Technical Specifications.

(2) Value entered in Item #B-1a shall be equivalent to the expected value determined by validation testing using an attenuated lamp conditions factor of 0.80 for the APC calculation. This factor will be used for all manufacturers for the life cycle cost analysis and is independent of the validated quartz sleeve fouling and lamp aging factors. Specific quartz sleeve fouling and lamp aging factors listed in Attachment 1 of Section 46_66_85 in the Technical Specifications shall be used for sizing equipment.

END OF BID SCHEDULE "B"

ARTICLE 3 - TIME OF COMPLETION

3.01 Bidder agrees that the furnishing of Goods and Special Services will conform to the schedule of Procurement Contract Times set forth in the Procurement Agreement.

3.02 Bidder accepts the provisions of the Procurement Agreement as to liquidated damages.

ARTICLE 4 - ATTACHMENTS TO THIS BID

4.01 The following documents are attached to and made a condition of this Bid:

A. Required Bid security in the form prescribed in Document 00_21_14 - Instructions to Bidders - Procurement.

B. Evidence of authority to do business in the state of the Project; or a written covenant to obtain such authority within the time for acceptance of Bids.

C. Completed information in Document 00_45_14.15 - UV Qualifications Form with additional project list attached.

D. Equipment cut sheets.
   1. Permanent UV disinfection modules.
   2. Temporary UV disinfection unit.
   3. Gates.

E. Detailed maintenance and cleaning instructions and schedule for proposed UV disinfection equipment.

ARTICLE 5 - BIDDER'S ACKNOWLEDGMENTS

5.01 Bidder accepts all terms and conditions of Document 00_21_14 - Instructions to Bidders - Procurement. This Bid will remain subject to acceptance for 60 days after the Bid opening, or for such longer period that Bidder may agree to in writing upon request of Buyer.

5.02 Bidder has examined and carefully studied the Procurement Bidding Documents, the related data identified in the Procurement Bidding Documents, and the following Addenda, receipt of which is hereby acknowledged:

Addendum No.	Addendum Date

ARTICLE 6 - BIDDER'S REPRESENTATIONS AND CERTIFICATIONS

6.01 Bidder's Representations

A. In submitting this Bid, Bidder represents that:
   1. Bidder has examined and carefully studied the Procurement Contract Documents.
   2. If required by Document 00_21_14 - Instructions to Bidders - Procurement to visit the Point of Destination and the site where the Goods are to be installed or Special Services will be provided, or if, in Bidder's judgment, any observable local or site conditions may affect the delivery, cost, progress, or furnishing of the Goods and Special Services, then Bidder has visited the Point of Destination and site where the Goods are to be installed or Special Services will be provided (as applicable) and become familiar with and is satisfied as to the observable local and site conditions that may affect delivery, cost, progress, and furnishing of the Goods and Special Services.
   3. Bidder is familiar with and is satisfied as to all Laws and Regulations that may affect the cost, progress, and performance of Seller's obligations under the Procurement Contract.
   4. Bidder has carefully studied, considered, and correlated the information known to Bidder with respect to the effect of such information on the cost, progress, and performance of Seller's obligations under the Procurement Contract.
   5. Bidder has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder has discovered in the Procurement Contract Documents, and the written resolution (if any) thereof by Engineer is acceptable to Bidder.
   6. The Procurement Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance of Seller's obligations under the Procurement Contract.
   7. The submission of a Bid will constitute an incontrovertible representation by Bidder that Bidder has complied with every requirement of the Bidding Requirements, that without exception the Bid (including all Bid prices) is premised upon furnishing the Goods and Special Services as required by the Procurement Contract Documents.

6.02 Bidder's Certifications

A. Bidder certifies that:
   1. This Bid is genuine and not made in the interest of or on behalf of any undisclosed individual or entity and is not submitted in conformity with any collusive agreement or rules of any group, association, organization, or corporation;
   2. Bidder has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid;
   3. Bidder has not solicited or induced any individual or entity to refrain from bidding; and
   4. Bidder has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for the Procurement Contract. For the purposes of this Document:
      a. "corrupt practice" means the offering, giving, receiving, or soliciting of anything of value likely to influence the action of a public official in the bidding process;

b. “fraudulent practice” means an intentional misrepresentation of facts made (a) to influence the bidding process to the detriment of Buyer, (b) to establish bid prices at artificial non-competitive levels, or (c) to deprive Buyer of the benefits of free and open competition;
c. “collusive practice” means a scheme or arrangement between two or more Bidders, with or without the knowledge of Buyer, a purpose of which is to establish bid prices at artificial, non-competitive levels; and
d. “coercive practice” means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the bidding process.

This Bid is offered by:

Bidder:

_____

(typed or printed name of organization)

By: _____

(individual's signature)

Date: _____

(date signed)

Name: _____

(typed or printed)

Title: _____

(typed or printed)

(If Bidder is a corporation, a partnership, or a joint venture, attach evidence of authority to sign.)

Attest: _____

(individual's signature)

Title: _____

(typed or printed)

Address for giving notices:

_____

_____

_____

Designated Representative:

Name: _____

(typed or printed)

Title: _____

(typed or printed)

Address:

_____

_____

_____

Phone: _____

Email: _____

License No.: _____

Classification: _____

Limitation: _____

END OF DOCUMENT

DOCUMENT 00_43_30
BID BOND (PENAL SUM FORM)

Bidder Name: Address *(principal place of business)*:	**Surety** Name: Address *(principal place of business)*:
Owner Name: Address *(principal place of business)*:	**Bid** Project *(name and location)*: Bid Due Date:
Bond Penal Sum: Date of Bond:	

Surety and Bidder, intending to be legally bound hereby, subject to the terms set forth in this Bid Bond, do each cause this Bid Bond to be duly executed by an authorized officer, agent, or representative.

Bidder	Surety
_____	_____
(Full formal name of Bidder)	*(Full formal name of Surety) (corporate seal)*
By: _____	By: _____
(Signature)	*(Signature) (Attach Power of Attorney)*
Name: _____	Name: _____
(Printed or typed)	*(Printed or typed)*
Title: _____	Title: _____
Attest: _____	Attest: _____
(Signature)	*(Signature)*
Name: _____	Name: _____
(Printed or typed)	*(Printed or typed)*
Title:	Title:

Notes: (1) Note: Addresses are to be used for giving any required notice. (2) Provide execution by any additional parties, such as joint venturers, if necessary.

1. Bidder and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to pay to Owner upon default of Bidder the penal sum set forth on the face of this Bond. Payment of the penal sum is the extent of Bidder's and Surety's liability. Recovery of such penal sum under the terms of this Bond will be Owner's sole and exclusive remedy upon default of Bidder.
2. Default of Bidder occurs upon the failure of Bidder to deliver within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents.
3. This obligation will be null and void if:
    3.1. Owner accepts Bidder's Bid and Bidder delivers within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents, or
    3.2. All Bids are rejected by Owner.
    3.3. Or Owner fails to issue a Notice of Award to Bidder within the time specified in the Bidding Documents (or any extension thereof agreed to in writing by Bidder and, if applicable, consented to by Surety when required by Paragraph 5 hereof).
4. Surety waives notice of any and all defenses based on or arising out of any time extension to issue Notice of Award agreed to in writing by Owner and Bidder, provided that the total time for issuing Notice of Award including extensions does not in the aggregate exceed 120 days from the Bid due date without Surety's written consent.
5. Payment under this Bond will be due and payable upon default of Bidder and within 30 calendar days after receipt by Bidder and Surety of written notice of default from Owner, which notice will be given with reasonable promptness, identifying this Bond and the Project and including a statement of the amount due.
6. No suit or action will be commenced under this Bond prior to 30 calendar days after the notice of default required in Paragraph 4 above is received by Bidder and Surety, and in no case later than 1 year after the Bid due date.
7. Any suit or action under this Bond will be commenced only in a court of competent jurisdiction located in the state in which the Project is located.
8. Notices required hereunder must be in writing and sent to Bidder and Surety at their respective addresses shown on the face of this Bond. Such notices may be sent by personal delivery, commercial courier, or by United States Postal Service registered or certified mail, return receipt requested, postage pre-paid, and will be deemed to be effective upon receipt by the party concerned.
9. Surety shall cause to be attached to this Bond a current and effective Power of Attorney evidencing the authority of the officer, agent, or representative who executed this Bond on behalf of Surety to execute, seal, and deliver such Bond and bind the Surety thereby.
10. The term "Bid" as used herein includes a Bid, offer, or proposal as applicable.

END OF DOCUMENT

DOCUMENT 00_45_14.15

ULTRAVIOLET DISINFECTION QUALIFICATIONS FORM

ARTICLE 1 — ULTRAVIOLET DISINFECTION SYSTEM

1.01 Qualification requirements are based on experience with UV systems and the information provided below.

ARTICLE 2 — CONTACT INFORMATION

2.01 Provide the following contact information:

UV Manufacturer Name:	
Address:	
Phone:	
Assigned Project Manager Name & Contact:	

ARTICLE 3 — MANUFACTURER EXPERIENCE REQUIREMENTS

3.01 Provide the following detailed information for three projects containing the UV manufacturer's project experience with similar UV installations using the same equipment proposed for CA Title 22 reuse disinfection.

Project 1 Name/ Operational Start Year:	
Owner Name:	
Owner Address:	
Contact Person:	
Contact Phone No.:	
Regulatory Discharge Water Quality Design Criteria (Design UVT and UV dose (mJ/cm^2), peak flow capacity):	

Project 2 Name/ Operational Start Year:	
Owner Name:	
Owner Address:	
Contact Person:	
Contact Phone No.:	
Regulatory Discharge Water Quality Design Criteria (Design UVT and UV dose (mJ/cm^2), peak flow capacity):	

Project 3 Name/ Operational Start Year:	
Owner Name:	
Owner Address:	
Contact Person:	
Contact Phone No.:	
Regulatory Discharge Water Quality Design Criteria (Design UVT and UV dose (mJ/cm^2), peak flow capacity):	

3.02 Provide an additional list of 20 wastewater installations using the same equipment proposed. Provide this list as an attachment including the following for each:

A. Project name, location, and start year.

B. Design flow.

C. Reuse application (Y/N)

ARTICLE 4 — PASS/FAIL REQUIREMENTS

4.01 Provide responses to the following questions. An answer of "NO" to any of the following questions may disqualify the bid:

A. Has the Supplier included the required project/owner references?

☐YES ☐NO

B. Has the Supplier proposed a Temporary UV Disinfection system that meets the technical and schedule requirements?

☐YES ☐NO

C. Does the proposed Permanent UV Disinfection system have DDW Conditional Approval for Title 22 reuse?

☐YES ☐NO

D. Does the proposed permanent UV equipment fit within the existing channel dimensions shown on the preliminary drawings with a minimum 12-inch thick center wall without increasing any dimensions of the existing channel? (Note: As shown, decreasing dimensions using concrete or other means is permitted.)

☐YES ☐NO

E. Can the proposed equipment be maintained and operated without a permanent external lifting device (e.g., overhead crane)?

☐YES ☐NO

F. Will the proposed equipment fit though the opening dimensions shown on the UV Pre-Purchase Drawings (Section 44_66_65, Attachment B)?

☐YES ☐NO

END OF DOCUMENT

DOCUMENT 00_52_64

AGREEMENT BETWEEN BUYER AND SELLER – PROCUREMENT

TABLE OF CONTENTS

This Procurement Agreement is by and between **City of Pacifica** ("Buyer") and _____ ("Seller").

Terms used in this Procurement Agreement have the meanings stated in Document 00_72_01 General Conditions - Procurement and Document 00_73_01 - Supplementary Conditions - Procurement.

Buyer and Seller hereby agree as follows:

ARTICLE 1 - PROCUREMENT CONTRACT

1.01 Goods and Special Services

A. Seller shall furnish the Goods and Special Services as specified or indicated in the Procurement Contract Documents. The Goods and Special Services are generally described as follows:

Permanent replacement Ultraviolet (UV) disinfection equipment temporary bypass UV disinfection system and associated operational equipment. Services include but are not limited to shop drawing submittals, testing, installation support, startup-up, and training related to all provided equipment.

- Provide Design Assistance (Shop drawings, design workshops, and design support, as specified in the Technical Specifications).
- Furnish UV Disinfection System and gates, as specified in the Technical Specifications.
- Furnish Spare parts and special tools, as specified in the Technical Specifications.
- Furnish Freight, as specified in the Technical Specifications.
- Provide Supervision of installation, testing, training, commissioning, warranty, and follow-up support services.

1.02 The Project

A. The Project, of which the Goods and Special Services are a part, is generally described as follows: The replacement of the Calera Creek Water Recycling Plant's (Plant) permanent UV disinfection system. The replacement includes continuous UV disinfection for NPDES discharge during construction and the modification of the Plant's single UV channel to two channels.

1.03 Engineer

A. Buyer has retained Carollo Engineers ("Engineer"), to prepare Procurement Contract Documents and act as Buyer's representative. Engineer assumes all duties and responsibilities and has the rights and authority assigned to Engineer in the Procurement Contract Documents in connection with Seller's furnishing of Goods and Special Services.

1.04 Point of Destination

A. The Point of Destination is designated as:

700 Coast Highway

Pacifica, CA 94044

ARTICLE 2 - PROCUREMENT CONTRACT TIMES

2.01 Time of the Essence

A. All time limits for Milestones, including the submittal of Shop Drawings and Samples, the delivery of Goods, and the furnishing of Special Services as stated in the Procurement Contract Documents, are of the essence of the Procurement Contract.

2.02 Schedule of Procurement Contract Times

A. The following schedule sets forth the Procurement Contract Times:

Milestone	Date or Days	Notes
Submit Shop Drawings	5/31/2023	
Deliver acceptable Temporary UV Disinfection Equipment to Point of Destination	3/11/2024	Delivery may be made in the 15-day period before delivery date. Delivery includes all equipment required for operation of the temporary UV disinfection system.
Deliver acceptable Permanent UV Disinfection Equipment to Point of Destination	5/17/2024	Delivery may be made in the 30-day period before delivery date. Delivery includes all equipment required for completion of the permanent UV disinfection system.
Removal of the Temporary UV Disinfection Equipment from Site	No later than: 11/11/2024	
Projected Equipment Installation	July – September 2024	Seller to provide installation and startup services assigned contractor during installation as indicated in this contract.
Projected Startup and Substantial Completion	October 2024	

2.03 Shop Drawings and Samples

A. Submittal of Shop Drawings and Samples: Seller shall submit all Shop Drawings and Samples required by the Procurement Contract Documents to Engineer for its review and approval.

B. Engineer's Review: It is the intent of the parties that Engineer will conduct its review of Shop Drawings and Samples and issue its approval, or a denial accompanied by substantive comments regarding information needed to gain approval, within 21 days after Seller's submittal of such Shop Drawings and Samples, or within such longer period that is needed because of the quantity and quality of such submittals. Resubmittals will be limited whenever possible.

2.04 Liquidated Damages

A. Buyer and Seller recognize that time is of the essence, and that Buyer will suffer financial and other losses if the Goods are not delivered to the Point of Destination and ready for receipt of delivery by Buyer within the time specified in this Document, plus any extensions thereof allowed in accordance with this Procurement Contract.

B. The parties also recognize that the timely performance of services by others involved in the Project is materially dependent upon Seller's specific compliance with the delivery requirements.

C. Further, the parties recognize the time, expense, and difficulties involved in proving, in a legal or arbitration proceeding, the loss (whether direct, consequential, or otherwise) suffered by Buyer if complete, acceptable Goods are not delivered on time.

D. Accordingly, instead of requiring any such proof, Buyer and Seller agree that as liquidated damages for delay (but not as a penalty) Seller shall pay Buyer according to the table below for each day that expires after the time specified in this Document for delivery of acceptable Goods and/or Services.

Item	Liquidated Damages, per day
Initial receipt by Engineer of Shop Drawings	$ 500
Completion of delivery of Goods to the Point of Delivery	$ 5,000

ARTICLE 3 - PROCUREMENT CONTRACT PRICE

3.01 Procurement Contract Price and Total Price—Based on Attached Bid

A. The Procurement Contract Price is comprised of the Lump Sum amounts set forth in the attached Bid Form, Bid Schedule "A".

B. For furnishing the Goods and Special Services in accordance with the Procurement Contract Documents, Buyer shall pay Seller the prices stated in Seller's Bid,

attached hereto as an exhibit, subject to final adjustments for Unit Price Goods and Special Services and Buyer's Contingency Allowance.

ARTICLE 4 - PAYMENT PROCEDURES

4.01 Submittal and Processing of Applications for Payment

A. Seller shall submit Applications for Payment in accordance with Article 13 of Document 00_72_01 - General Conditions - Procurement and the following paragraphs. Engineer and Buyer will process such Applications for Payment in accordance with said Article 13.

4.02 Progress Payments; Final Payment

A. Seller may submit an Application for Payment requesting the stated percentage of the referenced line item from Bid Schedule "A" upon attainment of each of the following Task's completion:

Task	**Lump Sum Progress Payment**
Owner's Acceptance of Approved UV Disinfection Shop Drawings	100 percent (Bid Item A-1)
Proof of Release for Fabrication for Entire UV Disinfection Equipment System	10 percent (Bid Item A-2)
Successful Factory Acceptance Testing for Entire UV Disinfection Equipment System with Approved Testing Submittal.	15 percent (Bid Item A-2)
Delivery of Entire UV Disinfection Equipment System to Point of Destination in accordance with the Procurement Contract Documents	50 percent (Bid Item A-2 and A-3); 100 percent (Bid Item A-4)
Supervision of installation, testing, training, commissioning, warranty, and follow-up support services for Entire UV Disinfection Equipment System	100 percent (Bid Item A-5)
Deliver Final O&M Manuals for all equipment provided and All Spare Parts and Special Tools for Entire UV Disinfection Equipment System	50 percent (Bid Item A-3)
Substantial Completion for Entire UV Disinfection Equipment System	10 percent (Bid Item A-2)
Owner's Acceptance of Approved Temporary UV Disinfection Shop Drawings and Delivery Plan	10 percent (Bid Item A-6)
Delivery of the Temporary UV Equipment System to Point of Destination and Start-up Commissioning	40 percent (Bid Item A-6)
Successful Operation of Temporary UV Equipment System for three months following Start-up.	25 percent (Bid Item A-6)

Task	Lump Sum Progress Payment
Decommissioning and Removal of Temporary UV Equipment System from Point of Destination	25 percent (Bid Item A-6)
Final Payment: Correction of non-conformities, provision of final Operations and Maintenance manuals, submittal of warranties and other final documentation required by the Procurement Contract Documents	Remaining Balances of all Bid Items

B. For Unit Price Goods and Special Services, if any, or for payments owed to Seller as a result of authorizations by Buyer under the Buyer's Contingency Allowance (if any), Seller shall submit a separate Application for Payment, no more frequently than monthly, that states (1) the actual quantities of such Unit Price Goods and Special Services that have been furnished, and the applicable unit prices; and (2) the services or items performed or furnished under the Buyer's Contingency Allowance, and the amounts owed. If practical, and at Seller's option, Seller may apply for such unit price and Buyer's Contingency Allowance payments in a separate section of an Application for Payment submitted for lump sum items.

C. Buyer shall pay Seller the amount owed under an Application for Payment within 30 days after Engineer's presentation to Buyer of the Application for Payment and Engineer's recommendation.

4.03 Interest

A. All amounts not paid when due will bear interest as the rate of 5 percent per annum.

ARTICLE 5 - ASSIGNMENT OF PROCUREMENT CONTRACT

5.01 Assignment of Contract

A. Buyer has the right to assign this Procurement Contract for furnishing Goods and Special Services, but only to a person or entity with sufficient and apparent ability to satisfy all of Buyer's obligations under this Procurement Contract, and Seller hereby consents to such assignment. Forms documenting the assignment of the Procurement Contract, and consent of Seller's surety to the assignment, have been executed by Buyer, Seller, and Seller's surety, and are attached as exhibits to this Procurement Agreement.

B. If so, assigned the following provisions apply:
   1. The Procurement Contract is initially executed in the name of the entity identified in this Document as Buyer and will be assigned by such Buyer (as assignor) to a construction contractor (Contractor/Assignee) designated by such Buyer. The assignment will occur on the effective date of the construction contract between such Buyer (Project Owner) and the Contractor/Assignee, which is expected to occur on or about **January 22, 2024**. Commencing on the date of acceptance of assignment by the Contractor/Assignee, all references in the Procurement Contract to "Buyer" shall mean the designated Contractor/Assignee.

2. The assignment of this Procurement Contract relieves the assignor from all further obligations and liabilities under this Procurement Contract. After assignment, Seller shall become a subcontractor or supplier to the Contractor/Assignee and, except as noted in this Document, all rights, duties, and obligations of Buyer under the Procurement Contract become the rights, duties, and obligations of the Contractor/Assignee.
3. After assignment:
    a. The Procurement Drawings and Procurement Specifications, and any modifying Addenda will become “Contract Documents” under the construction contract.
    b. If the Procurement Drawings or Procurement Specifications, as “Contract Documents” under the construction contract, are duly modified under such construction contract, then Seller and Contractor/Assignee shall enter into a corresponding Change Order under the applicable provisions of this Procurement Contract.
    c. The Procurement Drawings and Procurement Specifications may not be modified by Seller or Contractor/Assignee, singly or in tandem, except as such Procurement Drawings or Procurement Specifications, as “Contract Documents” under the construction contract, have been duly modified under such construction contract.
    d. All performance warranties, guarantees, and indemnifications required by the Procurement Contract will continue to run for the benefit of assignor (Project Owner) and, in addition, for the benefit of the Contractor/Assignee. However, if assignor (Project Owner) and Contractor/Assignee make the same warranty or guarantee claim, then Seller shall only be liable once for such claim. Other than its remedies under such warranties, guarantees, and indemnifications, assignor will not retain direct rights under this Procurement Contract, but will have rights and remedies as a party to the construction contract, whose scope of work will encompass the Procurement Drawings, Procurement Specifications, and modifying Addenda; provided, however, that any limitations on Seller’s liability in this Procurement Contract will continue to bind the original Buyer (assignor) after assignment.
    e. The Contractor/Assignee shall have all the rights of the Buyer under the Performance Bond and Payment Bond.
    f. Seller shall submit all Applications for Payment directly to Contractor/Assignee:
        1) Contractor/Assignee shall review each Application for Payment promptly, determine the amount that Contractor/Assignee approves for payment, and then include the amount approved in the next application for payment submitted to Project Owner (or Engineer) under the construction contract.
        2) Contractor/Assignee shall pay Seller within 15 days of receipt of payment from the Project Owner under the construction contract.
        3) After assignment Engineer will review, approve, or deny the content of Applications for Payment under the Procurement Contract only to the extent that Contractor/Assignee, as construction contractor, has incorporated such content into payment applications that Engineer reviews under the construction contract.
    g. The Contractor/Assignee shall have all the rights of the Buyer under any pending Claim by Buyer.

h. All Claims and supporting documentation will be submitted directly by the claimant party (either Buyer or Contractor/Assignee or Seller), to the other party, without submittal to Engineer:
    1) The other party will render a response in writing within 30 days of receipt of the last submittal of claimant.
    2) If the other party does not render a written response to a Claim within 30 days after receipt of the last submittal of the claimant, the other party shall be deemed to have approved the Claim in its entirety.
    3) The other party's written response to a Claim, or the approval of the Claim in its entirety as a function of failure to respond within 30 days, will be final and binding upon Buyer and Seller 30 days after it is issued, unless within such 30 days of issuance either Buyer or Seller appeals the result by initiating the mediation of the Claim in accordance with the dispute resolution procedures.
    4) Any Claim by Seller that Contractor/Assignee may choose to submit, present, or forward to Project Owner must be submitted to Buyer within sufficient time for Contractor/Assignee to preserve its rights under the construction contract, notwithstanding any procedures or time limits in this Procurement Contract.
i. Seller's recovery of additional cost, time, or both cost and time for any Claim attributable to the Project Owner will be limited to the proportionate recovery by Contractor/Assignee against Project Owner for such Claim. Seller will cooperate and assist Contractor/Assignee in pursuing any Claim by Contractor/Assignee against Project Owner on behalf of Seller, including the timely preparation and delivery of supporting documentation.
j. If the pursuit of any claim by Contractor/Assignee against Project Owner on Seller's behalf requires the expenditure by Contractor/Assignee of legal or consulting fees, or results in litigation, arbitration, or any dispute resolution procedures, Seller agrees to pay for a proportionate share of attorneys' fees, consultant fees, and litigation, arbitration, and other resolution costs incurred by Contractor/Assignee in pursuing the claim on behalf of Seller, based upon the amount claimed by Seller as compared to the total value of the claim pursued by the Contractor/Assignee.
k. All rights, duties, and obligations of Engineer to Contractor/Assignee and Seller under this Procurement Contract will cease.
l. Subject to the foregoing provisions, all references in the Procurement Contract to submitting items to Engineer, or to Engineer having tasks or obligations, will be read after such an assignment as requiring submittal to Contractor/Assignee, or as Contractor/Assignee having such tasks or obligations (which Contractor/Assignee may delegate when appropriate).
m. If the Procurement Contract includes a Buyer's Contingency Allowance, upon assignment such allowance will be automatically reduced to the amount previously authorized by Buyer (Project Owner) and cease to be operational.

C. No other assignment by a party hereto of any rights under or interests in the Procurement Contract will be binding on another party hereto without the written consent of the party sought to be bound. Specifically, but without limitation, Procurement Contract payments or other money that may become due, and Procurement Contract payments or other money that are due, may not be assigned without such consent (except to the extent that the effect of this restriction may be limited by Laws and Regulations). Unless specifically stated to the contrary in any written consent to such an assignment, such an assignment will not release or discharge the assignor from any duty or responsibility under the Procurement Contract Documents.

ARTICLE 6 - PROCUREMENT CONTRACT DOCUMENTS

6.01 List of Procurement Contract Documents

A. The Procurement Contract Documents consist of the following:
   1. This Procurement Agreement.
   2. Document 00_72_01 - General Conditions - Procurement.
   3. Document 00_73_01 - Supplementary Conditions - Procurement.
   4. Procurement Specifications.
   5. Procurement Drawings (not attached but incorporated by reference).
   6. Addenda Numbers _____ to _____..
   7. Bonds:
      a. Performance bond (together with power of attorney).
      b. Payment bond (together with power of attorney).
   8. Exhibits to this Procurement Agreement (enumerated as follows):
      a. Seller's Bid, solely as to the prices set forth.
      b. Exhibit A, Assignment of Contract, Consent to Assignment, and Acceptance of Assignment.
      c. Exhibit B, Surety's Consent to Assignment.
      d. Documentation submitted by Seller _____; and
      e. Other Exhibits:_____.
   9. The following which may be delivered or issued on or after the Effective Date of the Procurement Contract and are not attached hereto:
      a. Change Orders;
      b. Change Directives; and
      c. Field Orders.

B. The documents listed under List of Procurement Contract Documents are attached to this Procurement Agreement (except as expressly noted otherwise above).

C. There are no Procurement Contract Documents other than those listed above.

D. The Procurement Contract Documents may only be amended or supplemented as provided in Paragraph 11.01 of Document 00_72_01 - General Conditions - Procurement.

ARTICLE 7 - SELLER'S REPRESENTATIONS AND CERTIFICATIONS

7.01 Seller's Representations

A. In order to induce Buyer to enter into this Procurement Agreement, Seller makes the following representations:
   1. Seller has examined and carefully studied the Procurement Contract Documents.
   2. If required by the Instructions to Bidders to visit the Point of Destination and the site where the Goods are to be installed or Special Services will be provided, or if, in Seller's judgment, any observable local or site conditions may affect the delivery, cost, progress, or furnishing of the Goods and Special Services, then Seller has visited the Point of Destination and site where the Goods are to be installed or Special Services will be provided (as applicable) and become familiar with and is satisfied as to the observable local and site conditions that may affect delivery, cost, progress, and furnishing of the Goods and Special Services.
   3. Seller is familiar with and is satisfied as to all Laws and Regulations that may affect the cost, progress, and performance of Seller's obligations under the Procurement Contract.
   4. Seller has carefully studied, considered, and correlated the information known to Seller with respect to the effect of such information on the cost, progress, and performance of Seller's obligations under the Procurement Contract.
   5. Seller has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Seller has discovered in the Procurement Contract Documents, and the written resolution (if any) thereof by Engineer is acceptable to Seller.
   6. The Procurement Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance of Seller's obligations under the Procurement Contract.
   7. Seller's entry into this Procurement Contract constitutes an incontrovertible representation by Seller that without exception all prices in the Procurement Agreement are premised upon furnishing the Goods and Special Services as required by the Procurement Contract Documents.

7.02 Seller's Certifications

A. Seller certifies that it has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for or in executing the Procurement Contract. For the purposes of this Document:
   1. "corrupt practice" means the offering, giving, receiving, or soliciting of anything of value likely to influence the action of a public official in the bidding process or in the Procurement Contract execution;
   2. "fraudulent practice" means an intentional misrepresentation of facts made (a) to influence the bidding process or the execution of the Procurement Contract to the detriment of Buyer, (b) to establish bid or contract prices at artificial non-competitive levels, or (c) to deprive Buyer of the benefits of free and open competition;
   3. "collusive practice" means a scheme or arrangement between two or more Bidders, with or without the knowledge of Buyer, a purpose of which is to establish bid prices at artificial, non-competitive levels; and

4. “coercive practice” means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the bidding process or affect the execution of the Procurement Contract.

ARTICLE 8 - CONFIDENTIALITY

8.01 Confidential Information

A. Confidential information is information in documents submitted by Seller that Seller clearly and prominently labels in writing to be a trade secret, proprietary, or confidential. Such documents, if any, will be maintained in a manner that endeavors to avoid disclosing confidential information to third parties, to the extent allowed by Laws and Regulations.

B. Seller shall clearly and prominently mark confidential information with the word “CONFIDENTIAL” on each page or sheet or on the cover of bound documents. Place “CONFIDENTIAL” stamps or watermarks so that they do not obscure any of the required information on the document, either in the original or in a way that would obscure any of the required information in a photocopy of the document.

8.02 Disclosure of Confidential Information

A. If Buyer is requested to disclose confidential information, or becomes legally compelled (by oral questions, interrogatories, requests for information or documents, subpoena, civil or criminal investigative demand, public information requests, or other requests under Laws and Regulations) to disclose confidential information, or is required by a regulatory body, governing agency, or controlling authority to disclose confidential information, or make any other disclosure that is prohibited or otherwise constrained by the Procurement Contract, Buyer will provide Seller with prompt notice so Seller may seek an appropriate protective order or other remedy. Seller will be solely responsible for submitting to the regulatory body, governing agency, or controlling authority any arguments, briefs, memoranda, motions, authorities, or other information in opposition to disclosure.

B. Buyer’s obligations with respect to confidential information are nullified by the following exceptions:
   1. Confidential information becomes a part of the public domain through publication or otherwise, through no fault of the Buyer;
   2. Buyer can demonstrate through suitable documentation that the confidential information was already in the Buyer’s possession, and not previously marked as confidential, or was otherwise publicly available prior to the Effective Date of the Procurement Contract;
   3. The confidential information is subsequently and independently disclosed to the Buyer by a third party who has a lawful right to disclose such information;
   4. Buyer has a good faith belief that disclosure is required or justified; or
   5. Buyer is required to disclose the confidential information by court order or by applicable Laws and Regulations.

8.03 Waiver of Immunity

A. Notwithstanding any other provision of the Procurement Contract, it is stipulated and agreed that by accepting confidential information, Buyer has not and does not waive its legal immunity (if any) from suit or liability.

ARTICLE 9 - MUTUAL WAIVER

9.01 Mutual Waiver of Consequential Damages

A. Buyer and Seller waive against each other, and against the other's officers, directors, members, partners, employees, agents, consultants, and subcontractors, any and all claims for or entitlement to incidental, indirect, or consequential damages arising out of, resulting from, or related to the Procurement Contract. If Buyer (Project Owner) assigns this Procurement Contract to a construction contractor (Contractor/Assignee), then the terms of this Paragraph will be binding upon the Contractor/Assignee with respect to Seller and assignor. The terms of this mutual waiver do not apply to or limit any claim by either Buyer or Seller against the other based on any of the following: (a) contribution or indemnification, (b) liquidated damages, (c) costs, losses, or damages attributable to personal or bodily injury, sickness, disease, or death, or to injury to or destruction of the tangible property of others, (d) intentional or reckless wrongful conduct, or (e) rights conferred by any bond provided by Seller under this Procurement Contract.

IN WITNESS WHEREOF, Buyer and Seller have signed this Procurement Agreement. Counterparts have been delivered to Buyer and Seller.

The Effective Date of the Procurement Contract is _____.

Buyer	Seller
_____ *(typed or printed name of organization)*	_____ *(typed or printed name of organization)*
By: _____ *(individual's signature)*	By: _____ *(individual's signature)*
Date: _____ *(date signed)*	Date: _____ *(date signed)*
Name: _____ *(typed or printed)*	Name: _____ *(typed or printed)*
Title: _____ *(typed or printed)*	Title: _____ *(typed or printed)*
	(If Seller is a corporation, a partnership, or a joint venture, attach evidence of authority to sign.)
Attest: _____ *(individual's signature)*	Attest: _____ *(individual's signature)*
Title: _____ *(typed or printed)*	Title: _____ *(typed or printed)*
Address for giving notices:	Address for giving notices:
City of Pacifica	
Attn: Kevin Woodhouse, City Manager	
540 Crespi Dr, Pacifica CA 94044	
Designated Representative:	Designated Representative:
Name: _____ *(typed or printed)*	Name: _____ *(typed or printed)*
Title: _____ *(typed or printed)*	Title: _____ *(typed or printed)*
Address:	Address:
Phone:	Phone:
Email:	Email:
(If Buyer is a corporation, attach evidence of authority to sign. If Buyer is a public body, attach evidence of authority to sign and resolution or other documents authorizing execution of this Agreement.)	

END OF DOCUMENT

DOCUMENT 00_54_34

ASSIGNMENT OF PROCUREMENT CONTRACT

This assignment will be effective on the effective date of the construction contract between Buyer (as "Owner") and Contractor/Assignee (as "Contractor").

The Procurement Contract between City of Pacifica ("Buyer") and _____ ("Seller") for furnishing Goods and Special Services entitled UV Disinfection Replacement Equipment – Project P034 (Procurement Contract) is hereby assigned, transferred, and set over to Contractor/Assignee, as assignee, by Buyer, as assignor. Upon assignment the Contractor/Assignee shall have the duties, rights, and obligations of Buyer under the terms of the Procurement Contract, and will be responsible to Owner under the construction contract for the performance of obligations by Seller, which will become a Subcontractor or Supplier to Contractor/Assignee. Buyer, Seller, and Contractor/Assignee hereby acknowledge and agree to be bound by the terms and conditions of assignment set forth in Article 5 of the Agreement Between Buyer and Seller for Procurement Contract.

This assignment includes the Buyer's tax-exempt status, if any.

This assignment will be effective on the Effective Date of the Contract Agreement between the Owner and the Contractor for the General Construction Work.

Assignment Made by Buyer

_____
(typed or printed name of organization)

By: _____ Date: _____
(individual's signature) *(date signed)*

Name: _____ Title: _____
(typed or printed) *(typed or printed)*

If Buyer is a corporation, attach evidence of authority to sign. If Buyer is a public body, attach evidence of authority to sign and resolution or other documents authorizing execution of Buyer-Seller Agreement.

Assignment Acknowledged and Accepted by Seller

_____
(typed or printed name of organization)

By: _____ Date: _____
(individual's signature) *(date signed)*

Name: _____ Title: _____
(typed or printed) *(typed or printed)*

If Seller is a corporation, attach evidence of authority to sign.

Assignment Accepted by Contractor/Assignee

_____
(typed or printed name of organization)

By: _____ Date: _____
(individual's signature) *(date signed)*

Name: _____ Title: _____
(typed or printed) *(typed or printed)*

If Contractor/Assignee is a corporation, attach evidence of authority to sign.

END OF DOCUMENT

DOCUMENT 00_60_09

SURETY'S AGREEMENT TO ASSIGNMENT

Surety hereby acknowledges, agrees, and consents that the Procurement Contract for furnishing Goods and Special Services entitled UV Disinfection Replacement Equipment – Project P034 by and between City of Pacifica ("Buyer") and _____ ("Seller") may be assigned, transferred, and set over to _____ ("Contractor/Assignee"), in accordance with Article 5 and Exhibit A of the Agreement between Buyer and Seller for Procurement Contract.

Surety further agrees that, upon assignment of the Procurement Contract, the Contractor/Assignee shall have all the rights of the Buyer under the Procurement Performance Bond and Procurement Payment Bond.

Agreement to Assignment Acknowledged and Accepted by Surety

_____
(typed or printed name of organization)

By: _____ Date: _____
(individual's signature) *(date signed)*

Name: _____ Title: _____
(typed or printed) *(typed or printed)*

Attach Power of Attorney.

END OF DOCUMENT

DOCUMENT 00_61_12

WARRANTY BOND

Seller	**Surety**
Name:	Name:
Address *(principal place of business)*: **[Address of Seller's principal place of business]**	Address *(principal place of business)*: **[Insert address of Surety's principal place of business]**
Buyer	**Procurement Contract**
Name: **City of Pacifica**	Description *(name and location)*: **UV Disinfection Replacement Equipment – Project P034** **700 Coast Highway, Pacifica, CA 94044**
Address *(principal place of business)*: **540 Crespi Drive Pacifica, CA 94044**	Contract Price: Effective Date of Contract: Contract's Date of Substantial Completion:
Bond Bond Amount: _____ Date of Bond: _____ Modifications to this Bond form: ☐ None ☐ See Paragraph 9	Bond Period: Commencing 364 days after Substantial Completion of the Work under the Construction Contract, and continuing until 2 years after such Substantial Completion.

Surety and Seller, intending to be legally bound hereby, subject to the terms set forth in this Document, do each cause this Warranty Bond to be duly executed by an authorized officer, agent, or representative.

Seller as Principal	Surety
_____ *(Full formal name of Seller)*	_____ *(Full formal name of Surety) (corporate seal)*
By: _____ *(Signature)*	By: _____ *(Signature) (Attach Power of Attorney)*
Name: _____ *(Printed or typed)*	Name: _____ *(Printed or typed)*
Title: _____	Title: _____
Attest: _____ *(Signature)*	Attest: _____ *(Signature)*
Name: _____ *(Printed or typed)*	Name: _____ *(Printed or typed)*
Title:	Title:

Notes: (1) Provide supplemental execution by any additional parties, such as joint venturers. (2) Any singular reference to Seller, Surety, Buyer, or other party is considered plural where applicable.

1. The Seller and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to the Buyer for the performance of the Construction Contract's Correction Period Obligations. The Construction Contract is incorporated in this Document by reference.
2. If the Seller performs the Correction Period Obligations, the Surety and the Seller shall have no obligation under this Warranty Bond.
3. If Buyer gives written notice to Seller and Surety during the Bond Period of Seller's obligation under the Correction Period Obligations, and Seller does not fulfill such obligation, then Surety shall be responsible for fulfillment of such Correction Period Obligations. Surety shall either fulfill the Correction Period Obligations itself, through its agents or contractors, or, in the alternative, Surety may waive the right to fulfill the Correction Period Obligations itself, and reimburse the Buyer for all resulting costs incurred by Buyer in performing Seller's Correction Period Obligations, including but not limited to correction, removal, replacement, and repair costs.
4. The Surety's liability is limited to the amount of this Warranty Bond. Renewal or continuation of the Warranty Bond will not modify such amount, unless expressly agreed to by Surety in writing.
5. The Surety shall have no liability under this Warranty Bond for obligations of the Seller that are unrelated to the Construction Contract. No right of action will accrue on this Warranty Bond to any person or entity other than the Buyer or its heirs, executors, administrators, successors, and assigns.
6. Any proceeding, legal or equitable, under this Warranty Bond may be instituted in any court of competent jurisdiction in the location in which the Work or part of the Work is located and must be instituted within 2 years after the Surety refuses or fails to perform its obligations under this Warranty Bond.
7. Written notice to the Surety, the Buyer, or the Seller must be mailed or delivered to the address shown in this Warranty Bond.
8. Definitions:
    8.1. Construction Contract—The agreement between the Buyer and Seller identified on the cover page of this Warranty Bond, including all Contract Documents and changes made to the agreement and the Contract Documents.
    8.2. Contract Documents—All the documents that comprise the agreement between the Buyer and Seller.
    8.3. Correction Period Obligations—The duties, responsibilities, commitments, and obligations of the Seller with respect to correction or replacement of defective Work, as set forth in the Construction Contract's Correction Period clause, Document 00_72_01 - General Conditions - Procurement, Paragraph 15.08, as duly modified.
    8.4. Substantial Completion—As defined in the Construction Contract.
    8.5. Work—As defined in the Construction Contract.
9. Modifications to this Bond are as follows: None.

END OF DOCUMENT

DOCUMENT 00_61_14

PERFORMANCE BOND - PROCUREMENT

Seller Name: Address *(principal place of business)*:	**Surety** Name: Address *(principal place of business)*:
Buyer Name: **City of Pacifica** Mailing address *(principal place of business)*: **540 Crespi Drive** **Pacifica, CA 94044**	**Procurement Contract** Description *(name and location)*: **UV Disinfection Replacement Equipment – Project P034** **700 Coast Highway, Pacifica, CA 94044** Procurement Contract Price: Effective Date of Procurement Contract:

Bond

Bond Amount:

Date of Bond:

(Date of Bond cannot be earlier than Effective Date of Procurement Contract)

Modifications to this Bond form:

☐ None ☐ See modifications in this Document

Surety and Seller, intending to be legally bound hereby, subject to the terms set forth in this Performance Bond, do each cause this Performance Bond to be duly executed by an authorized officer, agent, or representative.

Seller as Principal	Surety
_____ *(Full formal name of Seller)*	_____ *(Full formal name of Surety) (corporate seal)*
By: _____ *(Signature)*	By: _____ *(Signature)(Attach Power of Attorney)*
Name: _____ *(Printed or typed)*	Name: _____ *(Printed or typed)*
Title: _____	Title: _____
Attest: _____ *(Signature)*	Attest: _____ *(Signature)*
Name: _____ *(Printed or typed)*	Name: _____ *(Printed or typed)*
Title: _____	Title: _____

Notes: (1) Provide supplemental execution by any additional parties, such as joint venturers. (2) Any singular reference to Seller, Surety, Buyer, or other party is considered plural where applicable.

1. The Seller and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to the Buyer for the performance of the Procurement Contract, which is incorporated herein by reference.
2. If the Seller performs the Procurement Contract, the Surety and the Seller shall have no obligation under this Bond, except when applicable to participate in a conference as provided in this Document.
3. If there is no Buyer Default under the Procurement Contract, the Surety's obligation under this Bond will arise after:
    3.1. The Buyer first provides notice to the Seller and the Surety that the Buyer is considering declaring a Seller Default. Such notice may indicate whether the Buyer is requesting a conference among the Buyer, Seller, and Surety to discuss the Seller's performance. If the Buyer does not request a conference, the Surety may, within 5 business days after receipt of the Buyer's notice, request such a conference. If the Surety timely requests a conference, the Buyer shall attend. Unless the Buyer agrees otherwise, any conference requested under this provision will be held within 10 business days of the Surety's receipt of the Buyer's notice. If the Buyer, the Seller, and the Surety agree, the Seller shall be allowed a reasonable time to perform the Procurement Contract, but such an agreement does not waive the Buyer's right, if any, subsequently to declare a Seller Default;
    3.2. The Buyer declares a Seller Default, terminates the Procurement Contract, and notifies the Surety; and
    3.3. The Buyer has agreed to pay the Balance of the Procurement Contract Price in accordance with the terms of the Procurement Contract to the Surety or to a seller selected to perform the Procurement Contract.
4. Failure on the part of the Buyer to comply with the notice requirement in Document does not constitute a failure to comply with a condition precedent to the Surety's obligations, or release the Surety from its obligations, except to the extent the Surety demonstrates actual prejudice.
5. When the Buyer has satisfied the conditions specified in this Document, the Surety shall promptly and at the Surety's expense take one of the following actions:
    5.1. Arrange for the Seller, with the consent of the Buyer, to perform and complete the Procurement Contract;
    5.2. Undertake to perform and complete the Procurement Contract itself, through its agents or independent contractors;
    5.3. Obtain bids or negotiated proposals from qualified sellers acceptable to the Buyer for a contract for performance and completion of the Procurement Contract, arrange for a contract to be prepared for execution by the Buyer and a seller selected with the Buyer's concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the bonds issued on the Procurement Contract, and pay to the Buyer the amount of damages as specified in this Document in excess of the Balance of the Procurement Contract Price incurred by the Buyer as a result of the Seller Default; or

5.4. Waive its right to perform and complete, arrange for completion, or obtain a new seller, and with reasonable promptness under the circumstances:

5.4.1 After investigation, determine the amount for which Surety may be liable to the Buyer and, as soon as practicable after the amount is determined, make payment to the Buyer; or

5.4.2 Deny liability in whole or in part and notify the Buyer, citing the reasons for denial.

6. If the Surety does not proceed as specified in this Document with reasonable promptness, the Surety shall be deemed to be in default on this Bond 7 days after receipt of an additional written notice from the Buyer to the Surety demanding that the Surety perform its obligations under this Bond, and the Buyer shall be entitled to enforce any remedy available to the Buyer. If the Surety proceeds as specified in this Document and the Buyer refuses the payment, or the Surety has denied liability, in whole or in part, without further notice, the Buyer shall be entitled to enforce any remedy available to the Buyer.

7. If the Surety elects to act, then the responsibilities of the Surety to the Buyer will not be greater than those of the Seller under the Procurement Contract, and the responsibilities of the Buyer to the Surety will not be greater than those of the Buyer under the Procurement Contract. Subject to the commitment by the Buyer to pay the Balance of the Procurement Contract Price, the Surety is obligated, without duplication for:

   7.1. the responsibilities of the Seller for correction of defective or non-conforming Goods and Special Services, and completion of the Procurement Contract;

   7.2. additional legal, design professional, and delay costs resulting from the Seller's Default, and resulting from the actions or failure to act of the Surety; and

   7.3. liquidated damages, or if no liquidated damages are specified in the Procurement Contract, actual damages caused by delayed performance or non-performance of the Seller.

8. If the Surety elects to act, the Surety's liability is limited to the amount of this Bond.

9. The Surety shall not be liable to the Buyer or others for obligations of the Seller that are unrelated to the Procurement Contract, and the Balance of the Procurement Contract Price will not be reduced or set off on account of any such unrelated obligations. No right of action will accrue on this Bond to any person or entity other than the Buyer or its heirs, executors, administrators, successors, and assigns.

10. The Surety hereby waives notice of any change, including changes of time, to the Procurement Contract or to related subcontracts, purchase orders, and other obligations.

11. Any proceeding, legal or equitable, under this Bond must be instituted in any court of competent jurisdiction where the Point of Destination is located and must be instituted within 2 years after a declaration of Seller Default, or within 2 years after the Seller ceased working, or within 2 years after the Surety refuses or fails to perform its obligations under this Bond, whichever occurs first. If the provisions of this Paragraph are void or prohibited by law, the minimum periods of limitations available to sureties as a defense in the jurisdiction of the suit will be applicable.

12. Notice to the Surety, the Buyer, or the Seller must be mailed or delivered to the address shown on the page on which their signature appears.

13. When this Bond has been furnished to comply with a statutory or other legal requirement in the location of the Point of Destination, any provision in this Bond conflicting with said statutory or legal requirement will be deemed deleted from this Bond and provisions conforming to such statutory or other legal requirement will be deemed incorporated herein. When so furnished, the intent is that this Bond will be construed as a statutory bond and not as a common law bond.

14. Definitions:

    14.1. Balance of the Procurement Contract Price—The total amount payable by the Buyer to the Seller under the Procurement Contract after all proper adjustments have been made including allowance for the Seller for any amounts received or to be received by the Buyer in settlement of insurance or other claims for damages to which the Seller is entitled, reduced by all valid and proper payments made to or on behalf of the Seller under the Procurement Contract.

    14.2. Buyer Default—Failure of the Buyer, which has not been remedied or waived, to pay the Seller as required under the Procurement Contract or to perform and complete or comply with the other material terms of the Procurement Contract.

    14.3. Goods and Special Services—The full scope of materials, equipment, other items, and services to be furnished by Seller, as defined in the Procurement Contract.

    14.4. Point of Destination—The location where delivery of the Goods shall be made, as stated in the Procurement Contract.

    14.5. Procurement Contract—The contractual agreement between the Buyer and Seller identified on the cover page, including all Procurement Contract Documents and changes made to the Procurement Contract.

    14.6. Seller Default—Failure of the Seller, which has not been remedied or waived, to perform or otherwise to comply with a material term of the Procurement Contract.

    14.7. Procurement Contract Documents—All the documents that comprise the contractual agreement between the Buyer and Seller.

15. Modifications to this Bond are as follows: None.

END OF DOCUMENT

DOCUMENT 00_61_73

PAYMENT BOND - PROCUREMENT

Seller	**Surety**
Name:	Name:
Address *(principal place of business)*:	Address *(principal place of business)*:
Buyer	**Procurement Contract**
Name: **City of Pacifica**	Description *(name and location)*: **UV Disinfection Replacement Equipment – Project P034** **700 Coast Highway, Pacifica, CA 94044**
Mailing address *(principal place of business)*: **540 Crespi Drive Pacifica, CA 94044**	Procurement Contract Price:
	Effective Date of Procurement Contract:

Bond

Bond Amount:

Date of Bond:

(Date of Bond cannot be earlier than Effective Date of Procurement Contract)

Modifications to this Bond form:

☐ None ☐ See modifications as specified in this Document

Surety and Seller, intending to be legally bound hereby, subject to the terms set forth in this Payment Bond, do each cause this Payment Bond to be duly executed by an authorized officer, agent, or representative.

Seller as Principal	Surety
(Full formal name of Seller)	*(Full formal name of Surety) (corporate seal)*
By: _____ *(Signature)*	By: _____ *(Signature)(Attach Power of Attorney)*
Name: _____ *(Printed or typed)*	Name: _____ *(Printed or typed)*
Title: _____	Title: _____
Attest: _____ *(Signature)*	Attest: _____ *(Signature)*
Name: _____ *(Printed or typed)*	Name: _____ *(Printed or typed)*
Title: _____	Title: _____

Notes: (1) Provide supplemental execution by any additional parties, such as joint venturers. (2) Any singular reference to Seller, Surety, Buyer, or other party is considered plural where applicable.

1. The Seller and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to the Buyer to pay for labor, materials, and equipment furnished for use in the performance of the Procurement Contract, which is incorporated herein by reference, subject to the following terms.
2. If the Seller promptly makes payment of all sums due to Claimants, and defends, indemnifies, and holds harmless the Buyer from claims, demands, liens, or suits by any person or entity seeking payment for labor, materials, or equipment furnished for use in the performance of the Procurement Contract, then the Surety and the Seller shall have no obligation under this Bond.
3. If there is no Buyer Default under the Procurement Contract, the Surety's obligation to the Buyer under this Bond will arise after the Buyer has promptly notified the Seller and the Surety of claims, demands, liens, or suits against the Buyer or the Buyer's property by any person or entity seeking payment for labor, materials, or equipment furnished for use in the performance of the Procurement Contract, and tendered defense of such claims, demands, liens, or suits to the Seller and the Surety.
4. When the Buyer has satisfied the conditions of notification, the Surety shall promptly and at the Surety's expense defend, indemnify, and hold harmless the Buyer against a duly tendered claim, demand, lien, or suit.
5. The Surety's obligations to a Claimant under this Bond will arise after the following:
    5.1. Claimants who do not have a direct contract with the Seller

        5.1.1 have furnished a written notice of non-payment to the Seller, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were, or equipment was, furnished or supplied or for whom the labor was done or performed, within 90 days after having last performed labor or last furnished materials or equipment included in the Claim; and

        5.1.2 have sent a Claim to the Surety.

    5.2. Claimants who are employed by or have a direct contract with the Seller have sent a Claim to the Surety.
6. If a notice of non-payment is given by the Buyer to the Seller, that is sufficient to satisfy a Claimant's obligation to furnish a written notice of non-payment.
7. When a Claimant has satisfied the specified conditions, the Surety shall promptly and at the Surety's expense take the following actions:
    7.1. Send an answer to the Claimant, with a copy to the Buyer, within 60 days after receipt of the Claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed; and

    7.2. Pay or arrange for payment of any undisputed amounts.

    7.3. The Surety's failure to discharge its obligations will not be deemed to constitute a waiver of defenses the Surety or Seller may have or acquire as to a Claim, except as to undisputed amounts for which the Surety and Claimant have reached agreement. If, however, the Surety fails to discharge its obligations, the Surety shall indemnify the Claimant for the reasonable attorney's fees the Claimant incurs thereafter to recover any sums found to be due and owing to the Claimant.

8. The Surety's total obligation will not exceed the amount of this Bond, plus the amount of reasonable attorney's fees, and the amount of this Bond will be credited for any payments made in good faith by the Surety.
9. Amounts owed by the Buyer to the Seller under the Procurement Contract will be used for the performance of the Procurement Contract and to satisfy claims, if any, under any procurement performance bond. By the Seller furnishing and the Buyer accepting this Bond, they agree that all funds earned by the Seller in the performance of the Procurement Contract are dedicated to satisfying obligations of the Seller and Surety under this Bond, subject to the Buyer's priority to use the funds for the completion of the Goods and Special Services.
10. The Surety shall not be liable to the Buyer, Claimants, or others for obligations of the Seller that are unrelated to the Procurement Contract. The Buyer shall not be liable for the payment of any costs or expenses of any Claimant under this Bond and shall have under this Bond no obligation to make payments to or give notice on behalf of Claimants, or otherwise have any obligations to Claimants under this Bond.
11. The Surety hereby waives notice of any change, including changes of time, to the Procurement Contract or to related subcontracts, purchase orders, and other obligations.
12. No suit or action will be commenced by a Claimant under this Bond other than in a court of competent jurisdiction in the state in which the Point of Destination is located or after the expiration of 1 year from the date (1) on which the Claimant sent a Claim to the Surety pursuant or (2) on which the last labor or service was performed by anyone or the last materials or equipment were furnished by anyone under the Procurement Contract, whichever of (1) or (2) first occurs. If the provisions of this paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit will be applicable.
13. Notice and Claims to the Surety, the Buyer, or the Seller must be mailed or delivered to the address shown on the page on which their signature appears. Actual receipt of notice or Claims, however accomplished, will be sufficient compliance as of the date received.
14. When this Bond has been furnished to comply with a statutory or other legal requirement where the Point of Destination is located, any provision in this Bond conflicting with said statutory or legal requirement will be deemed deleted from this Bond and provisions conforming to such statutory or other legal requirement will be deemed incorporated herein. When so furnished, the intent is that this Bond will be construed as a statutory bond and not as a common law bond.
15. Upon requests by any person or entity appearing to be a potential beneficiary of this Bond, the Seller and Buyer shall promptly furnish a copy of this Bond or shall permit a copy to be made.
16. Definitions

    16.1. Buyer Default—Failure of the Buyer, which has not been remedied or waived, to pay the Seller as required under the Procurement Contract or to perform and complete or comply with the other material terms of the Procurement Contract.

    16.2. Claim—A written statement by the Claimant including at a minimum:

        16.2.1 The name of the Claimant;

        16.2.2 The name of the person for whom the labor was done, or materials or equipment furnished;

16.2.3 A copy of the agreement or purchase order pursuant to which labor, materials, or equipment was furnished for use in the performance of the Procurement Contract;

16.2.4 A brief description of the labor, materials, or equipment furnished;

16.2.5 The date on which the Claimant last performed labor or last furnished materials or equipment for use in the performance of the Procurement Contract;

16.2.6 The total amount earned by the Claimant for labor, materials, or equipment furnished as of the date of the Claim;

16.2.7 The total amount of previous payments received by the Claimant; and

16.2.8 The total amount due and unpaid to the Claimant for labor, materials, or equipment furnished as of the date of the Claim.

16.3. Claimant—An individual or entity having a direct contract with the Seller or with a subcontractor of the Seller to furnish labor, materials, or equipment for use in the performance of the Procurement Contract. The term Claimant also includes any individual or entity that has rightfully asserted a claim under an applicable mechanic's lien or similar statute against the real property upon which the Point of Destination is located or where the Goods and Special Services are to be installed or furnished. The intent of this Bond is to include without limitation in the terms of "labor, materials, or equipment" that part of the water, gas, power, light, heat, oil, gasoline, telephone service, or rental equipment used in the Procurement Contract, architectural and engineering services required for performance of the work of the Seller and the Seller's subcontractors, and all other items for which a mechanic's lien may be asserted in the jurisdiction where the labor, materials, or equipment were furnished.

16.4. Goods and Special Services—The full scope of materials, equipment, other items, and services to be furnished by Seller, as defined in the Procurement Contract.

16.5. Point of Destination—The location where delivery of the Goods shall be made, as stated in the Procurement Contract.

16.6. Procurement Contract—The contractual agreement between the Buyer and Seller identified on the cover page, including all Procurement Contract Documents and all changes made to the Procurement Contract.

16.7. Procurement Contract Documents—All the documents that comprise the contractual agreement between the Buyer and Seller.

17. Modifications to this Bond are as follows: None.

END OF DOCUMENT

DOCUMENT 00_64_63

BUYER'S ACKNOWLEDGEMENT OF RECEIPT OF GOODS - PROCUREMENT

Buyer:	Buyer's Project No.:
Engineer:	Engineer's Project No.:
Seller:	Seller's Project No.:
Project:	
Contract Name:	

This Buyer's Acknowledgment of Receipt of Goods (Acknowledgment) applies to:

☐ All Goods ☐ The following specified portions of the Goods: _____

Date of delivery of the Goods to the Point of Destination: _____

Date of Buyer's visual inspection of the Goods: _____

Date of this Acknowledgment: _____

Buyer acknowledges:

1. The Goods to which this notice applies have been delivered to the Point of Destination.
2. Buyer has visually inspected such Goods pursuant to Paragraph 9.02.B.1 of Document 00_72_01 - General Conditions - Procurement.
3. Based on the visual inspection, such Goods appear to comply with the requirements of the Procurement Contract Documents as to quantities and condition, subject to any exceptions and limitations in this Acknowledgment.
4. Such Goods are deemed received for purposes of Paragraph 9.02.B.2 of Document 00_72_01 - General Conditions - Procurement.
5. Seller may submit its Application for Payment for the delivered Goods, subject to the terms of the Procurement Agreement.

Exceptions (if any) to this Acknowledgment: ☐ None ☐ As follows:

The responsibilities between Buyer and Seller for securing and storing the Goods, maintaining the Goods during storage, and for furnishing the Special Services, shall be as provided in the Procurement Contract.

The following documents are attached to and made a part of this Acknowledgement:

_____

This Acknowledgment does not constitute an acceptance of any Goods not in conformance with the Procurement Contract Documents, nor is it a release of Seller's obligation to furnish all Goods and Special Services in accordance with the Procurement Contract.

	Buyer	**Engineer, on behalf of Buyer**
By (signature):		
Name (Printed):		
Title:		
Date:		

END OF DOCUMENT

DOCUMENT 00_64_73

BUYER'S NOTICE REGARDING CONFORMITY OF GOODS AND SPECIAL SERVICES - PROCUREMENT

Buyer:	Buyer's Project No.:
Engineer:	Engineer's Project No.:
Seller:	Seller's Project No.:
Project:	
Contract Name:	
Notice Date:	Effective Date of the Procurement Contract:

Buyer hereby gives notice to Seller that, to the best of Buyer's knowledge, information, and belief, the Goods and Special Services:

- ☐ Are in conformance with the Procurement Contract Documents. Upon Seller's submittal of its final Application for Payment in accordance with the Procurement Contract Documents, Seller will be eligible for final payment, except as expressly indicated in the Procurement Contract.
- ☐ Are nonconforming with the Procurement Contract Documents for the following reason(s):
  1. _____
  2. _____
  3. _____

Seller's Special Services were completed on: _____

Buyer has consulted with and received Engineer's recommendation on conformity of the Goods and Special Services.

This Buyer's Notice Regarding Conformity of Goods and Special Services (Notice) is made expressly subject to the following terms and conditions to which all who receive and rely on said Notice agree:

1. This Notice is expressly subject to the terms and conditions set forth in the Procurement Contract.
2. This Notice is not a guarantee or warranty of Seller's performance under the Procurement Contract, an acceptance of Goods and Special Services that are not in accordance with the related Procurement Contract Documents, including but not limited to nonconforming Goods and Special Services discovered after final inspection, nor an assumption of responsibility for any failure of Seller to furnish the Goods and Special Services thereunder in accordance with the Procurement Contract, or to otherwise comply with the Procurement Contract Documents or the terms of any special guarantees specified.

3. This Notice does not relieve Seller of any surviving obligations under the Procurement Contract and is subject to Buyer's reservations of rights with respect to completion and final payment.

Buyer

By (signature): _____ Name (Printed): _____

Date: _____ Title: _____

END OF DOCUMENT

DOCUMENT 00_72_01

GENERAL CONDITIONS – PROCUREMENT

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ARTICLE 1 — DEFINITIONS

1.01 Defined Terms

A. Wherever used in these Procurement General Conditions or in the other Procurement Documents and printed with initial capital letters, the following terms have the meanings indicated which are applicable to both the singular and plural thereof. In addition to terms specifically defined, terms with initial capital letters in the Procurement Contract Documents include references to identified articles and paragraphs, and the titles of other documents or forms.

1. Addenda--Written or graphic instruments issued prior to the opening of Bids which clarify, correct, or change the bidding documents or the Procurement Documents.
2. Application for Payment—The document prepared by Seller, in a form acceptable to Buyer, to request progress or final payments, and which is to be accompanied by such supporting documentation as is required by the Procurement Contract Documents.
3. Bid--An offer or proposal of a prospective Seller submitted on the prescribed form setting forth the price(s) for furnishing the Goods and Services.
4. Bidder—An individual or entity that, as a prospective Seller, submits a Bid to Buyer.
5. Buyer—The individual or entity purchasing the Goods and Special Services.
6. Change Directive—A written directive from Buyer to Seller issued on or after the Effective Date of the Procurement Contract, ordering an addition, deletion, or revision in the Goods and Special Services.
7. Change Order--A document which is signed by Seller and Buyer and authorizes an addition, deletion, or revision to the Procurement Contract Documents or an adjustment in the Procurement Contract Price or the Procurement Contract Times, issued on or after the Effective Date of the Procurement Contract. Change Orders may be the result of mutual agreement by Buyer and Seller, or of resolution of a Claim.
8. Claim—A demand or assertion by Buyer or Seller seeking an adjustment of Procurement Contract Price or Procurement Contract Times, or both, or other relief with respect to the terms of the Procurement Contract. A demand for money or services by a third party is not a Claim.
9. Contractor/Assignee—A construction contractor with which Project Owner enters into a construction contract, and to which Project Owner, as initial Buyer, assigns this Procurement Contract.
10. Effective Date of the Procurement Contract—The date indicated in the Procurement Agreement on which the Procurement Contract becomes effective.
11. Electronic Document—Any Project-related correspondence, attachments to correspondence, data, documents, drawings, information, or graphics, including but not limited to Shop Drawings and other Submittals, that are in an electronic or digital format.
12. Electronic Means—Electronic mail (e-mail), upload/download from a secure Project website, or other communications methods that allow: the transmission or communication of Electronic Documents; the documentation of transmissions, including sending and receipt; printing of the transmitted Electronic Document by the recipient; the storage and archiving of the Electronic Document by sender and recipient; and the use by recipient of the Electronic Document for purposes permitted by this Procurement Contract. Electronic Means does not include the

use of text messaging, or of Facebook, Twitter, Instagram, or similar social media services for transmission of Electronic Documents.

13. Engineer-- The individual or entity designated as such in the Procurement Agreement.
14. Field Order-- A written order issued by Engineer which requires minor changes in the Goods or Special Services, but which does not involve a change in the Procurement Contract Price or Procurement Contract Times.
15. Goods--The tangible and movable personal property that is described in the Procurement Contract Documents, regardless of whether the property is to be later attached to realty.
16. Goods and Special Services—The full scope of materials, equipment, other items, and services to be furnished by Seller, including Goods, as defined herein, and Special Services, if any, as defined herein. This term refers to both the Goods and the Special Services, or to either the Goods or the Special Services, and to any portion of the Goods or the Special Services, as the context requires.
17. Laws and Regulations; Laws or Regulations—Any and all applicable laws, statutes, rules, regulations, ordinances, codes, and binding decrees, resolutions, and orders of any and all governmental bodies, agencies, authorities, and courts having jurisdiction.
18. Milestone--A principal event specified in the Procurement Contract that Seller must attain by the date or within the number of days indicated, including but not limited to the delivery of the Goods and the furnishing of Special Services.
19. Notice of Award-- The written notice, by Buyer to a Bidder, of Buyer's acceptance of the Bid.
20. Point of Destination-- The specific address of the location where delivery of the Goods will be made, as stated in the Procurement Agreement.
21. Procurement Agreement--The written instrument, executed by Buyer and Seller, that sets forth the Procurement Contract Price and Procurement Contract Times, identifies the parties and the Engineer, and designates the specific items that are Procurement Contract Documents.
22. Procurement Bidding Documents-- The Procurement Bidding Requirements and the proposed Procurement Contract Documents (including all Addenda).
23. Procurement Bidding Requirements—The advertisement or invitation to bid, Instructions to Bidders, Bid security of acceptable form, if any, and Bid Form with any supplements.
24. Procurement Contract—The entire and integrated written agreement between Buyer and Seller concerning the Goods and Special Services.
25. Procurement Contract Documents—Those items so designated in the Procurement Agreement, and which together comprise the Procurement Contract. Shop Drawings and other Seller submittals are not Procurement Contract Documents, even if accepted, reviewed, or approved by Engineer or Buyer.
26. Procurement Contract Price—The money that Buyer has agreed to pay Seller for furnishing the Goods and Special Services in accordance with the Procurement Contract Documents.
27. Procurement Contract Times—The times stated in the Procurement Agreement by which the Goods must be delivered, Special Services must be furnished, and other Milestones must be attained.

28. Procurement Drawings—That part of the Procurement Contract Documents prepared or approved by Engineer which graphically shows the scope, extent, and character of the Goods and Special Services to be furnished by Seller. Shop Drawings and other Seller submittals are not Procurement Drawings as so defined.
29. Procurement Specifications—That part of the Procurement Contract Documents consisting of written requirements for materials, equipment, systems, standards and workmanship as applied to the furnishing of the Goods and Special Services, and certain administrative requirements and procedural matters applicable thereto.
30. Project--The total undertaking to be accomplished for Project Owner by engineers, contractors, and others, including planning, study, design, construction, testing, commissioning, and start-up, and of which the Goods and Special Services are a part.
31. Project Owner—The entity that has retained (or will retain) engineers, contractors, and others for the planning, study, design, construction, testing, commissioning, and start-up of facilities and improvements. As of the Effective Date of the Procurement Contract, the Project Owner is the Buyer.
32. Samples—Physical examples of materials, equipment, or workmanship that are representative of some portion of the Goods and Special Services and which establish the standards by which such portion of the Goods and Special Services will be judged.
33. Schedule of Submittals—A schedule, prepared and maintained by Seller, of required Submittals and the time requirements for Engineer's review of the Submittals.
34. Seller—The individual or entity furnishing the Goods and Special Services.
35. Shop Drawings--All drawings, diagrams, illustrations, schedules, and other data or information which are specifically prepared or assembled by or for Seller and submitted by Seller to illustrate some portion of the Goods and Special Services. Shop Drawings, whether approved or not, are not Procurement Drawings and are not Procurement Contract Documents.
36. Special Services—Services to be performed by Seller (or its agents or subcontractors) in association with the Goods to be furnished by Seller, as required by the Procurement Contract Documents.
37. Submittal—A written or graphic document, prepared by or for Seller, which the Procurement Contract Documents require Seller to submit to Engineer, or that is indicated as a Submittal in the Schedule of Submittals accepted by Engineer. Submittals may include Shop Drawings and Samples; schedules; product data; Owner-delegated designs; sustainable design information; information on special procedures; testing plans; results of tests and evaluations, source quality-control testing and inspections, and field or site quality-control testing and inspections; warranties and certifications; suppliers' instructions and reports; records of delivery of spare parts and tools; operations and maintenance data; record documents; and other such documents required by the Procurement Contract Documents. Submittals, whether or not approved or accepted by Engineer, are not Procurement Contract Documents. Change proposals, Change Orders, Claims, notices, Applications for Payment, and requests for interpretation or clarification are not Submittals.
38. Successful Bidder—The Bidder whose Bid the Buyer accepts, and to which Buyer makes an award of the Procurement Contract.

39. Supplementary Conditions--The part of the Procurement Documents that amends or supplements these General Conditions.
40. Unit Price Goods and Special Services—Goods and Special Services to be paid for on the basis of unit prices (if any).

1.02 Terminology

A. The words and terms are not defined but have the indicated meanings when used in the Bidding Requirements or Procurement Contract Documents.

B. Intent of Certain Terms or Adjectives
   1. The Procurement Contract Documents include the terms “as allowed,” “as approved,” “as ordered,” “as directed” or terms of like effect or import to authorize an exercise of professional judgment by Engineer. In addition, the adjectives “reasonable,” “suitable,” “acceptable,” “proper,” “satisfactory,” or adjectives of like effect or import are used to describe an action or determination of Engineer as to the Goods and Special Services. It is intended that such exercise of professional judgment, action, or determination will be commercially reasonable and will be solely to evaluate, in general, the Goods and Special Services for compliance with the requirements of and information in the Procurement Contract Documents and conformance with the design concept of the completed Project as a functioning whole, as shown or indicated in the Procurement Contract Documents (unless there is a specific statement indicating otherwise). The use of any such term or adjective will not be effective to assign to Engineer any duty or authority to supervise or direct the furnishing of Goods or Special Services or any duty or authority to undertake responsibility contrary to any other provision of the Procurement Contract Documents.
   2. The word “non-conforming” when modifying the words “Goods and Special Services,” “Goods,” or “Special Services,” refers to Goods and Special Services that are unsatisfactory, faulty, or deficient in that they:
      a. do not conform to or comply with the requirements of the Procurement Contract Documents;
      b. do not meet the requirements of any applicable inspection, reference standard, test, or approval referred to in the Procurement Contract Documents; or
      c. in the case of Special Services, have not been completed.
   3. The word “receipt” when referring to the Goods, means the physical taking and possession by the Buyer.
   4. The word “day” means a calendar day of 24 hours measured from midnight to the next midnight.
   5. The word "furnish," when used in connection with the Goods and Special Services means to supply and deliver said Goods to the Point of Destination (or some other specified location) and to perform said Special Services fully, all in accordance with the Procurement Contract Documents.

C. Procurement Contract Price or Procurement Contract Times: References to a change in “Procurement Contract Price or Procurement Contract Times” or “Procurement Contract Times or Procurement Contract Price” or similar, indicate that such change applies to (1) Procurement Contract Price, (2) Procurement Contract Times, or (3) both Procurement Contract Price and Procurement Contract Times, as warranted, even if the term “or both” is not expressed.

D. Unless stated otherwise in the Procurement Contract Documents, words or phrases that have a well-known technical or construction industry or trade meaning are used in the Procurement Contract Documents in accordance with such recognized meaning.

ARTICLE 2 - PRELIMINARY MATTERS

2.01 Delivery of Bonds & Insurance Certificates

A. When Seller delivers the executed counterparts of the Procurement Agreement to Buyer, the Seller also shall deliver to Buyer the performance bond and payment bond (if the Procurement Contract requires Seller to furnish such bonds).

B. Evidence of Seller's Insurance: When Seller delivers the signed counterparts of the Procurement Agreement to Buyer, the Seller also shall deliver to Buyer, with copies to each additional insured (as identified in the Procurement Contract), the certificates, endorsements, and other evidence of insurance required to be provided by Seller in accordance with bonds and insurance. Evidence of insurance to be obtained at a later date, such as insurance relating to transit or storage of the Goods, will be provided to Buyer at the time of such insurance is obtained.

C. Evidence of Buyer's Insurance: After receipt of the signed counterparts of the Procurement Agreement and all required bonds and insurance documentation, Buyer shall promptly deliver to Seller, with copies to each additional insured (as identified in the Procurement Contract), certificates and other evidence of insurance (if any) required to be provided by Buyer.

2.02 Copies of Documents

A. Buyer shall furnish to Seller four printed copies of the Procurement Contract (including one fully executed counterpart of the Procurement Agreement), and one copy in electronic portable document format (PDF). Additional printed copies will be furnished upon request at the cost of reproduction.

2.03 Electronic Transmittals

A. Except as otherwise stated elsewhere in the Procurement Contract, the Buyer, Seller, and Engineer may send, and shall accept, Electronic Documents transmitted by Electronic Means.

B. If the Procurement Contract does not establish protocols for Electronic Means, then Buyer, Seller, and Engineer shall jointly develop such protocols.

C. Subject to any governing protocols for Electronic Means, when transmitting Electronic Documents by Electronic Means, the transmitting party makes no representations as to long-term compatibility, usability, or readability of the Electronic Documents resulting from the recipient's use of software application packages, operating systems, or computer hardware differing from those used in the drafting or transmittal of the Electronic Documents.

2.04 Preliminary Schedules

A. Within 15 days after the Effective Date of the Procurement Contract, Seller shall submit to Buyer and Engineer for timely review:
   1. a progress schedule of activities, consistent with the Procurement Contract Times, including at a minimum, Shop Drawing and Sample submittals, tests, and deliveries as required by the Procurement Contract Documents.
      a. The progress schedule will be acceptable to Buyer and Engineer if it provides an orderly progression of the Submittals, tests, and deliveries to completion within the specified Milestones of the Procurement Contract Times.
      b. Such acceptance will not impose on Buyer or Engineer responsibility for the progress schedule, for sequencing, scheduling, or progress of Seller's performance of its obligations under the Procurement Contract, nor interfere with or relieve Seller from Seller's full responsibility therefor.
      c. Such acceptance will not be deemed as an acknowledgment of the reasonableness and attainability of the schedule.
   2. a preliminary schedule of Submittals.

B. No progress payment will be made to Seller until an acceptable progress schedule and acceptable schedule of Submittals are submitted to Buyer and Engineer (and other conditions applicable to progress payments are met).

2.05 Preliminary Conference

A. Within 20 days after the Procurement Contract Times start to run, a conference attended by Seller, Buyer, Engineer and others as appropriate will be held to establish a working understanding among the parties as to the Goods and Special Services and to discuss the schedules, procedures for handling Shop Drawings and other Submittals, processing Applications for Payment, and maintaining required records.

2.06 Safety

A. Buyer and Seller shall comply with all applicable Laws and Regulations relating to the safety of persons or property, and to the protection of persons or property from damage, injury, or loss.

B. When Seller's personnel, or the personnel of any subcontractor to Seller, are present at the Point of Destination or any work area or site controlled by Buyer, the Seller shall be responsible for the compliance by such personnel with any applicable requirements of Buyer's safety programs that are made known to Seller.

C. If Buyer or its representatives visit the Seller's manufacturing or storage facilities, for testing, inspection, or other purposes, Seller shall inform Buyer in advance of any safety preparations, standards, or programs with which Buyer and its representatives must comply.

ARTICLE 3 - PROCUREMENT CONTRACT DOCUMENTS

3.01 Intent

A. The Procurement Documents are complementary; what is called for by one is as binding as if called for by all.

B. Any labor, documentation, services, materials, or equipment that may reasonably be inferred from the Procurement Contract Documents or from prevailing custom or trade usage as being required to produce or furnish the indicated Goods and Special Services will be provided, whether or not specifically called for, at no additional cost to Buyer.

C. Unless otherwise stated in the Procurement Contract Documents, if there is a discrepancy between the electronic or digital versions of the Procurement Contract Documents (including any printed copies derived from such electronic or digital versions) and the printed record version, the printed record version will govern.

D. The Procurement Contract supersedes prior negotiations, representations, and agreements, whether written or oral.

E. Engineer will issue clarifications and interpretations of the Procurement Contract Documents.

F. Any provision or part of the Procurement Contract Documents held to be void or unenforceable under any Law or Regulation will be deemed stricken, and all remaining provisions will continue to be valid and binding upon Buyer and Seller.

3.02 Reference Standards

A. Reference to standards, specifications, manuals, or codes of any technical society, organization, or association, or to Laws and Regulations, whether such reference be specific or by implication, means the standard, specification, manual, code, or Laws and Regulations in effect at the time of opening of Bids (or on the Effective Date of the Procurement Agreement if there were no Bids), except as may be otherwise specifically stated in the Procurement Contract Documents.

B. No provision of any such standard specification, manual, reference standard, or code, and no instruction of a supplier, will be effective to change the duties or responsibilities of Buyer, Seller, or Engineer from those set forth in the part of the Procurement Contract Documents prepared by or for Engineer. No such provision or instruction will be effective to assign to Buyer or Engineer any duty or authority to supervise or direct the performance of Seller's obligations, or any duty or authority to undertake responsibility inconsistent with the provisions of the part of the Procurement Contract Documents prepared by or for Engineer.

3.03 Reporting and Resolving Discrepancies

A. Reporting Discrepancies
   1. Seller's Review of Procurement Contract Documents: If, before or during the performance of Seller's obligations, Seller discovers any conflict, error,

ambiguity, or discrepancy within the Procurement Contract Documents, or between the Procurement Contract Documents and (a) any applicable Law or Regulation, (b) actual field conditions, (c) any standard specification, manual, reference standard, or code, or (d) any instruction of any supplier to Seller, then Seller shall promptly report it to Engineer (or if the Procurement Contract is assigned, then directly to Contractor/Assignee) in writing. Seller shall not proceed with the Goods and Special Services affected thereby until the conflict, error, ambiguity, or discrepancy is resolved, by a clarification or interpretation by Engineer (or if the Procurement Contract is assigned, then by Contractor/Assignee) or by an amendment or supplement to the Procurement Contract Documents issued pursuant to Article 11.

2. Seller shall not be liable to Buyer or Engineer for failure to report any conflict, error, ambiguity, or discrepancy in the Procurement Contract Documents unless Seller had actual knowledge thereof.

B. Resolving Discrepancies: Except as may be otherwise specifically stated in the Procurement Contract Documents, the provisions of the Procurement Contract Documents will take precedence in resolving any conflict, error, ambiguity, or discrepancy between the provisions of the Procurement Contract Documents and:
   1. the provisions of any standard, specification, manual, code, or instruction (whether or not specifically incorporated by reference in the Procurement Contract Documents); or
   2. the provisions of any Laws or Regulations applicable to the furnishing of the Goods and Special Services (unless such an interpretation of the provisions of the Procurement Contract Documents would result in violation of such Law or Regulation).

3.04 Requirements of the Procurement Drawings and Procurement Specifications

A. During the performance of Seller's obligations and until final payment, Seller and Buyer shall submit to the Engineer all matters in question concerning the requirements of the Procurement Drawings and Procurement Specifications (sometimes referred to as requests for information or interpretation—RFIs), or relating to the acceptability of the Goods and Special Services, as soon as possible after such matters arise. Engineer will be the initial interpreter of the requirements of the Procurement Drawings and Procurement Specifications, and judge of the acceptability of the Goods and Special Services thereunder.
   1. After assignment (if any) Seller shall submit such matters directly to Contractor/Assignee for response or administration, and the Procurement Contract provisions in Paragraphs 3.04.B and C will not apply.

B. Engineer will issue with reasonable promptness a written clarification, interpretation, or decision on the issue submitted, and if necessary, initiate an amendment or supplement to the Procurement Drawings or Procurement Specifications. Engineer's written clarification, interpretation, or decision will be consistent with the overall intent of the Procurement Contract Documents and will be final and binding on Seller and Buyer. If either Buyer or Seller believes that a written clarification or interpretation justifies an adjustment in the Procurement Contract Price or Procurement Contract Times, either may make a Claim for such adjustment.

C. If a submitted matter in question concerns terms and conditions of the Procurement Contract Documents that do not involve (1) the performance or acceptability of the Goods and Services, (2) the design (as set forth in the Procurement Drawings, Procurement Specifications, or otherwise), or (3) other engineering or technical matters, then Engineer will promptly give written notice to Buyer and Seller that Engineer is unable to provide a decision or interpretation.

3.05 Reuse of Documents

A. Seller and its subcontractors and suppliers shall not:
   1. have or acquire any title to or ownership rights in any of the Procurement Drawings, Procurement Specifications, or other documents (or copies of any thereof) prepared by or bearing the seal of Engineer or its consultants, including electronic media editions, or reuse any such Procurement Drawings, Procurement Specifications, other documents, or copies thereof, on extensions of the Project or any other project, without written consent of Buyer and Engineer and specific written verification or adaptation by Engineer; or
   2. have or acquire any title or ownership rights in any other Procurement Contract Documents, reuse any such Procurement Contract Documents for any purpose without Buyer's express written consent, or violate any copyrights pertaining to such Procurement Contract Documents.

B. The prohibitions of this Paragraph 3.05 will survive final payment, or termination of the Procurement Contract. Nothing herein precludes Seller from retaining copies of the Procurement Contract Documents for record purposes.

ARTICLE 4 - COMMENCEMENT AND SCHEDULE

4.01 Commencement of Procurement Contract Times

A. The Procurement Contract Times will commence to run on the Effective Date of the Procurement Contract.

4.02 Continuing Performance

A. Seller shall adhere to the progress schedule established in accordance with Paragraph 2.04.A., as duly adjusted, and the Goods will be delivered, and the Special Services furnished within the Procurement Contract Times.

B. Seller shall carry on furnishing of the Goods and Special Services and adhere to the progress schedule during all disputes or disagreements with Buyer. No furnishing of Goods and Special Services will be delayed or postponed pending resolution of any disputes or disagreements, except as expressly permitted herein, or as Buyer and Seller may otherwise agree in writing.

4.03 Adjustments to Progress Schedule

A. The progress schedule may be adjusted from time to time as provided below.
   1. Seller shall submit to Buyer for acceptance proposed adjustments in the progress schedule that will not result in changing the Procurement Contract Times. Such

adjustments will comply with any applicable provisions of the Procurement Specifications.

2. Proposed adjustments in the progress schedule that will change the Procurement Contract Times must be submitted in accordance with the requirements of Article 11. Adjustments in Procurement Contract Times may only be made by a Change Order.

4.04 Delays

A. If Buyer, Engineer, or anyone for whom Buyer is responsible, delays, disrupts, or interferes with Seller's performance or progress, then Seller shall be entitled to an equitable adjustment in Procurement Contract Price or Procurement Contract Times.

B. Seller shall not be entitled to an adjustment in Procurement Contract Price or Procurement Contract Times for delay, disruption, or interference caused by or within the control of Seller or anyone for whom Seller is responsible.

C. If Seller's performance or progress is delayed, disrupted, or interfered with by unanticipated causes not the fault of and beyond the control of Buyer, Seller, and those for which they are responsible, then Seller shall be entitled to an equitable adjustment in Procurement Contract Times. Such an adjustment will be Seller's sole and exclusive remedy for the delays, disruption, and interference described in this paragraph. Causes of delay, disruption, or interference that may give rise to an adjustment in Procurement Contract Times under this paragraph include but are not limited to the following:
   1. severe and unavoidable natural catastrophes such as fires, floods, epidemics, and earthquakes;
   2. abnormal weather conditions;
   3. inspection delays by governmental authorities, and custom delays;
   4. international shipping delays;
   5. acts or failures to act of third-party entities; and
   6. acts of war or terrorism.

D. Adjustments of Procurement Contract Times or Procurement Contract Price—General Provisions: Seller's entitlement to an adjustment of Procurement Contract Times or Procurement Contract Price is limited as follows:
   1. Seller's entitlement to an adjustment of the Procurement Contract Times is conditioned on the delay, disruption, or interference adversely affecting an activity on the critical path to completion of Seller's obligations, as of the time of the delay, disruption, or interference.
   2. Seller shall not be entitled to an adjustment in Procurement Contract Price for any delay, disruption, or interference if such delay is concurrent with a delay, disruption, or interference caused by or within the control of Seller. Such a concurrent delay by Seller does not preclude an adjustment of Procurement Contract Times to which Seller is otherwise entitled.
   3. Adjustments of Procurement Contract Times or Procurement Contract Price are subject to the provisions of Articles 11 and 12.

E. Each Seller request seeking a delay-related increase in Procurement Contract Times or Procurement Contract Price must be supplemented by supporting data that sets forth in detail the following: (1) the circumstances that form the basis for the

requested adjustment; (2) the date upon which each cause of delay, disruption, or interference began to affect Seller's progress; (3) the date upon which each cause of delay, disruption, or interference ceased to affect Seller's progress; (4) the number of days' increase in Procurement Contract Times claimed as a consequence of each such cause of delay, disruption, or interference; and (5) the impact on Procurement Contract Price. Seller shall also furnish such additional supporting documentation as Buyer or Engineer may require including, where appropriate, a revised progress schedule indicating all the activities affected by the delay, disruption, or interference, and an explanation of the effect of the delay, disruption, or interference on the critical path to completion.

ARTICLE 5 - BONDS AND INSURANCE

5.01 Performance, Payment, and Other Bonds

A. Seller shall furnish a performance bond and a payment bond, each in an amount at least equal to the Procurement Contract Price, as security for the faithful performance and payment of Seller's obligations under the Procurement Contract. These bonds must remain in effect until 1 year after the date when final payment becomes due or until completion of the correction period, whichever is later, except as provided otherwise by Laws or Regulations, the terms of a prescribed bond form, the Supplementary Conditions, or other provisions of the Procurement Contract.

B. Seller shall also furnish such other bonds (if any) as are required by the Supplementary Conditions or other provisions of the Procurement Contract.

C. All bonds must be in the form included in the Bidding Documents or otherwise specified by Buyer prior to execution of the Procurement Contract, except as provided otherwise by Laws or Regulations, and must be issued and signed by a surety named in "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Department Circular 570 (as amended and supplemented) by the Bureau of the Fiscal Service, U.S. Department of the Treasury. A bond signed by an agent or attorney-in-fact must be accompanied by a certified copy of that individual's authority to bind the surety. The evidence of authority must show that it is effective on the date the agent or attorney-in-fact signed the accompanying bond.

D. Seller shall obtain the required bonds from surety companies that are duly licensed or authorized, in the state or jurisdiction in which the Project is located, to issue bonds in the required amounts.

E. If the surety on a bond furnished by Seller is declared bankrupt or becomes insolvent, or the surety ceases to meet the requirements above, then Seller shall promptly notify Buyer and Engineer and shall, within 20 days after the event giving rise to such notification, provide another bond and surety, both of which shall comply with the bond and surety requirements of this Procurement Contract.

F. If Seller has failed to obtain a required bond, Buyer may exercise Buyer's termination rights.

G. Upon request to Buyer from any subcontractor, supplier, or other person or entity claiming to have furnished labor, services, materials, or equipment used in the performance of Seller's obligations, Buyer shall provide a copy of the payment bond to such person or entity.

H. Upon request to Seller from any subcontractor, supplier, or other person or entity claiming to have furnished labor, services, materials, or equipment used in the performance of Seller's obligations, Seller shall provide a copy of the payment bond to such person or entity.

5.02 Insurance

A. Seller shall provide insurance of the types and coverages and in the amounts stipulated in the Supplementary Conditions.

B. Failure of Buyer to demand certificates of insurance or other evidence of Seller's full compliance with these insurance requirements or failure of Buyer to identify a deficiency in compliance from the evidence provided will not be construed as a waiver of Seller's obligation to maintain such insurance.

C. Upon assignment of this Procurement Contract, Seller shall name the Contractor/Assignee as an additional insured and comply with the written request of Contractor/Assignee to provide evidence of insurance.

D. Buyer does not represent that insurance coverage and limits established in this Procurement Contract necessarily will be adequate to protect Seller.

E. The insurance and insurance limits required herein will not be deemed as a limitation on Seller's liability under the indemnities and other rights granted to Buyer in the Procurement Contract.

5.03 Surety or Insurance Companies

A. All bonds and insurance required by the Procurement Contract Documents to be purchased and maintained by Buyer or Seller shall be obtained from surety or insurance companies that are duly licensed or authorized in the jurisdiction in which the Project is located to issue bonds or insurance policies for the limits and coverages so required. Such surety and insurance companies must also meet such additional requirements and qualifications as may be provided in the Supplementary Conditions.

ARTICLE 6 - LICENSES AND FEES

6.01 Intellectual Property and License Fees

A. Except to the extent stated elsewhere in the Procurement Contract Documents, Seller is not transferring any patent rights, copyrights, or other intellectual property rights for the Goods delivered.

B. To the extent Seller is manufacturing to Buyer's design, Buyer retains all patent rights, copyrights, and other intellectual property rights in such design.

C. If an invention, design, process, product, or device is specified in the Procurement Contract Documents for incorporation in the Goods or for the performance of Special Services, and if, to the actual knowledge of Buyer or Engineer, its use is subject to patent rights, copyrights, or other intellectual property rights calling for the payment of a license fee or royalty to others, then the existence of such rights and payment obligations will be disclosed to Seller in the Procurement Contract Documents.

D. Seller shall pay all license fees and royalties and assume all costs incident to the use or the furnishing of the Goods, unless specified otherwise by the Procurement Contract Documents.

6.02 Seller's Infringement

A. Subject to Paragraph 6.01, to the fullest extent permitted by Laws and Regulations, Seller shall indemnify and hold harmless Buyer, Engineer, and their officers, directors, members, partners, employees, agents, consultants, contractors, and subcontractors, from and against all claims, costs, losses, damages, and judgments (including but not limited to all reasonable fees and charges of engineers, architects, attorneys and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement or alleged infringement of any patent, copyright, or other intellectual property right by any of the Goods as delivered or Special Services as performed.

B. Buyer will promptly notify Seller in writing of any claim, suit, or threat of suit by a third party for any infringement or alleged infringement of any patent, copyright, or other intellectual property right with respect to the Goods as delivered or Special Services as performed.

C. Seller shall promptly defend or settle the claim or suit. Seller shall have control over such claim or suit, bear all expenses, and satisfy any adverse judgment.
   1. If Seller fails to defend such suit or claim after written notice by Buyer, Seller will be bound, in any subsequent suit or claim against Seller by Buyer, by any factual determination in the prior suit or claim.
   2. If Buyer fails to provide Seller the opportunity to defend such suit or claim, Buyer shall be barred from any remedy against Seller for such suit or claim.

D. If a determination is made that Seller has infringed upon the intellectual property rights of another, Seller may, at Seller's own expense, obtain the necessary licenses for Buyer's benefit, or replace the Goods and provide related design and construction, consistent with the requirements of the Procurement Contract Documents, to avoid the infringement.

6.03 Buyer's Infringement

A. Subject to Paragraph 6.01, and to the fullest extent permitted by Laws and Regulations, Buyer shall be responsible to Seller for any infringement or alleged infringement of any patent, copyright, or other intellectual property right caused by Seller's compliance with the Procurement Drawings or Procurement Specifications,

and will reimburse Seller for any license fee or royalties paid by Seller to others if such payment resulted from any invention, design, process, product, or device specified to be furnished or performed in the Procurement Drawings or Procurement Specifications, but not identified as being subject to payment of such license fee or royalty.

B. Seller will promptly notify Buyer in writing of any claim, suit, or threat of suit by a third party for intellectual property infringement arising from Seller's compliance with the Procurement Drawings or Procurement Specifications.

C. Buyer shall defend or settle the claim or suit. Buyer shall have control over such claim or suit, bear all expenses, and satisfy any adverse judgment.
   1. If Buyer fails to defend such suit or claim after written notice by Seller, Buyer will be bound, in any subsequent suit or claim against Buyer by Seller, by any factual determination in the prior suit or claim.
   2. If Seller fails to provide Buyer the opportunity to defend such suit or claim, Seller shall be barred from any remedy against Buyer for such suit or claim.

ARTICLE 7 - SELLER'S RESPONSIBILITIES

7.01 Performance of Obligations

A. Seller shall be solely responsible for the means, methods, techniques, sequences, and procedures necessary to perform its obligations in accordance with the Procurement Contract Documents.

B. Seller shall supervise, inspect, and direct the furnishing of the Goods and Special Services competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform its obligations in accordance with the Procurement Contract Documents.

C. Seller shall coordinate the provision of Special Services to avoid or limit interference or disruption of other activities at the location where the Special Services are to occur, including but not limited to ongoing facility operations and construction activities.

7.02 Labor, Materials and Equipment

A. Seller shall provide competent, qualified and trained personnel in all aspects of its performance of the Procurement Contract.

B. All Goods, and all equipment and material incorporated into the Goods, must be as specified, and unless specified otherwise in the Procurement Contract Documents, must be:
   1. new, and of good quality;
   2. protected, assembled, connected, cleaned, and conditioned in accordance with the original manufacturer's instructions; and
   3. shop-assembled to the greatest extent practicable.

7.03 Laws and Regulations

A. Seller shall give all notices required by and shall comply with all Laws and Regulations applicable to the performance of its obligations in accordance with the Procurement Contract Documents. Except where otherwise expressly required by such Laws and Regulations, neither Buyer nor Engineer shall be responsible for monitoring Seller's compliance with any Laws or Regulations.

B. If Seller furnishes Goods and Special Services knowing or having reason to know that such furnishing is contrary to Laws or Regulations, Seller shall bear all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such performance. It will not be Seller's responsibility to make certain that the Procurement Specifications and Procurement Drawings are in accordance with Laws and Regulations, but this provision will not relieve Seller of Seller's obligations.

C. Changes in Laws or Regulations not known at the time of opening of Bids (or, on the Effective Date of the Procurement Contract if there were no Bids) that have a direct effect on the cost or time of Seller's performance will be the subject of an adjustment in Procurement Contract Price or Procurement Contract Times. If Buyer and Seller are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment, a Claim may be made.

7.04 "Or Equals"

A. Whenever an item of material or equipment to be incorporated into the Goods is specified or described in the Procurement Contract Documents by using the names of one or more proprietary items or specific suppliers or manufacturers, the specification or description is intended to establish the type, function, appearance, and quality required. Unless the specification or description contains or is followed by words reading that no like, equivalent, or "or equal" item is permitted, other items of material or equipment or material or equipment of other suppliers or manufacturers may be submitted to Buyer for Engineer's review.
   1. If in Engineer's sole discretion, such an item of material or equipment proposed by Seller is functionally equal to that named and sufficiently similar so that no change in related work will be required, it may be considered by Engineer as an "or equal" item.
   2. For the purposes of this paragraph, a proposed item of material or equipment may be considered functionally equal to an item so named only if in the exercise of reasonable judgment, Engineer determines that: 1) it is at least equal in quality, durability, appearance, strength, and design characteristics; 2) it will reliably perform at least equally well the function imposed by the design concept of the completed Project as a functioning whole; 3) it has an acceptable record of performance and availability of responsive service; and (4) Seller certifies that if approved: a) there will be no increase in any cost, including capital, installation or operating costs, to Buyer; and b) the proposed item will conform substantially to the detailed requirements of the item named in the Procurement Contract Documents.

B. Engineer's Evaluation: Engineer will be allowed a reasonable time within which to evaluate each proposal or Submittal made pursuant to Paragraph 7.04.A. Engineer will be the sole judge of whether to accept or reject such a proposal or Submittal. No "or equal" will be ordered, manufactured or utilized until Engineer's review is complete, which will be evidenced by an approved Shop Drawing. Engineer will advise Buyer and Seller in writing of any negative determination. Notwithstanding Engineer's approval of an "or-equal" item, Seller shall remain obligated to comply with the requirements of the Procurement Contract Documents.

C. Special Guarantee: Buyer may require Seller to furnish at Seller's expense a special performance guarantee or other surety with respect to any such proposed "or-equal."

D. Data: Seller shall provide all data in support of any such proposed "or equal" at Seller's expense.

7.05 Taxes

A. Seller shall pay all taxes and duties arising out of the sale of the Goods and the performance of Special Services. All taxes and duties are included in the Procurement Contract Price, except as noted in the Supplementary Conditions.

7.06 Submittals

A. Shop Drawing and Sample Requirements
   1. Before submitting a Shop Drawing or Sample, Seller shall:
      a. review and coordinate the Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Procurement Contract Documents;
      b. determine and verify:
         1) all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect to the Submittal; and
         2) the suitability of all materials and equipment offered with respect to the indicated application, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of Seller's obligations.
      c. confirm that the Submittal is complete with respect to all related data included in the Submittal.
   2. Each Shop Drawing or Sample must bear a stamp or specific written certification that Seller has satisfied its obligations under the Procurement Contract Documents with respect to Seller's review of that Submittal, and that Seller approves the Submittal.
   3. With each Shop Drawing or Sample, Seller shall give Engineer specific written notice of any variations that the Submittal may have from the requirements of the Procurement Contract Documents. This notice will be set forth in a written communication separate from the Submittal; and, in addition, in the case of a Shop Drawing by a specific notation made on the Shop Drawing itself.

B. Submittal Procedures for Shop Drawings and Samples: Seller shall label and submit Shop Drawings and Samples to Engineer for review and approval in accordance with the accepted Schedule of Submittals.
   1. Shop Drawings
      a. Seller shall submit the number of copies required in the Procurement Specifications.
      b. Data shown on the Shop Drawings must be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data to show Engineer the services, materials, and equipment Seller proposes to provide, and to enable Engineer to review the information for the limited purposes required.
   2. Samples
      a. Seller shall submit the number of Samples required in the Procurement Specifications.
      b. Seller shall clearly identify each Sample as to material, supplier, pertinent data such as catalog numbers, the use for which intended and other data as Engineer may require to enable Engineer to review the Submittal for the limited purposes required.
   3. Where a Shop Drawing or Sample is required by the Procurement Contract Documents or the Schedule of Submittals, any related work performed by Seller prior to Engineer's review and approval of the pertinent Submittal will be at the sole expense and responsibility of Seller.

C. Engineer's Review of Shop Drawings and Samples
   1. Engineer will provide timely review of Shop Drawings and Samples in accordance with the accepted Schedule of Submittals. Engineer's review and approval will be only to determine if the items covered by the Submittals will, after installation or incorporation in the Goods, comply with the requirements of the Procurement Contract Documents, and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Procurement Contract Documents.
   2. Engineer's review and approval will not extend to means, methods, techniques, sequences, or procedures of construction, manufacturing, fabrication, installation, or shipping, or to safety precautions or programs incident thereto.
   3. Engineer's review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.
   4. Engineer's review and approval of a Shop Drawing or Sample will not relieve Seller from responsibility for any variation from the requirements of the Procurement Contract Documents unless Seller has complied with the requirements of Paragraph 7.06.A.3 and Engineer has given written approval of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample. Engineer will document any such approved variation from the requirements of the Procurement Contract Documents in a Field Order or other appropriate Procurement Contract modification.
   5. Engineer's review and approval of a Shop Drawing or Sample will not relieve Seller from responsibility for complying with the requirements.

6. Engineer's review and approval of a Shop Drawing or Sample, or of a variation from the requirements of the Procurement Contract Documents, will not, under any circumstances, change the Procurement Contract Times or Procurement Contract Price, unless such changes are included in a Change Order.
7. Neither Engineer's receipt, review, acceptance or approval of a Shop Drawing or Sample will result in such item becoming a Procurement Contract Document.
8. Seller shall furnish Goods that comply with the requirements and commitments set forth in approved Shop Drawings and Samples, subject to the provisions of Paragraph 7.06.C.4.

D. Resubmittal Procedures for Shop Drawings and Samples
   1. Seller shall make corrections required by Engineer and shall return the required number of corrected copies of Shop Drawings and submit, as required, new Samples for review and approval. Seller shall direct specific attention in writing to revisions other than the corrections called for by Engineer on previous Submittals.

      1. Seller shall furnish required Shop Drawing and Sample Submittals with sufficient information and accuracy to obtain required approval of an item with no more than two resubmittals. Engineer will record Engineer's time for reviewing a third or subsequent resubmittal of a Shop Drawing or Sample, and Seller shall be responsible for Engineer's charges to Buyer for such time. Buyer may impose a set-off against payments due Seller to secure reimbursement for such charges.
      2. If Seller requests a change of a previously approved Shop Drawing or Sample, Seller shall be responsible for Engineer's charges to Buyer for its review time, and Buyer may impose a set-off against payments due Seller to secure reimbursement for such charges, unless the need for such change is beyond the control of Seller.

E. Submittals Other than Shop Drawings, Samples, and Owner-Delegated Designs
   1. The following provisions apply to all Submittals other than Shop Drawings and Samples, and Owner-delegated designs:
      a. Seller shall submit all such Submittals to the Engineer in accordance with the schedule of Submittals and pursuant to the applicable terms of the Procurement Contract Documents.
      b. Engineer will provide timely review of all such Submittals in accordance with the schedule of Submittals and return such Submittals with a notation of either Accepted or Not Accepted. Any such Submittal that is not returned within the time established in the schedule of Submittals will be deemed accepted.
      c. Engineer's review will be only to determine if the Submittal is acceptable under the requirements of the Procurement Contract Documents as to general form and content of the Submittal.
      d. If any such Submittal is not accepted, Seller shall confer with Engineer regarding the reason for the non-acceptance and resubmit an acceptable document.
   2. Procedures for the submittal and acceptance of the Progress Schedule, the Schedule of Submittals, and the Schedule of Values are set forth in Paragraphs 2.04 and 2.05.

F. Owner-delegated Designs: Submittals pursuant to Owner-delegated designs are governed by the provisions of Paragraph 7.09.

7.07 Indemnification

A. To the fullest extent permitted by Laws and Regulations, Seller shall indemnify and hold harmless Buyer, Engineer, Project Owner, and any assignee of Buyer, including Contractor/Assignee, and their officers, directors, members, partners, employees, agents, consultants, contractors, and subcontractors, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the performance of Seller's obligations under the Procurement Contract, provided that any such claim, cost, loss, or damage is attributable to bodily injury, sickness, disease, or death, or to injury to or destruction of tangible property (other than the Goods themselves), including the loss of use resulting therefrom, but only to the extent caused by any negligent act or omission of Seller, or any individual or entity directly or indirectly employed by Seller or anyone for whose acts Seller may be liable.

B. In any and all claims against Buyer, Engineer, Project Owner, or any assignee of Buyer, including Contractor/Assignee, or their officers, directors, members, partners, employees, agents, consultants, contractors, or subcontractors, by any employee (or the survivor or personal representative of such employee) of Seller, any subcontractor, any supplier, or any individual or entity directly or indirectly employed by any of them to furnish any of the Goods and Special Services, or anyone for whose acts any of them may be liable, the indemnification obligation under Paragraph 7.07.A will not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for Seller or any such subcontractor, supplier, or other individual or entity under workers' compensation acts, disability benefit acts, or other employee benefit acts.

7.08 Concerning Subcontractors and Suppliers

A. Seller may retain subcontractors and suppliers for the performance of parts of the furnishing of the Goods and Special Services. The Seller's retention of a subcontractor or supplier will not relieve Seller's obligation to Buyer to perform and complete the furnishing the Goods and Special Services in accordance with the Procurement Contract Documents.

7.09 Delegation of Professional Design Services

A. Project Owner may require Contractor/Assignee to provide professional design services for a portion of the Work by express delegation in the Contract Documents. Such delegation will specify the performance and design criteria that such services must satisfy, and the Submittals that Contractor/Assignee must furnish to Engineer with respect to the Owner-delegated design.

B. Contractor/Assignee shall cause such Owner-delegated professional design services to be provided pursuant to the professional standard of care by a properly licensed design professional, whose signature and seal must appear on all drawings, calculations, specifications, certifications, and Submittals prepared by such design professional. Such design professional must issue all certifications of design required by Laws and Regulations.

C. If a Shop Drawing or other Submittal related to the Owner-delegated design is prepared by Contractor/Assignee, a subcontractor, or others for submittal to Engineer, then such Shop Drawing or other Submittal must bear the written approval of Contractor/Assignee's design professional when submitted by Contractor/Assignee to Engineer.

D. Project Owner and Engineer shall be entitled to rely upon the adequacy, accuracy, and completeness of the services, certifications, and approvals performed or provided by the design professionals retained or employed by Contractor/Assignee under an Owner-delegated design, subject to the professional standard of care and the performance and design criteria stated in the Contract Documents.

E. Pursuant to this Paragraph 7.19, Engineer's review, approval, and other determinations regarding design drawings, calculations, specifications, certifications, and other Submittals furnished by Contractor/Assignee pursuant to an Owner-delegated design will be only for the following limited purposes:
   1. Checking for conformance with the requirements of this Paragraph 7.19;
   2. Confirming that Contractor/Assignee (through its design professionals) has used the performance and design criteria specified in the Contract Documents; and
   3. Establishing that the design furnished by Contractor/Assignee is consistent with the design concept expressed in the Contract Documents.

F. Contractor/Assignee shall not be responsible for the adequacy of performance or design criteria specified by Owner or Engineer.

G. Contractor/Assignee is not required to provide professional services in violation of applicable Laws and Regulations.

ARTICLE 8 - SHIPPING AND DELIVERY

8.01 Shipping

A. Seller shall select the carrier and bear all costs of packaging, transportation, insurance, special handling, and all other costs associated with shipment and delivery.

8.02 Delivery

A. Seller shall deliver the Goods free on board (FOB) to the Point of Destination, freight prepaid, in accordance with the Procurement Contract Times set forth in the Procurement Agreement, or other date agreed to by Buyer and Seller.

B. At least 10 days before shipment, Seller shall provide written notice to Buyer of the manner of shipment and the anticipated delivery date. The notice must also include any instructions concerning special equipment or services required at the Point of Destination to unload and care for the Goods. Seller shall also require the carrier to give Buyer at least 24 hours' notice by telephone prior to the anticipated time of delivery.

C. Buyer will be responsible and bear all costs for unloading the Goods from carrier.

D. Buyer will assure that adequate facilities are available to receive delivery of the Goods at the time established for delivery, or on another date agreed to by Buyer and Seller.

E. No partial deliveries will be allowed, unless permitted or required by the Procurement Contract Documents or agreed to in writing by Buyer.

F. Provisions governing inspection on delivery are set forth in Paragraph 9.02.

8.03 Risk of Loss

A. Risk of loss and insurable interests transfer from Seller to Buyer upon Buyer's receipt of the Goods.

B. Notwithstanding the provisions of Paragraph 8.03.A, if Buyer rejects the Goods as non-conforming, the risk of loss on such Goods will remain with Seller until Seller corrects the non-conformity or Buyer accepts the Goods. If rejected Goods remain at the Point of Destination pending modification and acceptance, then Seller shall be responsible for arranging adequate protection and maintenance of the Goods at Seller's expense.

ARTICLE 9 - BUYER'S RIGHTS

9.01 Seller's Warranties and Guarantees

A. Seller warrants and guarantees to Buyer that the title to the Goods conveyed will be proper, its transfer rightful, and free from any security interest, lien, or other encumbrance. Seller shall defend, indemnify, and hold Buyer harmless against any liens, claims, or demands contesting or affecting title of the Goods conveyed.

B. Seller warrants and guarantees to Buyer that all Goods and Special Services will conform with the Procurement Contract Documents, and with the standards established by any Samples approved by Engineer. Engineer shall be entitled to rely on Seller's warranty and guarantee. If the Procurement Contract Documents do not otherwise specify the characteristics or the quality of the Goods, the Goods must comply with the requirements of Paragraph 7.02.B.

C. Seller's warranty and guarantee hereunder excludes defects or damage caused by:
   1. abuse, improper modification, improper maintenance, or improper operation by persons other than Seller;

2. excessive corrosion or chemical attack, unless corrosive or chemically damaging conditions were disclosed by Buyer in the Procurement Contract Documents and the Procurement Contract Documents required the Goods to withstand such conditions;
3. use in a manner contrary to Seller's written instructions for installation, operation, and maintenance; or
4. normal wear and tear under normal usage.

D. Seller's obligation to furnish the Goods and Special Services in accordance with the Procurement Contract Documents will be absolute. None of the following will constitute an acceptance of Goods and Special Services that are non-conforming, or a release of Seller's obligation to furnish the Goods and Special Services in accordance with the Procurement Contract Documents:
   1. observations by Buyer, Engineer, or Project Owner;
   2. recommendation by Engineer or payment by Buyer of any progress or final payment;
   3. use of the Goods by Buyer or Project Owner;
   4. any acceptance by Buyer, Engineer, or Project Owner, or any failure to do so;
   5. the end of the correction period established in Paragraph 9.04;
   6. the issuance of a notice of acceptance;
   7. any inspection, test or approval by others; or
   8. any correction of non-conforming Goods and Special Services by Buyer or Project Owner.

E. Buyer shall promptly notify Seller of any breach of Seller's warranties or guarantees.

9.02 Inspections and Testing

A. General Provisions
   1. The Procurement Contract Documents specify required inspections and tests. Buyer shall have the right to perform, or cause to be performed, reasonable inspections and require reasonable tests of the Goods at Seller's facility, and at the Point of Destination. Seller shall allow Buyer a reasonable time to perform such inspections or tests.
   2. Seller shall reimburse Buyer for all expenses, except for travel, lodging, and subsistence expenses of Buyer's and Engineer's representatives, for inspections and tests specified in the Procurement Contract Documents. If as the result of any such specified testing the Goods are determined to be non-conforming, then Seller shall also bear the travel, lodging, and subsistence expenses of Buyer's and Engineer's representatives, and all expenses of re-inspection or retesting.
   3. Buyer shall bear all expenses of inspections and tests that are not specified in the Procurement Contract Documents (other than any re-inspection or retesting resulting from a determination of non-conformity, as set forth in Paragraph 9.03); provided, however, that if as the result of any such non-specified inspections or testing the Goods are determined to be non-conforming, then Seller shall bear all expenses of such inspections and testing, and of any necessary re-inspection and retesting.
   4. Seller shall provide Buyer timely written notice of the readiness of the Goods for all inspections, tests, or approvals which the Procurement Contract Documents specify are to be observed by Buyer prior to shipment.

5. Buyer will give Seller timely notice of all specified tests, inspections, and approvals of the Goods which are to be conducted at the Point of Destination, and a representative of Seller will attend such tests, inspections, and approvals.
6. If, on the basis of inspections or testing, the Goods appear to be conforming, Buyer will give Seller prompt notice thereof. If on the basis of inspections or testing, the Goods appear to be non-conforming, Buyer will give Seller prompt notice thereof and will advise Seller of the remedy Buyer elects under the provisions of Paragraph 9.03.
7. Neither payments made by Buyer to Seller prior to any tests or inspections, nor any tests or inspections, will constitute acceptance of non-conforming Goods, or prejudice Buyer's rights under the Procurement Contract.

B. Visual Inspection on Delivery
   1. Buyer will visually inspect the Goods upon delivery solely for purposes of identifying the Goods, general verification of quantities, and observation of apparent condition. Such visual inspection will not be construed as final or as receipt of any Goods and Special Services that, as a result of subsequent inspections and tests, are determined to be non-conforming.
   2. If, on the basis of the visual inspection specified in this Document, the Goods appear to comply with the requirements of the Procurement Contract Documents as to quantities and condition, then within 10 days of delivery Buyer shall issue to Seller Buyer's acknowledgment of the receipt of Goods.

C. Final Inspection
   1. After all of the Goods have been incorporated into the Project, tested in accordance with such testing requirements as are specified, and are functioning as required, and Seller has performed and completed all Special Services, Buyer will make a final inspection.
   2. If, on the basis of the final inspection, Buyer determines that the Goods and Special Services are conforming, Buyer's notice thereof will constitute Buyer's acceptance of the Goods and Special Services, subject to any limitations stated in the notice.
   3. If, on the basis of the final inspection, the Goods and Special Services are non-conforming, Buyer will identify the non-conformity in writing.

9.03 Non-Conforming Goods and Special Services

A. If, on the basis of inspections and testing prior to delivery, the Goods and Special Services are found to be non-conforming, or if at any time after Buyer has acknowledged receipt of delivery and before the expiration of the correction period described in this Document, Buyer determines that the Goods and Special Services are non-conforming, then Seller shall promptly, without cost to Buyer and in response to written instructions from Buyer, either correct such non-conforming Goods and Special Services, or, if Goods are rejected by Buyer, remove and replace the non-conforming Goods with conforming Goods, including all work required for reinstallation.

B. Buyer's Rejection of Non-Conforming Goods
   1. If Buyer elects to reject the Goods in whole or in part, Buyer's notice to Seller will describe in sufficient detail the non-conforming aspect of the Goods. If Goods

have been delivered to Buyer, Seller shall promptly, and within the Procurement Contract Times, remove and replace the rejected Goods.
2. Seller shall bear all costs, losses and damages attributable to the removal, replacement, reinspection, and retesting of the non-conforming Goods.
3. Upon rejection of the Goods, Buyer retains a security interest in the Goods to the extent of any payments made and expenses incurred in their testing and inspection.

C. Buyer's Rejection of Non-Conforming Special Services
1. If at any time Buyer elects to reject the Special Services in whole or in part, Buyer's notice to Seller will describe in sufficient detail the non-conforming aspect of the Special Services.
2. Seller shall promptly provide conforming Special Services acceptable to Buyer.
3. If Seller fails to provide conforming Special Services, Buyer may remove the Special Services from the scope of the Procurement Contract, and equitably reduce the Procurement Contract Price.

D. Remedying Non-Conforming Goods: If Buyer elects to permit the Seller to modify the Goods to correct the non-conformance, then Seller shall promptly provide a schedule for such modifications and shall make the Goods conforming within a reasonable time.

E. Buyer's Acceptance of Non-Conforming Goods: Instead of requiring correction or removal and replacement of non-conforming Goods discovered either before or after final payment, Buyer may accept the non-conforming Goods. Seller shall bear all reasonable costs, losses, and damages attributable to Buyer's evaluation of and determination to accept such non-conforming Goods.

F. Seller Obligations: Seller shall pay all claims, costs, losses, and damages, including but not limited to all fees and charges for re-inspection, retesting and for any engineers, architects, attorneys and other professionals, and all court or arbitration or other dispute resolution costs arising out of or relating to the non-conforming Goods and Special Services. Seller's obligations will include the costs of the correction or removal and replacement of the non-conforming Goods and the replacement of property of Buyer and others destroyed by the correction or removal and replacement of the non-conforming Goods and obtaining conforming Special Services from others.

G. Buyer's Rejection of Conforming Goods: If Buyer asserts that Goods and Special Services are non-conforming and such Goods and Special Services are determined to be conforming, or if Buyer rejects as non-conforming Goods and Special Services that are later determined to be conforming, then Seller shall be entitled to reimbursement from Buyer of costs incurred by Seller in inspecting, testing, correcting, removing, or replacing the conforming Goods and Special Services, including but not limited to fees and charges of engineers, architects, attorneys and other professionals, and all court or arbitration or other dispute resolution costs associated with the incorrect assertion of non-conformance or rejection of conforming Goods and Special Services.

9.04 Correction Period

A. Seller's responsibility for correcting all non-conformities in the Goods and Special Services will extend for a period of 1 year after the acceptance of the Goods and Special Services.

B. Where non-conforming Goods and Services (and damage to other work resulting therefrom) have been corrected or removed and replaced under this paragraph, the correction period hereunder with respect to such Goods and Services will be extended for an additional period of 1 year after such correction or removal and replacement has been satisfactorily completed.

C. Seller's obligations under this paragraph are in addition to all other obligations and warranties. The provisions of this paragraph may not be construed as a substitute for, or a waiver of, the provisions of any applicable statute of limitation or repose.

ARTICLE 10 - ENGINEER'S STATUS

10.01 Engineer's Role Defined

A. Engineer will be Buyer's representative until assignment (if any) of the Procurement Contract.

B. The duties and responsibilities and the limitations of authority of Engineer prior to assignment, if any, of the Procurement Contract, are set forth in the Procurement Contract Documents.

C. Engineer's responsibilities, if any, after an assignment (if any) of the Procurement Contract, are set forth in the Procurement Agreement.

10.02 Duties and Responsibilities; Authority; Limitations

A. Engineer will be the initial interpreter of the Procurement Contract Documents and judge of the acceptability of the Goods and Special Services, and will issue clarifications, interpretations, and decisions regarding such issues.

B. Acting on behalf of Buyer under the provisions of Article 9, Engineer has the authority to disapprove or reject Goods and Special Services that Engineer believes to be non-conforming. Engineer also has the authority to require special inspection or testing of the Goods or Special Services, whether or not the Goods are fabricated or installed, or the Special Services are completed.

C. Engineer may authorize minor deviations or variations in the Procurement Contract Documents by: 1) written approval of specific variations set forth in Shop Drawings when Seller has duly noted such variations, or 2) a Field Order.

D. Engineer will review Claims, and render decisions on Claims.

E. In rendering any interpretations, clarifications, reviews, decisions, disapprovals, acceptances, rejections, authorizations, and judgments, Engineer will not show

partiality to Buyer or Seller. Engineer will not be liable to Buyer, Seller, or others in connection with any interpretations, clarifications, reviews, decisions, disapprovals, acceptances, rejections, authorizations, or judgments conducted or rendered by Engineer in good faith.

F. Engineer will not supervise, direct, control, or have authority over or be responsible for the means, methods, techniques, sequences, or procedures used by Seller to perform its obligations under this Procurement Contract, or the safety precautions and programs incident thereto, or for any failure of Seller to comply with Laws and Regulations applicable to the performance of its obligations. Engineer will not be responsible for Seller's failure to furnish the Goods and Special Services in accordance with the Procurement Contract Documents.

ARTICLE 11 - CHANGES

11.01 Amending and Supplementing the Procurement Contract

A. The Procurement Contract may be amended or supplemented by a Change Order, a Change Directive, or a Field Order.

B. If an amendment or supplement to the Procurement Contract includes a change in the Procurement Contract Price or the Procurement Contract Times, such amendment or supplement must be set forth in a Change Order.

C. All changes to the Procurement Contract that involve (1) the conformance or acceptability of the Goods and Special Services, (2) the design (as set forth in the Procurement Drawings, Procurement Specifications, or otherwise), or (3) other engineering or technical matters, must be supported by Engineer's recommendation. Buyer and Seller may amend other terms and conditions of the Procurement Contract without the recommendation of the Engineer.

11.02 Change Orders

A. Buyer and Seller shall execute appropriate Change Orders covering:
   1. Changes in Procurement Contract Price or Procurement Contract Times which are agreed to by the parties, including any undisputed sum or amount of time for Goods and Special Services furnished in accordance with a Change Directive;
   2. Changes in Procurement Contract Price resulting from a Buyer set-off, unless Seller has duly contested such set-off;
   3. Changes in the Goods and Special Services which are: (a) ordered by Buyer pursuant to Paragraph 11.05, (b) required because of Buyer's acceptance of non-conforming Goods and Services or (c) agreed to by the parties, subject to the need for Engineer's recommendation if the change in the Goods and Special Services involves the design (as set forth in the Procurement Drawings, Procurement Specifications, or otherwise) or other engineering or technical matters; and
   4. Changes that embody the substance of any final and binding results under: Paragraph 11.03.B, resolving the impact of a Change Directive; Article 12, Claims; and similar provisions.

B. If Buyer or Seller refuses to execute a Change Order that is required to be executed under the terms of Paragraph 11.02.A, it will be deemed to be of full force and effect, as if fully executed.

11.03 Change Directives

A. A Change Directive will not change the Procurement Contract Price or the Procurement Contract Times but is evidence that the parties expect that the modification ordered or documented by a Change Directive will be incorporated in a subsequently issued Change Order, following negotiations by the parties as to the Change Directive's effect, if any, on the Procurement Contract Price and Procurement Contract Times; or, if negotiations are unsuccessful, by a determination under the terms of the Procurement Contract Documents governing adjustments, expressly including Paragraph 11.08 regarding change of Procurement Contract Price.

B. If Buyer has issued a Change Directive and Buyer or Seller believes that an adjustment in Procurement Contract Times or Procurement Contract Price is necessary, then such party shall submit a Claim seeking such an adjustment no later than 30 days after the completion of the Goods and Services set out in the Change Directive.

11.04 Field Orders

A. Engineer may authorize minor changes in the Goods and Services if the changes do not involve an adjustment in the Procurement Contract Price or the Procurement Contract Times and are compatible with the design concept as indicated by the Procurement Contract Documents. Such changes will be accomplished by a Field Order and will be binding on Buyer and also on Seller, which shall perform the Goods and Special Services involved promptly.

B. If Seller believes that a Field Order justifies an adjustment in the Procurement Contract Price or Procurement Contract Times, then before proceeding with the Goods and Special Services at issue, Seller shall submit a Claim as provided in this Document.

11.05 Buyer-Authorized Changes in the Goods and Special Services

A. Without invalidating the Procurement Contract and without notice to any surety, Buyer may, at any time or from time to time, order additions, deletions, or revisions in the Goods and Special Services. Changes involving the design (as set forth in the Procurement Drawings, Procurement Specifications, or otherwise) or other engineering or technical matters will be supported by Engineer's recommendation.

B. Such changes in the Goods and Special Services may be accomplished by a Change Order, if Buyer and Seller have agreed as to the effect, if any, of the changes on Procurement Contract Times or Procurement Contract Price; or by a Change Directive. Upon receipt of any such document, Seller shall promptly proceed with the Goods and Special Services involved; or, in the case of a deletion in the Goods and Special Services, promptly cease activities with respect to such deletion.

Added or revised Goods and Special Services must be performed under the applicable conditions of the Procurement Contract Documents.

11.06 Buyer's Contingency Allowance

A. The Buyer's Contingency Allowance, if any such is set forth in the Procurement Agreement, is for the sole use of Buyer to cover unanticipated costs.

B. If Buyer exercises its unilateral right to use all or a portion of the Buyer's Contingency Allowance, Buyer will issue a written directive that documents the costs to which the allowance is applied, Seller's entitlement to compensation, and the consequent reduction in such allowance.

C. Prior to final payment, the Total Price, as set forth in the Procurement Agreement, will be duly adjusted to account for any unused portion of the Buyer's Contingency Allowance.

D. The Procurement Agreement addresses the impact on Buyer's Contingency Allowance of an assignment of the Procurement Contract.

11.07 Unauthorized Changes in the Goods and Special Services

A. Seller shall not be entitled to an increase in the Procurement Contract Price or an extension of the Procurement Contract Times with respect to any work performed that is not required by the Procurement Contract Documents, as amended, modified, or supplemented.

11.08 Change of Procurement Contract Price

A. The Procurement Contract Price may only be changed by a Change Order. Any Claim for an adjustment of Procurement Contract Price must comply with the provisions of Article 12.

B. An adjustment in the Procurement Contract Price will be determined as follows:
   1. For changes in Unit Price Goods and Special Services, by application of the unit prices to the quantities of the items involved;
   2. To the extent the cost of the change is not covered by unit prices, then by a mutually agreed lump sum; or
   3. To the extent the cost of the change is not covered by unit prices and the parties do not reach mutual agreement to a lump sum, then on the basis of documented costs plus a Seller's fee for overhead and profit of 15 percent.

11.09 Change of Procurement Contract Times

A. The Procurement Contract Times may only be changed by a Change Order. Any Claim for an adjustment in the Procurement Contract Times must comply with the provisions of Article 12.

11.10 Notification to Surety

A. If the provisions of any bond require notice to be given to a surety of any change affecting the general scope of the Goods and Special Services or the provisions of the Procurement Contract (including, but not limited to, Procurement Contract Price or Procurement Contract Times), the giving of any such notice will be Seller's responsibility. The amount of each applicable bond will be adjusted to reflect the effect of any such change.

ARTICLE 12 - CLAIMS, DISPUTES, AND DISPUTE RESOLUTION

12.01 Claims

A. The parties agree to endeavor to avoid or resolve Claims through direct, good faith discussions and negotiations whenever practicable. Such discussions and negotiations should at the outset address whether the parties mutually agree to suspend the Claims process, including the time periods established in this Document; if so, a written record of such mutual agreement should be made and jointly executed.

B. Claimant shall deliver to Engineer and the other party to the Procurement Contract written notice of each Claim within 15 days after the occurrence of the event giving rise to the Claim.

C. Claimant shall deliver written supporting data to Engineer and the other party within 45 days after such occurrence unless Engineer allows an additional period of time.

D. Engineer will review each such Claim and render a decision in writing within 30 days after receipt of the last submittal of the claimant or the last submittal of the opposing party, if any.

E. If Engineer does not render a formal written decision on a Claim within the time stated in this Document., Engineer shall be deemed to have issued a decision denying the Claim in its entirety 31 days after receipt of the last submittal of the claimant or the last submittal of the opposing party, if any.

F. The rendering of a decision by Engineer pursuant to this Paragraph 12.01 with respect to any such Claim, dispute, or other matter (except any which have been waived by the making or acceptance of final payment) will be a condition precedent to any exercise by Buyer or Seller of such rights or remedies as either may otherwise have under the Procurement Contract Documents or by Laws or Regulations in respect of any such Claim, dispute, or other matter. If the exercise of such rights or remedies will imminently be time-barred, a party may take actions necessary to preserve such rights and remedies notwithstanding the lack of the condition precedent referred to in this paragraph.

G. If a submitted matter in question concerns terms and conditions of the Procurement Contract Documents that do not involve (1) the performance or acceptability of Goods and Special Services under the Procurement Contract Documents, (2) the design (as set forth in the Procurement Drawings, Procurement Specifications,

Addenda, or otherwise), or (3) other engineering or technical matters, then Engineer will promptly give written notice to Buyer and Seller that Engineer is unable to provide a decision or interpretation. If Buyer and Seller are unable to agree on resolution of such a matter in question, either party may pursue resolution as provided in this Document.

H. Engineer's written decision on such Claim or a decision denying the Claim in its entirety that is deemed to have been issued pursuant to Paragraph 12.01, will be final and binding upon Buyer and Seller 30 days after it is issued unless within 30 days of issuance Buyer or Seller appeals Engineer's decision by initiating the mediation of such Claim in accordance with the dispute resolution procedures set forth in this Document.

I. If Article 12 has been amended to delete the mediation requirement, then Buyer or Seller may appeal Engineer's decision within 30 days of issuance by following the alternative dispute resolution process set forth in in this Document, as amended; or if no such alternative dispute resolution process has been set forth, Buyer or Seller may appeal Engineer's decision by 1) delivering to the other party within 30 days of the date of such decision a written notice of intent to submit the Claim to a court of competent jurisdiction, and 2) within 60 days after the date of such decision instituting a formal proceeding in a court of competent jurisdiction.

J. No Claim for an adjustment in Procurement Contract Price or Procurement Contract Times will be valid if not submitted in accordance with Article 12.

K. The effect on Claims of an assignment of the Procurement Contract by Buyer to a Contractor/Assignee is addressed in the Procurement Agreement.

12.02 Dispute Resolution Method

A. Either Buyer or Seller may initiate the mediation of (1) any Claim decided in writing by Engineer under Paragraph 12.01 before such decision becomes final and binding, or (2) any other dispute between the parties, including but not limited to any dispute arising after final inspection of the Goods and Services. The mediation will be governed by the Construction Industry Mediation Rules of the American Arbitration Association in effect as of the Effective Date of the Procurement Contract. The request for mediation must be submitted in writing to the American Arbitration Association and the other party to the Procurement Contract. Timely submission of the request will stay Engineer's decision from becoming final and binding.

B. Mediation is a condition precedent to seeking final dispute resolution. Buyer and Seller shall participate in the mediation process in good faith. The process must be concluded within 60 days of filing of the request. The date of termination of the mediation will be determined by application of the mediation rules referenced above.

C. If the mediation process does not result in resolution of the dispute, then Engineer's written Claim decision under Paragraph 12.01.D or a Claim denial pursuant to Paragraph 12.01.E becomes final and binding, or if applicable such other dispute is

deemed resolved in favor of respondent, unless, within 30 days after termination of the mediation, Buyer or Seller:

1. elects in writing to invoke any final dispute resolution process provided for in the Supplementary Conditions, or
2. agrees with the other party to submit the Claim or dispute to another final dispute resolution process, or
3. if no final dispute resolution process has been provided for in the Supplementary Conditions, delivers to the other party written notice of the intent to submit the Claim or dispute to a court of competent jurisdiction, and within 60 days of the termination of the mediation institutes such formal proceeding.

ARTICLE 13 - PAYMENT

13.01 Applications for Progress Payments

A. Seller shall submit to Buyer for Engineer's review Applications for Payment filled out and signed by Seller and accompanied by such supporting documentation as is required by the Procurement Contract Documents and also as Buyer or Engineer may reasonably require.

B. The timing and amounts of progress payments will be as stipulated in the Procurement Agreement.

C. Any Application for Payment that is based in whole or in part on the delivery of Goods must be accompanied by a bill of sale, invoice, or other documentation reasonably satisfactory to Buyer warranting that Buyer has rightfully received good title to the Goods from Seller and that, upon payment, the Goods will be free and clear of all liens. Such documentation will include releases and waivers from all parties with viable lien rights.

D. Buyer shall notify Seller promptly of any deficiency in the required documentation.

13.02 Review of Applications for Progress Payments

A. Review of Applications
   1. Engineer will, within 10 days after receipt of each Application for Payment, including each resubmittal, either indicate in writing a recommendation of payment and present the Application to Buyer, or return the Application to Seller indicating in writing Engineer's reasons for refusing to recommend payment.
   2. Engineer's recommendation of any payment requested in an Application for Payment will constitute a representation by Engineer to Buyer, based on Engineer's observations of Seller's progress, as an experienced and qualified design professional, and on Engineer's review of the Application for Payment and the accompanying data and schedules, that to the best of Engineer's knowledge, information and belief:
      a. the Goods and Special Services or other obligations of Seller have progressed to the point indicated;
      b. the quality of the Goods and Special Services or other obligations of Seller are generally in accordance with the Procurement Contract Documents; and

c. the conditions precedent to Seller being entitled to such payment appear to have been fulfilled in so far as it is Engineer's responsibility to observe the Seller's progress.

3. By recommending any such payment Engineer will not thereby be deemed to have represented that:
   a. inspections made to check the quality or the quantity of the Goods and Special Services or other obligations of Seller have been exhaustive, extended to every aspect of the Goods and Special Services or other obligations of Seller in progress, or involved detailed inspections of the Goods and Special Services or other obligations of Seller beyond the responsibilities specifically assigned to Engineer in the Procurement Contract; or
   b. there may not be other matters or issues between the parties that might entitle Seller to be paid additionally by Buyer or entitle Buyer to withhold payment to Seller.
4. Neither Engineer's review of Seller's progress for the purposes of recommending payments nor Engineer's recommendation of any payment, including final payment, will impose responsibility on Engineer:
   a. to supervise, direct, or control the Seller's performance or furnishing of Goods and Special Services or other obligations of Seller; or
   b. for the means, methods, techniques, sequences, or procedures of construction, manufacturing, fabrication, installation, or shipping, or the safety precautions and programs incident thereto; or
   c. for Seller's failure to comply with Laws and Regulations applicable to Seller's performance under the Procurement Contract; or
   d. to make any examination to ascertain how or for what purposes Seller has used the money paid for the Procurement Contract Price; or
   e. to determine that title to any of the Goods or component parts have passed to Buyer free and clear of any Liens.
5. Engineer may refuse to recommend the whole or any part of any payment if, in Engineer's opinion, it would be incorrect to make the representations to Buyer stated in Paragraph 13.02.A.2.
6. Engineer will recommend reductions in payment (set-offs) necessary in Engineer's opinion to protect Buyer from loss because:
   a. the Goods and Services are non-conforming, requiring correction or replacement;
   b. the Procurement Contract Price has been reduced by Change Orders;
   c. Buyer has been required to correct non-conforming Goods and Special Services in accordance with Paragraph 9.03.C, or has accepted non-conforming Goods and Special Services pursuant to Paragraph 9.03.E; or
   d. Engineer has actual knowledge of the occurrence of any of the events that would constitute a default by Seller and therefore justify termination for cause under the Procurement Contract Documents.

13.03 Basis and Amount of Progress Payments

A. The basis and amounts of the progress payments will be as provided in the Procurement Agreement, subject to the provisions of this Article 13 regarding reductions in payment.

13.04 Suspension of or Reduction in Payment

A. Buyer may temporarily cease making progress payments, or reduce the amount of a progress payment, even though recommended for payment by Engineer, under the following circumstances:
   1. Buyer has reasonable grounds to conclude that Seller will not furnish the Goods or the Special Services in accordance with the Procurement Contract Documents, and
   2. Buyer has requested in writing assurances from Seller that the Goods and Special Services will be delivered or furnished in accordance with the Procurement Contract Documents, and Seller has failed to provide adequate assurances within ten days of Buyer's written request.
   3. In addition to any reductions in payment (set-offs) recommended by Engineer, Buyer is entitled to impose a set-off against payment based on any of the following:
      a. claims have been made against Buyer based on Seller's conduct in the performance or furnishing of the Goods and Special Services, or has incurred costs, losses, or damages resulting from Seller's conduct in the performance or furnishing of the Goods and Special Services, including but not limited to claims, costs, losses, or damages from workplace injuries, adjacent property damage, non-compliance with Laws and Regulations, and patent infringement;
      b. Seller has failed to take reasonable and customary measures to avoid damage, delay, disruption, and interference with other work at or adjacent to the Point of Destination or the worksite;
      c. Seller has failed to provide and maintain required bonds or insurance;
      d. Buyer has incurred extra charges or engineering costs related to Submittal reviews, evaluations of proposed substitutes, tests and inspections, or return visits to manufacturing or assembly facilities;
      e. the Goods and Special Services are non-conforming, requiring correction or replacement;
      f. Buyer has been required to correct non-conforming Goods and Special Services, in accordance with Paragraph 9.03.C, or has accepted non-conforming Goods and Special Services pursuant to Paragraph 9.03.E;
      g. the Procurement Contract Price has been reduced by Change Orders;
      h. an event that would constitute a default by Seller and therefore justify a termination for cause has occurred;
      i. liquidated or other damages have accrued as a result of Seller's failure to achieve Milestones, Substantial Completion, or final completion of the Goods and Special Services; or
      j. liens have been filed in connection with the Procurement Contract, except where Seller has delivered a specific bond satisfactory to Buyer to secure the satisfaction and discharge of such liens.

B. If Buyer refuses to make payment of the full amount recommended by Engineer, Buyer will provide Seller and Engineer immediate written notice stating the reason for such action and promptly pay Seller any amount remaining after deduction of the amount withheld. Buyer shall promptly pay Seller the amount withheld when Seller corrects the reason for such action to Buyer's satisfaction.

13.05 Final Payment

A. After Seller has corrected all non-conformities to the reasonable satisfaction of Buyer and Engineer and furnished all Special Services, Seller may submit its final Application for Payment following the procedures for progress payments.

B. The final Application for Payment will be accompanied by all documentation called for in the Procurement Contract Documents (including but not limited to all final operations and maintenance manuals, and any special warranties), a list of all unsettled Claims, and the written consent of surety to the making of final payment.

C. If, on the basis of final inspection and the review of the final Application for Payment and accompanying documentation, Engineer is reasonably satisfied that Seller has furnished the Goods and Special Services in accordance with the Procurement Contract Documents, and that Seller has fulfilled all other obligations under the Procurement Contract Documents, then Engineer will, within 10 days after receipt of the final Application for Payment, indicate in writing Engineer's recommendation of final payment subject to the provisions of Paragraph 13.02, and present the final Application for Payment to Buyer. Such recommendation will account for any set-offs against payment that are necessary in Engineer's opinion to protect Buyer from loss for the reasons stated in Paragraph 13.02.

D. If Engineer does not recommend final payment, Engineer will return the final Application for Payment to Seller, indicating the reasons for refusing to recommend final payment, in which case Seller shall make the necessary corrections and resubmit the final Application for Payment.

E. In support of its recommendation of final payment Engineer will also give written notice to Buyer and Seller that the Goods and Special Services are acceptable, subject to stated limitations in the notice and to the provisions of Paragraph 13.06.

F. If the final Application for Payment and accompanying documentation are appropriate as to form and substance, Buyer shall, within 30 days after receipt thereof, pay Seller the amount recommended by Engineer, less any sum Buyer is entitled to set off against Engineer's recommendation, pursuant to the provisions of Paragraph 13.04.

G. Buyer will not make final payment, or return or release included retainage (if any) at any time, unless Seller submits written consent of the surety to such payment, return, or release.

13.06 Waiver of Claims

A. By making final payment, Buyer waives its claim or right to liquidated damages or other damages for late completion by Seller, except as set forth in an outstanding Claim, appeal, set-off, or express reservation of rights by Buyer. Buyer reserves all other claims or rights after final payment.

B. The acceptance of final payment by Seller will constitute a waiver by Seller of all claims and rights against Buyer other than those pending matters that have been duly submitted or appealed under the provisions of Article 12.

ARTICLE 14 - CANCELLATION, SUSPENSION, AND TERMINATION

14.01 Cancellation

A. Buyer has the right to cancel the Procurement Contract, without cause, at any time prior to delivery of the Goods by written notice. Cancellation pursuant to the terms of this paragraph will not constitute a breach of contract by Buyer. Upon cancellation:
   1. Buyer shall pay Seller for the direct costs incurred in producing any Goods that Seller has specially manufactured for the Project, plus a fair and reasonable amount for overhead and profit.
   2. For Goods that are not specially manufactured for the Project, Seller shall be entitled to a restocking charge of 10 percent of the unpaid Procurement Contract Price of such Goods.

14.02 Suspension of Performance by Buyer

A. Buyer has the right to suspend performance of the Procurement Contract for up to 90 days, without cause, by written notice. Upon suspension under this paragraph, Seller shall be entitled to an increase in the Procurement Contract Times and Procurement Contract Price caused by the suspension, provided that performance would not have been suspended or delayed for causes attributable to Seller.

14.03 Suspension of Performance by Seller

A. Seller may suspend the furnishing of the Goods and Special Services only under the following circumstance:
   1. Seller has reasonable grounds to conclude that Buyer will not perform its future payment obligations under the Procurement Contract; and
   2. Seller has requested in writing assurances from Buyer that future payments will be made in accordance with the Procurement Contract, and Buyer has failed to provide such assurances within ten days of Seller's written request.

14.04 Breach and Termination

A. Buyer's Breach
   1. Seller shall have the right to terminate the Procurement Contract for cause by declaring a breach if Buyer fails to comply with any material provision of the Procurement Contract. Upon termination, Seller shall be entitled to all remedies provided by Laws and Regulations.
   2. If Seller believes Buyer is in breach of its obligations under the Procurement Contract, Seller shall provide Buyer with reasonably prompt written notice setting forth in sufficient detail the reasons for declaring that it believes a breach has occurred. Buyer shall have 7 days from receipt of the written notice declaring the breach (or such longer period of time as Seller may grant in writing) within which to cure or to proceed diligently to cure such alleged breach.

B. Seller's Breach
   1. Buyer may terminate Seller's right to perform the Procurement Contract for cause by declaring a breach should Seller fail to comply with any material provision of the Procurement Contract Documents. Upon termination, Buyer shall be entitled to all remedies provided by Laws and Regulations.

2. In the event Buyer believes Seller is in breach of its obligations under the Procurement Contract, Buyer shall provide Seller with reasonably prompt written notice setting forth in sufficient detail the reasons for declaring that it believes a breach has occurred. Seller shall have 7 days from receipt of the written notice declaring the breach (or such longer period of time as Buyer may grant in writing) within which to cure or to proceed diligently to cure such alleged breach.
3. If and to the extent that Seller has provided a performance bond under the provisions of Paragraph 5.01, the notice and cure procedures of that bond, if any, will supersede the notice and cure procedures of Paragraph 14.04.B.2.

ARTICLE 15 - MISCELLANEOUS

15.01 Giving Notice

A. Whenever any provision of the Procurement Documents requires the giving of written notice to Buyer, Seller, or Engineer, it will be deemed to have been validly given if delivered:
   1. in person, by a commercial courier service or otherwise, to the recipient's place of business;
   2. by registered or certified mail, postage prepaid, to the recipient's place of business; or
   3. by e-mail to the recipient, with the words "Formal Notice" or similar in the e-mail's subject line.

15.02 Controlling Law

A. This Procurement Contract is to be governed by the law of the state in which the Goods are to be installed.

B. In the case of any conflict between the express terms of this Procurement Contract and the Uniform Commercial Code, as adopted in the state whose law governs, it is the intent of the parties that the express terms of this Procurement Contract will apply.

15.03 Computation of Time

A. When any period of time is referred to in the Procurement Documents by number of days, it will be computed to exclude the first and include the last day of such period. If the last day of any such period falls on a Saturday or Sunday or on a day made a legal holiday by the law of the applicable jurisdiction, such day will be omitted from the computation. When any period of time is referred to in the Procurement Documents by number of days, it will be computed to exclude the first and include the last day of such period. If the last day of any such period falls on a Saturday or Sunday or on a day made a legal holiday by the law of the applicable jurisdiction, such day will be omitted from the computation

15.04 Cumulative Remedies

A. The duties and obligations imposed by these General Conditions and the rights and remedies available hereunder to the parties hereto are in addition to, and are not to

be construed in any way as a limitation of, any rights and remedies available to any or all of them which are otherwise imposed or available by Laws or Regulations, by special warranty or guarantee, or by other provisions of the Procurement Contract, and the provisions of this paragraph will be as effective as if repeated specifically in the Procurement Contract in connection with each particular duty, obligation, right, and remedy to which they apply.

15.05 Survival of Obligations

A. All representations, indemnifications, warranties, and guarantees made in, required by, or given in accordance with the Procurement Contract, as well as all continuing obligations indicated in the Procurement Contract, will survive final payment, completion, and acceptance of the Goods and Special Services or termination or completion of the Procurement Contract or of the services of Seller.

15.06 Entire Agreement

A. Buyer and Seller agree that this Procurement Contract is the complete and final agreement between them, and supersedes all prior negotiations, representations, or agreements, either written or oral. This Procurement Contract may not be altered, modified, or amended except in writing signed by an authorized representative of both parties.

15.07 No Waiver

A. A party's non-enforcement of any provision will not constitute a waiver of that provision, nor will it affect the enforceability of that provision or of the remainder of this Procurement Contract.

15.08 Headings

A. Article and paragraph headings are inserted for convenience only and do not constitute parts of these General Conditions.

15.09 Successors and Assigns

A. Buyer and Seller each binds itself, its partners, successors, assigns, and legal representatives to the other party hereto, its partners, successors, assigns, and legal representatives in respect to all covenants, agreements, and obligations contained in the Procurement Contract.

END OF DOCUMENT

DOCUMENT 00_73_01

SUPPLEMENTARY CONDITIONS - PROCUREMENT

Scope: These Supplementary Conditions amend or supplement Document 00_72_01 - General Conditions - Procurement and other provisions of the Procurement Documents as indicated in this Document. All provisions which are not so amended or supplemented remain in full force and effect.

ARTICLE 1 — DEFINITIONS

1.01 Defined Terms

SC-1.01 Defined Terms: Delete 1.01.5 and replace with the following:

5. Buyer— The individual or entity purchasing the Goods and Special Services. As used in these Procurement Documents, defined as the City of Pacifica, also referred to as 'Owner' or 'Project Owner.'

SC-1.01_Defined Terms: Add the following definitions immediately after 1.01.40:

41. "Or Equal" — Alternate product that does not affect Contract Time, Contract Price, or Contract Scope.
42. Submittals — Shop Drawings, catalog cuts, samples, operating and maintenance instructions, progress payments, requests, and other documents and items specified to be delivered to Owner or Owner's representative.
43. Substitution — Alternate product that requires a Change Order to adjust the Contract Time, Contract Price, or Contract Scope.

ARTICLE 2 — PRELIMINARY MATTERS

2.04 Preliminary Schedules

2.04 Add the following new paragraph immediately after Paragraph 2.04.A.2:

3. a preliminary Schedule of Values.

ARTICLE 3 — PROCUREMENT CONTRACT DOCUMENTS (NOT USED)

ARTICLE 4 — COMMENCEMENT AND SCHEDULE (NOT USED)

ARTICLE 5 — BONDS AND INSURANCE

5.01 Performance, Payment, and Other Bonds

SC-5.01 Add the following paragraphs immediately after Paragraph 5.01.A:

1. Required Performance Bond Form: The performance bond that Seller furnishes will be in the form of Document 00_61_14 - Performance Bond - Procurement.
2. Required Payment Bond Form: The performance bond that Seller furnishes will be in the form of Document 00_61_73 - Payment Bond - Procurement.

SC-5.01 ADD THE FOLLOWING PARAGRAPHS IMMEDIATELY AFTER PARAGRAPH 5.01.H:

I. Supplier shall furnish a fully executed warranty bond.

1. Bond shall be issued in the form of Document 00_61_12 - Warranty Bond prior to or with the final application for payment, and in any event no later than 12 months after Substantial Completion.
2. The warranty bond must be in a bond amount of 100 percent of the final Contract Price for Bid Schedule “A”, Item A-2.
3. The warranty bond period will extend to the end of the correction period, as specified in SC 9.04.A.
4. The warranty bond must be issued by the same surety that issues the performance bond.

5.02 Insurance

SC-5.02 Add the following new paragraphs immediately after Paragraph 5.02.E:

F. Seller shall purchase and maintain such liability and other insurance as is appropriate for the furnishing of Goods and Special Services and as will provide protection from claims set forth below which may arise out of or result from Seller’s furnishing of the Goods or Special Services and Seller’s other obligations under the Procurement Contract Documents, whether the furnishing of Goods and Special Services or other obligations are to be performed by Seller, any subcontractor or supplier, or by anyone directly or indirectly employed by any of them to furnish the Goods and Special Services, or by anyone for whose acts any of them may be liable:

1. claims under workers’ compensation, disability benefits, and other similar employee benefit acts;
2. claims for damages because of bodily injury, occupational sickness or disease, or death of Seller’s employees;
3. claims for damages because of bodily injury, sickness or disease, or death of any person other than Seller’s employees;
4. claims for damages insured by reasonably available personal injury liability coverage which are sustained: (a) by any person as a result of an offense directly or indirectly related to the employment of such person by Seller, or (b) by any other person for any other reason;
5. claims for damages, other than to the Goods, because of injury to or destruction of tangible property wherever located, including loss of use resulting therefrom; and
6. claims for damages because of bodily injury or death of any person or property damage arising out of the ownership, maintenance or use of any motor vehicle.

G. The policies of insurance so required by this Paragraph 5.02 to be purchased and maintained must:

1. with respect to insurance required by Paragraphs SC-5.02.F.3 through SC-5.02.F.6 inclusive, include as additional insureds (subject to any customary exclusion in respect of professional liability) Buyer, Engineer, their consultants all of whom must be listed as additional insureds, and include coverage for the respective officers, directors, partners, employees, agents, and other consultants and subcontractors of each and any of all such additional insureds,

and the insurance afforded to these additional insureds must provide primary coverage for all claims covered thereby;

2. include at least the specific coverages and be written for not less than the limits of liability provided below or required by Laws or Regulations, whichever is greater;
3. include completed operations insurance;
4. include contractual liability insurance covering Seller's indemnity obligations under Paragraph 7.07;
5. contain a provision or endorsement that the coverage afforded will not be canceled, or renewal refused, until at least 10 days prior written notice has been given to the purchasing policyholder. Within three days of receipt of any such written notice, the purchasing policyholder will provide a copy of the notice to the other party, each other insured, and Engineer;
6. remain in effect at least until final payment and at all times thereafter when Seller may be correcting, removing, or replacing non-conforming Goods in accordance with Paragraph 9.03 and 9.04; and
7. with respect to completed operations insurance, and any insurance coverage written on a claims-made basis, remain in effect for at least two years after final payment (and Seller shall furnish Buyer and each other additional insured identified in these Supplementary Conditions, to whom a certificate of insurance has been issued, evidence satisfactory to Buyer and any such additional insured of continuation of such insurance at final payment and one year thereafter).

H. The limits of liability for the insurance required by Paragraph SC-5.02.F must provide coverage for not less than the following amounts or greater where required by Laws and Regulations:

1. Workers' Compensation, and related coverages under Paragraphs SC-5.02.F.1 and F.2:

Workers' Compensation and Related Policies	**Policy limits of not less than**
Workers' Compensation	
State	Statutory
Applicable Federal	Statutory
Foreign voluntary workers' compensation (employer's responsibility coverage), if applicable	Statutory
Employer's Liability	
Each accident	$1,000,000
Each employee	$1,000,000
Policy limit	$1,000,000
Stop-gap Liability Coverage	
For work performed in monopolistic states, stop-gap liability coverage must be endorsed to either the worker's compensation or commercial general liability policy with a minimum limit of:	$1,000,000

2. Seller's General Liability under Paragraphs SC-5.02.F.3 through F.6 which must include completed operations and product liability coverages, a "contractual liability" endorsement, and eliminate the exclusion with respect to property under the care, custody and control of Seller:

Commercial General Liability	Policy limits of not less than
General Aggregate	$2,000,000
Products—Completed Operations Aggregate	$2,000,000
Personal and Advertising Injury	$2,000,000
Bodily Injury and Property Damage—Each Occurrence/Annual Aggregate	$2,000,000

3. Automobile Liability under Paragraph SC-5.02.F.6:

Automobile Liability	Policy limits of not less than
Annual Aggregate	$2,000,000
Property Damage—each accident	$2,000,000
Bodily Injury—each person	$2,000,000
Bodily Injury—each accident	$2,000,000

4. Professional Liability (if the Special Services include professional services):

Seller's Professional Liability	Policy limits of not less than
Each Claim	$2,000,000
Annual Aggregate	$2,000,000

5. Transportation Insurance: Transportation insurance shall be of the "all risks" type and shall protect Supplier and Owner from all insurable risks of physical loss or damage to equipment and materials in transit to the designated location. The coverage amount shall be not less than the full value of items exposed to risk in transit at any one time.

    a. Transportation insurance shall provide for losses to be payable to Supplier and Owner as their interests may appear and shall contain a waiver of subrogation rights against the insured parties. For insurance purposes, the risk of loss to equipment and materials shall remain with Supplier until the equipment and materials are accepted by the assignee general construction contractor at the designated location.

    b. Supplier shall submit a copy of the transportation insurance policy to Owner at least 30 days before the scheduled shipping date. The policy shall quote the insuring agreement, shall list all exclusions, and shall state that 30 days' written notice will be given Owner before the policy is changed or canceled.

I. Seller shall deliver to Buyer, with copies to each additional insured identified in these Supplementary Conditions, certificates of insurance (and other evidence of insurance requested by Buyer or any other additional insured) which Seller is required to purchase and maintain.

ARTICLE 6 — LICENSES AND FEES (NOT USED)

ARTICLE 7 — SELLER'S RESPONSIBILITIES

7.04 "Or Equals"

SC-7.04 Add the following new language at the end of 7.04.A:

In accordance with California Public Contract Code, Section 3400, the successful Bidder is permitted a period of 14 days after the award of contract for submission of data substantiating a request for a substitution of an "or equal" item.

7.09 Delegation of Professional Design Services

SC-7.09 Add the following new subparagraph immediately after 7.09.A.:

1. Where the technical specs require the Contractor/Assignee to provide professional design services and to submit signed and sealed documents from a registered professional engineer, such Work is "Delegated Design."

ARTICLE 8 — SHIPPING AND DELIVERY (NOT USED)

ARTICLE 9 — BUYER'S RIGHTS

9.04 Correction Period

SC-9.04 Delete paragraph 9.04.A in its entirety and insert the following in its place:

A. Seller's responsibility for correcting all non-conformities in the Goods and Special Services will extend for a period of 2 years after the acceptance of the Goods and Special Services in accordance with Paragraph 9.02.C.2.

9.05 Limitation of Seller's Liability

SC-9.05 Add the following new paragraph after Paragraph 9.04:

9.05 Limitation of Seller's Liability

A. Buyer and Seller agree that the total liability of Seller to Buyer for claims, costs, losses, and damages arising from this Procurement Contract will be limited to the amount established in the Procurement Agreement as the Procurement Contract Price.

B. Upon assignment the terms of this Paragraph 9.05 will be binding upon both the assignor and assignee with respect to Seller's liability, The terms of this limitation do not apply to or limit any claim by Buyer against Seller based on any of the following: (a) contribution or indemnification with respect to third-party claims, losses, and damages; (b) costs, losses, or damages attributable to personal or bodily injury, sickness, disease, or death, or to injury to or destruction of the tangible property of others, (c) intentional or reckless wrongful conduct, or (d) rights conferred by any bond provided by Seller under this Contract.

ARTICLE 10 — ENGINEER'S STATUS (NOT USED)

ARTICLE 11 — CHANGES

11.02 Change Orders

SC-11.02 Insert the following new subparagraphs immediately following Paragraph 11.02.A.4:

5. In signing a Change Order, the Owner and Contractor acknowledge and agree that:
   a. the stipulated compensation (Contract Price or Contract Times, or both) set forth in the Change Order includes not only all direct costs of Contractor such as labor, material, job overhead, and profit markup, but also includes any costs for modifications or changes in sequence of work to be performed, delays, rescheduling, disruptions, extended direct overhead or general overhead, acceleration, material or other escalation which includes wages and other impact costs. This Document will become a supplement to the Contract and all Contract provisions will apply hereto. It is understood that this Change Order shall be effective on the date approved by the Owner's Representative;
   b. the Change Order constitutes full mutual accord and satisfaction for the change to the Work;
   c. no reservation of rights to pursue subsequent claims on the Change Order will be made by either party; and
   d. no subsequent claim or amendment of the Contract Documents will arise out of or as a result of the Change Order.

ARTICLE 12 — CLAIMS, DISPUTES, AND DISPUTE RESOLUTION (NOT USED)

ARTICLE 13 — PAYMENT

13.02 Review of Applications for Progress Payments

SC-13.02 Delete Paragraph 13.02.A.1 in its entirety and insert the following in its place:

1. Engineer will, within 7 days after receipt of each Application for Payment, including each resubmittal, either indicate in writing a recommendation of payment and present the Application to Owner, or return the Application to Supplier indicating in writing Engineer's reasons for refusing to recommend payment. In the latter case, Supplier may make the necessary corrections and resubmit the Application.
2. In accordance with California Public Contract Code, Section 20104.50, Owner will make progress payments on the basis of Supplier's Applications for Payment within 30 days after receipt, provided that such Applications for Payment have been submitted in a timely manner and otherwise meet the requirements of the Contract.

ARTICLE 14 — CANCELLATION, SUSPENSION, AND TERMINATION (NOT USED)

ARTICLE 15 — MISCELLANEOUS (NOT USED)

END OF DOCUMENT

SECTION 01_33_00

SUBMITTAL PROCEDURES

PART 1 GENERAL

1.01 SUMMARY

A. Section includes: Requirements and procedures for submittals to confirm compliance with Contract Documents.

1.02 GENERAL INSTRUCTIONS

A. Contractor is responsible to determine and verify field measurements, field construction criteria, materials, dimensions, catalog numbers and similar data, and check and coordinate each item with other applicable approved shop drawings and Contract Document requirements.

B. Provide submittals:
   1. That are specified or reasonably required for construction, operation, and maintenance of the Work.
   2. That demonstrate compliance with the Contract Documents.

C. Where multiple submittals are required, provide a separate submittal for each specification section:
   1. In order to expedite construction, the Contractor may make more than 1 submittal per specification section, but a single submittal may not cover more than 1 specification section:
      a. The only exception to this requirement is when 1 specification section covers the requirements for a component of equipment specified in another section.
      b. For example, circuit breakers are a component of switchgear. The switchgear submittal must also contain data for the associated circuit breakers, even though they are covered in a different specification section.

D. Prepare submittals in the English language. Do not include information in other languages.

E. Present measurements in customary American units (feet, inches, pounds, etc.).

F. Must be clear and legible, and of sufficient size for presentation of information.

G. Page size other than drawings:
   1. Minimum page size will be 8 1/2 inches by 11 inches.
   2. Maximum page size will be 11 inches by 17 inches.

H. Drawing sheet size:
   1. Maximum sheets size: 22-inch by 34-inch:
      a. Minimum plan scale: 1/8-inch equals 1 foot-0 inches.
      b. Minimum font size: 1/8 inch minimum.
   2. 11-inch by 17-inch sheet:
      a. Minimum plan scale: 1/8-inch equals 1 foot-0 inches.
      b. Minimum font size: 1/8 inch minimum.

I. Show dimensions, construction details, wiring diagrams, controls, manufacturers, catalog numbers, and all other pertinent details.

J. Provide submittal information from only 1 manufacturer for a specified product. Submittals with multiple manufacturers for 1 product will be rejected without review.

1.03 SUBMITTAL ORGANIZATION

A. Organize submittals in exactly the same order as the items are referenced, listed, and/or organized in the specification section.

B. For submittals that cover multiple devices used in different areas under the same specification section, the submittal for the individual devices must list the area where the device is used.

C. Bookmarks:
   1. Bookmarks shall match the table of contents.
   2. Bookmark each section (tab) and heading.
   3. Drawings: Bookmark at a minimum, each discipline, area designation, or appropriate division.
   4. At file opening, display all levels of bookmarks as expanded.

D. Where applicable (i.e., except for drawings, figures, etc.) submittal content shall be electronically searchable utilizing the PDF file as submitted.

E. Thumbnails optimized for fast web viewing.

F. Sequentially number pages within the tabbed sections:
   1. Submittals that are not fully indexed and tabbed with sequentially numbered pages, or are otherwise unacceptable, will be returned without review.

G. Attachments:
   1. Specification section: Include with each submittal a copy of the relevant specification section:
      a. Indicate in the left margin, next to each pertinent paragraph, either compliance with a check (√) or deviation with a consecutive number (1, 2, 3).
      b. Provide a list of all numbered deviations with a clear explanation and reason for the deviation.
   2. Drawings: Include with each submittal a copy of the relevant Drawing, including relevant addendum updates:
      a. Indicate either compliance with a check (√) or deviation with a consecutive number (1, 2, 3).

b. Provide a list of all numbered deviations with a clear explanation and reason for the deviation.
c. Provide field dimensions and relationship to adjacent or critical features of the Work or materials.

H. Supplier: Prepare submittal information in sufficient detail to show compliance with specified requirements:
1. Determine and verify quantities, field dimensions, product dimensions, specified design and performance criteria, materials, catalog numbers, and similar data.
2. Coordinate submittal with other submittals and with the requirements of the Contract Documents.
3. Check, verify, and revise submittals as necessary to bring them into conformance with Contract Documents and actual field conditions.

I. Supplier: Prepare "Or Equal" submittal information:
1. Provide standard submittal requirements:
a. In addition, provide in sufficient detail to show reason for variance from specified product and impacts.
2. Provide reason the specified product is not being provided.
3. Explain the benefits to the Owner for accepting the "Or Equal".
4. Itemized comparison of the proposed "Or Equal" with product specified including a list of significant variations:
a. Design features.
b. Design dimensions.
c. Installation requirements.
d. Operations and maintenance requirements.
e. Availability of maintenance services and sources of replacement materials.
5. Reference projects where the product has been successfully used:
a. Name and address of project.
b. Year of installation.
c. Year placed in operation.
d. Name of product installed.
e. Point of contact: Name and phone number.
6. Define impacts:
a. Impacts to other contracts.
b. Impacts to other work or products.
7. Supplier represents the following:
a. Supplier bears the burden of proof of the equivalency of the proposed "Or Equal".
b. Proposed "Or Equal" is equal or superior to the specified product.
c. Supplier will provide the warranties or bonds that would be provided on the specified product on the proposed "Or Equal", unless Owner requires a Special Warranty.
d. Supplier will support design of installation of accepted "Or Equal" into the final replacement design and will be responsible for the costs to make changes as required to the design.
e. Supplier waives rights to claim additional costs caused by proposed "Or Equal" which may subsequently become apparent.

J. Supplier: Prepare substitution submittal information:
    1. Provide standard submittal requirements:
        a. In addition, provide in sufficient detail to show reason for variance from specified product and impacts.
    2. Provide reason the specified product is not being provided.
    3. Explain the benefits to the Owner for accepting the substitution.
    4. Itemized comparison of the proposed substitution with product specified including a list of significant variations:
        a. Design features.
        b. Design dimensions.
        c. Installation requirements.
        d. Operations and maintenance requirements.
        e. Availability of maintenance services and sources of replacement materials.
    5. Reference projects where the product has been successfully used:
        a. Name and address of project.
        b. Year of installation.
        c. Year placed in operation.
        d. Name of product installed.
        e. Point of contact: Name and phone number.
    6. Define impacts:
        a. Impacts to Contract Price:
            1) Required license fees or royalties.
            2) Do not include costs under separate contracts.
            3) Do not include Engineer’s costs for redesign or revision of Contract Documents.
        b. Impacts to Contract Time.
        c. Impacts to Contract Scope.
        d. Impacts to other contracts.
        e. Impacts to other work or products.
    7. Supplier represents the following:
        a. Supplier shall pay associated costs for Engineer to evaluate the substitution.
        b. Supplier bears the burden of proof of the equivalency of the proposed substitution.
        c. Proposed substitution does not change the design intent and will have equal performance to the specified product.
        d. Proposed substitution is equal or superior to the specified product.
        e. Supplier will provide the warranties or bonds that would be provided on the specified product on the proposed substitution, unless Owner requires a Special Warranty.
        f. Supplier will support design of installation of accepted "Or Equal" into the final replacement design and will be responsible for the costs to make changes as required to the design.
        g. Supplier waives rights to claim additional costs caused by proposed substitution which may subsequently become apparent.

1.04 SUBMITTAL IDENTIFICATION NUMBERING

A. Number each submittal using the format defined below:

	Spec Section Number	Dash	Initial Submittal - Sequential Number	Decimal Point	Subsequent Submittal Revisions Sequential Number
Example 1 Description	*Cast-In-Place Concrete*		*8th initial submittal*		
	00_30_30	-	0008		
Example 2 Description	*Cast-In-Place Concrete*		*8th initial submittal*		*First revision to the 8th initial submittal*
	00_30_30	-	0008	.	1

1.05 SUBMITTALS IN ELECTRONIC MEDIA FORMAT

A. General: Provide all information in PC-compatible format using Windows® operating system as utilized by the Owner and Engineer.

B. Text: Provide text documents and manufacturer's literature in Portable Document Format (PDF).

C. Graphics: Provide graphic submittals (drawings, diagrams, figures, etc.) utilizing Portable Document Format (PDF).

1.06 SUBMITTAL PROCEDURE

A. Engineer: Review submittal and provide response:
   1. Review description:
      a. Engineer will be entitled to rely upon the accuracy or completeness of designs, calculations, or certifications made by licensed professionals accompanying a particular submittal whether or not a stamp or seal is required by Contract Documents or Laws and Regulations.
      b. Engineer's review of submittals shall not release Supplier from Supplier's responsibility for performance of requirements of Contract Documents. Neither shall Engineer's review release Supplier from fulfilling purpose of design nor from Supplier's liability to replace defective work.
      c. Engineer's review of shop drawings, samples, or test procedures will be only for conformance with design concepts and for compliance with information given in Contract Documents.
      d. Engineer's review does not extend to:
         1) Accuracy of dimensions, quantities, or performance of equipment and systems designed by Supplier.

2) Supplier's means, methods, techniques, sequences, or procedures except when specified, indicated on the Drawings, or required by Contract Documents.
3) Safety precautions or programs related to safety which shall remain the sole responsibility of the Supplier.

e. Engineer can Approve or Not Approve any exception at their sole discretion.

2. Review timeframe:
   a. Except as may be provided in technical specifications, a submittal will be returned within 30 days.
   b. When a submittal cannot be returned within the specified period, Engineer will, within a reasonable time after receipt of the submittal, give notice of the date by which that submittal will be returned.
   c. Engineer's acceptance of progress schedule containing submittal review times less than those specified or agreed to in writing by Engineer will not constitute Engineer's acceptance of review times.
   d. Critical submittals:
      1) Supplier will notify Engineer in writing that timely review of a submittal is critical to the progress of Work.
3. Schedule delays:
   a. No adjustment of Contract Times or Contract Price will be allowed due to Engineer's review of submittals, unless all of the following criteria are met:
      1) Engineer has failed to review and return first submission within the agreed upon time frame.
      2) Supplier demonstrates that delay in progress of Work is directly attributable to Engineer's failure to return submittal within time indicated and accepted by Engineer.
4. Review response will be returned to Supplier with one of the following dispositions:
   a. Approved:
      1) No Exceptions:
         a) There are no notations or comments on the submittal and the Supplier may release the equipment for production.
      2) Make Corrections Noted - See Comments:
         a) The Supplier may proceed with the Work, however, all notations and comments must be incorporated into the final product.
         b) Resubmittal not required.
      3) Make Corrections Noted - Confirm:
         a) The Supplier may proceed with the Work, however, all notations and comments must be incorporated into the final product.
         b) Submit confirmation specifically addressing each notation or comment to the Engineer within 15 calendar days of the date of the Engineer's transmittal requiring the confirmation.
   b. Not approved:
      1) Correct and resubmit:
         a) Supplier may not proceed with the Work described in the submittal.
         b) Supplier assumes responsibility for proceeding without approval.
         c) Resubmittal of complete submittal package is required within 30 calendar days of the date of the Engineer's submittal review response.

2) Rejected - See Remarks:
    a) Supplier may not proceed with the Work described in the submittal.
    b) The submittal does not meet the intent of the Contract Documents. Resubmittal of complete submittal package is required with materials, equipment, methods, etc. that meet the requirements of the Contract Documents.

c. Receipt acknowledged - Filed for record:
    1) This is used in acknowledging receipt of informational submittals that address means and methods of construction such as schedules and work plans, conformance test reports, health and safety plans, etc.

d. Receipt acknowledged with comments - Resubmit:
    1) This is used in acknowledging receipt of informational submittals that address means and methods of construction such as schedules and work plans, conformance test reports, health and safety plans, etc. Feedback regarding missing information, conflicting information, or other information that makes it incomplete can be made with comments.

B. Supplier: Prepare resubmittal, if applicable:
1. Clearly identify each correction or change made.
2. Include a response in writing to each of the Engineer's comments or questions for submittal packages that are resubmitted in the order that the comments or questions were presented from the 1st and subsequent submittals and numbered consistent with the Engineer's numbering:
    a. Acceptable responses to Engineer's comments are listed below:
        1) "Incorporated" Engineer's comment or change is accepted and appropriate changes are made.
        2) "Response" Engineer's comment not incorporated. Explain why comment is not accepted or requested change is not made. Explain how requirement will be satisfied in lieu of comment or change requested by Engineer.
    b. Reviews and resubmittals:
        1) Supplier shall provide resubmittals which include responses to all submittal review comments separately and at a level of detail commensurate with each comment.
        2) Supplier responses shall indicate how the Supplier resolved the issue pertaining to each review comment:
            a) Responses such as "acknowledged" or "noted" are not acceptable.
        3) Resubmittals which do not comply with this requirement may be rejected and returned without review.
        4) Supplier shall be allowed no extensions of any kind to any part of their contract due to the rejection of non-compliant submittals.
        5) Submittal review comments not addressed by the Supplier in resubmittals shall continue to apply whether restated or not in subsequent reviews until adequately addressed by the Supplier to the satisfaction of the reviewing and approving authority.
    c. Any resubmittal that does not contain responses to the Engineer's previous comments shall be returned for Revision and Resubmittal.

No further review by the Engineer will be performed until a response for previous comments has been received.

3. Resubmittal timeframe:
   a. Supplier shall provide resubmittal within 15 days.
   b. When a resubmittal cannot be returned within the specified period, Supplier shall notify Engineer in writing.
4. Review costs:
   a. Costs incurred by Owner as a result of additional reviews of a particular submittal after the second time it has been reviewed shall be borne by Supplier.
   b. Reimbursement to Owner will be made by deducting such costs from Supplier's subsequent progress payments.

1.07 PRODUCT DATA

A. Edit submittals so that the submittal specifically applies to only the product furnished.

B. Neatly cross out all extraneous text, options, models, etc. that do not apply to the product being furnished, so that the information remaining is only applicable to the product being furnished.

1.08 SHOP DRAWINGS

A. Indicate project designated equipment tag numbers for submittal of devices, equipment, and assemblies.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

ATTACHMENT A - CONTRACTOR SUBMITTAL TRANSMITTAL FORM

CONTRACTOR SUBMITTAL TRANSMITTAL FORM

Owner:	Click here to enter text.	**Date:**	MM/DD/YYYY
Contractor:	Click here to enter text.	**Project No.:**	XXXXX.XX
Project Name:	Click here to enter text.	**Submittal Number:**	000
Submittal Title:	Click here to enter text.		
To:	Click here to enter text.		
From:	Click here to enter text.	Click here to enter text.	
	Click here to enter text.	Click here to enter text.	

Specification No. and Subject of Submittal / Equipment Supplier			
Spec ##:	Spec ##.	**Subject:**	Click here to enter text.
Authored By:	Click here to enter text.	**Date Submitted:**	XX/XX/XXXX

Submittal Certification
Check Either (A) or (B):
☐ (A) We have verified that the equipment or material contained in this submittal meets all the requirements specified in the project manual or shown on the contract drawings with no exceptions.
☐ (B) We have verified that the equipment or material contained in this submittal meets all the requirements specified in the project manual or shown on the contract drawings except for the deviations listed.
Certification Statement: By this submittal, I hereby represent that I have determined and verified all field measurements, field construction criteria, materials, dimensions, catalog numbers and similar data, and I have checked and coordinated each item with other applicable approved shop drawings and all Contract requirements.
Supplier's Reviewer's Signature:
Printed Name:
In the event, Contractor believes the Submittal response does or will cause a change to the requirements of the Contract, Contractor shall immediately give written notice stating that Contractor considers the response to be a Change Order.
Firm: Click here to enter text. **Signature:** **Date Returned:** XX/XX/XXXX

PM/CM Office Use	
Date Received Supplier to PM/CM:	
Date Received PM/CM to Reviewer:	
Date Received Reviewer to PM/CM:	
Date Sent PM/CM to Supplier:	

SECTION 01_60_00

PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY

A. Section includes: Requirements for tangible materials, raw or manufactured, that become part of the project.

1.02 REFERENCES

A. International Organization for Standardization (ISO):
   1. 9001 - Quality Management Systems - Requirements.

B. NSF International (NSF).

C. Underwriters Laboratories, Inc. (UL).

1.03 TERMINOLOGY

A. The words and terms listed below, are not defined terms that require initial capital letters, but, when used in this Section have the indicated meaning:
   1. Calculations:
      a. Documentation of the process of transforming the design and prescriptive criteria into a design meeting the performance criteria.
   2. Certificates:
      a. An official document that attests a fact is in accordance with the Contract Documents.
   3. Manufacturer's instructions:
      a. Stipulations, directions, and/or recommendations issued form by the manufacturer of the product addressing handling, installation, erection, and/or application of the product.
   4. Products:
      a. Raw materials, finished goods, equipment, systems, and shop fabrications that will become part of the Work.
   5. Product data:
      a. Public information about the product which is found in the manufacturer's catalogs or on their web site including catalog pages, data sheets, bulletins, layout drawings, exploded views, and brochures.
   6. Samples:
      a. As defined in the General Conditions and Supplementary Conditions.
      b. Full-size actual products or pieces of products intended to illustrate the products to be incorporated into the project. Sample submittals are often necessary for such characteristics as colors, textures, and other appearance issues.
   7. Schedules:
      a. Product parts and materials lists.

8. Shop drawings:
    a. As defined in the General Conditions and Supplementary Conditions.
    b. Shop drawings are prepared specifically for the project to illustrate details, dimensions, and other data necessary for satisfactory fabrication or construction that are not shown completely in the Drawings.
    c. Shop drawings could include graphic line-type drawings and single-line diagrams.
9. Spare parts and materials:
    a. Duplicate parts necessary to replace a damaged or worn part of the product.
    b. Consumables such as operating fluids.
10. Special tools:
    a. Special wrenches, gauges, circuit setters, and other similar devices required for the proper operation or maintenance of a system that would not normally be in the Owner's tool kit and that have been specifically made for use on a product for assembly, disassembly, repair, or maintenance.
11. Submittals:
    a. As defined in the General Conditions and Supplementary Conditions.
    b. Samples, product data, shop drawings, and others that demonstrate how Seller intends to conform to the Contract Documents.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Provide products as Engineer has approved by the submittal process or by other written documents.

B. Provide products by same manufacturer when units are of similar nature, unless otherwise specified.

C. Provide like parts of duplicate units that are interchangeable.

D. Provide equipment or product that has not been in service prior to delivery, except as required by tests.

E. Provide products produced by manufacturers regularly engaged in the production of these products.

F. Provide products that bear approvals and labels as specified such as Factory Mutual(FM), Underwriters Laboratory (UL), or National Sanitation Foundation (NSF International).

2.02 MATERIAL

A. Dissimilar metals:
    1. Separate contacting surfaces with dielectric material.
    2. Neoprene, bituminous impregnated felt, heavy bituminous coatings, nonmetallic separators or washers, or other materials as specified.

B. Edge grinding:
   1. Sharp projections of cut or sheared edges of ferrous metals which are not to be welded shall be ground to a radius required to ensure satisfactory paint adherence.

C. Use anti-galling compound on threads of stainless steel fasteners during factory assembly.

D. Provide anti-galling compound with stainless steel fasteners shipped for field assembly.

E. Aluminum in contact with concrete or masonry: Apply epoxy mastic as specified in Section 09_96_01 - High-Performance Coatings, coating system EPX-M-5 (Not included in this contract).

F. Pipes:
   1. Provide new pipe manufactured for the project, not from manufacturer's inventory, under the following conditions:
      a. Pipes 24-inch diameter and larger.
      b. Except steel pipes 6-inch diameter and larger.
   2. Prove pipe manufactured more than 6 months prior to delivery if the pipe material or its coating is subject to ultraviolet (UV) degradation.
   3. Provide ductile iron pipe with cement-mortar lining manufactured more than 6 months prior to delivery to the project.

G. Mark each length of pipe in accordance with applicable standards.

2.03 PRODUCT SELECTION

A. When products are specified without named manufacturers, provide products that meet or exceed the Specifications.

B. When products are specified with names of manufacturers but no model numbers or catalog designations, provide Products by one of named manufacturers that meet or exceed specifications.

C. When products are specified with names of manufacturers and model numbers or catalog designations, provide Products with model numbers or catalog designations by one of the named manufacturers.

D. When products are specified with names of manufacturers, but with brand or trade names, model numbers, or catalog designations by one manufacturer only, provide:
   1. Products specified by brand or trade name, model number, or catalog designation.
   2. Products by another named manufacturers proven, in accordance with requirements for an "or equal", including Engineer’s approval, to meet or exceed quality, appearance and performance of specified brand or trade name, model number, or catalog designation.

E. When Products are specified with only one manufacturer followed by "or Equal," provide:
   1. Products meeting or exceeding Specifications by specified manufacturer.
   2. Engineer deemed "or equal" evidenced by an approved shop drawing or other written communication.

F. When Products are specified by naming two or more manufacturers with one manufacturer as a "Basis of Design":
   1. Any of the named manufacturers can be submitted.
   2. If the product submitted is not by the named “Basis of Design” product and requires a change in the scope (dimensions, configuration, physical properties, etc.), schedule (longer lead time), or budget, the Seller must submit a substitution request.

2.04 SPARE PARTS, MAINTENANCE PRODUCTS, AND SPECIAL TOOLS

A. Provide spare parts and maintenance products as required by Technical Sections:
   1. Submit completed Attachment A - Spare Parts, Maintenance Products, and Special Tools Inventory List.

B. Provide one set of special tools required to install or service the equipment.

C. Box, tag, and clearly mark items.

D. Seller is responsible for spare parts, maintenance products, and special tools until acceptance by Owner.

PART 3 EXECUTION

3.01 SHIPMENT

A. Requirements prior to shipment of equipment:
   1. Engineer approved submittals or other written documentation.
   2. Engineer approved Manufacturer’s Certificate of Source Testing as specified in the Technical Sections.
   3. Draft operations and maintenance manuals, as specified in Section 01_78_24 - Operation and Maintenance Manuals as specified in the Technical Sections.

B. Transport products by methods that avoid product damage.

C. Deliver products in undamaged condition in manufacturer's unopened containers or packaging.

3.02 DELIVERY AND HANDLING

A. Handle equipment in accordance with manufacturer's instructions.

B. Deliver products in undamaged condition in manufacturer's unopened containers or packaging.

C. Provide construction equipment and personnel to handle products by methods in accordance with manufacturer's instructions.

D. Upon delivery, promptly inspect shipments:
   1. Verify compliance with Contract Documents, correct quantities, and undamaged condition of products.
   2. Acceptance of shipment does not constitute final acceptance of equipment.

E. Spare parts, maintenance products, special tools.
   1. Immediately store in accordance with the manufacturer's instructions.
   2. Store spare parts, maintenance products, and special tools in enclosed, weather-proof, and lighted facility during the construction period:
      a. Protect parts subject to deterioration, such as ferrous metal items and electrical components with appropriate lubricants, desiccants, or hermetic sealing.
   3. With Owner's written request for advanced delivery of spare parts, maintenance products, and special tools:
      a. Deliver requested items and deduct them from the inventory list.
      b. Provide transmittal documentation.
   4. Store large items individually:
      a. Weight: Greater than 50 pounds.
      b. Size: Greater than 24 inches wide by 18 inches high by 36 inches long.
      c. Clearly labeled:
         1) Equipment tag number.
         2) Equipment manufacturer.
         3) Subassembly component, if appropriate.
         4) Store smaller items in spare parts box.
      d. Weight: Less than 50 pounds.
      e. Size: Less than 24 inches wide by 18 inches high by 36 inches long.
      f. Clearly labeled:
         1) Equipment tag number.
         2) Equipment manufacturer.
         3) Subassembly component, if appropriate.
         4) Spare parts and special tools box.
      g. Box material: Waterproof, corrosion resistant.
      h. Hinged cover:
         1) Locking hasp.
      i. Spare parts inventory list taped to underside of cover.
      j. Clearly labeled:
         1) The words "Spare Parts and/or Special Tools".
         2) Equipment tag number.
         3) Equipment manufacturer.
         4) Subassembly component, if appropriate.

3.03 STORAGE AND PROTECTION DURING STORAGE

A. Storage of equipment to be in accordance with the manufacturer's instructions:
   1. Including connection of motor heaters, lubrication, manually rotating shafts, etc.
   2. The Seller shall furnish a copy of the manufacturer's instructions for storage to the Engineer prior to storage of equipment and materials.

B. Immediately store and protect products until installed in Work.

C. Furnish covered, weather-protected storage structures providing a clean, dry, noncorrosive environment for mechanical equipment, valves, architectural items, electrical and instrumentation equipment and special equipment to be incorporated into this project.

D. Store products with seals and legible labels intact.

E. Protect painted or coated surfaces against impact, abrasion, discoloration, and damage.

F. Storage of spare parts, maintenance products, special tools:
   1. Immediately store in accordance with the manufacturer's instructions.
   2. Store spare parts, maintenance products, and special tools in enclosed, weather-proof, and lighted facility during the construction period.
   3. Protect parts subject to deterioration, such as ferrous metal items and electrical components with appropriate lubricants, desiccants, or hermetic sealing.
   4. Store large items individually:
      a. Weight: Greater than 50 pounds.
      b. Size: Greater than 24 inches wide by 18 inches high by 36 inches long.
      c. Clearly labeled:
         1) Equipment tag number.
         2) Equipment manufacturer.
         3) Subassembly component, if appropriate.
   5. Store smaller items in spare parts boxes:
      a. Weight: Less than 50 pounds.
      b. Size: Less than 24 inches wide by 18 inches high by 36 inches long.
      c. Clearly labeled:
         1) Equipment tag number.
         2) Equipment manufacturer.
         3) Subassembly component, if appropriate.
   6. Spare parts and special tools box:
      a. Box material: Waterproof, corrosion resistant.
      b. Hinged cover with locking hasp:
      c. Inventory list taped to underside of cover:
         1) Clearly labeled.
         2) The words “Spare Parts and/or Special Tools”.
         3) Equipment tag number.
         4) Equipment manufacturer.
         5) Subassembly component, if appropriate.

G. Exterior storage of fabricated products:
   1. Place on aboveground supports that allow for drainage.
   2. Cover products subject to deterioration with impervious sheet covering.
   3. Provide ventilation to prevent condensation under covering.

H. Store moisture sensitive products in watertight enclosures.

I. Store loose granular materials on solid surfaces in well-drained area:
   1. Prevent materials mixing with foreign matter.
   2. Provide access for inspection.

J. Provide an equipment log and stored products log with monthly pay applications:
   1. Data includes as a minimum: The storage location, equipment or product identification, date stored, date of inspection/maintenance, date removed from storage, copy of manufacturer’s recommended storage guidelines, description of inspection/maintenance activities performed, and signature of party performing inspection/maintenance.

K. When needed and approved by the Engineer, offsite storage location shall be within 10 miles of the project site:
   1. Provide proof of insurance coverage for products stored offsite.

L. Payment will not be made for equipment and materials improperly stored or stored without providing Engineer with the manufacturer's instructions for storage.

3.04 INSTALLATION

A. Product to be installed under separate contract.

END OF SECTION

ATTACHMENT A - SPARE PARTS, MAINTENANCE PRODUCTS, AND SPECIAL TOOLS INVENTORY LIST

SPARE PARTS, MAINTENANCE PRODUCTS, AND SPECIAL TOOLS INVENTORY LIST

Owner: _____ **Date:** _____

Seller: _____ **Project No.:** _____

Project Name: _____

Inventory List				
Spec Number: _____		Spec Title _____		
Equipment Tag No.: _____		Equipment Manufacturer: _____		
Quantity	**Subassembly Component**	**Description**	**Manufacturer's Part Number**	**Storage Location**

SECTION 01_75_17

COMMISSIONING

TABLE OF CONTENTS

PART 1 GENERAL

1.01 SUMMARY

A. Section includes: Commissioning.

B. The Seller will be required to support the installation Contractor/Assignee with the listed requirements within this Section. The language herein reflects the final installation Contractor/Assignee contract requirements; the “Seller” will be referred to as the “Manufacturer” in this Section.

1.02 DEFINITIONS

A. Commissioning: The process of planning for, testing of, and start-up of systems, subsystems, equipment, components, and devices of the Work to demonstrate, through documented verification, that the Work has successfully met the Contract Documents. It includes training the Owner's staff on the operation and maintenance of the installed Work.

B. Commissioning Phases: The activities of commissioning are grouped into the phases defined in the following table:
   1. Table 1 - Commissioning Phases.

TABLE 1 - COMMISSIONING PHASES		
Planning Phase	**Testing and Training Phase**	**Start-Up Phase**
Draft Test Plans	Source Testing • Documentation	Start-Up • Documentation • Owner Training
	Installation Verification • Documentation • Owner Training	
	Functional Testing • Documentation • Owner Training	

   2. Attachment A provides Commissioning Flowcharts.

C. Component: A part of a system that does not have an electrical connection or internal electronics. Examples: Piping and pressure gauges.

D. Device: A part of a system that has electrical connections or internal electronics. Examples: level transmitter or pressure transmitter.

E. Electrical Energization Plan: A plan to manage how and when power is applied to electrical equipment.

F. Equipment: A factory or field assembled apparatus that performs an identifiable function. Examples: pumps, motors, VFDs, MCCs.

G. Functional Testing: Testing performed on a completed subsystem or system to demonstrate that the system meets the specified requirements. Example systems: backwash system, dewatering system.

H. Installation Verification: Testing to demonstrate that equipment or system and associated components or devices have been properly installed. Example equipment: pumps, meters, and blowers with associated piping.

I. Manufacturer: Seller of UV Equipment and associated equipment contained within the Pre-Purchase agreement.

J. Manufacturer's Certificate of Functional Compliance: The form completed by the manufacturer to confirm that testing of the installed equipment or system has been performed and the results conform to the specified performance. The form is provided in Attachment D provided at the end of this Section.

K. Manufacturer's Certificate of Installation Verification: The form completed by the manufacturer to confirm that the equipment or system is installed in conformance with the Contract. The form is provided in Attachment C at the end of this Section.

L. Manufacturer's Certificate of Source Testing: The form completed by the manufacturer to confirm that the specified source tests have been performed and the results conform to the specified requirements. The form is provided in Attachment B at the end of this Section.

M. Owner Training: The Owner's staff is trained by the Contractor, with assistance from the manufacturer, to operate and maintain the completed Work. This is sometimes referred to as Vendor Specific Training.

N. Process Stream: A series of liquid or solids flow processes that are designed to improve the water quality to meet regulatory permit requirements.

O. Source Testing: Test equipment or products for performance at point of manufacture or assembly for the requirements specified in the Contract Documents. Also referred to as factory testing and factory acceptance testing (FAT).

P. Start-Up Phase: The phase when Start-Up occurs.

Q. Start-Up: Operating the Work with process water to verify the Work meets the Contract Documents.

R. Subsystem: A grouping of equipment, components, and devices that is a part of a larger system and that performs a single definable function. Examples: sand filters, filter backwash.

S. System: A grouping of equipment, components, and devices that perform a single definable function. If a system is a part of a larger system, it is referred to as a subsystem. Examples: Flocculation and sedimentation, filtration.

T. System Testing: Testing of a completed system for an extended time period. Examples: Headworks, filtration.

U. Water Management Plan: A plan to manage the test water used for commissioning from source to disposal. The test water may be clean water, potable water, non-potable water, or process water (e.g., raw water, plant water, sludge). The plan demonstrates how water will be produced, conveyed, treated, disposed of as directed by the plant manager, and/or recycled.

1.03 SUBMITTALS

A. Project commissioning:
   1. Commissioning Coordinator's qualifications:
      a. Submit to Engineer no later than 30 days after Notice to Proceed.
      b. Describe previous similar experience on similar projects with a list of references including phone numbers.
      c. Provide names and qualifications of commissioning assistants, if applicable.
   2. Schedules:
      a. Commissioning Schedule containing all commissioning activities.
      b. Owner Training Schedule.
   3. Test Plans:
      a. Submit draft Test Plan outlined in the Planning Phase, unless specified otherwise:
         1) Engineer approval of draft Test Plans required for successful completion of Planning Phase.
      b. Submit final Test Plan a maximum of 60 calendar days prior to testing.
      c. Engineer approval of final Test Plan required prior to start of testing.
   4. Test Reports:
      a. Submit draft Test Reports outline in the Planning Phase, unless specified otherwise:
         1) Engineer approval of draft Test Reports outline required for successful completion of Planning Phase.
      b. Submit final Test Report a maximum of 30 calendar days after testing.

B. Technical Sections commissioning:
   1. Manufacturer's representative's qualifications:
      a. Submit to Engineer no later than 30 days in advance of required services.
      b. Representative's name, phone, and e-mail address:
         1) May use 2 representatives: 1 for field testing and 1 for Owner Training.
         2) Provide resume stating instructor's technical expertise and instructional technology skills and experience.
   2. Test Plans:
      a. Submit draft Test Plan outlined in the Planning Phase, unless specified otherwise:
         1) Engineer approval of draft Test Plans required for successful completion of Planning Phase.
      b. Submit final Test Plan a maximum of 60 calendar days prior to testing.
      c. Engineer approval of final Test Plan required prior to start of testing.

3. Test Reports:
    a. Submit draft Test Reports outline in the Planning Phase, unless specified otherwise:
        1) Engineer approval of draft Test Reports outline required for successful completion of Planning Phase.
    b. Submit final Test Report a maximum of 30 calendar days after testing.
4. Manufacturer's representatives field notes and data.
5. Owner Training:
    a. Prior to the training session:
        1) Training instructor qualifications.
        2) Training course materials: Due 30 calendar days prior to initial training session:
            a) Drafts of training agenda, lesson plan, presentation, handouts, and list of audio-visual aids.
            b) Format: 1 electronic copy in format video mp4 and PDF for presentation material, and 3 hard copies organized in notebooks.
    b. Post training session:
        1) Training course materials: Due 14 calendar days after class completion:
            a) Recordings.
            b) Class attendance sheet.
            c) Final version of training agenda, final lesson plan, presentation, handouts, and audio-visual aids.
            d) Format: 1 electronic copy in format video mp4 and PDF for presentation material, and 3 hard copies organized in notebooks.
        2) Provide materials for all sessions of the class in a single transmittal.

1.04 COMMISSIONING COORDINATOR (CC)

A. Responsibilities include the following:
    1. Part-time person.
    2. Become thoroughly familiar with Contract commissioning requirements.
    3. Provide the primary interface with Engineer and Owner for Commissioning efforts.
    4. Lead Commissioning efforts - all phases and tasks.
    5. Coordinate training efforts.
    6. Meetings:
        a. CC is responsible for setting commissioning coordination meeting dates and times, as well as preparing the agendas and meeting minutes.
        b. CC shall conduct commissioning progress meetings throughout construction, to plan, scope, coordinate, and schedule future activities, resolve problems, etc.
        c. Frequency: Monthly minimum. Increase frequency as needed based on complexity and quantity of commissioning activities.

1.05 MANUFACTURER'S REPRESENTATIVES

A. Qualifications: as specified below and in the Technical Sections:
   1. For Installation and Functional Testing:
      a. Factory trained and experienced in the technical applications, installation, operation, and maintenance of respective equipment/system with full authority by the equipment/system manufacturer to issue the certifications required of the manufacturer.
   2. Training instructor qualifications:
      a. Provide resume stating instructor's technical preparation and instructional technology skills and experience.
      b. If CEUs are required, the operator training instructors must comply with state regulatory.
      c. Knowledgeable in the equipment/system for which they are training.
      d. Experienced in conducting classes.
      e. Sales representatives are not qualified instructors unless they possess the detailed operating and maintenance knowledge required for proper class instruction.
   3. Representatives to be approved by Owner and Engineer.
   4. No substitute representatives without written approval by Owner and Engineer.

B. Duties:
   1. Determine if additional time and/or trips (beyond those specified in the Technical Sections) is required to perform the specified services.
   2. Coordinate services in accordance with the Contractor's project schedule up to and including making multiple trips to project site when there are separate milestones associated with installation of each occurrence of manufacturer's equipment.
   3. Perform on-site services as specified in the Technical Sections:
   4. Provide weekly copies of manufacturer's representatives field notes and data to Contractor.

1.06 PLANNING PHASE

A. Overview of Planning Phase:
   1. Define approach and timing for commissioning.
   2. Obtain Engineer approval of draft Test Plans.

B. Test Plans.
   1. Define approach and timing for:
      a. Testing and Training Phases:
         1) Major systems, with separate plans for each system.
      b. Start-Up Phase.
   2. Source Test (Factory Acceptance Test) and Functional Test Plans:
      a. As specified in this Section and other Technical Sections.
      b. Based on approved shop drawings.
      c. Prepared by Manufacturer.
      d. Include the following items for each test:
         1) Purpose of the test.

2) Identification of each item of equipment/system to be tested, including system designation, location, tag number, control loop identifier, etc.
3) Description of the pass/fail criteria that will be used.
4) Listing of pertinent reference documents (Contract and industry standards or sections applicable to the testing):
a) Credentials of test personnel.
5) Test equipment:
a) Include Product Data for the test equipment.
b) Appropriate calibration records:
(1) Drawings or photographs of test stands and/or test apparatus.
6) Duration: Determine test durations with Owner's input.
7) Detailed step-by-step test procedures:
a) The level of detail shall be sufficient for the witness to follow the steps.

e. Define for Functional Testing:
1) Required temporary systems (pumps, piping, etc.).
2) Shutdown requirements for existing systems.

f. Furnish labor, power, tools, equipment, instruments, and services required for and incidental to testing activities.

3. Test forms minimum requirements:
a. Name of product to be tested.
b. Test date.
c. Names of persons conducting the test.
d. Names of persons witnessing the test, where applicable.
e. Test data.
f. Applicable project requirements as specified in the Technical Sections.
g. Check offs for each completed test or test step.
h. Place for signature of person conducting tests and for the witnessing person, as applicable.

4. Owner responsibilities:
a. Schedule Owner's staff within the constraints of their workloads:
1) Those who will participate in this test have existing full-time work assignments, and testing is an additional assigned work task, therefore, scheduling is imperative.
2) Owner staff work schedules regularly shift, as treatment facilities are typically operated on an around-the-clock basis.
3) Maximum hours per week: 8, unless agreed upon through submitted schedule.
4) Days available: Tuesday through Thursday and when agreed upon through submitted schedule for Monday and Friday
5) Scheduling coordination.
6) CC is responsible for the following:
a) Coordinate schedule with the Owner's personnel and manufacturer's representatives (instructors).

C. Test Reports:
1. Minimum requirements:
a. Title.
b. Abstract.

c. Equipment.
d. Procedures.
e. Results:
1) Complete disclosure of the calculation methodologies.
f. Conclusions.
g. Signature by an authorized party.
h. Appendices:
1) Completed test forms signed by witnesses.

2. Water Management Plan:
a. Requirements:
1) Demonstrate how water will be produced, conveyed, treated, recycled, and or disposed until testing verifies specified requirements.

3. Commissioning Schedule:
a. Content:
1) Comply with Attachment G - Functional Testing Requirements and provide activities organized by system and subsystem.
2) Include:
a) Source testing when required.
b) Functional testing.
c) Owner Training.
3) Comply with Attachment F - Commissioning Roles and Responsibilities Matrix.
b. Procedures:
1) Submit commissioning schedule as specified.

1.07 TESTING AND TRAINING PHASE

A. Overview of Testing and Training Phase:
1. General:
a. Contractor tests the Work to verify it meets the Contract requirements.
b. Contractor trains the Owner to operate and maintain the Work.
2. Contractor responsibilities:
a. Furnish labor, tools, equipment, instruments, and services required for and incidental to completing commissioning activities in accordance with the approved Commissioning Plans.
3. Owner responsibilities:
a. Furnish labor, power, and services required for and incidental to completing commissioning activities in accordance with the approved Commissioning Plans.
b. Owner provided services, equipment, and/or materials to be as specified.

B. Source Testing:
1. As specified in the Technical Section.
2. Source Test Plan:
a. Engineer approval of Source Test Plan required prior to testing.
3. Witnessed in person:
a. As specified in the Technical Section.

b. Manufacturer is responsible for trip costs associated with Owner's and Engineer's representatives.
    1) Transportation:
        a) Commercial airline costs to and from San Francisco International Airport including related fees.
        b) Rental car to and from arrival airport, hotel, and test site including related fees.
    2) Hotel/Meals:
        a) Hotel with an American Automobile Association 3 Diamond rating or higher equivalent for single occupancy room per person per day.
        b) Meal allowance based on state government per diem guidelines per test site location.

4. If the Source Test is not ready on the scheduled date or if the Source Test fails:
    a. Manufacturer is responsible for associated costs:
        1) First test costs that are non-refundable, if applicable.
        2) Repeat test costs:
            a) Trip costs, if applicable.
        3) Virtual witness costs, if applicable.
5. Source testing is complete after successful testing, submittal of test report, and Manufacturer's Certificate of Source Testing.
6. Engineer approval of Source Testing Report is required.

C. Installation Verification:
1. Overview:
    a. Verifying the installation of equipment to be in accordance with Manufacturer's Instructions.
2. Prerequisite:
    a. Engineer approval of Source Testing Report.
3. Perform checks:
    a. Structural anchorage check.
    b. Electrical energization check:
        1) As specified in the flowchart shown in Attachment A.
    c. Health and safety check.
4. Submit Manufacturer's Certificate of Installation Verification.
5. Engineer approval of Manufacturer's Certificate of Installation Verification is required.

D. Functional Testing:
1. Overview:
    a. Testing the function of a system or subsystem.
2. Prerequisites:
    a. Engineer approval of Manufacturer's Certificate of Installation Verification.
    b. Engineer approval of Functional Test Plan required prior to testing.
    c. Draft Operations and Maintenance Manual as specified in Section 01_78_24 - Operations and Maintenance Manual.
    d. Completed pipe, valve, and gate labeling of system or subsystem.
3. Witnessed.

4. Discipline checks:
    a. Verify support systems function properly, such as seal water, pipes, valves, etc.
    b. As specified in the individual Technical Sections.
5. Consecutive Day Test:
    a. Operate the Work as specified in Attachment G - Functional Testing Requirements and as specified in the individual Technical Sections:
        1) Successful completion of subsystem testing required prior to system testing.
    b. Failure response time:
        1) Be equipped and ready to provide emergency repairs, adjustments, and corrections to comply with the "Significant Interruption Duration" requirements as specified in Attachment G - Functional Testing Requirements.
    c. Duration:
        1) As specified in Attachment G - Functional Testing Requirements.
        2) Restart the consecutive day test when the system performance failures exceed the "Significant Interruption Duration" time period specified in Attachment G - Functional Testing Requirements:
            a) Individual equipment/system failures that are corrected within the "Significant Interruption Duration" time specified in Attachment G - Functional Testing Requirements shall not require the consecutive day test to be restarted unless the failure recurs.
            b) Engineer has the authority to reject the consecutive day test if individual equipment/system failures are repetitive.
6. Instrumentation and controls tests:
    a. Loop Validation Tests.
    b. Complete End-to-End Testing (CEET):
        1) Signal are tested from the field device through the PLC program, the network, and all the way to the operator's HMI graphic screens.
7. Restore to condition prior to testing:
    a. Pretest status according to the testing plan.
8. Submit Manufacturer's Certificate of Functional Compliance.
9. Engineer approval of Manufacturer's Certificate of Functional Compliance is required.

E. Documentation:
1. Provide records generated during Commissioning Phase of Project including but not limited to:
    a. Training documentation.
    b. Manufacturer's Certificate of Source Testing.
    c. Manufacturer's Certificate of Installation Verification.
    d. Manufacturer's Certificate of Functionality Compliance.
    e. Daily logs of equipment/system testing identifying tests conducted and outcome.
    f. Test forms and documentation.
    g. Functional Testing results.
    h. Logs of time spent by manufacturer's representatives performing services on the job site.
    i. Equipment lubrication records.

j. Electrical phase, voltage, and amperage measurements.
k. Insulation resistance measurements.
l. Bearing temperature measurements.
m. Data sheets of control loop testing, including testing and calibration of instrumentation devices and setpoints.
n. Provide: 1 electronic copy in format PDF and 3 hard copies organized in notebooks.
o. Store the data within 24 hours of the test or document creation in the project system.
p. Due date: Within 14 calendar days of Substantial Completion.

2. Engineer approval of documentation is required.

F. Owner Training:
1. Train Owner's staff on the operation and maintenance of the equipment/system:
2. Train on each topic of the approved Operation and Maintenance Manual:
a. Include classroom instruction and field demonstration with all necessary tools and test equipment.
3. Training tailored to the skills and job classifications of the staff attending the classes (e.g., plant superintendent, treatment plant operator, maintenance technician, electrician, etc.).
4. Training outcomes:
a. Owner's staff can safely operate, maintain, and repair the equipment/systems provided as recommended by the manufacturer.
5. Training plan:
a. CC shall meet with Engineer and Owner's designated training coordinator to develop a list of personnel to be trained and to establish expected training outcomes and objectives at least 90 calendar days prior to commissioning of equipment/system.
b. Coordinate and arrange for manufacturer's representatives to provide both classroom-based learning and field (hands-on) training, based on training module content and stated learning objectives.
c. Conduct classroom training at location designated by Owner.
d. Scope and sequence:
1) Plan and schedule training in the correct sequence to provide prerequisite knowledge and skills to trainees:
a) Describe recommended procedures to check/test equipment/system following corrective maintenance repair.
2) If multiple classes are needed to meet the training objectives, they shall be included in the training plan.
6. Owner Training Schedule:
a. Schedule Owner's staff training within the constraints of their workloads:
1) Those who will participate in this training have existing full-time work assignments, and training is an additional assigned work task, therefore, scheduling is imperative.
2) Owner staff work schedules regularly shift, as treatment facilities are typically operated on an around-the-clock basis.
3) Maximum training hours per week: 8.
4) Days available for training:
a) Tuesday to Thursday.

b. Training scheduling coordination:
    1) CC is responsible for the following:
        a) Coordinate schedule for training periods with the Owner's personnel and manufacturer's representatives (instructors).
    2) Complete Owner Training no sooner than 10 calendar days after Functional Testing of each system.
c. Class logistics:
    1) Delivery time minimum: 2 hours.
    2) Delivery time maximum: 4 hours.
    3) Class agenda:
        a) Refreshment break: One 10-minute break.
        b) Meal break: One 45-minute break, unless otherwise specified.
        c) Schedule refreshment breaks and meal breaks to meet the class needs and Owner work rules.
    4) Schedule specific sessions:
        a) Minimum of 30 days in advance to allow Owner staffing arrangements to take place.
        b) At the times requested by the Owner, within the period 7 a.m. to 4 p.m. Tuesday through Thursday:
            (1) Times scheduled will be at Owner's discretion.
        c) Owner approval and confirmation required for session schedules.
        d) Provide minimum of 2 sessions for each class unless otherwise noted:
            (1) The purpose of having multiple sessions on each class is to accommodate the attendance of as many Owner personnel working different shifts as possible.
        e) A maximum of 1 session per day for each class.
d. Number of students:
    1) Estimated class size maximum: 10 staff.
    2) Engineer will confirm the headcount 1 week prior to the class, so that the instructor can provide the correct number of training aids for students.

7. Submittals:
    a. Submit Training Plan Schedule 60 calendar days before the first scheduled training session, including but not limited to lesson plans, participant materials, instructor's resumes, and training delivery schedules.
    b. Submit training documentation including the following:
        1) Training plan:
            a) Training modules.
            b) Scope and sequence statement.
            c) Contact information for manufacturer's instructors including name, phone, and e-mail address.
            d) Instructor qualifications.
        2) Training program schedule:
            a) Format: Bar chart:
                (1) Include in the Project Progress Schedule.
            b) Contents:
                (1) Training modules and classes.

8. Lesson plans:
    a. Divide training into discrete modules appropriate for the equipment and trades.
    b. State performance-based learning objectives in terms of what the trainees will be able to do at the end of the lesson.
    c. Define student conditions of performance and criteria for evaluating instructional success.
    d. Minimum requirements:
        1) Hands-on demonstrations planned for the instructions.
        2) Cross-reference training aids.
        3) Planned training strategies such as whiteboard work, instructor questions, and discussion points or other planned classroom or field strategies.
        4) Attach handouts cross-referenced by section or topic in the lesson plan.
        5) Indicate duration of outlined training segments.
    e. Provide instruction lesson plans for each trade:
        1) Detailed component description:
            a) Identify each component function and describe in detail.
            b) Identify equipment's mechanical, electrical, and electronic components and features.
            c) Where applicable, group relative components into subsystems.
            d) Identify and describe in detail equipment safety features, permissive and controls interlocks.
        2) Equipment operation:
            a) Describe equipment's operating (process) function and system theory.
            b) Describe equipment's fundamental operating principles and dynamics.
            c) Identify support equipment associated with the operation of subject equipment.
            d) Detail the relationship of each piece of equipment or component to the subsystems, systems, and process.
            e) Cite hazards associated with the operations, exposure to chemicals associated with the component, or the waste stream handled by the component.
            f) Specify appropriate safety precautions, equipment, and procedures to eliminate, reduce, or overcome hazards.
        3) Define Preventative Maintenance (PM) inspection procedures required on equipment in operation, spot potential trouble symptoms (anticipate breakdowns), and forecast maintenance requirements (predictive maintenance):
            a) Review preventive maintenance frequency and task analysis table.
        4) Define equipment Corrective Maintenance (CM) troubleshooting:
            a) Describe recommended equipment preparation requirements as they relate to specific craft problems.
            b) Identify and describe the use of any special tools required for maintenance of the equipment as they relate to specific craft problems.

c) Provide component specific troubleshooting checklists as they relate to specific craft problems.
d) Describe component removal/installation and disassembly/assembly procedures for specific craft repairs.
e) Perform at least 2 hands-on demonstrations of common corrective maintenance repairs.

5) Describe recommended measuring instruments and procedures, and provide instruction on interpreting alignment measurements, as appropriate.

9. Training instruction format:
   a. The training for operations and maintenance personnel shall be provided as 1 entity.
   b. The training for operations personnel shall be provided separately from the maintenance personnel:
      1) The training for maintenance personnel shall be further subdivided into the following 4 trade groups:
         a) Mechanical maintenance.
         b) Electrical maintenance.
         c) Instrumentation and controls maintenance.
         d) Process Controls Network (PCN) maintenance.
   c. Instructors shall apply adult education best practices, emphasizing learner participation and activity.
   d. Lecturing should be less than 30 percent of class time.
   e. Training delivery may include problem solving, question/answer, hands-on instruction, practice, evaluation/feedback tools, and lecture to support training objectives.
   f. Conduct hands-on instruction according to the following descriptions:
      1) Present hands-on demonstrations of at least the following tasks:
         a) Proper start-up, shutdown, and normal and alternative operating strategies.
         b) Common corrective maintenance repairs for each group.
         c) Recommended procedures to check/test equipment/system following a corrective maintenance repair.
         d) Preventative maintenance points.
         e) Calibration, if applicable.
      2) Use tools and equipment provided by manufacturer to conduct the demonstrations:
         a) Submit requests for supplemental assistance and facilities with the Contractor’s proposed lesson plans.
      3) Contractor remains responsible for equipment disassembly or assembly during hands-on training situations involving equipment disassembly or assembly by Owner’s personnel.
   g. Training aids:
      1) Instructors shall provide needed audio-visual devices such equipment (televisions, video recorder/player, computer, projectors, screens, easels, etc.), models, charts, etc. for each class.
      2) Instructor to confirm with Engineer in advance of each class that the classroom will be appropriate for the types of audiovisual equipment to be employed.

10. Training sessions:
    a. Provide training sessions for equipment/system as specified in the individual equipment/system section.
    b. Include the following information in the agenda:
        1) Instructor name.
        2) Listing of subjects to be discussed.
        3) Time estimated for each subject.
        4) Allocation of time for Owner staff to ask questions and discuss the subject matter.
        5) List of documentation to be used or provided to support training.
    c. Owner may request that particular subjects be emphasized, and the agenda be adjusted to accommodate these requests.
    d. Digitally record audio and video of each training session:
        1) Include classroom and field instruction with question and answering periods.
        2) Engineer approval required for producer of video materials from one of the following options:
            a) Qualified, professional video production company or individual.
        3) Record in digital format and recording shall become property of the Owner with exclusive rights:
            a) No video recording agreements will be entered into by the Owner.
        4) Media:
            a) Video quality shall be 720p HD or greater in MPG, AVCHD, AVI, or MP4 format.
            b) Digital color video format.
            c) Provide audio portion of the composite CD sufficiently free from electrical interference and background noise to provide complete intelligibility of oral report.
            d) Identification: On each copy provide a label with the following information:
                (1) Name of training.
                (2) Date video was recorded.
            e) Display continuous running time.
            f) At start of each video recording, record training class name, date, instructor's name.
            g) Provide audio quality that is not degraded during the recording of the field sessions due to background noise, space, distance or other factors.
        5) The Contractor shall provide a written release from all claims to the recorded training material produced, if required.
    e. Distribute copies of the agenda to each student at the beginning of each training class.
    f. Trainees will keep training materials and documentation after the session.
    g. Distribute Training Evaluation Form following each training session:
        1) Training Evaluation Form is included in this Section.
        2) Return completed Training Evaluation Forms to Owner's designated training coordinator immediately after session is completed.

3) Revise training sessions judged "Unsatisfactory" by a majority of attendees:
    a) Conduct training sessions again until a satisfactory rating is achieved.

11. Engineer approval of Owner Training is required.

1.08 START-UP PHASE

A. Overview of Start-Up Phase:
1. General:
    a. Confirm reliability requirements.
    b. Confirm regulatory compliance.

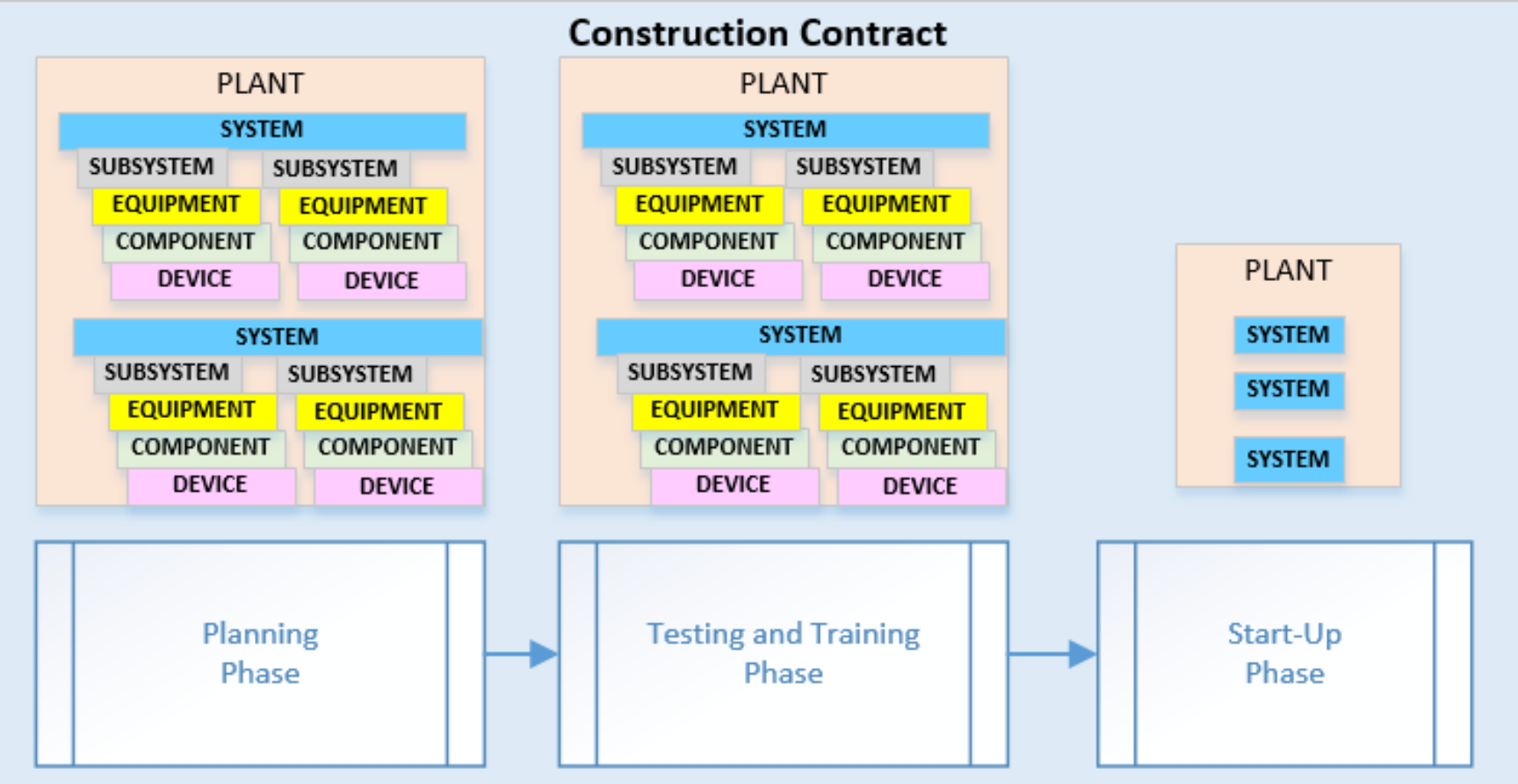
B. Start-Up Period:
1. Contractor responsibilities:
    a. Support Owner to operate the Work.
2. Owner responsibilities:
    a. Owner to operate the Work.
    b. Owner-provided services, equipment, and/or materials to be as specified.
    c. Furnish labor, power, tools, equipment, instruments, and services required for and incidental to completing commissioning activities in accordance with the approved Commissioning Plans.
3. Prerequisites:
    a. Engineer approval of Testing and Training Phase.
4. Witnessed.
5. Duration: 7 days for each mode of operation: reuse and discharge.
6. Engineer approval of Start-Up Period is required to achieve substantial completion.

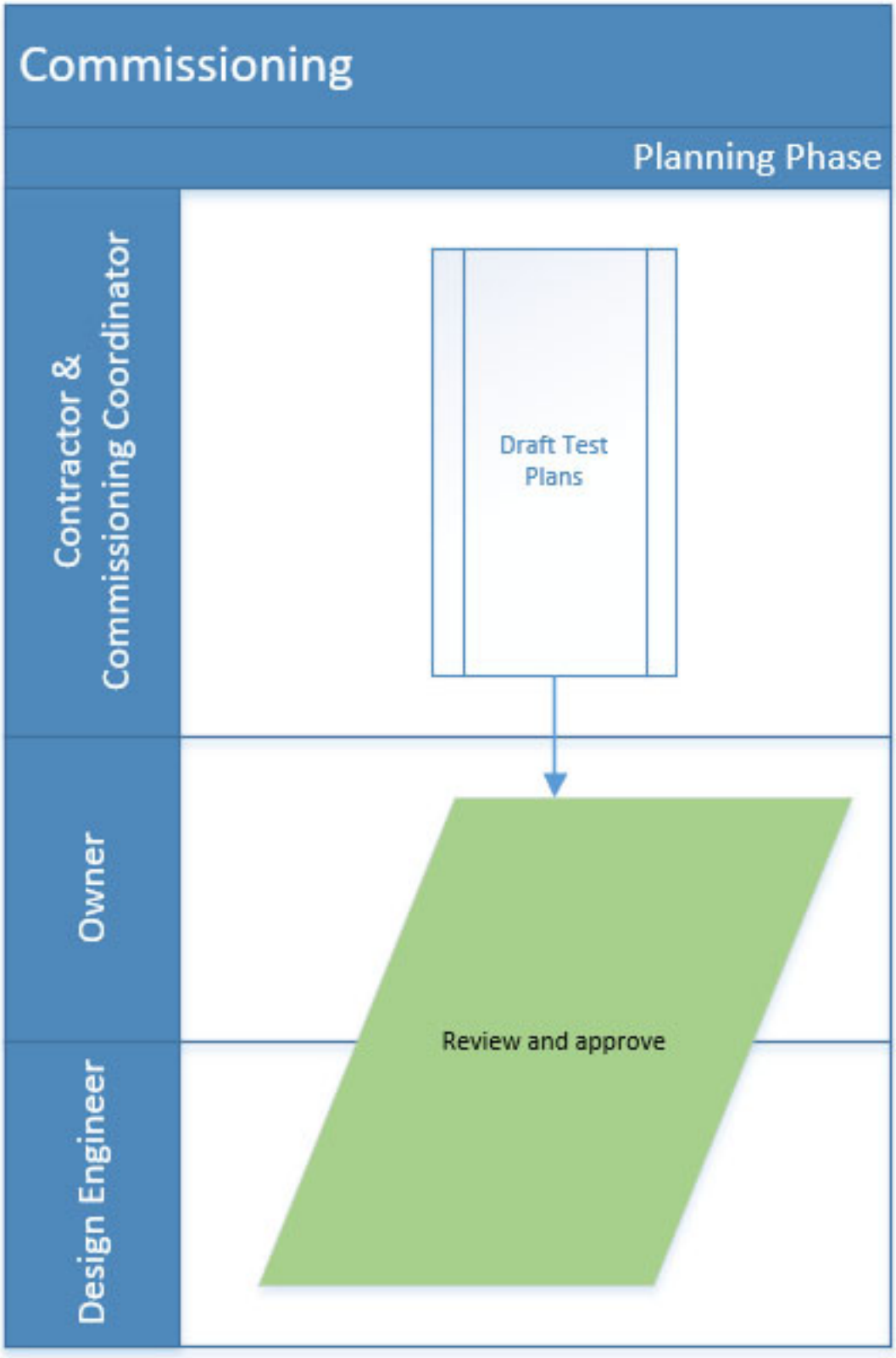
PART 2 PRODUCTS (NOT USED)

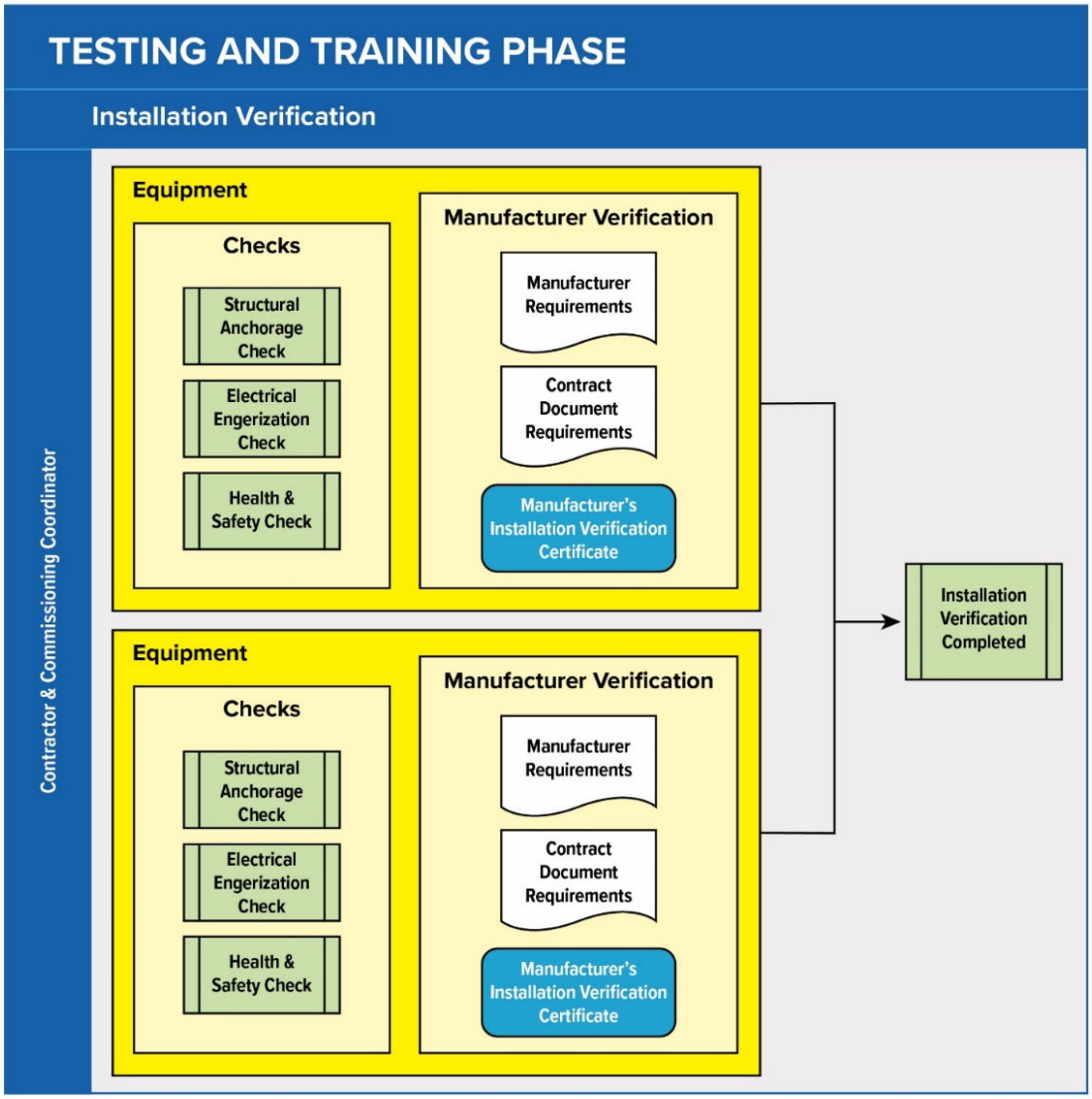
PART 3 EXECUTION (NOT USED)

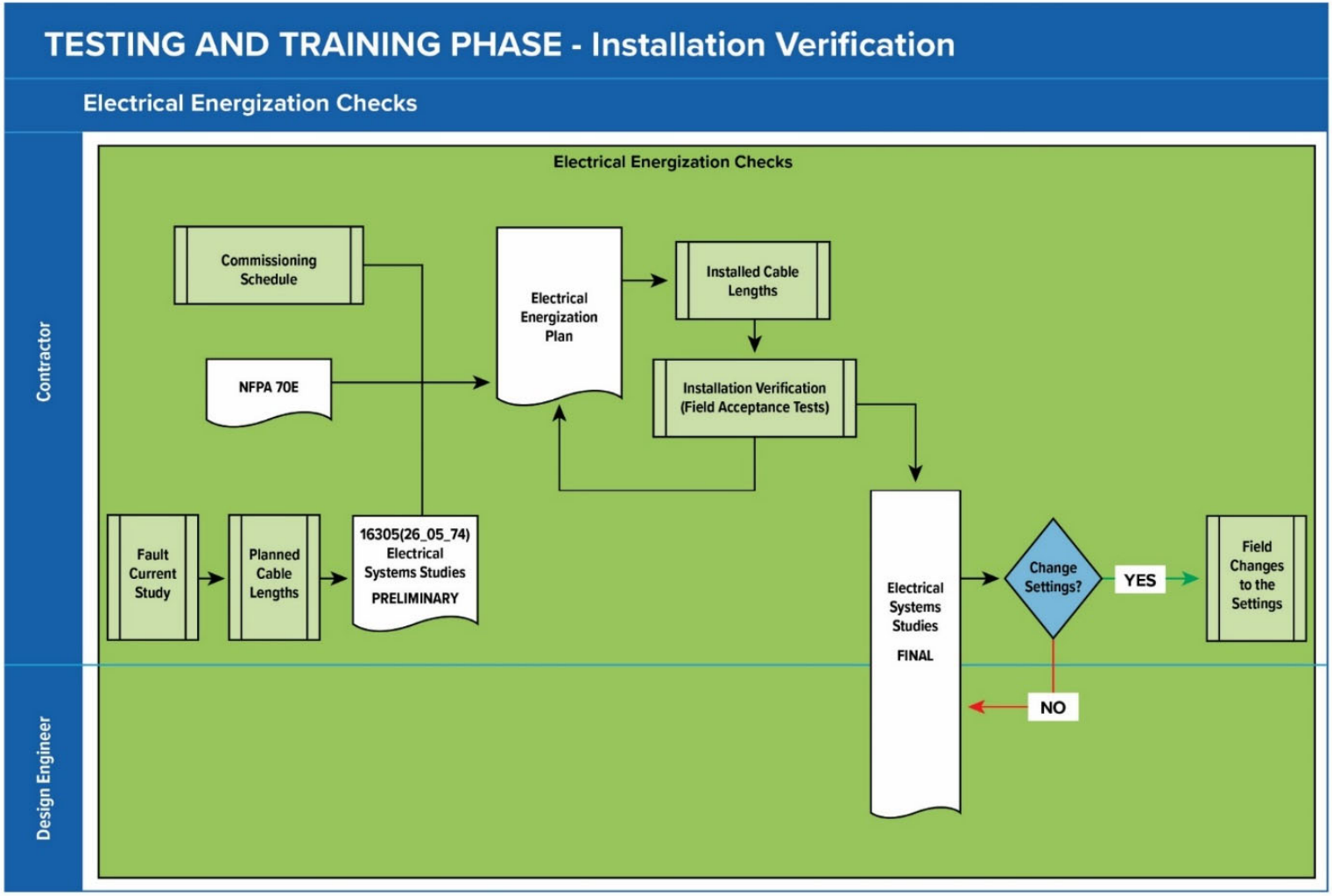
END OF SECTION

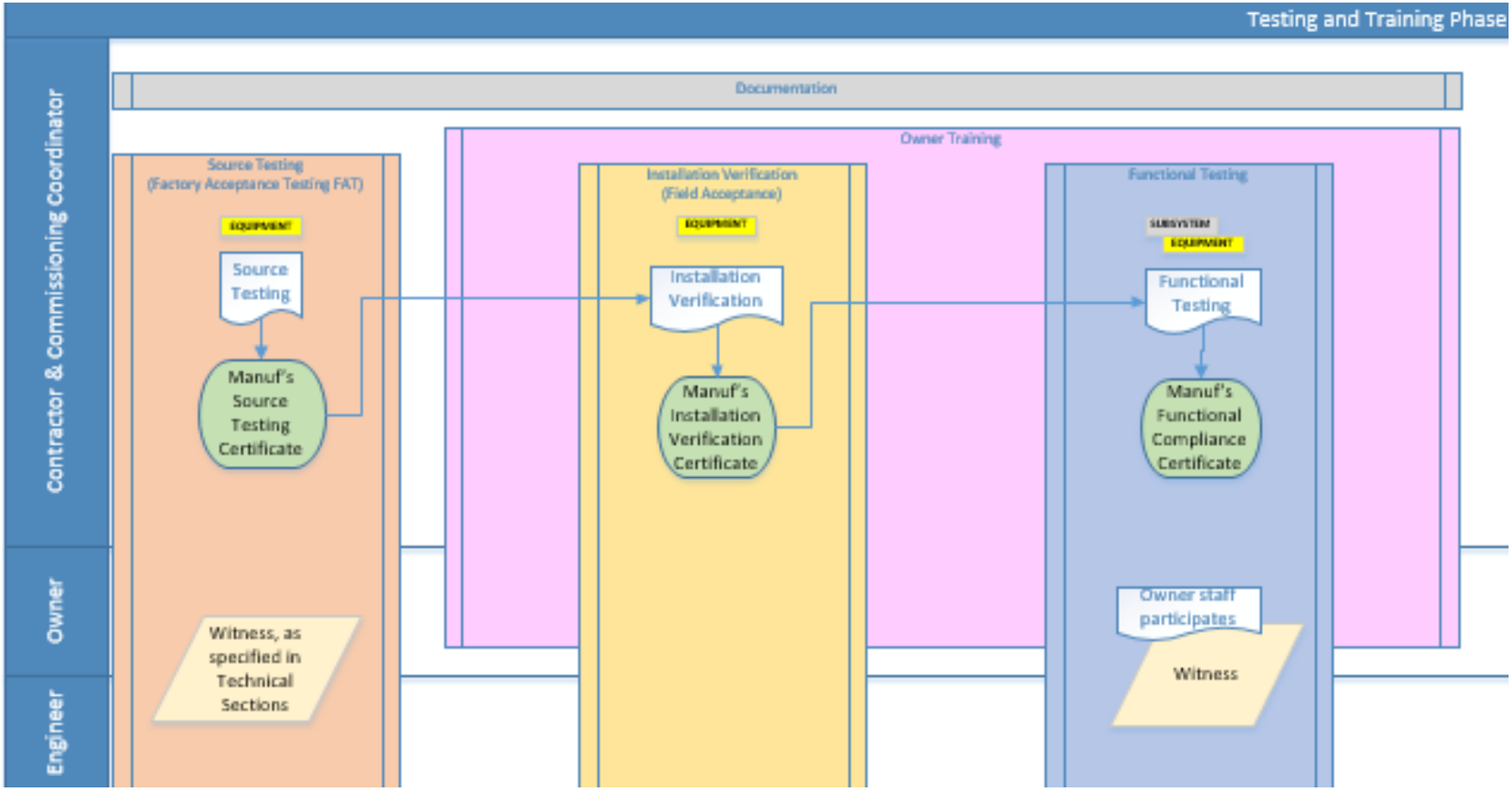
ATTACHMENT A - COMMISSIONING FLOWCHARTS

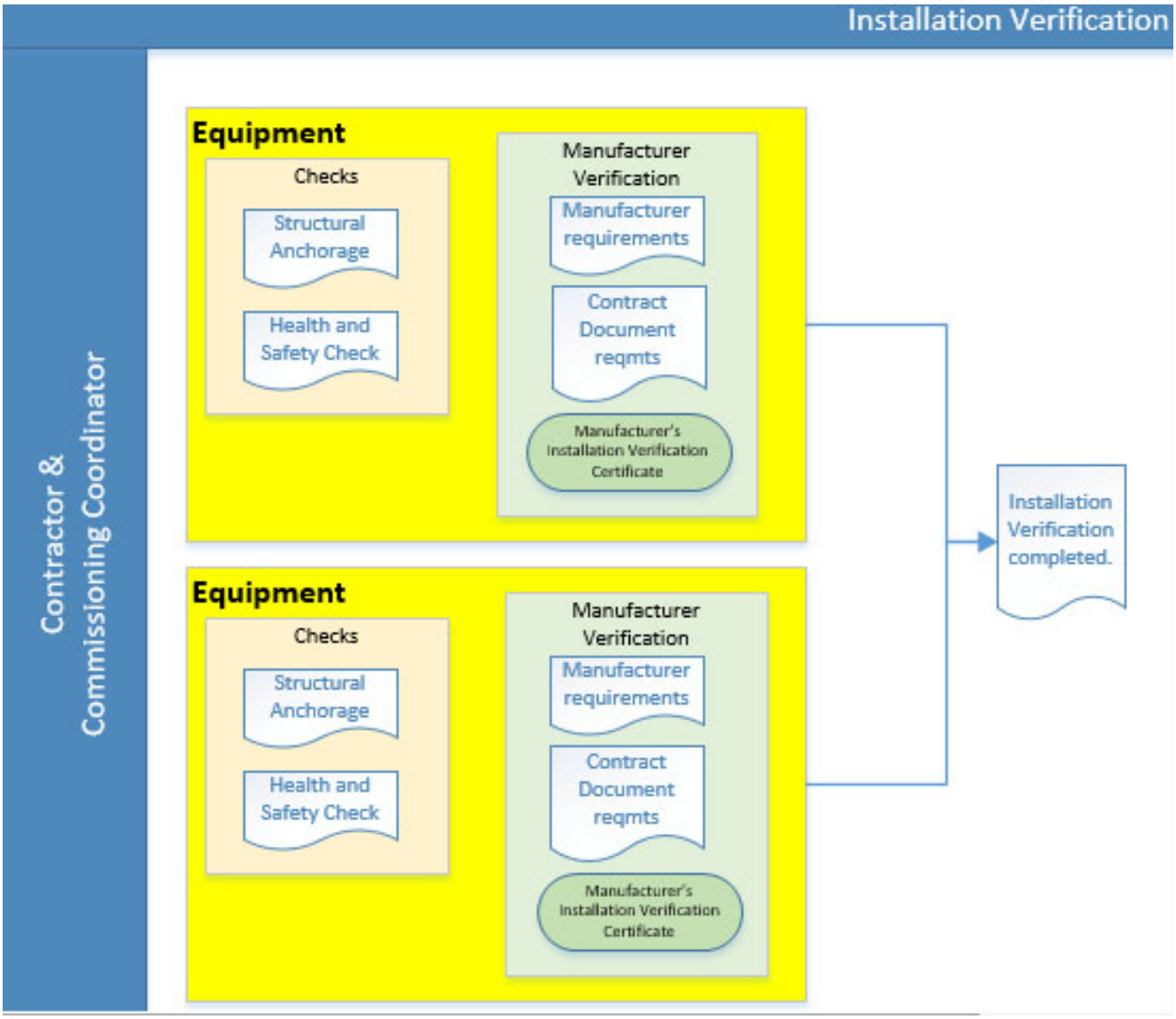

Construction Contract
PLANT
SYSTEM
SUBSYSTEM
SUBSYSTEM
EQUIPMENT
EQUIPMENT
COMPONENT
COMPONENT
DEVICE
DEVICE
SYSTEM
SUBSYSTEM
SUBSYSTEM
EQUIPMENT
EQUIPMENT
COMPONENT
COMPONENT
DEVICE
DEVICE
PLANT
SYSTEM
SUBSYSTEM
SUBSYSTEM
EQUIPMENT
EQUIPMENT
COMPONENT
COMPONENT
DEVICE
DEVICE
SYSTEM
SUBSYSTEM
SUBSYSTEM
EQUIPMENT
EQUIPMENT
COMPONENT
COMPONENT
DEVICE
DEVICE
PLANT
SYSTEM
SYSTEM
SYSTEM
Planning Phase
Testing and Training Phase
Start-Up Phase

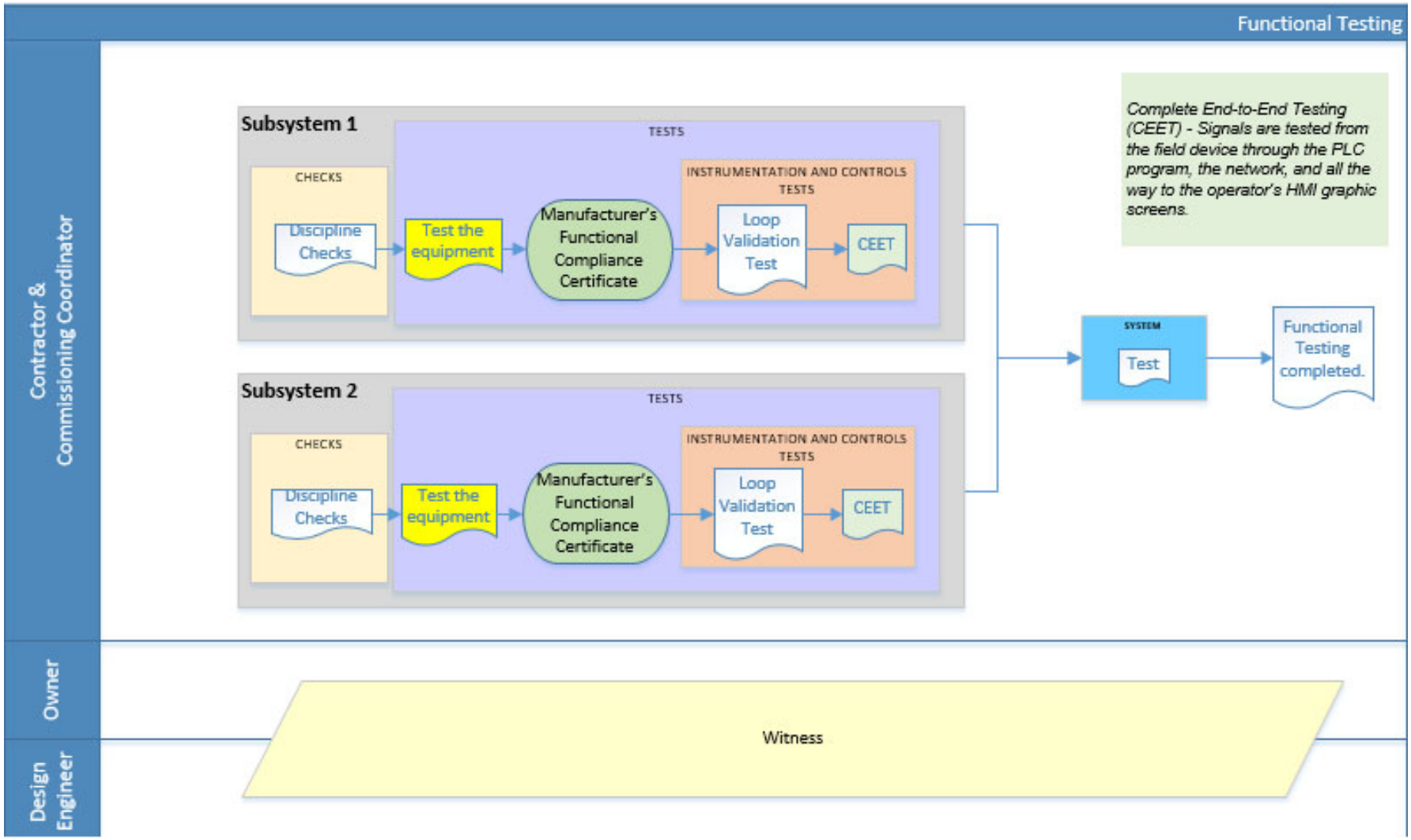

Commissioning
Planning Phase
Contractor & Commissioning Coordinator
Draft Test Plans
Owner
Review and approve
Design Engineer

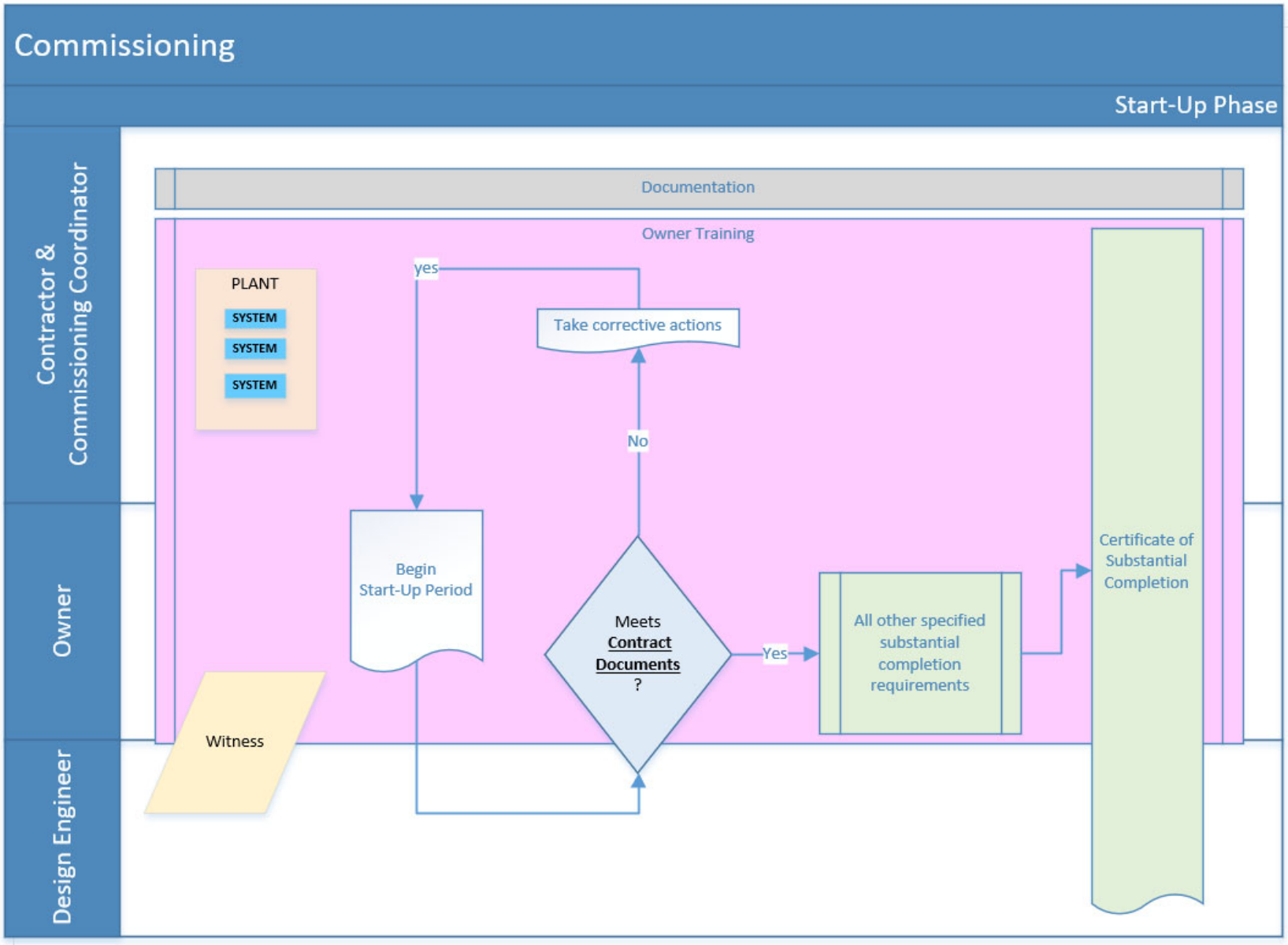

TESTING AND TRAINING PHASE
Installation Verification
Contractor & Commissioning Coordinator
Equipment
Checks
Structural Anchorage Check
Electrical Engerization Check
Health & Safety Check
Manufacturer Verification
Manufacturer Requirements
Contract Document Requirements
Manufacturer's Installation Verification Certificate
Equipment
Checks
Structural Anchorage Check
Electrical Engerization Check
Health & Safety Check
Manufacturer Verification
Manufacturer Requirements
Contract Document Requirements
Manufacturer's Installation Verification Certificate
Installation Verification Completed


TESTING AND TRAINING PHASE - Installation Verification
Electrical Energization Checks
Contractor
Design Engineer
Electrical Energization Checks
Commissioning Schedule
NFPA 70E
Electrical Energization Plan
Installed Cable Lengths
Installation Verification (Field Acceptance Tests)
Fault Current Study
Planned Cable Lengths
16305(26_05_74) Electrical Systems Studies
PRELIMINARY
Electrical Systems Studies
FINAL
Change Settings?
YES
NO
Field Changes to the Settings


Testing and Training Phase
Contractor & Commissioning Coordinator
Owner
Engineer
Documentation
Owner Training
Source Testing
(Factory Acceptance Testing FAT)
EQUIPMENT
Source Testing
Manuf's Source Testing Certificate
Witness, as specified in Technical Sections
Installation Verification
(Field Acceptance)
EQUIPMENT
Installation Verification
Manuf's Installation Verification Certificate
Functional Testing
SUBSYSTEM
EQUIPMENT
Functional Testing
Manuf's Functional Compliance Certificate
Owner staff participates
Witness


Installation Verification
Contractor & Commissioning Coordinator
Equipment
Checks
Structural Anchorage
Health and Safety Check
Manufacturer Verification
Manufacturer requirements
Contract Document reqmts
Manufacturer's Installation Verification Certificate
Equipment
Checks
Structural Anchorage
Health and Safety Check
Manufacturer Verification
Manufacturer requirements
Contract Document reqmts
Manufacturer's Installation Verification Certificate
Installation Verification completed.


Functional Testing
Contractor & Commissioning Coordinator
Owner
Design Engineer
Subsystem 1
TESTS
CHECKS
Discipline Checks
Test the equipment
Manufacturer's Functional Compliance Certificate
INSTRUMENTATION AND CONTROLS TESTS
Loop Validation Test
CEET
Subsystem 2
TESTS
CHECKS
Discipline Checks
Test the equipment
Manufacturer's Functional Compliance Certificate
INSTRUMENTATION AND CONTROLS TESTS
Loop Validation Test
CEET
Complete End-to-End Testing (CEET) - Signals are tested from the field device through the PLC program, the network, and all the way to the operator's HMI graphic screens.
SYSTEM
Test
Functional Testing completed.
Witness


Commissioning
Start-Up Phase
Contractor & Commissioning Coordinator
Owner
Design Engineer
Documentation
Owner Training
PLANT
SYSTEM
SYSTEM
SYSTEM
yes
Take corrective actions
No
Begin Start-Up Period
Meets Contract Documents ?
Yes
All other specified substantial completion requirements
Certificate of Substantial Completion
Witness

ATTACHMENT B - MANUFACTURER'S CERTIFICATE OF SOURCE TESTING

MANUFACTURER'S CERTIFICATE OF SOURCE TESTING

OWNER _____ EQPT/SYSTEM _____

PROJECT NAME _____ EQPT TAG NO. _____

PROJECT NO. _____ EQPT SERIAL NO. _____

SPECIFICATION NO. _____

SPECIFICATION TITLE _____

Comments: _____

_____

_____

_____

_____

I hereby certify Source Testing has been performed on the above-referenced equipment/system as defined in the Contract, and results conform to the Contract Document requirements. Testing data is attached.

Date of Execution: _____, 20____

Manufacturer: _____

Manufacturer's Authorized Representative Name *(print)*: _____

_____

(Authorized Signature)

If applicable, Witness Name *(print)*: _____

_____

(Witness Signature)

ATTACHMENT C - MANUFACTURER'S CERTIFICATE OF INSTALLATION VERIFICATION

MANUFACTURER'S CERTIFICATE OF INSTALLATION VERIFICATION

OWNER _____ EQPT/SYSTEM _____

PROJECT NAME _____ EQPT TAG NO. _____

PROJECT NO. _____ EQPT SERIAL NO. _____

SPECIFICATION NO. _____

SPECIFICATION TITLE _____

I hereby certify the installation of the above-referenced equipment/system as defined in the Contract Documents.

NOTES:
Attach written certification report prepared by and signed by the electrical and/or instrumentation subcontractor.

Comments: _____

_____

I, the undersigned manufacturer's representative, hereby certify that I am (i) a duly authorized representative of the manufacturer, (ii) empowered by the manufacturer to inspect, approve, and operate this equipment/system, and (iii) authorized to make recommendations required to ensure that the equipment/system furnished by the manufacturer is complete and operational, except as may be otherwise indicated herein. I further certify that all information contained herein is true and accurate.

Date: _____

Manufacturer: _____

Manufacturer's Authorized Representative Name *(print)*: _____

By Manufacturer's Authorized Representative: _____
(Authorized Signature)

ATTACHMENT D - MANUFACTURER'S CERTIFICATE OF FUNCTIONAL COMPLIANCE

MANUFACTURER'S CERTIFICATE OF FUNCTIONAL COMPLIANCE

OWNER _____ EQPT/SYSTEM _____
PROJECT NAME _____ EQPT TAG NO. _____
PROJECT NO. _____ EQPT SERIAL NO. _____
SPECIFICATION NO. _____
SPECIFICATION TITLE _____

I hereby certify the Functional Testing of the above-referenced equipment/system as defined in the Contract Documents.

NOTES:
Attach test results with collected data and test report.

Attach written certification report prepared by and signed by the electrical and/or instrumentation subcontractor.

Comments: _____

_____

I, the undersigned manufacturer's representative, hereby certify that I am (i) a duly authorized representative of the manufacturer, (ii) empowered by the manufacturer to inspect, approve, and operate this equipment/system, and (iii) authorized to make recommendations required to ensure that the equipment/system furnished by the manufacturer is complete and operational, except as may be otherwise indicated herein. I further certify that all information contained herein is true and accurate.

Date: _____

Manufacturer: _____

Manufacturer's Authorized Representative Name *(print)*: _____

By Manufacturer's Authorized Representative: _____
(Authorized Signature)

WITNESSES

By Owner's Authorized Representative: _____
(Authorized Signature)

By Engineer's Authorized Representative: _____
(Authorized Signature)

ATTACHMENT E - TRAINING EVALUATION FORM

TRAINING EVALUATION FORM

EQUIPMENT/SYSTEM ITEM: _____

VENDOR/MANUFACTURER: _____

DATE: _____ NAME OF REPRESENTATIVE: _____

1.	Was representative prepared?	Acceptable	Unacceptable	or	N/A
2.	Was an overview description presented?	Acceptable	Unacceptable	or	N/A
3.	Were specific details presented for system components?	Acceptable	Unacceptable	or	N/A
4.	Were alarm and shutdown conditions clearly presented?	Acceptable	Unacceptable	or	N/A
5.	Were step-by-step procedures for starting, stopping, and troubleshooting presented?	Acceptable	Unacceptable	or	N/A
6.	Were routine/preventative maintenance items clearly identified?	Acceptable	Unacceptable	or	N/A
7.	Was the lubrication schedule (if any) discussed?	Acceptable	Unacceptable	or	N/A
8.	Was the representative able to answer all questions?	Acceptable	Unacceptable	or	N/A
9.	Did the representative agree to research and answer unanswered questions?	Acceptable	Unacceptable	or	N/A

10. Comments: _____

_____

_____

_____

11. Overall Rating: Satisfactory Unsatisfactory

Note:

Sessions judged "Unsatisfactory" by a majority of attendees shall be revised and conducted again until a satisfactory rating is achieved.

ATTACHMENT F - COMMISSIONING ROLES AND RESPONSIBILITIES MATRIX

COMMISSIONING ROLES AND RESPONSIBILITIES MATRIX

NO.	TASK	OWNER	CONTRACTOR	ENGINEER
Testing and Training Phase				
Source Testing				
	Source Testing	Witness	Lead	Witness Review
	Manufacturer's Certificate of Source Testing	No Action	Lead	Review
Installation Verification				
	Structural Anchorage Check	Witness	Lead	Review
	Health and Safety Check	Witness	Lead	Review
	Manufacturer Requirements Verification	No Action	Lead	Review
	Contract Documents Verification	No Action	Lead	Review
	Manufacturer's Certificate of Installation Verification	No Action	Lead	Review
Functional Testing				
	Checks	Witness	Lead	Witness, Review
	Tests	Witness	Lead	Witness, Review
	Manufacturer's Certificate of Functional Compliance	No Action	Lead	Witness, Review
System Testing				
	System Testing	Witness	Lead	Witness, Review
Start-Up Phase				
	Start-Up	Lead	Support	Witness, Review

Legend:
Lead: Primarily responsible for organization, coordination, and execution of task work product or result.
Support: Assist the lead with organization, coordination, and execution of task work product or result.
Witness: Observe and document completion of task work product or result.
No Action: Limited or no involvement.
Review: Approve for compliance with Contract Documents or reject.

ATTACHMENT G - FUNCTIONAL TESTING REQUIREMENTS

FUNCTIONAL TESTING REQUIREMENTS

System	Subsystem	Consecutive Day Test Duration (Days)	Significant Interruption Duration (Hours)	Test Liquid	System Operated By
UV Disinfection System		7	6	Filtered Effluent	Contractor
	Influent Gates				
	UV Banks				
	Weir Gates				

Notes:

1. As specified in Section 01_11_00 - Summary of Work. (Not included in this Contract)
2. As specified in Section 40_61_05 – Packaged Control System
3. As specified in Section 46_66_85 – Ultravoilet Disinfection System: Open Channel Wastewater/Reuse.
4. As specified in this Section under Functional Testing.

A. Schedule delays:
   1. Changes in the dates for source testing less than 30 days of the date provided in the latest approved Commissioning Schedule are considered delays.
   2. Contractor is responsible for associated costs resulting from delays:
      a. In person and/or virtual witnessing.
      b. Travel costs and witness labor costs.
         1) Witness labor costs at $250 per hour.

B. Repeat test costs:
   1. Contractor is responsible for associated costs for repeat testing:
      a. In person and/or virtual witnessing.
      b. Travel costs and witness labor costs.
         1) Witness labor costs at $250 per hour.

SECTION 01_78_24

OPERATION AND MAINTENANCE MANUALS

PART 1 GENERAL

1.01 SUMMARY

A. Section includes:
   1. Preparation and submittal of manual with requirements to operate and maintain the equipment.

1.02 PREPARATION

A. General requirements:
   1. Provide dimensions in English units.
   2. Assemble material, where possible, in the same order within each volume.
   3. Reduce drawings and diagrams to 8 1/2 by 11-inch size, if possible unless otherwise specified.
   4. Complete forms on computer, handwriting not acceptable.
   5. Delete items or options not provided in the supplied equipment or system.
   6. Provide package control system annotated ladder logic for PLC, if applicable.
   7. Provide all manuals in PDF in addition to hardcopy

B. Hard copy requirements:
   1. Binders: 3-ring with rigid covers:
      a. Break into separate binders as needed to accommodate large size.
   2. Utilize numbered tab sheets to organize information.
   3. Provide original and clear text on reproducible non-colored paper, 8 1/2 by 11-inch size, 24-pound paper.
   4. Drawings larger than 8 1/2 by 11 inch:
      a. Fold drawings separately and place in envelope bound into the manual.
      b. Label each drawing envelope on the outside regarding contents.

C. Electronic requirements:
   1. File format:
      a. Entire manual in PDF format.
         1) Include text and drawing information.
         2) Provide a single PDF file even if the hard copy version is broken into separate binders due to being large.
         3) Create PDF from the native format of the document (Microsoft Word, graphics programs, drawing programs, etc.):
            a) If material is not available in native format and only available in paper format, remove smudges, fingerprints, and other extraneous marks before scanning to PDF format.
            b) Hard copy record drawing requirements:
               (1) Provide a single multipage PDF file of each set of the scanned drawings.
               (2) Page 1 shall be the cover of the drawing set.

c) At file opening, display the entire cover:
(1) Scan drawings at 200 to 300 dots per inch (DPI), black and white, Group IV Compression, unless otherwise specified.
(2) Scan drawings with photos in the background at 400 dots per inch (DPI), black and white, Group IV Compression.
4) Pagination and appearance to match hard copy.
5) Searchable.
6) Scanned images are not acceptable.
7) Bookmarks:
a) Bookmarks shall match the table of contents.
b) Bookmark each section (tab) and heading.
c) Drawings: Bookmark at a minimum, each discipline, area designation, or appropriate division.
d) At file opening, display all levels of bookmarks as expanded.
8) Thumbnails optimized for fast web viewing.
b. Drawing requirements:
1) Provide additional copy of drawings in most current version of AutoCAD format.
2) Drawings shall have a white background.
3) Drawing shapes shall not degrade when closely zoomed.
4) Screening effects intended to de-emphasize detail in a drawing must be preserved.
5) Delete items or options not provided in the supplied equipment or system.
2. Media:
a. USB flash drive.
b. Secure File Transfer Protocol (SFTP).
3. Label media with the following information:
a. Operation and Maintenance Manual.
b. Equipment name.
c. Specification Section Number
d. Equipment tag number.
e. Owner's name.
f. Project number and name.
g. Date.
4. If multiple submittals are made together, each submittal must have its own subdirectory that is named and numbered based on the submittal number.

1.03 CONTENTS

A. Table of Contents: General description of information provided within each tab section.

B. Complete Attachment A - Equipment Summary Form.

C. Description of system and components.

D. Description of equipment function, normal operating characteristics, and limiting conditions.

E. On-line resources.

F. Telephone resources.

G. Approved submittals:
   1. Markup with any field changes.
   2. Final programming.

H. Start-up procedures: Recommendations for installation, adjustment, calibration, and troubleshooting.

I. Operating procedures:
   1. Step-by-step instructions including but not limited to the following:
      a. Safety precautions and applicable Safety Data Sheets.
      b. Guidelines.
      c. Other information as needed for safe system operation and maintenance.

J. Preventative maintenance procedures:
   1. Recommended steps and schedules for maintaining equipment.
   2. Troubleshooting.

K. Lubrication information: Required lubricants and lubrication schedules.

L. Overhaul instructions: Directions for disassembly, inspection, repair and reassembly of the equipment; safety precautions; and recommended tolerances, critical bolt torques, and special tools that are required.

M. Manufacturer's technical reference manuals.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

ATTACHMENT A - EQUIPMENT SUMMARY FORM

EQUIPMENT SUMMARY FORM

1. EQUIPMENT ITEM _____

2. MANUFACTURER _____

3. EQUIPMENT TAG NUMBER(S) _____

4. LOCATION OF EQUIPMENT _____

5. WEIGHT OF INDIVIDUAL COMPONENTS (OVER 100 POUNDS) _____

_____

_____

_____

6. NAMEPLATE DATA -
   - Horsepower _____
   - Amperage _____
   - Voltage _____
   - Service Factor (S.F.) _____
   - Speed _____
   - ENC Type _____
   - Capacity _____
   - Other _____

7. MANUFACTURER'S LOCAL REPRESENTATIVE

   Name _____

   Address _____

   Telephone Number _____

8. MAINTENANCE REQUIREMENTS:

Maintenance Operation	Frequency	Lubricant (if applicable)	Comments
(List each operation required. Refer to specific information in Manufacturer's Manual, if applicable)	(List required frequency of each maintenance operation)	(Refer by symbol to lubricant list as required)	

9. LUBRICANT LIST:

Reference Symbol	Conoco Phillips	Exxon/Mobil	BP/Amoco	Other (List)
(Symbols used in Item 7 above)	(List equivalent lubricants, as distributed by each manufacturer for the specific use recommended)			

10. SPARE PARTS (recommendations)_____

_____

11. COMMENTS_____

12. GENERAL INFORMATION:

Date Accepted*: _____

Expected Life*: _____

Project Name & Number: _____

Design Engineer: _____

13. WARRANTY:

Start Date: _____

Expiration Date: _____

Prorated: _____

SECTION 01_78_36

WARRANTIES AND BONDS

PART 1 GENERAL

1.01 SUMMARY

A. Section includes: Warranty and bonds requirements.

1.02 SUBMITTALS

A. For each item of material or equipment furnished under the Contract:
   1. Submit manufacturer's warranty prior to fabrication and shipment of the item from the manufacturer's facility.
   2. Submit manufacturer's special warranty when specified.

B. Provide consolidated warranties and bonds within 15 calendar days of Substantial Completion:
   1. Contents:
      a. Organize warranty and bond documents:
         1) Include Table of Contents organized by specification section number and the name of the product or work item.
      b. Include each required warranty and bond in proper form, with full information, certified by manufacturer as required, and properly executed by Contractor, or subcontractor, supplier, or manufacturer.
      c. Provide name, address, phone number, and point of contact of manufacturer, supplier, and installer, as applicable.
   2. Hardcopy format:
      a. Submit 2 copies.
      b. Assemble in 3 D-side ring binders with durable cover.
      c. Identify each binder on the front and spine with typed or printed title "Warranties and Bonds"; Project Name or Title, and the Name Address and Telephone Number of the Contractor.
   3. Electronic copy in PDF format:
      a. Submit 1 copy.

1.03 OWNER'S RIGHTS

A. Owner reserves the right to reject warranties.

B. Owner reserves the right to refuse to accept Work for the project if the required warranties have not been provided.

1.04 RELATIONSHIP TO GENERAL WARRANTY AND CORRECTION PERIOD

A. Warranties specified for materials and equipment shall be in addition to, and run concurrent with, both Contractor's general warranty and the correction period requirements.

B. Disclaimers and limitations in specific materials and equipment warranties do not limit Contractor's general warranty, nor does such affect or limit Contractor's performance obligations under the correction period.

1.05 MANUFACTURER'S 1 YEAR WARRANTY MINIMUM REQUIREMENTS

A. Written warranty issued by item's manufacturer.

B. Project-specific information, properly executed by product manufacturer, and expressly states that its provisions are for the benefit of the Contactor.

C. Covers all costs associated with the correction of the defect, including but not limited to removal of defective parts, new parts, labor, and shipping.

D. Provides a timely response to correct the defect:
   1. Manufacturer shall provide, in a timely fashion, temporary equipment as necessary to replace warranted items requiring repair or replacement, when warranted items are in use and are critical to the treatment process, as defined by Owner.

E. Warranty commence running on the date of substantial completion:
   1. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit warranty within 10 calendar days after acceptance, listing date of acceptance as beginning of warranty period.

F. Duration of Warranty: 1 year.

1.06 MANUFACTURER'S SPECIAL WARRANTY

A. Manufacturer's special warranty is a written warranty published by the manufacturer which includes the requirements as specified in the Technical Section:
   1. Project-specific information and requirements.
   2. Properly executed by product manufacturer.
   3. Expressly states that its provisions are for the benefit of the Contractor or Owner.
   4. Manufacturer's special warranties commence on the date that the associated item is certified by Engineer as substantially complete.

1.07 WARRANTY WORK

A. Contractor's responsibilities:
   1. Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the work that incorporates the product, nor does it relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with Contractor.

B. Replacement cost:
   1. Upon determination that work covered by warranty has failed, replace or rebuild the work to an acceptable condition complying with requirement of the Contract Documents:
      a. Contractor is responsible for the cost of replacing or rebuilding defective work regardless of whether Owner has benefited from the use of the work through a portion of its anticipated useful service life.

C. Related damages and losses:
   1. When correcting warranted work that has failed, remove and replace other work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of warranted work.

D. Owner's recourse:
   1. Written warranties are in addition to implied warranties, and shall not limit the duties, obligations, rights, and remedies otherwise available under the law, nor shall warranty periods be interpreted as limitation on time in which Owner can enforce such other duties, obligations, rights, or remedies.

E. Reinstatement of warranty:
   1. When work covered by a warranty has failed and has been corrected by replacement or rebuilding, reinstate the warranty by written endorsement:
      a. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.

1.08 IMPLIED WARRANTIES

A. Warranty of title and intellectual rights:
   1. Except as may be otherwise indicated in the Contract Documents, implied warranty of title required by Laws and Regulations is applicable to the Work and to materials and equipment incorporated therein.
   2. Provisions on intellectual rights, including patent fees and royalties, are in the General Conditions, as may be modified by the Supplementary Conditions.

B. Implied warranties: Duration in accordance with Laws and Regulations.

1.09 BONDS

A. Equipment bond and other bond requirements as specified in the Technical Sections.

B. Bonds commence running on the date of substantial completion:
   1. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit warranty within 10 calendar days after acceptance, listing date of acceptance as beginning of bond period.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01_81_50

DESIGN CRITERIA

PART 1 GENERAL

1.01 SUMMARY

A. Section includes:
   1. Design criteria for use in the selection of equipment and appurtenances specified in Technical Sections of these Specifications and indicated on the Drawings.
   2. Criteria for design of systems, components and equipment fabricated off site and shipped to the Work for installation.
   3. Criteria for design of anchors to connect equipment and appurtenances to supports and structures.

B. The criteria in this Section apply throughout the Work, unless additional criteria, or more restrictive criteria, are indicated:
   1. Additional criteria and requirements relevant to specific locations, specific materials, and specific equipment are indicated on the Drawings, and in the Technical Sections.

1.02 REFERENCES

A. American Society of Civil Engineers (ASCE):
   1. 7-16 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures. (ASCE 7).

B. American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE):
   1. ASHRAE Fundamentals Handbook.

C. International Code Council (ICC):
   1. International Energy Conservation Code (IECC).
   2. International Plumbing Code (IPC).

D. Sheet Metal and Air Conditioning Contractor's National Association (SMACNA):
   1. Seismic Restraint Manual: Guidelines for Mechanical Systems, 3rd edition - 2008.

PART 2 PRODUCTS

2.01 DESIGN CRITERIA - SITE INFORMATION

A. Site name: Calera Creek Water Reclamation Plant:
   1. Street Address: 700 Pacific Coast Hwy, Pacifica, CA 94044.
   2. Site elevation (approximate):
      a. 70 feet above mean sea level.

3. Groundwater elevation:
    a. Approximately 70’ above mean sea level.

2.02 DESIGN CRITERIA - REGULATORY REQUIREMENTS

A. Requirements of authorities having jurisdiction over the project are included in Technical Specifications.

2.03 DESIGN CRITERIA - OPERATING ENVIRONMENT

A. The Drawings and Technical Sections include additional criteria and requirements relevant to specific locations, materials, and equipment.

B. Outdoor conditions:
    1. International Energy Conservation Code (IECC): Climate Zone 3C.
    2. Site climatic data location: San Francisco International Airport (WMO: 724940).
    3. Temperature criteria: As specified in the following Table: Design Temperatures - Outdoor Criteria in Accordance with ASHRAE Fundamentals Handbook.

Table: Design Temperatures - Outdoor Criteria in Accordance with ASHRAE Fundamentals Handbook

Reference Location:	San Francisco International Airport
Condition	**Criteria**
Daily mean range:	45 degrees Fahrenheit.
Winter:	At or above this temperature 99.6 percent of the time: 40 degrees Fahrenheit dry-bulb.
Summer:	At or above this temperature 0.4 percent of the time: 63 degrees Fahrenheit dry-bulb.

C. Indoor Conditions:
    1. HVAC schedules as specified.
    2. Humidity:
        a. Moisture/humidity conditions: As specified, and as defined in individual equipment sections.

2.04 DESIGN CRITERIA - STRUCTURAL

A. General:
    1. Criteria for structural design of:
        a. Equipment at locations subject to seismic events.
        b. Equipment exposed to outdoor environments.
        c. Equipment supports and bracing, and anchorage of such items to building and non-building structures.
        d. Structures provided for the Work through Delegated Design.

e. Manufactured and prefabricated structures, and anchorage of such structures to foundations or other supporting elements.

2. Structural design criteria used by the engineer of record and required by the building code to be indicated on the Drawings included under the installation contract.

B. Delegated Design:
1. As specified in Section 01_35_73 - Delegated Design Procedures.
2. Structural engineering design shall be performed by a Civil or Structural Engineer licensed in the State of California.

C. Structure risk category:
1. Develop design loads and provide detailing in accordance with the provisions of ASCE 7 and Technical Specifications, based on the Structure Risk Category indicated in Table: Project Structures - Risk Category and Seismic Design Information.

D. Seismic loads:
1. Seismic design parameters: Basic parameters - ASCE 7:
a. Ground motion MCE_R, 5 percent damped:
1) Short periods, Ss = 2.125 g.
2) One second period, S_1 = 0.882 g.
b. Peak ground acceleration, MCE_G:
1) Peak ground acceleration, PGA = 0.91 g.
c. Mapped long-period transition period:
1) TL = 12 seconds.
2. Structures - General:
a. Seismic Design Category (SDC): As indicated in the following Table: Project Structures - Risk Category and Seismic Design Information.

Table: Project Structures - Risk Category and Seismic Design Information

Description: Water Treatment Facility

Area	Description	Risk Category	Site Class	S_{DS}	S_{D1}	Seismic Design Category(1)
40	UV Channel	III	D	1.7	n/a	D

Notes:

(1) Seismic Design Category for Delegated Design, and for seismic certification of electrical and mechanical equipment as required by ASCE 7.

b. Structure response modification coefficient, R:
1) In accordance with ASCE 7, and the requirements of the Technical Sections.
3. Structures - Tanks and vessels:
a. Includes: Tank structures, tank supports, and anchorage to structures or foundations:
b. Liquid storage structures (e.g.: basins and tanks):
1) Include impulsive and convective (“sloshing”) effects.

2) Component response modification factor - impulsive effects, Ri: In accordance with ASCE 7, Table 15.4-2.
3) Component response modification factor - convective effects, Rc = 1.0.

c. Dry material storage structures (e.g.: silos, hoppers):
1) Include effects of stored materials.
2) Component response modification factor - impulsive effects, Ri: In accordance with ASCE 7, Table 15.4-2.

4. Non-structural components - General:
a. Includes:
1) Mechanical and electrical equipment; anchorage of equipment to structures or supports; design of supports; and anchorage of supports to structures or foundations.
2) Distribution systems associated with mechanical and electrical equipment such as piping, ductwork, conduits, cable trays, raceways, bus ducts, and similar items; anchorage of such systems to supports and structures; and bracing or such systems.

b. Seismic design requirements for non-structural components are based on the Seismic Design Category (SDC) of the structure or facility where the equipment is installed.

c. Design components, component anchorage, and component connections to piping and utilities in accordance with the requirements of ASCE 7, Table 13.2-1.

d. Component amplification factor (ap), response factor (Rp), and overstrength factor for anchorage to concrete (Ωo):
1) Mechanical and electrical components and systems: In accordance with ASCE 7, Table 13.6-1, unless otherwise indicated in the Technical Sections for these items.
2) Architectural components and systems: In accordance with ASCE 7, Table 13.6-1, unless otherwise indicated in the Technical Sections for these items.

e. Component importance factor, Ip:
1) In accordance with the following Table: Component Importance Factor for seismic design, I_p.
2) For items not listed in Table: Component Importance Factor for seismic design, I_p, designate importance factor in accordance with the provisions of ASCE 7, Chapter 13 and submit to Engineer for review prior to developing calculations and details related to that component.

Table: Component Importance Factor for seismic design, I_p		
Structure Seismic Design Category	**Components**	**Ip**
All	Electrical: Items and distribution system components specified in Division 26 - Electrical.	1.5
All	Process Control and Instrumentation Systems: Components and distribution systems specified in Division 40 - Process Integration.	1.5
All	Equipment and components specified in Divisions 11 through 49.	1.5
All	Other equipment not listed above.	1.0

E. Operational loads:
   1. Loads may include equipment vibration, torque, thermal effects, effects of internal contents (weight and sloshing), surge or "water hammer," and other load conditions.
   2. Design for loads indicated by equipment manufacturer.
   3. Design for loads indicated in the Technical Sections for equipment and appurtenances.

F. Serviceability considerations:
   1. Deflection, unless otherwise indicated on the Drawings, or specified:
      a. Beam deflection as fraction of span:
         1) Walkways and platforms: total load = L/240; live load = L/360.
         2) Equipment supports: L/450.

PART 3 EXECUTION

3.01 GENERAL

A. Design approach and criteria in accordance with:
   1. Regulatory requirements, including but not limited to those specified in the Technical Specifications.
   2. Reference standards and project-specific design criteria listed in this Section.
   3. Specific requirements for individual elements and components of the Work as specified in subsequent Technical Sections.

B. In the event of conflicts between design criteria, contact Engineer for interpretation.

C. Where Owner-Delegated Design is required by the Specifications, prepare and submit designs as specified in Section 01_35_73 - Delegated Design Procedures.

3.02 DELEGATED DESIGN:

A. Contractor or Subcontractor shall retain a licensed professional engineer to perform Delegated Design.

B. Qualifications:
   1. Holding a current license to perform the specified design in the same jurisdiction as the Project site.
   2. Experienced in designing similar systems of similar complexity.

C. Where Delegated Design is required by the Technical Sections, prepare and submit designs as specified.
   1. Product data:
      a. Details related to the Delegated Design as specified in technical sections to completely describe the system.
   2. Design documents with signature and seal from the Contractor's Professional Engineer:
      a. Design documents include but are not limited to drawings, calculations, specifications, inspection reports, and certifications.
   3. Lists and schedules:
      a. Prepare and submit lists or schedules of items where delegated design is required by the Contract Documents.
      b. Group items by location in the Work:
         1) When "Area Numbers" are indicated on the Contract Drawings, group lists in accordance with those "areas."
         2) For work without area numbers, group using logical divisions acceptable to Engineer.
         3) Group items within each "area" as follows:
            a) Systems.
            b) Components.
            c) Supports.
            d) Anchorage.
            e) Bracing.

D. Calculations:
   1. Where submittal of calculations is required:
      a. Provide complete calculations, including sketches to illustrate the design concepts being evaluated, and details to fully describe proposed construction.
   2. Requirements for seismic design calculations will be waived for the following:
      a. Furniture and storage racks 6 feet in height or less.
      b. Moveable equipment.
      c. Mechanical and electrical equipment and components located in structures designated as Seismic Design Category A or B.
      d. Mechanical and electrical equipment and components located in structures designated as Seismic Design Category C and where the component importance factor, Ip, is equal to 1.0.
   3. Requirements for wind design calculations will be waived for the following:
      a. Equipment and components located inside structures, and away from the effects of wind loads.

E. Shop drawings:
    1. Shop drawings describing components and manufacturer's requirements for connections:
        a. Include details for connections of components to structures and supports.
        b. Include details for anchoring bracing to structures where required.

3.03 DESIGN - ANCHORS FOR EQUIPMENT, COMPONENTS, AND BRACING

A. General:
    1. Engineer's approval of anchor designs is required before placement of construction that supports or provides bracing for anchored equipment and components:
        a. Prepare anchor designs after Engineer's approval of the products and layout, and before placement of concrete or masonry that supports them.
    2. Adjust equipment pad sizes and add additional anchor confinement reinforcing to provide required strength at anchorage points between equipment and pad, and between pad and structure.
    3. Supports and bracing:
        a. Design and install braces and anchors to transfer forces from equipment and components to the lateral force resisting system of the surrounding structure.
        b. Anchor and brace piping, ductwork, and electrical distribution components so that lateral or vertical displacement does not result in damage to or failure of essential architectural, mechanical, or electrical equipment:
            1) Provide supplementary framing where required to transfer forces.
            2) Detail and locate braces and anchors to minimize differential movements between components and structure.

B. Preparation:
    1. Obtain manufacturer's information:
        a. Weight and dimensions of components.
        b. Layout and location of anchors that connect to equipment base plates, sole plates, skids, or pads.
        c. Sizes of holes for anchors that will be provided in equipment bases or support frames.

C. Analysis and design:
    1. Perform and submit calculations to determine anchor designs at locations where equipment and equipment supports are connected to the supporting structure:
        a. Indicate number, size, type, and material for anchors.
    2. In determining forces at locations where equipment is anchored to structures, include effects of:
        a. Equipment self-weight and operating weight.
        b. Location of equipment center of mass.
        c. Forces from equipment operation including, but not limited to:
            1) Effects of internal contents including weight and sloshing.
            2) Effects of thrust, surge, and water hammer where specified.
            3) Equipment reactions and operating torque.
            4) Equipment vibration.

5) Thermal effects from equipment and from distribution systems connected to the equipment (piping, ducts, and electrical).
6) Other load or displacement inducing conditions.

d. Forces on equipment from loads specified in this Section:
1) Include effects of wind, snow, and icing loads where applicable.
2) Design for load combinations indicated in ASCE 7, unless otherwise specified or indicated on the Drawings.
3) Seismic and wind loads: For equipment and tanks with weight that varies based on the volume of contained material, determine anchor forces to accommodate the full range of filled, partially filled, and empty conditions.

3. Determine forces and overturning moments at equipment supports and at locations where supports are anchored to structures:
a. Indicate shear force and associated axial force at each anchor.
4. Do not use friction to resist sliding resulting from seismic or wind forces:
a. Resist sliding only by direct application of sliding loads to fasteners as bearing, shear, tension, or compression forces.
5. Using combined shears and axial forces at each anchor, design anchors and anchor groups for ductile failure:
a. Ductile failure: Anchor yield before failure of base material, typically concrete or masonry, at the anchor.
6. Anchor selection:
a. Provide anchors type indicated on the Drawings.
b. Where anchors are not specifically indicated on the Drawings, select in accordance with the following:
1) Anchors that resist seismic and wind forces:
a) Cast-in-place forged hex-head anchor bolt.
2) Anchors loaded in sustained tension:
a) Cast-in-place forged hex-head anchor bolt.
3) Anchors for reciprocating, vibrating, and rotating equipment:
a) Cast-in-place forged hex-head anchor bolt.

c. Do not use post-installed anchors, mechanical or adhesive, unless:
1) Post-installed anchors are indicated on the Drawings; or
2) Post-installed are approved by Engineer prior to placement of the surrounding concrete or masonry.

d. Anchor diameter:
1) Select diameter so that hole in base plate is not greater than 125 percent of the nominal diameter of the anchor, nor greater than the diameter of the anchor plus 1/4 inch.

7. Determine number, size, layout, and minimum effective embedment for anchors:
a. Layout includes anchor spacing and required distance(s) from anchor to edge(s) of supporting concrete or masonry.
b. Anchors in concrete: Design based on minimum specified 28-day compressive strength, f'c, as follows, unless otherwise indicated on the Drawings for the Work area:
1) Concrete placed for this Work: f'c = **4,500** pounds per square inch.
2) Existing concrete in place prior to this Work: f'c = **4,000** pounds per square inch.

8. Prepare drawings showing construction details of anchor designs.

9. Submit design calculations and drawings prior to placement of anchors, and of the structural elements to which they will connect.

END OF SECTION

SECTION 40_05_57.24

ELECTRIC ACTUATORS

PART 1 GENERAL

1.01 SUMMARY

A. Section includes: Electric motor-driven actuators for valves and gates.

1.02 REFERENCES

A. American Water Works Association (AWWA):
   1. C504 - Standard for Rubber-Seated Butterfly Valves.
   2. C542 - Standard for Electric Motor Actuators for Valves and Slide Gates.

B. National Electrical Manufacturers Association (NEMA):
   1. 250 - Enclosures for Electrical Equipment (1000 V Maximum).

1.03 SUBMITTALS

A. Submit as specified in Section 01_33_00 - Submittal Procedures and Section 46_05_10 - Common Work Results for Mechanical Equipment.

B. Provide a complete list/schedule of all actuators being provided with their associated tag names as indicated on the design drawings and/or specifications, service process area and the size of the valve they are actuating.

C. Product data:
   1. Electrical ratings:
      a. Voltage and number of phases.
      b. Starting and running current.
      c. Voltage levels and source for control and status.
   2. Description of integral control interface.
   3. Remote control station components (If applicable).
   4. Environmental ratings, including NEMA enclosure rating and submergence capabilities.
   5. Gear ratios for both manual and motorized actuation.
   6. Opening and closing directions.
   7. Allowable starts per hour.
   8. List of all included options and accessories.
   9. Full travel times.
   10. Gearbox data including gear ratio, and gearbox efficiency.

D. Shop drawings:
   1. Wiring diagrams:
      a. Include all options and expansion cards furnished with each actuator.
   2. Dimensioned drawings of each valve and actuator combination.

3. Dimensioned drawings of each valve gearbox.
4. Electric motor data.

E. Calculations:
1. Operating torque.
2. Maximum torque calculations for seating and unseating.
3. Maximum operating torque at starting and normal operation.
4. Signed by Professional Engineer licensed in the State where project is located.

F. Provide draft vendor operation and maintenance manual as specified in Section 01_78_24 - Operation and Maintenance Manuals:
1. Include a list of all configurable parameters, and the final values for each.
2. Include a troubleshooting chart covering the complete valve and controls/electrical power systems, showing description of trouble, probable cause, and suggested remedy.

G. Commissioning submittals:
1. Provide Manufacturer's Certificate of Source Testing as specified in Section 01_75_17 – Commissioning:
a. Affidavit in accordance with AWWA C542.
2. Provide Manufacturer's Certificate of Installation and Functionality Compliance as specified in Section 01_75_17 - Commissioning.

H. Project closeout documents:
1. Provide final vendor operation and maintenance manual as specified in Section 01_78_24 - Operation and Maintenance Manuals.

1.04 WARRANTY

A. Provide warranty as specified in Section 01_78_36 - Warranties and Bonds.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers for lines 4 inch and larger:
1. The following, no equal will be accepted:
a. Auma:
1) SA (multi-turn) with Aumatic AC controls.

2.02 CHARACTERISTICS FOR ACTUATORS ON UV CHANNEL SLIDE GATES

A. Provide actuators complete and operable with all components and accessories required for operation.

B. Power supply:
1. Voltage and phases as indicated in the Motorized Actuator Schedule.
2. Valve or gate motion independent of power supply phase rotation.
3. Provide an internal backup power source or mechanical indicator to maintain settings and track valve position when main power is off.

4. The actuators shall incorporate all major components such as the motor, starter, local controls, terminals, etc. housed within a self-contained, sealed enclosure.

C. Size actuator to move gates from full open to closed position within the time indicated in the Motorized Actuator Schedule:
   1. If an operating time is not indicated on the Motorized Actuator Schedule, size the actuator to move gates or valves at minimum 12 inches per minute under maximum load.
   2. Size actuators so that gear boxes are not required where possible.

D. Control interface:
   1. Configuration:
      a. Provide a non-intrusive, non-contacting interface for configuring all input and output settings, control values, ranges, torque switch settings, valve positions switch settings, and options:
         1) Configurable from a handheld configuring tool or input devices on the actuator.
   2. Local interface, integral to actuator:
      a. Non-intrusive, non-contacting selector switches:
         1) LOCAL-OFF-REMOTE:
            a) Motor actuator operation is prevented with the switch in OFF.
         2) OPEN-STOP-CLOSE:
            a) Controls the valve when LOCAL-OFF-REMOTE is in LOCAL.
            b) Momentary pushbuttons.
            c) Configurable between maintained (actuator runs until end of travel, high torque, or a LOCAL-OFF-REMOTE is switched to OFF) and momentary (actuator stops when STOP pushbutton is depressed).
         3) RESET:
            a) Momentary pushbutton which when depressed clears an actuator alarm condition following resolution of the alarm condition.
      b. Local display:
         1) Valve fully open and fully closed indicators.
         2) Numerical display showing actual valve or gate position in percent of travel.
   3. Coatings:
      a. Material requirements:
         1) Factory prime and coat with an ISO 12944 classification coating of C5M (Marine, offshore estuaries with high salinity) coating with 15 year durability.
         2) Touch-up damaged coatings with manufacturer provided coating repair kit.
      b. Application requirements:
         1) Painting shall commence within four hours of blast cleaning.
         2) Each paint coat within the system is to be applied in accordance with the paint manufacturer's instructions.
         3) Paint thickness shall be checked for each coat on each actuator.

c. Qualification requirements:
    1) Operators shall be experienced and proficient in surface preparation and coating application techniques.
    2) Personnel shall have relevant knowledge of health and safety hazard, use of protective equipment, coating materials, mixing and thinning coatings, coating pot life, surface requirements etc.
    3) Personnel carrying out inspection or verification shall be certified as NACE coating inspector or equivalent such as ICorr.

4. Control inputs:
    a. Capable of using discrete 24 VDC.
    b. Controls the valve when LOCAL-OFF-REMOTE is in REMOTE.
    c. Isolated inputs capable of operating from external control voltage source or internal power supply:
    d. Provide the following inputs:
        1) OPEN.
        2) CLOSE.
        3) STOP.
    e. OPEN and CLOSE inputs configurable between maintained (actuator runs until end of travel, high torque, or a STOP input) and momentary (actuator stops when command is removed).
5. Status outputs:
    a. Monitor relay output: Dry contact, normally closed, opens when actuator is not in REMOTE or in the event of any internal fault or alarm condition.
    b. Dry contact outputs configured for the functions. Provide the following outputs for all actuators:
        1) Fully closed.
        2) Fully open.
        3) LOCAL-OFF-REMOTE in REMOTE position.
    c. Capable of being configured for the following additional functions as recommended by the UV system supplier:
        1) Communications failure.
        2) High motor temperature.
        3) Valve opening or closing.
        4) Valve moving (continuous or pulsing).
        5) Motor tripped on torque in mid-travel.
        6) Motor stalled.
        7) Actuator being operated by hand wheel.
        8) Open or close interlock active.
        9) ESD active.
        10) Motor tripped on torque in mid-travel.
        11) Motor tripped on torque going open.
        12) Motor tripped on torque going closed.
        13) Pre-set torque exceeded.
        14) Valve jammed.
        15) Lost main power phase.
        16) Control supply lost.
        17) Battery low (when applicable).
        18) Internal failure detected.
    d. All output contacts rated for 5 amps, 120 VAC, and 24 VDC.

6. Analog input:
    a. Provide a 4-20 milliampere analog input for analog modulating valves as scheduled and when indicated on the Drawings.
    b. Modulate valve to maintain position based on analog input value.
    c. Maximum input impedance 250 ohms.
7. Analog output:
    a. Provide an isolated 4-20 milliampere analog output as scheduled and when indicated on the Drawings:
        1) Loop power sourced from the actuator power supply.
        2) Capable of driving into a load up to 500 ohms.
        3) Output proportional to process value(s) as required by the UV system equipment.
        4) Valve or gate position.

E. Features:
1. Time delay on reversal: Incorporate time delay between stopping actuator and starting in opposite direction to limit excessive current, torque, and heating from instantaneous reversal.
2. Data logging:
    a. Store diagnostic data and reference data.
    b. Time-stamped historical operating data, including number of operations and most recent operations.
    c. Starting torque, maximum running torque, and end of travel torque:
        1) Store reference data (recorded during commissioning) and data from last operation.
3. Provide display of logged data on the actuator, or provisions to download to a personal computer.

F. Materials:
1. Construct motorized actuators of materials suitable for the environment in which actuator is to be installed:
    a. Enclosure ratings:
        1) As scheduled with the following requirements:
            a) All actuators will be double sealed for corrosion protection rated at ip68.
        2) NEMA 4X for all actuators located outside of Class I areas.
        3) All others shall be rated FM - Class I Groups B,C & D and Class II E, F, & G.

G. Components:
1. Motors:
    a. Specifically designed for valve actuator service with high starting torque, totally enclosed non-ventilated construction.
    b. Torque ratings equal to or greater than that required for seating and dynamic torques with a 25 percent factor of safety:
        1) Design requirements for slide gates, gate valves, knife gate valves, globe valves, and diaphragm valves:
            a) Design valves, gates and actuators for maximum operating torque, in accordance with and using safety factors required in AWWA C542.

b) Design for the maximum torque and thrust running load over the full cycle.
c) Maximum torque or thrust rating: The actuator stall torque or maximum thrust output shall not exceed the torque or thrust capability of the valve or gate, as determined by the valve or gate manufacturer.

c. Capable of being removed and replaced without draining the actuator gear case.
d. Motor bearings shall be amply proportioned of the anti-friction type and permanently lubricated.
e. Rated for operating under the following conditions without exceeding temperature limits with ambient temperature of 40 degrees Celsius:
1) Continuous operation for 15 minutes or twice the open-to-close operating time (whichever is greater) at normal operating torque or 33 percent of maximum torque (whichever is greater).
2) 60 starts per hour for open/close service or 1,200 starts per hour for modulating service.
f. Provide the following motor protection features:
1) Jammed valve/gate (no valve/gate motion detected through a time delay).
2) High motor temperature (sensed by an embedded thermostats).
3) High torque.
4) Single phasing protection.

H. Enclosures:
1. Actuator housing ratings as indicated in the Motorized Actuator Schedule.
2. Stainless steel external fasteners.
3. Provide o-ring seals for each of the following areas:
a. Between the terminal compartment and the internal electrical elements.
b. Between the mechanical and electrical portions to protect from the ingress of oil, and to protect the mechanical components of oil from dust and moisture when the electrical terminal is open.
4. Provide actuators with the following minimum enclosure ratings as scheduled:
a. NEMA Type 4X enclosure for general applications.

I. Position sensing:
1. Electronic and adjustable using a solid-state encoder wheel:
a. Mechanical limit switches and potentiometers are not acceptable.
2. Capable of retaining position and monitoring valve or gate motion when valve is manually actuated and when main power is not present.
3. Valve range and position switch outputs field adjustable.

J. Torque sensing:
1. Torque shutdown setting: 40 percent to 100 percent rated torque:
a. Adjustable in 1 percent increments.
2. Torque display: 0 to 100 percent-rated torque.
3. Capable of interrupting control circuit during both opening and closing and when valve torque overload occurs.
4. Electrical or electronic torque sensing.
5. Independent of variations in frequency, voltage, or temperature.

6. The actuator shall store actual operational torque curves for retrieval by plant maintenance staff.
7. Provide a temporary inhibit of the torque sensing system during unseating or during starting in mid-travel against high inertia loads.
8. Provide visible verification of torque switch status without any housing disassembly.

K. Manual actuators:
1. Hand wheel for manual operation:
a. Maximum 60-pound pull on rim when operating gate or valve under maximum load.
b. Provide pull chain when motorized actuator is located more than 6 feet above floor surface:
1) Chain shall be of sufficient length to reach approximately 4 feet above the operating level.
2) Where the chain obstructs an aisle or walkway, provide holdback or other means to ensure chain does not create a nuisance or hazard to operating personnel.
3) Provide Type 316 stainless steel.
2. Declutch lever: Padlockable, capable of mechanically disengaging motor and related gearing and freeing hand wheel for manual operation.

L. Gearing: Hardened alloy steel spur or helical gears and self-locking, alloy bronze worm gear set:
1. Accurately cut to ensure minimum backlash.

M. Bearings:
1. Anti-friction bearing with caged balls or rollers throughout.
2. Sealed-for-life type thrust bearings housed in a separate thrust base.

N. Drive bushing:
1. Easily detachable for machining to suit the valve stem or gearbox input shaft.
2. Positioned in a detachable base of the actuator.

O. Lubrication:
1. Provide totally enclosed actuator gearing with oil or grease filled gear case suitable for operation at any angle.
2. Actuators requiring special or exotic lubricants are not acceptable.

2.03 ACCESSORIES

A. Software:
1. Furnish PC-based diagnostic and configuration software to display diagnostic data and configure actuators.
2. Provide software communications to the valve actuator using Bluetooth wireless communications:
a. Provide all accessories and drivers required for operation and communications with a standard personal computer running Microsoft Windows.

2.04 SPARE PARTS AND SPECIAL TOOLS

A. As specified in Section 01_60_00 - Product Requirements.

B. Spare parts:
   1. Provide the following (minimum 10 percent of total number of actuators of each model type furnished, but not less than 1 for each model of actuator furnished):
      a. Stem nut.
      b. Worm shaft subassembly.
      c. Drive sleeve subassembly.
      d. Complete actuator seal kit.
      e. Actuator gearbox oil (sufficient quantity to fill 4 gearboxes).
      f. Encoder.
      g. Control module.
   2. Provide 1 spare motor for each size motor furnished where identified on Attachment A - Intelligent Actuator Schedule.

PART 3 EXECUTION

3.01 GENERAL

A. As specified in Section 46_05_10 - Common Work Results for Mechanical Equipment.

B. Position visual indicators so that they are most easily visible.

C. Operation of related existing equipment:
   1. Owner will operate related existing equipment or facilities necessary to accomplish the testing.
   2. Schedule and coordinate testing as required by Section 01_75_17 Commissioning.

D. Provide necessary test instrumentation that has been calibrated within 1 year from date of test to recognized test standards traceable to the NIST or approved source:
   1. Properly calibrated field instrumentation permanently installed as a part of the Work may be utilized for tests.
   2. Prior to testing, provide signed and dated certificates of calibration for test instrumentation and equipment.

E. Test measurement and result accuracy:
   1. Use test instruments with accuracies as recommended in the appropriate referenced standards. When no accuracy is recommended in the referenced standard, use 1 percent or better accuracy test instruments:
      a. Improved (lower error tolerance) accuracies specified elsewhere prevail over this general requirement.
   2. Do not adjust results of tests for instrumentation accuracy:
      a. Measured values and values directly calculated from measured values shall be the basis for comparing actual equipment performance to specified requirements.

3.02 COMMISSIONING

A. As specified in Section 01_75_17 - Commissioning, Section 46 66 85 - Ultraviolet Disinfection System and this Section.

B. Manufacturer services:
   1. Provide certificates:
      a. Manufacturer's Certificate of Source Testing:
         1) Proof-of-Design and Performance Test Reports in accordance with AWWA C542.
      b. Manufacturer's Certificate of Installation and Functionality Compliance.
   2. Manufacturer's Representative on-site requirements:
      a. Installation: 1 trips, 2-day minimum each.
      b. Functional testing: 2 trips, 2-day minimum each.
   3. Training:
      a. Maintenance: 4 hours per session, 2 sessions.
      b. Operation: 2 hours per session, 2 sessions.

C. Source testing:
   1. Design and Performance Test Reports in accordance with AWWA C542.
   2. Test each actuator with a simulated load:
      a. Simulate a typical valve load.
   3. Electrical Instrumentation and Controls:
      a. Test witnessing: not witnessed.
      b. Conduct testing as specified in Section 40_80_01 - Commissioning for Instrumentation and Controls.

D. Functional testing:
   1. Installed actuator:
      a. Test witnessing: Witnessed.
      b. Conduct General Equipment Performance Tests.
         1) For equipment, operate, rotate, or otherwise functionally test for at least 2 hours after components reach normal operating temperatures.
            1. Operate at rated design load conditions.
         2) Confirm that equipment is properly assembled.
            2. Confirm the equipment moves or rotates in the proper direction.
         3) Confirm shafting, drive elements, and bearings are installed and lubricated in accordance with proper tolerances.
            3. Confirm that no unusual power consumption, lubrication temperatures, bearing temperatures, or other conditions are observed.
   2. Electrical Instrumentation and Controls:
      a. Test witnessing: Witnessed.
      b. Conduct testing as specified in Section 40_80_01 - Commissioning for Instrumentation and Controls.

3.03 INTELLIGENT ACTUATOR SCHEDULE

A. Provide actuators indicated on the Drawings:
   1. Major process actuators are listed in the Intelligent Actuator Schedule shown in Attachment A - Intelligent Actuator Schedule.

END OF SECTION

ATTACHMENT A - INTELLIGENT ACTUATOR SCHEDULE

INTELLIGENT ACTUATOR SCHEDULE

Item	Reference DWG	Type	Size	Duty	NEMA Rating	Voltage/ Phase/ Hz	Notes	Service	Controls
UV Channel No. 1 Inlet Gate	40N01, M01	SG	Note 2	STD	4X	480/3 60 Hz	1	O/C	D O/C
UV Channel No. 2 Inlet Gate	40N01, M01	SG	Note 2	STD	4X	480/3 60 Hz	1	O/C	D O/C
UV Channel No. 1 Outlet Weir Gate	40N01, M01	SG	Note 2	MD	4X	480/3 60 Hz	3	MOD	A
UV Channel No. 2 Outlet Weir Gate	40N01, M01	SG	Note 2	MD	4X	480/3 60 Hz	3	MOD	A

Notes:

(1) Provide actuators with remote control station.

(2) Refer to Specification Section 40_05_59.20 – Low-Head Fabricated Stainless Steel Slide Gates.

(3) Provide 1 spare motor for the pair of Weir Gates.

Abbreviations:

Types:

BFV = Butterfly Valve.
BV = Ball Valve.
PV = Plug Valve.
SG = Slide Gate.

Duty:

ST = Standard service (0-60 starts/hr) duty.
MD = Modulating duty (~1000 starts/hr).

Service:

O/C = Open/Close.
MOD = Modulating.

Controls:

A = Analog (4-20 mA) control, modulating.
D O/C = Discrete open/close.
FF = Foundation Fieldbus H1.

SECTION 40_05_59.20

LOW-HEAD FABRICATED STAINLESS STEEL SLIDE GATES

PART 1 GENERAL

1.01 SUMMARY

A. Section includes:
   1. Low-head fabricated stainless steel slide gates:
      a. Gate Schedule is included in this Section.

B. As specified in Section 01_60_00 - Product Requirements.

1.02 REFERENCES

A. American Water Works Association (AWWA):
   1. C561 - Fabricated Stainless Steel Slide Gates.

B. American Welding Society (AWS):
   1. D1.6 - Structural Welding Code-Stainless Steel.

C. ASTM International (ASTM):
   1. A276 - Standard Specification for Stainless Steel Bars and Shapes.
   2. B584 - Standard Specifications for Copper Alloy Sand Castings for General Application.
   3. D2000 - Standard Classification System for Rubber Products in Automotive Applications.
   4. D4020 - Standard Specification for Ultra-High-Molecular-Weight Polyethylene Molding and Extrusion Materials.

1.03 TERMINOLOGY

A. The words and terms listed below are not defined terms that require initial capital letters, but, when used in this Section, have the indicated meaning:
   1. Design head: Depth from surface of water to centerline of gate. Use value specified in the gate schedule.
   2. Seating head: Pressure applied to gate slide from weight of water column above gate centerline that forces gate slide into seat.
   3. Slenderness ratio (l/r): The largest ratio obtained by dividing the unsupported length of the stem by the radius of gyration of the stem cross section.
   4. Substantially similar:
      a. Similar in size, design head, and service.
      b. Utilizes the proposed design for critical components including guides and seals.
   5. Unseating head: Pressure applied to gate slide from weight of water column above gate centerline that forces gate slide away from seat.

1.04 DELEGATED DESIGN

A. Contractor or Subcontractor shall retain a licensed professional engineer to perform Delegated Design.

B. Qualifications:
   1. Holding a current license to perform the specified design in the same jurisdiction as the Project site.
   2. Experienced in designing similar systems of similar complexity.

C. Items requiring Delegated Design from this section:
   1. Anchoring and bracing.

1.05 SUBMITTALS

A. Submit as specified in Section 01_33_00 - Submittal Procedures and Section 01_60_00 - Product Requirements.

B. Delegated Design Submittals:
   1. Anchoring and bracing: Provide project-specific calculations based on support conditions and requirements to resist loads specified in Section 01_81_50 - Design Criteria.

C. Shop Drawings:
   1. Layout and installation drawings for each gate size and type.
   2. Complete bill of materials.

D. Installation instructions:
   1. Detail the complete installation of the equipment including rigging, moving, and setting into place.
   2. Provide manufacturer's installation instructions.

E. Calculations:
   1. Calculations and design data substantiating conformance with the Drawings and Specifications.
   2. For coordination purposes, gate manufacturer shall supply calculations verifying the suitability of the selected operator for the application:
      a. For all gates:
         1) The maximum torque required for operation of the gate (including breakaway from seat) with a safety factor of 1.4.
         2) Indicate thrust value and stem factor.
      b. For each electrically actuated gate include:
         1) Open/close speed as specified in Section 40_05_57.24 - Electric Actuators.
         2) The torque supplied by the motorized operator scheduled in Section 40_05_57.24 - Electric Actuators for the operating speed specified in Section 40_05_57.24 - Electric Actuators.
         3) The thrust output capacity of the motorized operator with the furnished motor.
   3. Gate opening and closing thrust forces that will be transmitted to the support structure with operator at extreme positions and load.

4. Guide frame in accordance with AWWA C561 stress threshold compliance for exterior guide leg and fasteners.

F. Commissioning Submittals:
   1. As specified in Section 01_75_17 - Commissioning, including the following:
      a. Manufacturer's representative qualifications.
      b. Certificates:
         1) Requirements as specified in this Section.
      c. Test Plans:
         1) Test requirements as specified in this Section.
      d. Test Reports.
      e. Manufacturer's representatives field notes and data.

G. Leakage test results.

H. Vendor operation and maintenance manuals: As specified in Section 01_78_24 - Operation and Maintenance Manuals

1.06 QUALITY ASSURANCE

A. Factory markings:
   1. Mark gates according to the scheduled equipment tag numbers when such numbers are used.
   2. For thimbles, frames, and other non-interchangeable components, match mark the entire system.

B. Assembled gates: Shop inspected, adjusted, and tested before shipment.

1.07 WARRANTY

A. Provide warranty as specified in Section 01_78_36 - Warranties and Bonds.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. One of the following or equal:
   1. H. Fontaine, Series 20 or 25.
   2. Whipps, Inc., Series 900.
   3. Waterman Industries, Inc., equivalent product.
   4. Rodney Hunt, Series A-111 or A-112.
   5. Hydro Gate, equivalent product.
   6. RW Gate, equivalent product.
   7. Golden Harvest, Series 44 or 46.

B. Operators and anchor bolts: Provided by slide gate manufacturer.

2.02 DESIGN AND PERFORMANCE CRITERIA

A. Except as modified or supplemented in this Section, all gates and operators shall conform to the requirements of AWWA C561, latest edition.

B. Gate components:
   1. Frames:
      a. Design for the design head scheduled with a minimum safety factor of 5 with regard to ultimate tensile, compressive, and shear strength.
      b. Self-contained gates: Where frames extend above the operating floor, design to be self-supporting so that no further reinforcing or support is required.
   2. Stem: Select stem diameter, stem guide quantity and stem guide spacing based on following criteria:
      a. Slenderness ratio (l/r): Shall not exceed 200.
      b. Maximum diameter: Provide stem guides at a spacing to maintain stem diameter of 2 inches or less.
      c. Tensile strength: Suitable to withstand the force generated by the operator with the application of a 200 pound force applied to the crank or handwheel or a 250 foot-pound torque applied to the wrench nut.
      d. Compressive strength:
         1) Suitable to withstand buckling due to the force generated by the operator with the application of an 80 pound force applied to the crank or handwheel or a 100 foot-pound torque applied to the wrench nut.
         2) Determine buckling load using Euler Column formula in accordance with AWWA C561, where C = 2.
      e. Design force for power actuators:
         1) Electric motor operators: 1.25 times the output thrust in the stalled-motor condition.
   3. Thrust nut: Suitable to withstand thrust developed by operator with the application of a 40 pound force on the crank or handwheel with safety factor of 5. Base design on ultimate strength of material used.
   4. Yokes for self-contained gates:
      a. Design yoke using design loading criteria for stem with safety factor of 5 based on the ultimate strength of the material used.
      b. Maximum deflection at design load: Not to exceed 1/360 of the span.
   5. Slide:
      a. Deflection shall be less than or equal to 1/540 of the span of the gate or 1/16 inch, whichever is less, under the design head.
      b. Design for the maximum design head specified with a minimum safety factor of 5 with regard to ultimate tensile, compressive, and shear strength.

C. Maximum allowable leakage shall be 0.05 gallons per minute per foot of sealing perimeter, half the allowable limit set forth in AWWA C561. Leakage testing shall be conducted in accordance with AWWA C561.

2.03 MATERIALS

A. Stainless steel, ASTM A276, Type 304:
   1. Components or structural shapes which are welded:
      a. Materials: Type 304L stainless steel.
      b. Manufacturer's shop welds, welding procedures, and welders:
         1) Qualified and certified in accordance with the requirements of AWS D1.6.
   2. All wetted and unwetted parts including all fasteners and hardware, except as specified in this Section, shall be stainless steel.

B. Manganese bronze: ASTM B584, UNS Number C86500 or Alloy 432.

C. Neoprene, ASTM D2000, Grade 2 BC 510.

D. Ultra-high molecular weight polyethylene, ASTM D4020, virgin materials only.

E. Silicon bronze: ASTM B584 UNS Number C87300.

2.04 COMPONENTS

A. Slide:
   1. Type 304L stainless steel.
   2. Rectangular or square.
   3. Fabricated with a flat plate reinforced with formed plates or structural members.

B. Frame:
   1. Construct gate frame of Type 304L stainless steel structural members or formed plate welded to form a rigid 1-piece frame:
      a. Capable of providing true dimensions within tolerances and preventing binding and excessive wear of sliding parts.
   2. Mounting: As indicated on the Drawings and Slide Gate Schedule:
      a. Centerline of anchors shall be located no closer than 4-1/2 inches from the edge of concrete opening for face-mounted gates.
   3. Adjustable ultra-high molecular weight polyethylene pressure pads.
   4. Flush bottom type unless otherwise indicated on the Drawings.
   5. Allow replacement of top, side, and bottom seals without removing the gate frame from concrete.
   6. Embedded gates: Extend frame to provide access to pressure pad adjusting screws (For seal design alternatives A and B only).

C. Yoke for self-contained gates:
   1. Type 304L stainless steel.
   2. Extend guides and frame so that bottom of yoke is at least 12 inches above top of slide at full open position.
   3. Bolt or weld to frame.
   4. Provide mounting plate on top of yoke to mount operator.
   5. Design yoke to allow removal of gate slide.

D. Guides:
   1. Type 304L stainless steel with ultra-high molecular weight polyethylene insert in contact with gate.
   2. Minimum face width of 1 inch.
   3. Length: To support the slide fully in the open position.
   4. Anchor bolts shall not pass through the guides and seals.

E. Seals:
   1. Designed to achieve the specified leakage requirements.
   2. Sealing and sliding surfaces shall provide a low coefficient of friction with the surface of the slide.
   3. Field replaceable without removing gate from concrete or wall thimble.
   4. Anchor bolts shall not pass through the guides and seals.
   5. Minimum seating surface width: 3/4 inch in contact with slide.
   6. Bottom seal:
      a. Resilient neoprene or EPDM, minimum durometer of 45.
      b. Attached to the bottom of the slide or embedded in gate frame invert.
      c. Compressed by closing action of gate slide against plate for all standard upward opening gates.
   7. Side and top seals: Provide seal design listed below:
      a. UHMWPE self-adjusting type seals: Utilize a continuous silicon or nitrile compression cord to ensure contact between the seals and the slide:
         1) Side seals:
            a) Attach to frame using one of the following approaches:
               (1) Held in place between the front and back angles of the guide with Type 316 stainless steel bolts passing through the guide and seal along the length of the guide.
               (2) Held in place between front and back of a formed, 1 piece, rigid channel guide. Attach seals to frame using Type 316 stainless steel bolts.
            b) Design and installation shall provide access to and removal of the bolt to allow removal of the side seal without removing the gate from the concrete.
         2) Top seal:
            a) UHMWPE self-adjusting type seal with a single or double compression cord.
   8. Provide invert seal for all downward (weir) gates.
   9. Set seals to be slightly compressed with slide in closed position.

F. Stem:
   1. Material: Type 304 stainless steel.
   2. Diameter: Capable of withstanding anticipated opening and closing thrusts under head as indicated on the Drawings. Minimum stem diameter: 1-1/2 inch at the threads.
   3. Length: Capable of permitting easy installation and removal.
   4. Stem couplings:
      a. Silicon bronze or Type 304 stainless steel.
      b. Threaded and keyed to stem or threaded and bolted to stem.
   5. Stem guides:
      a. Type 304 stainless steel.
      b. Split collar.

c. Adjustable in 2 directions.
d. Ultra-high molecular weight polyethylene bushing.

6. Provide manganese bronze stop collar on stem above actuator.
7. Drill and connect stem to slide structural sections with Type 304 stainless steel bolts.
8. Coordinate the selection of the gate stem configuration with the gate operator and operating speed:
   a. The selected gate stem configuration shall provide the most efficient combination of stem diameter/pitch/lead and keep the operating temperature at the stem nut to a minimum during operation.
   b. For motorized applications, if the proposed gate stem configuration would result in any deviation from the operating rise rate specified in Section 40_05_57.24 - Electric Actuators, submit proposed deviation for approval by the Engineer.

G. Gate operators: As scheduled and specified in Section 40_05_57.24 - Electric Actuators:
   1. Provide cranks and gears necessary to bring operator to height specified, or typical operator height of 3 feet 6 inches if not otherwise shown.

H. Coordination with motorized operator supplier:
   1. Sizes and model numbers of motorized operators for gates are estimated in Section 40_05_57.24 - Electric Actuators. Gate manufacturer's responsibility shall extend to confirming these sizes and model numbers for each gate based on:
      a. Design seating and unseating head.
      b. Open/close speed specified in Section 40_05_57.24 - Electric Actuators.
      c. Torque safety factor of 1.4, minimum, applied to the maximum torque requirement, including breakaway from seat.
   2. Verify, in writing, that the motorized operators are adequately sized.
   3. If the motorized operators are not properly sized for each furnished gate, notify the Engineer immediately.
   4. In the event that a different size or model is required for any gate, gate manufacturer shall advise Contractor of the proper selection and Contractor shall provide, at no additional cost, the proper operator.
   5. The gate supplier shall machine the stem nuts, provide proper mounting adaptation, and adaptation hardware to ensure adequate interface between the motorized operators and the slide gates.

I. Bolts, nuts, and fittings: Type 304 stainless steel.

J. Anchor bolts: Type 316 stainless steel of sufficient quantity and length to anchor the gate:
   1. Quantity, size, and location of anchor bolts shall be determined by the gate manufacturer in accordance with requirements of Section 46_05_10 - Common Work Results for Mechanical Equipment.

2.05 FINISHES

A. Stainless steel: Remove weld splatter and polish scratches after fabrication to produce an even color and sheen.

2.06 FABRICATION

A. Shop assembly:
   1. Gates shall be factory assembled, adjusted, and tested.
   2. Mount all accessories and appurtenances including, but not limited to, motor operators and limit switches so that the complete system may be tested at the factory.

PART 3 EXECUTION (TO BE COMPLETED UNDER INSTALLATION CONTRACT)

3.01 EXAMINATION

A. Inspect all components for shipping damage, conformance to specifications, and proper torques and tightness of fasteners, as specified in Section 46_05_10 - Common Work Results for Mechanical Equipment

3.02 PREPARATION

A. Anchoring and bracing to structures:
   1. Prepare equipment anchor setting template(s) and use to position anchors during construction of supporting structure(s).
   2. Install anchors of type and material indicated on approved anchoring designs.

B. Install anchors with embedment indicated on approved anchoring designs.

3.03 INSTALLATION

A. Install equipment as indicated on the Drawings and as specified in Section 46_05_10 - Common Work Results for Mechanical Equipment and in accordance with the accepted installation instructions and anchorage details.

B. Mount thimbles and gates plumb in both vertical planes and level in horizontal plane.

C. Coat seating surfaces between frame and wall thimble with a waterproof plastic compound or provide EPDM gasket prior to tightening frame studs.

D. Adjust wedges or other parts of the gate to the point where it will not be possible to insert a 0.004 inch feeler gauge between the gate slide and the gate frame at any point:
   1. Securely lock wedges into position after adjustment.

E. Adjust limit switches in electric and hydraulic operators in accordance with manufacturer's instructions.

F. Face mounted gates:
   1. Mount gate to wall with anchor bolts and provide a 1-inch grout pad in accordance with manufacturer’s recommendations.

G. Embedded gates:
   1. Provide blockouts in sidewalls and/or channel bottom for installation of gates.
   2. After gate placement, adjustment, and alignment in accordance with manufacturer's recommendations, grout frame with non-shrink grout.

3.04 COMMISSIONING

A. As specified in Section 01_75_17 - Commissioning.

B. Source Testing (Factory Acceptance Tests):
   1. Not witnessed.
   2. Furnish test reports and Manufacturer's Certificate of Source Testing.

C. Installation Verification:
   1. Furnish Manufacturer's Certificate of Installation Verification.

D. Functional Testing:
   1. Test witnessing: Witnessed.
   2. After installation and checking, run each gate through at least 2 full cycles from closed position to fully open and back to closed position.
   3. Leakage tests:
      a. Conduct in accordance with AWWA C561.
      b. Comply with specified allowable leakage limits.
   4. Furnish Manufacturer's Certificate of Functional Compliance and leakage test.

3.05 GATE SCHEDULE

A. The Gate Schedule is as specified in Attachment A - Gate Schedule.

B. Gate Schedule is not a take-off list:
   1. Contractor shall provide gates specified and as indicated on the Drawings.

END OF SECTION

ATTACHMENT A - GATE SCHEDULE

GATE SCHEDULE

GATE SCHEDULE													
Gate Tag Number	Drawing Number	Location	Opening Size W x H (inches) [7]	Wall Opening Shape	Gate Opening Direction	Type of Closure[1]	Gate Design Pressure[2]		Gate Mounting[3]	Frame Type[4]	Stem Type[5]	Type of Operator[6]	Minimum Gate Travel (inches)[7]
							Seating (feet)	Unseating (feet)					
40-G-11-FEF	40N01, M01	UV Ch. 1	52”x82” [8]	Rec-tangle[8]	Up	FB	4	4	FM/EC (side), EMB (btm) [8]	SC	NRS	MO	82”
40-G-21-FEF		UV Ch. 2											
40-G-12-FE		UV Ch. 1	42”x66”	Rec-tangle	Down	DO	N/A	4	FM (side,btm), FM/EC (side)	SC	RS	MOD	42”
40-G-22-FE		UV Ch. 2											

Notes:

(1) Closure: DO = Downward Opening; FB = Flush Bottom; STD = Standard.

(2) Gate design pressure applied at centerline of gate.

(3) Mounting: FM = Face Mounted; EC = Inside Existing Channel; EMB = Embedded; SP = Spigot back; FWT = “F” Wall Thimble; EWT = “E” Wall Thimble;

(4) Frame: SC = Self-Contained; NSC = Non-Self Contained; F = Flatback; FL = Flange back.

(5) Stem: RS = Rising Stem; NRS = Non-Rising Stem.

(6) Operator: CO = Hand crank operator with 2-inch AWWA nut for portable operator; HW = Handwheel; HC = Hand crank; MO = Motor Operator; MOD = Modulating Motor Operator; HO = Hydraulic Operator; MHO = Manual Hydraulic Operator (Hand Pump); BS = Bench Stand; FS = Floor Stand; IFS = Interconnect Floor Stand; PS = Pedestal Support.

(7) Final gate dimensions to be confirmed after UV equipment selection; dimensions shown are based on maximum anticipated dimensions for bidding proposal purposes. Engineer and gate manufacturer to coordinate installation details and dimensions based on selected UV equipment. Engineer will produce revised structural and mechanical drawings after selection.

(8) Influent gates are installed at a 45-degree angle in the channel. Refer to mechanical drawings for layout.

SECTION 40_61_05

PACKAGED CONTROL SYSTEM

TABLE OF CONTENTS

PART 1 GENERAL

1.01 SUMMARY

A. Section includes:
   1. General requirements for a vendor-supplied ultraviolet (UV) disinfection system Master Control Panel (MCP) designed to monitor and control all supplied UV equipment, vendor-supplied power distribution centers (PDCs), UV equipment skids and ancillary equipment furnished for each skid, local control panels at each skid, local control panels for other furnished equipment, and field instruments required for a complete package control system.

1.02 REFERENCES

A. Abbreviations:
   1. CCS: The PCS central computer system (CCS) consisting of computers and software. The personal computer-based hardware and software system that includes the operator interface, data storage, data retrieval, archiving, alarming, historian, reports, trending, and other higher level control system software and functions.
   2. DPDT: Double-pole, double-throw.
   3. ES: Enterprise system: Computer based communications or data sharing system utilized for non-process control functions such as E-mail, sharing files, creating documents, etc.
   4. FAT: Factory acceptance test also known as Source Test.
   5. HART: Highway addressable remote transducer.
   6. HOA: Hand-Off-Auto control function that is totally PLC based. In the Hand mode, equipment is started or stopped, valves are opened or closed through operator direction under the control of the PLC software. In the Auto mode, equipment is started or stopped, and valves are opened or closed through a control algorithm within the PLC software. In the Off mode, the equipment is prohibited from responding from the PLC control.
   7. HMI: Human machine interface is a software application that presents information to an operator or user about the state of a process, and to accept and implement the operators control instructions. Typically, information is displayed in a graphical format.
   8. ICSC: Instrumentation and control system contractor: Subcontractor who specializes in the design, construction, fabrication, software development, installation, testing, and commissioning of industrial instrumentation and control systems. ICSC shall be retained by the project installation General Contractor and shall include PCS Programmer and field installation of control and instrumentation systems for both the supplied UV system equipment and field interconnections between UV system control panels and UV system equipment connections to the Owner’s treatment facility PCS equipment.
   9. IJB: Instrument junction boxes: A panel designed with cord sets to easily remove, replace, or relocate instrument signals.
   10. I/O: Input/Output.
   11. IP: Internet protocol or ingress protection.
   12. LCP: Local control panel: Operator interface panel that may contain an HMI, pilot type control devices, operator interface devices, control relays, etc. and does not contain a PLC or RIO.

13. LAN: Local area network: A control or communications network that is limited to the physical boundaries of the facility.
14. LOI: Local Operator Interface is an operator interface device consisting of an alphanumeric or graphic display with operator input functionality. The LOI is typically a flat panel type of display mounted on the front of an enclosure with either a touch screen or tactile button interface.
15. LOR: Local-Off-Remote control function. In the Remote mode, equipment is started or stopped, and valves are opened or closed through the PLC based upon the selection of the HOA. In the Local mode, equipment is started or stopped, valves are opened or closed based upon hardwired control circuits completely independent of the PLC with minimum interlocks and permissive conditions. In the Off mode, the equipment is prohibited from responding to any control commands.
16. NJB: Network junction box. An enclosure that contains multiple access points to various networks within the facility. Networks could be Ethernet, Ethernet/IP, Fieldbus, RIO, etc.
17. P&ID: Process and instrumentation diagram.
18. PC: Personal computer.
19. PCIS: Process control and instrumentation system: Includes the entire instrumentation system, the entire control system, and all of the Work specified in the Instrumentation and Control Specifications and depicted on the Instrumentation Drawings. This includes all the PCS and instruments and networking components as well as the various servers, workstations, thin clients, etc.
20. PCM: Process control module: An enclosure containing any of the following devices: PLC, RTU, or RIO.
21. PCS: Process Control System: A general name for the computerized system that gathers and processes data from equipment and sensors and applies operational controls to the process equipment. It includes the PLCs and/or RIOs, LOIs, HMIs, both LCPs, VCPs and all data management systems accessible to staff.
22. PJB: Power junction box: An enclosure with terminal blocks that distribute power to multiple instruments.
23. PLC: Programmable logic controller.
24. PS: Power supply.
25. RIO: Remote I/O device for the PLC consisting of remote I/O racks or remote I/O blocks.
26. RTU: Remote telemetry unit: A controller typically consisting of a PLC, and a means for remote communications. The remote communications devices typically are radios, modems, etc.
27. SCADA: Supervisory control and data acquisition system: A general name for the computerized system that gathers and processes data from sensors and equipment located outside of the facility, such as wells, lift stations, metering stations etc.
28. SPD: Surge protection device.
29. SPDT: Single-pole, double-throw.
30. SPST: Single-pole, single-throw.
31. UPS: Uninterruptible power supply.
32. VCP: Vendor control panel: Control panels that are furnished with particular equipment by a vendor other than the ICSC. These panels may contain PLCs, RIO, LOI, HMI, etc.

WAN: Wide area network: A control or communications network that extends beyond the physical boundaries of the facility.

B. Definitions:
   1. Definitions of terms and other electrical and instrumentation considerations as set forth in the:
      a. Factory Mutual or FM Global (FM).
      b. Institute of Electrical and Electronic Engineers (IEEE).
      c. InterNational Electrical Testing Association (NETA).
      d. International Electrotechnical Commission (IEC).
      e. International Organization for Standardization (ISO).
      f. International Society of Automation (ISA).
      g. National Electrical Code (NEC).
      h. National Fire Protection Association (NFPA).
      i. National Institute of Standards and Technology (NIST).
      j. Underwriter Laboratories (UL).
   2. 2-Wire transmitter (loop powered):
      a. A transmitter that derives its operating power supply from the signal transmission circuit and requires no separate power supply connections.
      b. As used in this Section, 2-wire transmitter refers to a transmitter that provides 4 to 20 mA current regulation of a signal in a series circuit with an external 24 VDC driving potential:
         1) Field Bus Communications signal or both.
   3. Control circuit: Any circuit operating at 120 volts alternating current (AC) or 24 volts direct current (DC) or less, whose principal purpose is the conveyance of information (including performing logic) and not the conveyance of energy for the operation of an electrically powered device.
   4. Digital Bus: A communication network, such as Profibus, Foundation Fieldbus, or DeviceNet, allowing instruments and devices to transmit data, control functions, and diagnostic information.
   5. Hardwired control: Control circuitry that does not utilize software to initiate functionality.
   6. Hardwired interlocks: A safety or protective feature that will interrupt operation of the equipment in all operating modes with no required operator intervention.
   7. Panel: An instrument support system that may be either a flat surface, a partial enclosure, or a complete enclosure for instruments and other devices used in process control systems. Unless otherwise specified or clearly indicated by the context, the term “panel” in these Contract Documents is interpreted as a general term, which includes flat surfaces, enclosures, cabinets, and consoles.
   8. Power circuit: Any circuit operating at 90 volts (AC or DC) or more, whose principal purpose is the conveyance of energy for the operation of an electrically powered device.
   9. Powered transmitters: A transmitter that requires a separate power source (120 VAC, 240 VAC, etc.) in order for the transmitter to develop its signal. As used in this Section, the produced signal may either be a 4 to 20 mA current signal, a Digital Bus communications signal or both.
   10. Signal circuit: Any circuit operating at less than 50 volts AC or DC, which conveys analog information or digital communications information.
   11. Software interlocks: A safety or protective feature that will interrupt operation of the equipment when the RTU has control.
   12. The term “panel” in this Section is interchangeable with the term “enclosure”.

C. Code compliance:
    1. The following codes and standards are hereby incorporated into these Specifications:
        a. Institute of Electrical and Electronics Engineers (IEEE):
            1) C62.41.1 - IEEE Guide on the Surge Environment in Low-Voltage (1000V and less) AC Power Circuits.
        b. International Society of Automation (ISA):
            1) 5.4 - Instrument Loop Diagrams.
            2) 20 - Specification Forms for Process Measurement and Control Instruments, Primary Elements, and Control Valves.
        c. National Electrical Manufacturer's Association (NEMA):
            1) 250 - Enclosures for Electrical Equipment (1,000 Volts Maximum).
        d. National Fire Protection Association (NFPA).
        e. Underwriters Laboratories Inc. (UL):
            1) 508 - Standard for Industrial Control Equipment.
            2) 508A - Standard for Industrial Control Panel.
            3) 508C - Power Conversion Equipment.
            4) 489 - Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures.
            5) 913 - Standard for Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, III, Division 1, Hazardous (Classified) Locations.
            6) 1283 - Standard for Electromagnetic Interference Filters.
            7) 1449 - Transient Voltage Surge Suppressors.

1.03 DELEGATED DESIGN

A. Contractor or Subcontractor shall retain a licensed professional engineer to perform Delegated Design.

B. Qualifications:
    1. Holding a current license to perform the specified design in the same jurisdiction as the Project site.
    2. Experienced in designing similar systems of similar complexity.

C. Items requiring Delegated Design from this section:
    1. Anchoring and bracing.

1.04 SUBMITTALS

A. General:
    1. Furnish submittals as specified in Section 01_33_00 - Submittal Procedures and this Section.
    2. Furnish submittals that are fully indexed with a tabbed divider for every component.
    3. Sequentially number pages within the tabbed sections. Submittals and Operations and Maintenance manuals that are not fully indexed and tabbed with sequentially numbered pages, or are otherwise unacceptable, will be returned without review.
    4. Edit all submittals and operation and maintenance manuals so that the submittal specifically applies to only the equipment furnished. Neatly cross out

all extraneous text, options, models, etc. that do not apply to the equipment being furnished, so that the information remaining is only applicable to the equipment being furnished.

5. Use equipment and instrument tags, as **indicated on the Drawings**, for all submittals.

B. Pre-bid information:
   1. These documents have been prepared based on information provided by potential equipment suppliers and existing installations of similar equipment. Suppliers of packaged systems shall provide sufficient information to the Contractor to allow an adequate estimate of the Electrical and Instrumentation Work associated with the installation of the packaged system.
   2. To the extent practical, packaged systems shall be factory assembled and wired. Information on packing splits and other anticipated field wiring requirements shall be provided to the Contractor prior to the bid.
   3. The Contractor shall be responsible to obtain the necessary information to accurately estimate the electrical connections to the packaged system equipment.

C. Product data:
   1. General:
      a. Submitted for non-custom manufactured material specified in this and other sections and indicated on shop drawings.
      b. Include:
         1) Catalog cuts.
         2) Bulletins.
         3) Brochures.
         4) Quality photocopies of applicable pages from these documents.
         5) Identify on the data sheets the project name, applicable specification section, and paragraph.
         6) Identify model number and options for the actual equipment being furnished.
      c. Neatly cross out options that do not apply or equipment not intended to be supplied.
   2. Material and equipment schedules:
      a. Furnish a complete schedule and/or matrix of all materials, equipment, apparatus, and instruments that are proposed:
         1) Include sizes, names of manufacturers, catalog numbers, and such other information required to identify the items.
   3. Instrument data sheets:
      a. Furnish fully completed data sheets, both electronically in Microsoft Word or Excel and in hard copy, for each instrument and component according to ISA 20. Include the following information on the data sheet:
         1) Component functional description specified in this Section and **indicated on the Drawings**.
         2) Manufacturers model number or other product designation.
         3) Tag number specified in this Section and **indicated on the Drawings**.
         4) System or loop of which the component is a part.
         5) Location or assembly at which the component is to be installed.
         6) Input and output characteristics, including digital bus communication.

7) Scale range with units and multiplier.
8) Requirements for electric supply.
9) Requirements for air supply.
10) Power consumption.
11) Response timing.
12) Materials of construction and of component parts that are in contact with, or otherwise exposed to, process media, and or corrosive ambient air.
13) Special requirements or features, such as specifications for ambient operating conditions.
14) Features and options that are furnished.

D. Shop drawings:
1. General:
a. Show all interfaces between any of the following: instruments, vendor control panels, control valves, flowmeters, digital bus network equipment, and other equipment related to the control work provided.
2. Shop drawing requirements:
a. Front, side, and, rear elevations, and top and bottom views, showing all dimensions.
b. Locations of conduit entrances and access plates.
c. Component layout and identification.
d. Schematic and wiring diagrams with wire numbers and terminal identification.
e. Connection diagrams, terminal diagrams, internal wiring diagrams, conductor size, etc.
f. Anchoring method and leveling criteria, including manufacturer's recommendations for the Project site seismic criteria.
g. Weight.
h. Finish.
i. Nameplates with legends:
1) As **indicated on the Drawings**.
j. Temperature limitations, as applicable.
3. Loop drawings:
a. Submit loop drawings for every analog, discrete, and fieldbus signal and control circuit comprising the complete supplied UV disinfection system:
1) Provide a loop drawing submittal that completely defines and documents the contents of each monitoring, alarming, interlock, and control loop for supplier provided equipment.
b. Show every instrument and I/O point on at least one loop diagram.
c. Provide a complete index in the front of each bound volume:
1) Index the loop drawings by systems or process areas.
d. Provide drawings showing definitive diagrams for every instrumentation loop system:
1) Show and identify each component of each loop or system using requirements and symbols from ISA S5.4.
2) Furnish a separate drawing sheet for each system or loop diagram.
e. In addition to the ISA S5.4 requirements, show the following details:
1) Functional name of each loop.
2) Reference name, drawing, and loop diagram numbers for any signal continuing off the loop diagram sheet.

3) Show all terminal numbers, regardless of the entity providing the equipment.
4) Power supply panel, circuit, and breaker numbers for all power feeds to the loops and instrumentation.
5) Designation of and, if appropriate, terminal assignments associated with, every manhole, pull-box, junction box, conduit, and panel through which the loop circuits pass.
6) If a circuit is continued on another drawing show the name and number of the continuation drawing on the loop drawing. Provide complete references to all continuation drawings.

4. Control panel drawings:
   a. Layout drawings:
      1) Submit panel, enclosure, console, and cabinet layout drawings for all items provided.
      2) As a minimum, include the following information:
         a) To scale front, side, and plan views.
         b) Dimensions.
         c) Interior and exterior arrangements.
         d) Mounting information, including conduit entrance location.
         e) Finish data.
         f) Tag number and functional name of items mounted in and on each panel, console, and cabinet.
         g) Nameplate legend including text, letter size, materials, and colors.
   b. Wiring and piping diagrams:
      1) Submit panel wiring and piping diagrams for every panel that contains wiring and/or piping.
      2) Include the following information:
         a) Name of panel.
         b) Wiring and piping sizes and types.
         c) Terminal strip numbers.
         d) Wire tags and labels.
         e) Functional name and manufacturer's designation for items to which wiring and piping are connected.
         f) Electrical control schematics in accordance with ANSI standards.
   c. Calculations:
      1) Provide installation details based on calculated shear and tension forces:
         a) Calculations shall be signed and sealed by a Professional Engineer licensed in the state where the cabinets and panels will be installed.
      2) For assembled enclosures and other equipment with a weight of 200 pounds or more, provide calculations for:
         a) Weight including panel internal components.
         b) Seismic forces and overturning moments.
         c) Shear and tension forces in connections.
      3) Cooling calculations, to include but not limited to:
         a) Highest expected ambient temperature for the enclosure's location.
         b) Internal heat load.

c) Exposure to direct sunlight.
d) Dimensions of the enclosure in inches.
e) Maximum allowable temperature inside the enclosure, based on the lowest operating temperature limit of the installed components.

5. Schematic diagrams:
   a. Submit schematic diagrams for all electrical equipment in ladder diagram format.
   b. Include device and field connection terminal numbers on all schematic diagrams.

E. Process control and LOI software submittal:
   1. A complete listing of the PLC system point I/O database:
      a. Include for each data point, relevant parameters such as range, contact orientation, limits, incremental limits, I/O card byte, I/O hardware address, and PLC assignment.
      b. Organize on a site-by-site basis, separate by point type.
      c. In addition to the active I/O points, list the implemented spare I/O points and the available I/O points remaining on each card, as well as other defined future points specified or shown.
      d. Upon completion of the Work, update all I/O lists to indicate the final as-built configuration of the systems:
         1) Organize as-built I/O list on a site-by-site basis, separated by equipment and point type.
   2. Preliminary LOI screens, including pop-ups, trends, and alarm screens. Provide electronic and hard copy.
   3. Final LOI screens for use by the ICSC in developing graphic screens for Owner's treatment facility PCS system. Provide electronic and hard copy.
   4. Provide a complete, documented listing of all PLC codes.

F. Testing:
   1. For each test specified in this Section, prepare and submit complete test plans, test procedures, test forms, test binders, and test reports, and other submittals, as specified below.
   2. Submit manufacturer's certifications and manufacturer's field reports where required.
   3. Submit Test plans, procedures, forms, and binders for approval by the Engineer before scheduling or performing tests.
   4. Additional test form and test procedure requirements are specified with individual test requirements.

G. Delegated design submittals:
   1. Anchoring and bracing: Provide project-specific calculations based on support conditions and requirements to resist loads specified in Section 01_81_50 - Design Criteria:
      a. To structures for equipment installed in structures designated as seismic design category C, D, E, or F.
      b. For equipment installed outdoors.
      c. For wall mounted equipment weighing 125 pounds or more.

H. Furnish commissioning submittals listed below and specified in this Section as specified in Section 01_75_17 - Commissioning:
   1. Manufacturer's representative qualifications.
   2. Owner training.

1.05 QUALITY ASSURANCE

A. Assemble panels, enclosures, and rack systems along with all internal and external devices, wiring, equipment, and materials in a facility that is recognized by UL to assemble and certify UL-labeled control panels.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Shipping precautions:
   1. After completion of shop assembly and successful Source Testing, pack all equipment, cabinets, panels, and consoles in protective crates and enclose in heavy duty polyethylene envelopes or secured sheeting to provide complete protection from damage, dust, and moisture.
   2. Place dehumidifiers when required, inside the polyethylene coverings.
   3. Skid-mount the equipment for final transport.
   4. Provide lifting rings for moving without removing protective covering.
   5. Display boxed weight on shipping tags together with instructions for unloading, transporting, storing, and handling at the job site.

B. Tagging:
   1. Tag each component and/or instrument to identify its location, instrument tag number, and function in the system.
   2. Firmly attach a permanent tag indelibly machine marked with the instrument tag number, as given in the tabulation, on each piece of equipment provided as part of this Section.
   3. Tag instruments immediately upon receipt in the field.
   4. Prominently display identification on the outside of the package.

1.07 PROJECT OR SITE CONDITIONS

A. As specified in Section 01_81_50 - Design Criteria.

1.08 ADMINISTRATIVE REQUIREMENTS

A. Coordination with ICSC to support installation of the supplied UV system equipment.

B. Meetings:
   1. The Construction Manager shall schedule a coordination meeting with the UV system supplier, Owner, ICSC, ICSC Programmer and Engineer:
      a. The meeting shall take place before installation of control systems equipment.
      b. The supplier shall bring sample LOI graphic screens, including pop-up, trends, and alarm screens.
      c. Sample LOI graphic screens shall be reviewed and discussed.

d. Discuss Ethernet communications between the MCP and connected devices provided by others.
e. Data transfer between the MCP and connected devices shall be discussed, including PLC data register addresses.
f. Additional items for discussion:
    1) Tag Naming Conventions.
    2) Interlock and Permissive definitions.
    3) Standard code blocks for common control functionality.
    4) Alarms: Clearing, formats, colors, and status.

C. Sequencing:
1. After successful completion of the pre-commissioning test as accepted by the Engineer and Owner, the performance test can proceed.
2. The performance test may be performed concurrently with the 7-day operational test specified in Section 01_75_17 - Commissioning.

D. Scheduling.

1.09 WARRANTY

A. As specified in Section 01_78_36 - Warranties and Bonds.

1.10 MAINTENANCE

A. The supplier shall provide the following spare PLC hardware for the PLC equipment in the supplied UV system MCP:
1. 1 spare CPU.
2. 2 spare I/O modules for every type of I/O module in the system.
3. 1 spare PLC rack power supply.
4. 1 spare network and/or communications card for every network or communications card in the system.
5. 1 spare remote adaptor for every remote adaptor in the system.
6. 1 spare chassis for every chassis size in the system.
7. 1 spare network communication cable for every type used in the system.

B. Provide 5 spare fuses of each type and rating furnished.

PART 2 PRODUCTS

2.01 GENERAL

A. Master control panel (MCP):
1. PLC processor, power supply, I/O backplanes, I/O modules, communications modules, and communication cables sized for connected I/O and required spares.
2. LOI on the face of the MCP enclosure for monitoring and control of the package control system.
3. Ethernet communication equipment to provide communications with plant PCS system.
4. Uninterruptable power supply.

5. The MCP shall exercise control over all aspects of the package control system.
6. All PLC and LOI programming required for fully functional package control system.

B. Other control panels:
1. Provide other control panels at the supplier's discretion.
2. I/O modules and equipment necessary to interface with the MCP.
3. Additional LOIs on individual unit skid local control panels at the supplier's discretion.

C. Field instruments for process and equipment monitoring.

2.02 DESIGN AND PERFORMANCE CRITERIA

A. Provide instruments suitable for the installed site conditions including, but not limited to, material compatibility, site altitude, site seismic conditions, humidity, and process and ambient temperatures.

B. Signal transmission:
1. Analog signals:
a. Furnish analog measurements and control signals that vary in direct linear proportion to the measured variable, unless otherwise indicated.
b. Furnish electrical analog signals outside control panels that are 4 to 20 mA 24 VDC, except as indicated.
c. Analog signals within enclosures may be 1 to 5 VDC.
d. Electrically or optically isolate all analog signals from other signals.
e. Discrete output signals:
1) Output type according to the supplier's discretion.
2) Provide external terminal block mounted fuse with blown fuse indication for all discrete outputs.
3) Interposing relays:
a) Provide interposing relays as required.
f. Furnish regulated analog signals that are not affected by changes in supply voltage or load resistance within the unit's rating.
g. Maintain the total 4 to 20 mA loop impedance to 10 percent below the published value at the loop operating voltage.
h. Where necessary, reduce loop impedance by providing current-to-current (I/I) isolation amplifiers for signal re-transmission.

C. Discrete circuit configuration:
1. Configure discrete control circuits to fail safe, on loss of continuity or loss of power.
2. Alarm contacts: Fail to the alarm condition.
3. Control contacts fail to the inoperative condition.

D. Grounding:
1. Provide control panels with a signal ground bus, isolated from the power ground bus:
a. Provide multiple panels in one location with a common point for signal ground bus connection to ground.

2. Single-point ground shields and measurement loops at the source panel external terminals, unless otherwise noted, by bonding to the control panel signal ground bus.
3. Provide isolating amplifiers within control panels for field equipment possessing a grounded input or output, except when the panel circuit is galvanically isolated.

2.03 CONTROL PANEL

A. General:
1. PLC processor, power supply, I/O backplanes, and modules sized for connected I/O and required spares.
2. An LOI shall be provided on the face of the MCP enclosure for monitoring and control of the system. Additional HMIs may be provided on individual units local control panels at the supplier's discretion.
3. The MCP shall exercise control over all aspects of the system. Each UV system field-mounted unit shall be equipped with a control panel containing I/O modules and necessary interface with the MCP.
4. Ethernet communication equipment to provide communications with plant PCS system.
5. The MCP shall continuously monitor all operating parameters, and shall respond to alarms and emergency conditions by shutting down or activating system components. The MCP shall indicate alarm conditions locally at the LOI, and remotely for monitoring by the Owner's treatment plant PCS system.
6. The MCP shall be integrated into the Owner's overall treatment plant PCS system via Ethernet.
7. The MCP shall be capable of sending and receiving equipment status signals, analog data and alarms, and receiving both discrete and analog control signals from the Owner's treatment plant PCS system via Ethernet.
8. The Owner's treatment plant PCS system (configured by the ICSC) will be configured to store data for the system for reports and alarm generation. System manufacturer shall provide information on register addresses on all data, which are to be transmitted. The data register shall be contiguous for each data type.
9. Provide high-speed modem in the MCP for remote troubleshooting of the system via wireless cellular telephone.
10. Uninterruptible power supply.
11. All PLC and LOI programming required for fully functional package control system.

2.04 PROGRAMMABLE LOGIC CONTROLLERS (PLC) HARDWARE

A. PLC hardware shall be the following (no equal to match Owner's facility control system hardware platform):
1. Rockwell Automation ControlLogix.

B. General:
1. Install all communications modules in the PLC backplane.

C. Installed spare requirements:
    1. I/O points:
        a. Provide a minimum of 25 percent spare capacity for each type of I/O signal at the MCP including field wiring terminal blocks for each spare I/O point supplied.
        b. Provide a minimum of 25 percent spare capacity for each type of I/O signal at the local control panels including field wiring terminal blocks for each spare I/O point supplied.
        c. Wire all spare I/O points to field terminal blocks in the same enclosure the PLC resides in.
        d. Space shall be available in the MCP to support the future addition of 50 percent additional spare I/O.
    2. PLC backplane capacity:
        a. Provide 25 percent or 3 spare backplane slots, whichever is greater, in all racks containing I/O. Spare backplane slots shall be arranged in proximity to the rack power supply to permit the installation of any type of future I/O card (e.g. discrete input, discrete output, analog input or analog output).
    3. PLC memory:
        a. 50 percent spare memory.

2.05 UNINTERRUPTIBLE POWER SUPPLY (UPS)

A. General:
    1. Provide UPS at MCP.
    2. Provide UPS power at LCPs, either via UPS in the MCP, or via separate UPS mounted in each LCP.
    3. The minimum VA rating of the UPS shall be greater than or equal to 1.5 times the connected load or 700 VA, whichever is greater.
    4. The battery shall be sized to provide minimum 30 minutes runtime at full load.
    5. Provide calculations showing run time and VA loading of the UPS.

B. Double-conversion true-online UPS: One of the following or equal:
    1. Free-standing UPS, 700-3,000 VA:
        a. Vertiv, Liebert GXT 4.
        b. Eaton Corp., 9SX.

C. Provide manual maintenance bypass switch:
    1. 700 to 3,000 VA units: One of the following or equal:
        a. Vertiv, Liebert Micropod 2U.
        b. Eaton Corp.: Powerware HotSwap.

2.06 HUMAN MACHINE INTERFACE (LOI) HARDWARE

A. General:
    1. NEMA Type 4X rated.
    2. LOI shall communicate directly with PLC processor via dedicated communication cable.
    3. Provide color touch-screen type display.
    4. Screen size: Packaged Control System Supplier's preference.

B. LOI: The following (no equal):
   1. Allen-Bradley, PanelView Plus 7.

2.07 PLC AND LOI PROGRAMMING

A. General:
   1. The PLC programming software system shall be manufactured by the PLC hardware manufacturer.
   2. Provide one licensed copy of PLC programming software to the Owner.
   3. The LOI programming software system shall be manufactured by LOI hardware manufacturer.
   4. Provide one licensed copy of LOI programming software to the Owner.

B. PLC programming software: The following (no equal):
   1. Rockwell Software RSLogix 5000.

C. LOI programming software: The following (no equal):
   1. Rockwell, Studio 5000.

D. Coordination with plant control system:
   1. Coordinate with the ICSC to determine the requirements for data transfer between the packaged system controls and the plant process control system.
   2. Supplier shall program MCP to aggregate the data into contiguous registers for efficient transfer to the plant process control system.
   3. Minimum data transfer shall be as discussed and determined during the coordination meeting with the ICSC as specified in paragraph 1.08 herein.
   4. Unless otherwise stated, the packaged control system shall provide data to the plant control system with data in engineering units.
   5. In addition to the supplier provided UV system equipment, field instrumentation and electrically actuated gates shall be monitored and controlled by supplier provided MCP PLCs as indicated on the P&IDs.

E. General programming requirements:
   1. Use variable names or aliases derived from tag and loop identification on the P&IDs for all process values:
      a. Unless otherwise noted, utilize floating-point format for all PLC algorithms and calculations.
      b. Provide PLC logic to convert raw input values into engineering units in a floating-point format.
   2. Store all adjustable parameters in the PLC, and configure so that an operator with sufficient security access can change the parameters from the LOI or HMI. Update and display the current value at all locations, regardless of where the last change was made.
   3. Reusable PLC code blocks:
      a. Develop and use new standard user defined function blocks (UDFBs) and user defined types (UDTs) where appropriate. One instance of each standard code block shall reside in each PLC and shall be referenced in main routines and subroutines.
      b. Provide complete library of standard code blocks to Owner as part of O&M documentation.

4. Documentation:
    a. All control logic shall be completely annotated including all rungs, instructions, and tags.
    b. Each routine shall have a title and a detailed description of the control strategy represented by the control logic. Where parameters are passed to the routine, all parameters shall be defined in the routine description.
    c. Analog tag descriptions representing process variables shall include the engineering unit range of the analog variable.
    d. Digital tag descriptions shall include the On and Off state labels.
    e. Complete, grammatically correct sentences and terminology, consistent with water treatment processes, shall be utilized in the development of rung and routine descriptions.
    f. All equations developed in the process logic shall be fully documented in the rung or routine description. A description of each constant and variable utilized in the equation shall be defined including engineering units.
5. Saved setpoints:
    a. Provide an operator selection to save all setpoint values.
    b. Provide an operator selection to restore all setpoints to the last saved value.
6. Calculated values:
    a. Program calculations such that division by zero errors cannot occur.
    b. Prevent calculations from generating values that exceed the limits of the equipment or data type structures (integers) internal to the PLC.
    c. Configure counting functions (start counts and operation counts) to allow a minimum of 10,000 counts and to rollover to zero at an even decimal interval (1 followed by 4 or more zeros).
7. Timers:
    a. Provide programmable settling and proving timers in control sequences as required for starting and stopping of equipment to allow the process to settle down before proceeding with any additional control functions:
        1) The settling timers may be overridden by setting the timer to 0 seconds.
8. PLC status:
    a. Furnish all information that depicts the status of all enclosures containing PLC or I/O in the control system, including but not limited to the following:
        1) PLC cabinet over-temperatures from high temperature switch.
        2) Intrusion status on all enclosures equipped with intrusion switches.
        3) AC power failure:
            a) Monitor ahead of UPS.
        4) DC power supply failure:
            a) For redundant power supplies, alarm when either power supply or the diode bridge fails.
        5) UPS failure signal.
        6) UPS Low Battery signal.
        7) Digital bus network Coupler and or Gateway failure signal.
        8) Ethernet Switch failure signal.
9. PLC system communication status:
    a. Furnish a minimum of 1 screen to display all communication errors and status within the control system network:
        1) Communication between PCS and PLC.

2) PLC to RIO.
3) Digital bus network status.
4) Display status of each node, and summary of failures over the past 60 minutes.

b. Generate a communications alarm if any communication fault is detected.
c. In the event of communications loss:
1) Continue normal operation at each PLC with last known shared values.

F. Common control functions:
1. Incorporate common control functions into all control loops and devices and into the control programming, whether or not specifically shown in the specific control descriptions or elsewhere in the Contract Documents.
2. Alarms:
a. Generate alarms within the PLC logic.
b. Indicate alarms at PCS and the LOI. Enable acknowledgement from either the PCS or the LOI.
c. Generate high, high-high, low, and low-low level alarms where indicated:
1) Provide an alarm reset deadband for each analog value to prevent excessive repeated alarms.
2) Provide logic and timers to inhibit analog alarms based on process events. For example, inhibit low flow alarms when a pump is stopped, or has not been running long enough to establish flow.
d. Once the alarm is acknowledged by an operator, display alarm conditions in a steady state (not flashing) while the alarm condition is still present:
1) Use interlocks and proving timers to prevent alarms from operating due to power loss, except for loss of power alarms.
3. Where run time accumulation is required, integrate accumulated run time to the nearest 0.1 hours whenever the running status input indicates that the equipment is running:
a. Display total run time in hours.
4. For all monitored analog values:
a. Convert all values to engineering units in floating-point format within the PLC.
b. Totalize flows in the PLC logic:
1) Where totalized flows are input to a discrete input, count input pulses and multiply by the volume per pulse.
2) Where no totalizer input is shown, integrate the analog input over time.
3) Display totals on the HMI and LOI.
5. Analog data processing:
a. Engineering units conversion:
1) Use engineering units for all analog point values. Convert analog inputs to engineering units.
b. Analog magnitude checking:
1) Provide clamps to prevent operator-entered values (setpoints, etc.) that fall outside acceptable limits.
c. Analog value quality:
1) Monitor analog values received at each PLC from analog inputs or communications from another PLC or RIO specific to critical analog values, and generate alarms for the following conditions.

2) Rate of change in excess of acceptable limit:
    a) Provide a separate rate limit for each value.
3) Stale value:
    a) For analog signals that come from analog inputs or calculations using analog inputs, which are expected to have some variation each time the input is read, alarm when there is no change in the value for 10 times the normal expected scan or communication update.

6. Tank and vessel levels:
    a. Display all tank and vessel levels as both a level (typically in feet) and a volume (typically in gallons):
        1) Some individual displays may be only level or volume, when agreed to by the Owner and Engineer during the submittal phase.
    b. Monitor rate of change of volume on all tanks and vessel:
        1) Establish the maximum withdraw rate at which the volume should decrease (all pumps or feeders operating at maximum output). Generate an alarm whenever the volume decreases faster than this rate.
7. I/O filtering and processing:
    a. Analog input filtering:
        1) Provide PLC programming for each analog input to implement an adjustable first order filter, for the purpose of smoothing out spikes and other noise for analog transmitter input signals. By default, shall configure analog inputs with no filtering affect.
        2) Monitor analog input signal quality:
            a) Over range: The input value is above the normal range (typically over 21 mA).
            b) Under range: The input value is below the normal range (typically under 3 mA, indicating a probable broken connection).
            c) Generate alarms for over or under range inputs.
            d) Do not use over- or under-range values for control or calculation purposes:
                (1) Where a second instrument is provided to monitor the same condition (a redundant instrument, or additional instruments furnished for averaging or different operating modes), and has a valid signal, use that input for control.
                (2) Otherwise, hold all outputs affected by the signal at their last values before the signal went out of range.
        3) Digital input filtering (proving timer):
            a) Provide an adjustable time delay function (0 to 10 seconds) on discrete input for the purpose of de-bouncing.
            b) By default, discrete inputs shall be configured with de-bounce timers set to zero seconds.
8. LOI/HMI HAND-OFF-AUTO:
    a. Provide HAND-OFF-AUTO and START-STOP selections accessed from an LOI or HMI for operators with sufficient security, to provide the following operating modes:
        1) AUTO: The normal, automatic control mode of the strategy which allows full PLC control in response to process conditions and programmed sequences.

2) HAND: Enables Manual control where control decisions are made by an operator through the START-STOP, OPEN/CLOSE, or other selections as indicated.
3) OFF: Automated control is disabled, and PLC calls for all associated equipment to stop and valves to close or go to their identified safe state.

9. Display the current status of all operator selections (HAND/AUTO, START/STOP, etc.) on the LOI and HMI.
10. Interlocks:
    a. Implement software interlocks where indicated to place equipment in a safe condition in response to impending hazardous process conditions.
    b. Apply software interlocks when equipment is operating in PCS AUTO or PCS HAND.
11. Permissives:
    a. Implement software permissives where required to prevent equipment from starting in an unsafe condition.
    b. Apply software permissives when equipment is operating in PCS AUTO or PCS HAND.

2.08 PANELS, ENCLOSURES, AND PANEL COMPONENTS

A. General:
1. Provide instruments and other components performing similar functions of the same type, model, or class, and from one manufacturer.
2. It shall be the responsibility of the supplier to design and size all panels.
3. Design panels to fit in the space as **indicated on the Drawings**.

B. Requirements:
1. Each panel will be fed by a 120-volt single-phase AC power circuit. Panel designs shall include control power transformers, power supplies and distribution components required to derive all necessary control voltages. Panels shall have an overall short circuit rating of 22kAIC, minimum.
2. Design cabinets for the environmental conditions described in Section 46_05_10 - Common Work Results for Mechanical Equipment.
3. Instruments provided as part of the packaged system shall be powered from supplier provided control cabinets.

C. Panels/enclosures:
1. Manufacturers: One of the following or equal:
    a. Rittal.
    b. nVent (formerly Hoffman Engineering.
    c. Saginaw Control & Engineering.
2. Panel assembly:
    a. General guidelines for panel fabrication include:
        1) Continuous welds ground smooth.
        2) Exposed surfaces free of burrs and sharp edges.
        3) Base formed of heavy channel iron, either galvanized or powder coated, minimum 1/2-inch holes at 12-inch spacing to accommodate anchoring of freestanding enclosures to floor.

b. Provide stiffeners for back mounting panels in enclosures larger than 4 feet. In addition, secure the panels in place by collar studs welded to the enclosure.

3. In addition to the requirements specified above, the following requirements for NEMA Type 12 stainless steel enclosures apply:
   a. Minimum 14-gauge, Type 316 stainless steel.
   b. Captive stainless steel cover screws threaded into sealed wells.
   c. Finish: Unpainted, brushed finish.
   d. Specifically designed for use with three-point latch door handles with lockable provisions.
4. General wiring requirements:
   a. Wiring methods: Wiring methods and materials for panels shall be in accordance with the NEC requirements for general purpose (no open wiring) unless otherwise specified.
   b. Install all components in accordance with the manufacturer's instructions included in the listing and labeling.
   c. Control panels supplied with 120 VAC:
      1) Provide an internal breaker with the line side terminals covered by a barrier.
      2) Provide a nameplate prominently positioned on the control panel identifying the location of the power source and a warning statement requiring the source to be disconnected before opening the door to the enclosure.
   d. Provide a nameplate on the cover of the control panel identifying all sources of power supply and foreign voltages within the control panel.
   e. Provide transformers, protective devices, and power supplies required to convert the supply voltage to the needed utilization voltage.
   f. Provide surge protection device on input supply power.
   g. Provide nonmetallic ducts for routing and organization of conductors and cables:
      1) Provide separate ducts for signal and low voltage wiring from power and 120 VAC control wiring:
         a) 120 VAC: Grey colored ducts.
         b) 24 VDC: White colored ducts.
   h. Cables shall be fastened with cable-mounting clamps or with cable ties supported by any of the following methods:
      1) Screw-on cable tie mounts.
      2) Hammer-on cable-tie mounting clips.
      3) Fingers of the nonmetallic duct.
   i. Wire ties:
      1) No wire ties inside wire duct.
      2) Use Panduit Cable tie installation tool, with tension control/cutoff.
      3) Verify cut ends are cut flush filed smooth after installed.
   j. Provide supports at the ends of cables to prevent mechanical stresses at the termination of conductors.
   k. Support panel conductors where necessary to keep them in place.
   l. Wiring to rear terminals on panel-mount instruments shall be run in nonmetallic duct secured to horizontal brackets run adjacent to the instruments.

m. Conductors and cables shall be run from terminal to terminal without splice or joints. Exceptions:
    1) Factory applied connectors molded onto cables shall be permitted. Such connectors shall not be considered as splices or joints.
n. The control panel shall be the source of power for all 120 VAC or 24 VDC UV system field devices and instrumentation supplied by the UV system supplier and shall be connected to system control panels.

D. Thermal management:
1. Provide heating, cooling, and dehumidifying devices in order to maintain all instrumentation and control devices to within an acceptable range.
2. Provide enclosure temperature sensor:
    a. Manufacturers: One of the following or equal:
        1) Omega, EWS Series.
        2) TCS Basys Controls, TS Series.

E. Panel meters:
1. Digital:
    a. Self-contained instruments that display process signals directly in engineering units.
    b. Manufacturers: The following or equal:
        1) Red Lion.
        2) Action Instruments Visipak.

F. Pilot devices:
1. General:
    a. Provide operator pushbuttons, switches, and pilot lights, from a single manufacturer.
    b. Size:
        1) 30.5 millimeters.
    c. Heavy duty.
    d. Pushbuttons:
        1) Contacts rated:
            a) NEMA Type A600.
        2) Furnish 1 spare normally open and normally closed contact with each switch.
    e. Selector switches:
        1) Contacts rated:
            a) NEMA Type A600.
            b) Knob type.
        2) Furnish 1 spare normally open contact and normally closed contact with each switch.
        3) Provisions for locking in the OFF position where lockout provisions are **indicated on the Drawings**.
    f. Pilot lights:
        1) Type:
            a) LED for interior installations.
        2) Push to test.
        3) Lamp color:
            a) On/Running/Start: Red.
            b) Off/Stop: Green.

c) Power: White.
d) Alarm: Amber.
e) Status or normal condition: White.
f) Opened: Red.
g) Closed: Green.
h) Failure: Red.

2. All control system panel installation areas:
   a. NEMA Type 4X.
   b. Manufacturers: One of the following or equal:
      1) Allen-Bradley, Type 800T.
      2) Square D, Class 9001 Type K.
      3) General Electric, Type CR104P.
      4) IDEC TWTD Series.

G. Signal isolators and converters:
   1. Furnish signal isolators that provide complete isolation of input, output, and power input:
      a. Minimum isolation level: 1.5 kV AC/50 Hz for at least 1 minute.
      b. Adjustable span and zero.
      c. Accuracy: Within 1.0 percent of span.
      d. Ambient temperature range: -20 degrees Celsius to +65 degrees Celsius.
   2. Manufacturers: One of the following or equal:
      a. Phoenix Contact, Mini Analog Pro.
      b. Acromag, 1500, 600T, 800T, Flat Pack or ACR Series.
      c. Action Instruments, Q500 Series or Ultra SlimPakII.
      d. AGM Electronics, Model TA-4000.
      e. Moore Industries, MIT 4-Channel.

H. Relays:
   1. General:
      a. For all types of 120 VAC relays, provide transient surge protection across the coil of each relay.
      b. For all types of 24 VDC relays, provide a free-wheeling diode across the coil of each relay.
      c. For plug in type relays, provide a relay base from the same manufacturer as the relay manufacturer.
   2. General purpose:
      a. Magnetic control relays.
      b. NEMA ratings:
         1) 300 volts.
         2) 10 Amps thermal continuous test current.
         3) 60 Amps make.
         4) 6 Amps break.
      c. Plug-in type.
      d. LED indication for relay energized.
      e. Coil voltages: As required for the application.
      f. Minimum poles: DPDT.
      g. Touch safe design: All connection terminals to be protected against accidental touch.
      h. Enclose each relay in a clear plastic heat and shock-resistant dust cover.
      i. Quantity and type of contact shall be as needed for system compatibility.

j. Relays with screw-type socket terminals.
k. Provide additional (interposing) relays when the following occurs:
1) The number or type of contacts shown exceeds the contact capacity of the specified relays.
2) Higher contact rating is required in order to interface with starter circuits or other equipment.
l. DIN rail mounting on 35-mm rail.
m. Ice Cube type relays shall be provided with retainer clips to secure relay in socket.
n. Manufacturers: One of the following or equal:
1) Potter and Brumfield, Type KRP or KUP.
2) IDEC, R* series. (* = H, J, R, S, U).
3) Allen-Bradley, Type 700 HC Series.
4) Schneider Electric, Type K.

3. Time delay:
a. Provide time-delay relays to control contact transition time.
b. Contact rating:
1) 240 volts.
2) 10 Amps continuous.
3) 3,600 volt-amperes make.
4) 360 volt-amperes break.
c. Coil voltage: As required for the application.
d. Provide electronic type with on-delay, off-delay, and on/off-delay:
1) For off-delay, use true power-off time-delay relays. Where the required timing range exceeds capability of the off-delay relay use, signal off-delay where power loss will not cause undesirable operation of time-delay relays.
e. Minimum poles: 2 PDT.
f. Units include adjustable dial with graduated scale covering the time range in each case.
g. Minimum timing range: 0.1 seconds to 10 minutes, or as required for the application.
h. Manufacturers: One of the following or equal:
1) IDEC, RTE Series.
2) Allen-Bradley, Type 700-HR.

I. Terminal blocks:
1. Din rail mounting on 35-mm rail.
2. Suitable for specified AWG wire.
3. Rated for 30 amperes at 600 volts.
4. Screw terminal type.
5. Provide mechanism to prevent wire connection from loosening in environments where vibration is present. This mechanism shall not cause permanent deformation to the metal body.
6. Finger safe protection for all terminals for conductors.
7. Construction: Polyamide insulation material capable of withstanding temperature extremes from - 40 degrees Celsius to 105 degrees Celsius.
8. Terminals: Plainly identified to correspond with markings on the diagrams:
a. Permanent machine printed terminal identification.
9. Identify terminals suitable for use with more than 1 conductor.

10. Position:
    a. So that the internal and external wiring does not cross.
    b. To provide unobstructed access to the terminals and their conductors.
11. Provide minimum 10 percent spare terminals.
12. Terminal blocks shall be “single stack” type. Double-stack terminal blocks are not acceptable.
13. Manufacturers: One of the following or equal:
    a. Phoenix Contact, UT4 Series.
    b. Allen-Bradley Series 1492.

J. Surge protection devices (SPD):
1. 120 VAC control panel power SPD:
    a. Provide SPD for panel 120 VAC power entrances:
        1) Non-faulting and non-interrupting design.
        2) Provide line to neutral and neutral to ground surge protection.
    b. Provide surge protection at secondary of main circuit breaker:
        1) Surge protection is not required for 120 VAC circuits that are only used for panel lights and receptacles.
        2) For panels receiving power at 480 VAC, provide surge protection on the 120 VAC control power transformer secondary.
    c. DIN rail mounting.
    d. Attach wiring to the SPD by means of a screw-type cable-clamping terminal block:
        1) Gastight connections.
        2) Visual status indication of MOV status on the input and output circuits.
        3) Dry contact rated for remote status indication.
    e. Approvals:
        1) Tested in accordance with IEC 61643-11.
        2) Tested in accordance with UL 1283.
        3) Tested in accordance with UL 1449.
        4) Surge protection minimum requirements: Withstand a minimum 10-kA test current of an 8/20 µs waveform in accordance with IEEE C62.41.1 Category C Area.
    f. Manufacturers: One of the following or equal:
        1) Phoenix Contact, Type SFP Filter.
        2) ASCO, Model 277.
2. 24 VDC control panel power SPD:
    a. Provide SPD for 24VDC power circuits.
    b. Provide surge protection at DC power supply output.
    c. DIN rail mounting.
    d. Attach wiring to the SPD by means of a screw-type cable clamping terminal block:
        1) Optical status indicator.
        2) Dry contact rated for remote status indication.
    e. Approvals:
        1) Tested in accordance with IEC 61643-11.
    f. Manufacturers: One of the following or equal:
        1) Phoenix Contact, Plugtrab PLT-SEC-T3-24-FM-UT.

3. Panel mounted control, signal, and data line SPD:
    a. General:
        1) This section applies to SPD located in a control panel, field panel, network junction box, or marshalling panel.
        2) Approvals:
            a) Tested in accordance with IEC 61643-21.
            b) Tested in accordance with UL 497B.
        3) SPD shall consist of 2 parts:
            a) Base module:
                (1) DIN rail mounting:
                    (a) Grounded to DIN rail via mounting rail foot.
            b) Plug protection module:
                (1) Replacing a plug shall not require the removal of any wires nor interrupt the signal.
        4) Provide indirect shield ground style SPD unless otherwise noted.
        5) Provide ability to locally identify and indicate SPD health.
        6) SPD shall be provided with controller module with dry contact for remote status monitoring of SPD device health.
        7) SPD modules shall be compatible with signal, communication bus type, data type, or control power being protected.
        8) Provide dedicated SPD for each signal, communication bus type, or data line being protected.
    b. Manufacturers: One of the following or equal:
        1) Phoenix Contact, Plugtrab PT-IQ Series.
        2) Dehn, Blitzductor XTU Series.
4. Copper Ethernet SPD:
    a. Protects network equipment from lightning or other surge events.
    b. Suitable for Gigabit networks.
    c. Compatible with shielded Cat 6 cabling with shielded RJ-45 ports.
    d. Compliant with PoE standards IEEE 802.3af and 802.3at.
    e. Nominal discharge surge current: 10 kA.
    f. Approvals:
        1) Tested in accordance with IEC 61643-21.
        2) Tested in accordance with UL 497B.
    g. Manufacturers: One of the following or equal:
        1) Phoenix Contact, DT-LAN-CAT6+.
        2) Weidmuller, VDATA CAT6.
        3) Eaton/MTL, ZoneBarrier.
5. Field device mounted SPD:
    a. Conduit entry mounting:
        1) Provide parallel or through wiring configurations as required by the application:
            a) Use parallel wiring configuration if there is an available cable gland at the device.
            b) Use through wiring configuration if there is no available cable gland at the device.
        2) Provide Screw connections compatible with field device.
    b. NEMA 4X stainless steel material housing.
    c. Approvals:
        1) Tested in accordance with IEC 61643-21.

d. 4-wire field device:
    1) Module shall provide simultaneous protection of signal cable, communication bus, or data line, and power supply line:
        a) Maximum continuous voltage:
            (1) DC:
                (a) Signal: 32 VDC.
                (b) Power supply: 255 VDC.
            (2) AC:
                (a) Signal: 22.6 VAC.
                (b) Power supply: 255 VAC.
    2) Manufacturers: The following, engineer knows of no equal:
        a) Endress+Hauser, HAW569-CB2C.
e. 2-wire or 3-wire field device:
    1) Module shall provide protection for the signal cable, communication bus or data line.
    2) Manufacturers: One of the following or equal:
        a) Endress+Hauser, HAW569 Series.
        b) Phoenix Contact, Surgetrab S-PT Series.
        c) Eaton/MTL, TP Series.

K. Power supplies:
1. Design power supply system so that either the primary or backup supply can be removed, repaired or replaced, and returned to service without disrupting the system operation.
2. Convert 120 VAC to 24-volt DC or other DC voltages required or as required for the application.
3. Provide redundant backup 24 VDC power supply units to automatically supply the load upon failure of the primary supply.
4. Provide power supply arrangement that is configured with several modules to supply adequate power in the event of a single module failure in either a 1+1 or N+1 configuration as required:
    a. Provide automatic switchover upon module failure.
    b. Alarm contacts monitored by the PLC.
5. Provide protective isolation between power supply units either by means of Diodes, Diode Modules, MOSFET Modules, or use power supplies with built in redundancy. Power supplies with built in redundancy must actively isolate each power supply and be designed as such.
6. Sized to provide 40-percent excess rated capacity.
7. UL 508C listed to allow full-rated output without de-rating.
8. Provide fuse or short-circuit protection.
9. Provide a minimum of 1 set of dry contacts for each power supply configured to change state on failure for monitoring and signaling purposes.
10. Output regulation: Within 0.05 percent for a 10-percent line change or a 50-percent load change.
11. Operating temperature range: 32 degrees to 140 degrees Fahrenheit.
12. Touch-safe design: All connection terminals to be protected against accidental touch.
13. DIN rail mounting on 35-millimeter rail:
    a. Mount the power supply in the proper orientation as recommended by the manufacturer to ensure adequate thermal dispersion without derating the power supply.

14. Provide self-protecting power supplies with a means of limiting DC current in case of short circuit.
15. Manufacturers: One of the following or equal:
    a. Fully redundant:
        1) Phoenix Contact, Quint Power Supply with SFB technology:
            a) Phoenix Contact, Quint.
        2) IDEC, PS5R Series.
        3) Sola.
        4) PULS.
    b. Redundancy module:
        1) Phoenix contact, O-ring redundancy module.

L. Limit switches:
1. NEMA 4X.
2. AC contact rating 120 V, 10 A.
3. DC contact rating 125 V, 0.4 A.
4. Provide robust actuation mechanism not prone to degradation.
5. Provide complete actuator mechanism with all required hardware.
6. Allows for contact opening even during contact weld condition.
7. UL approved.
8. Operating temperature range: -18 degrees to +110 degrees Celsius (0 degrees to 230 degrees Fahrenheit).
9. Manufacturers: One of the following or equal:
    a. Allen-Bradley, 802 Series.
    b. Honeywell HDLS Series.
    c. Omron D4 Series.
    d. Eaton, E47, E49, E50.
    e. ABB.

M. Provide a folding shelf for enclosures that contain programmable controllers. The shelf shall be mounted on the inside surface of the door, capable of supporting a laptop computer.

N. Conductors and cables:
1. Power and control wiring:
    a. Materials: Stranded, soft annealed copper.
    b. Insulation: 600 volts Type MTW.
    c. Minimum sizes:
        1) Primary power distribution: 12 AWG.
        2) Secondary power distribution: 14 AWG.
        3) Control: 16 AWG.
    d. Color:
        1) AC power (line and load): BLACK.
        2) AC power (neutral): WHITE.
        3) AC control: RED.
        4) AC control: ORANGE for foreign voltages.
        5) DC power and control (ungrounded): BLUE.
        6) DC power and control (grounded): WHITE with BLUE stripe.
        7) Ground: GREEN.
2. Signal cables:
    a. Materials: Stranded, soft annealed copper.

b. Insulation: 600 V, PVC outer jacket, 16 AWG paired triad overall aluminum shield (tape), with copper drain wire.
c. Color:
    1) 2 conductor:
        a) Positive (+): BLACK.
        b) Negative (-): WHITE and RED.
    2) 3 Conductor:
        a) Positive (+): BLACK.
        b) Negative (-): RED.
        c) Signal: WHITE.
d. Insulate the foil shielding and exposed drain wire for each signal cable with heat shrink tubing.

O. Receptacles:
1. Provide 1 duplex receptacle located every 4 feet of enclosure width, spaced evenly along the back mounting panels.
2. GFCI, 125-volt, single-phase, 15-ampere style plug.
3. Provide circuit breaker or fuse to limit receptacle draw to 5 amperes.

P. Grounding:
1. Provide the following:
    a. Grounding strap between enclosure doors and the enclosure.
    b. Equipment grounding conductor terminals.
    c. Provide equipment ground bus with lugs for connection of all equipment grounding wires.
    d. Bond multi-section panels together with an equipment grounding conductor or an equivalent grounding bus.
2. Identify equipment grounding conductor terminals with the word “GROUND,” the letters “GND,” the letter “G,” or the color green.
3. Signal (24 VDC) grounding: Terminate each drain wire of a signal (shielded) cable to a unique grounding terminal block, or common ground bus at the end of the cable as shown on the Loop Drawings.
4. Ensure the continuity of the equipment grounding system by effective connections through conductors or structural members.
5. Design so that removing a device does not interrupt the continuity of the equipment grounding circuit.
6. Provide an equipment-grounding terminal for each incoming power circuit, in the vicinity of the phase conductor terminal.
7. Size ground wires in accordance with NEC and UL Standards, unless noted otherwise.
8. Connect all exposed, noncurrent-carrying conductive parts, devices, and equipment to the equipment-grounding circuit.
9. Connect the door stud on the enclosures to an equipment-grounding terminal within the enclosure using an equipment-bonding jumper.
10. Bond together all remote and local control panels, processor racks, and conductive enclosures of power supplies and connect to the equipment-grounding circuit to provide a common ground reference.

2.09 FIELD INSTRUMENTS

A. General:
   1. Instrument housing shall be rated NEMA Type 4X.
   2. Wetted materials shall be compatible with process fluid and manufacturer's recommendations for the intended service.
   3. For analog field instruments, provide local LCD display.
   4. Provide sunshades for all transmitters located outdoors.
   5. Provide all hardware for instrument mounting.
   6. Factory calibrate each instrument at a facility that is traceable to the NIST.
   7. Analog instrument outputs:
      a. Isolated 4-20 mA DC with HART communication protocol.

B. Radar Level Transmitters: As specified in Section 40 72 24.

PART 3 EXECUTION

3.01 PREPARATION

A. Anchoring and bracing to structures:
   1. Provide recommended type and material of panel and equipment anchors to be installed by the ICSC.

3.02 INSTALLATION SUPPORT

A. Field instruments installation:
   1. Provide support to the ICSC as required during field installation of field instruments supplied with the UV system equipment package.

B. Instrument tagging:
   1. Provide all field-mounted instruments with nameplates:
      a. Nameplates engraved with the instrument's full tag number as **indicated on the Drawings**:
         1) Affix tags with stainless steel wire fasteners.
   2. Provide all back of panel instruments with nameplates:
      a. Engraved with the instrument's full tag number.
   3. Provide all front of panel instruments with a nameplate:
      a. Engraving to include the following:
         1) Instrument's full tag number.
         2) Service description.
      b. Nameplates:
         1) Secure nameplates to the panel with stainless steel screws.
         2) Use an approved adhesive if screws would violate the NEMA or other ratings of the enclosure.

C. Cable and conductor termination:
   1. Terminate all cables and conductors on terminal blocks.

D. Surge protection:
   1. Provide outdoor field instrument loops with voltage surge protection units installed on the instruments.
   2. Individually fuse each 4-20 mA DC loop with a 1/16-ampere fuse between power supplies and receiver surge protectors.
   3. Provide voltage surge protection for 4-wire transmitters and analyzers:
      a. Protect both power source and signal loop.

E. Control panel installation:
   1. Provide support to the ICSC as required during installation of all supplied UV system control panels.
   2. Provide floor stand kits for enclosures larger than 48 inches high.

3.03 COMMISSIONING

A. As specified in Section 01_75_17 - Commissioning.

B. Source Testing:
   1. Right of observation: The Owner retains the right to observe all Source test activities including any and all subsystem preparation, pretests, troubleshooting, retests, warm-up, and software modification and/or update.
   2. The Owner reserves the right to test any specified function, whether or not explicitly stated in the test submittal.
   3. Costs for repeating testing: The supplier shall pay for Engineer's and other Owner's representatives' travel, subsistence for witnessing the repetition of failed tests.
   4. Correction of deficiencies: Any deficiencies observed during the test shall be corrected and retested before completion of the test.
   5. Any changes and/or corrections shall be noted on the test forms. Engineer shall witness the revisions and/or corrections prior to leaving the test site.
   6. If the corrections and/or revisions are too extensive to be made while the Engineer is scheduled to be at the Source test site, the Source Test shall be, at the Engineer's sole discretion, considered failed, and the test shall be restarted at a later date. All costs for the re-test shall be borne by the supplier.

C. Testing simulation:
   1. The UV system supplier shall make use of hardware simulators during Source tests that contain switches, pilot lights, variable analog signal generators, and analog signal level displays, which shall be connected to the I/O points of the PLCs and controllers provided. All inputs and outputs shall be simulated, and proper control and system operation shall be validated.

D. Panel inspections:
   1. The Engineer to inspect each control panel for completeness, workmanship, fit and finish, and compliance with the Contract Documents and the approved shop drawings.
   2. Inspection to include, as a minimum: Layout, mounting, wire and data cable routing, wire tags, power supply, components and wiring, I/O components layout (including terminals, wiring and relays), device layout on doors and front panels, and proper ventilation operation.

E. I/O test:
   1. Verify that I/O is properly wired to field terminals and is properly mapped into the PLC and operator displays.
   2. Test methodology:
      a. Discrete inputs:
         1) Apply appropriate input from simulator at panel terminal, observe input card indicator, observe data value at each indicated data address, and observe data received at field wiring terminals or operator interface screen.
      b. Discrete outputs:
         1) Issue commands from operator interface screen or PLC, verify output card indicator light, and measure response at field wiring terminals or multimeter.
      c. Analog inputs:
         1) Apply appropriate analog input signal at panel terminals on simulator, observe data value at each indicated data address, and observe data properly received at field wiring terminals or operator interface screen.
         2) Check each point at 0 percent, 25 percent, 50 percent, and 100 percent of scale.
      d. Analog outputs:
         1) Enter scaled values in the output buffer file, observe the output data file value, and measure appropriate response at field wiring terminals or multimeter.
   3. Test forms to include, but not be limited to:
      a. PLC and panel number.
      b. I/O type.
      c. I/O tag name.
      d. Panel terminal block numbers.
      e. Rack/slot/number of I/O point.
      f. Check-off for correct response for each I/O point.
      g. Space for comments.
      h. Initials of individual performing test.
      i. Date test was performed.
      j. Witness' signature lines.

F. Control logic test:
   1. Verify the PLC and LOI provides monitoring and control functionality based upon specified and designed control requirements.
   2. Testing requirements:
      a. Demonstrate each UV system function pursuant to the UV system supplier's developed system control strategies.
      b. Demonstrate in detail how each function operates under a variety of operating scenarios:
         1) Test to verify the application of each general control strategy function to each specific control strategy or loop description.
      c. Demonstrate the proper operation of the programming and configuration for each control strategy or loop description:
         1) Test each strategy or loop description on a sentence by sentence and function by function basis.
         2) Loops with similar or identical logic must each be tested individually.

3) Test the boundaries of each numeric operator input by entering values outside of the allowable range.

d. Demonstrate the proper operation of all digital communication links and networks:
   1) Verify each digital communication I/O point.

e. Failure testing: Demonstrate how the system responds to and recovers from abnormal conditions including, but not limited to: Equipment failure, operator error, communications subsystem error, communications failures, simulated/forced software lockups, power failure (both utility power and power to HMI and/or SCADA hardware), process equipment failure, and high system loading conditions.

3. Test forms:
   a. Include the fully revised and approved for the loop being tested.
   b. Identify the cause and effect as each I/O point is toggled through the simulator. Check boxes shall be provided to track proper and/or improper operation of the loop.
   c. Any deficiencies or operational changes shall be noted on the forms for correction and documentation.
   d. Include signature and date lines.
4. Engineer approval of the FAT submittal is required prior to shipment of system components.

G. Installation Verification: Supplier shall provide on-site field inspection to verify correctness of installation of supplied equipment by the ICSC. Supplier shall include up to four separate site visits on non-consecutive days, 8-hours per day (travel time not included) with visit dates coordinated with the installation Contractor at mutually agreeable dates.

H. Functional Testing:
1. General:
   a. Commence pre-commissioning tests after completion of all loop check/validation tests performed by the ICSC:
      1) Pre-commissioning to demonstrate proper operation of all systems with process equipment operating over full operating ranges under conditions as closely resembling actual operating conditions as possible.
2. Control logic operational validation:
   a. The purpose of control logic validation is to field test the operation of the complete control system, including all parts of the system, all control panels (including vendor control panels), all control circuits, all control stations, all monitored/controlled equipment, and final control elements.
3. Loop tuning:
   a. Optimally tune all electronic control stations and software control logic incorporating proportional, integral, or derivative control. Apply control signal disturbances at various process variable levels and adjusting the gain, reset, or rate settings as required to achieve proper response.
4. Pre-commissioning validation sheets:
   a. Document each pre-commissioning test on an approved test form.
   b. Document loop tuning with a report for each loop, including 2-pen chart recordings showing the responses to step disturbance at a minimum of 3 setpoints or process rates approved by the Engineer. Show tuning

parameters on the charts, along with time, date, and sign-off by supplier and Engineer.

5. Pre-commissioning certification:
    a. Document via a certified report the completion of all pre-commissioning and test activities:
        1) Including all test forms with test data entered, submitted to the Engineer with a clear and unequivocal statement that all pre-commissioning test requirements have been satisfied.

I. Owner Training:
1. Perform Owner training as specified in Section 01_75_17 - Commissioning.
2. Number of sessions:
    a. Operations 2.
    b. Maintenance 2.

J. Training topics:
1. Provide system maintenance and operator training courses for all the instrumentation, control systems furnished.
2. Training course requirements:
    a. Operator training:
        1) Operator's training shall include:
            a) Control system overview: Architecture, equipment functions, software components, etc.
            b) Display navigation, overview, and types of displays.
            c) Process and equipment monitoring and control: Basic principles and operation.
            d) Logging ON and OFF the system and description of the security and access system.
            e) Alarm subsystem.
    b. PLC hardware training:
        1) Furnish training on PLC hardware and on related components, including battery backup equipment, UPSs, LOI hardware, control circuits, and analog circuits.
        2) Furnish training on PLC hardware principles, product features, proper installation, operation, troubleshooting, and maintenance.
        3) PLC training may be provided by manufacturer's certified trainers.
    c. PLC software training:
        1) Furnish training on PLC software:
            a) Training covers the programming conventions, new standardized software modules, specific control strategy programs, and documentation created for the work performed under this Contract.
    d. LOI hardware and software training:
        1) Provide the following:
            a) Overview of hardware and firmware, including starting, stopping, and PLC interface.
            b) Configuration of tag database.
            c) Creating, editing, and saving display screens.
            d) Troubleshooting.
    e. Instrumentation training:
        1) Furnish training covering all instruments and control panels.

2) Train maintenance staff in the use, cleaning, calibration, maintenance, and troubleshooting of all the instruments furnished within this project.
3) Furnish training on the operation of new hardwired controls.

3.04 FIELD QUALITY CONTROL

A. General:
1. Failure testing:
a. Demonstrate how the system reacts and recovers from abnormal conditions including, but not limited to:
1) Equipment failure.
2) Communications sub-system error.
3) Power failure.
4) Process equipment failure.
5) High system loading conditions.

B. Loop check/validation:
1. Check all control loops under simulated operating conditions.
2. Provide “end-to-end” tests:
a. Test PLC/controller inputs and outputs from field device to all operator displays and pilot devices.

3.05 ADJUSTING

A. Control valves:
1. Stroke all control valves, cylinders, drives and connecting linkages from the control system as well as local control devices and adjust to verify proper control action, hand switch action, limit switch settings, torque settings, remote control actions, and remote feedback of valve status and position.
2. Check control valve actions and positioner settings with the valves in place to ensure that no changes have occurred since the bench calibration.

END OF SECTION

SECTION 40_72_24

LEVEL MEASUREMENT: RADAR PULSE TIME OF FLIGHT (PTOF)

PART 1 GENERAL

1.01 SUMMARY

A. Section includes:
   1. Non-contact radar (PTOF) level instruments.
   2. Radar level transmitters and associated field measurement elements shall be supplied with the ultraviolet (UV) system equipment for field installation by the installation Contractor's ICSC as specified in Section 40_61_05 - Packaged Control System.
   3. Three field-mounted radar level transmitters and associated level elements shall be supplied at locations indicated on the Drawings and as follows:
      a. UV channel inlet box.
      b. UV Channel No.1 outlet.
   4. UV Channel No.2 outlet. Radar level transmitter signals shall be included as part of the overall UV system master control panel (MCP) integration specified in Section 40_61_05 - Packaged Control System.

1.02 REFERENCES

A. As specified in Section 40_61_05 - Packaged Control System.

B. Abbreviations:
   1. PTOF: Pulse Time of Flight.

1.03 SUBMITTALS

A. Furnish submittals as specified in Sections 01_33_00 - Submittal Procedures and 40_61_05 - Packaged Control System.

B. Furnish commissioning submittals listed below and specified in this Section as specified in Section 01_75_17 - Commissioning:
   1. Manufacturer's representative qualifications.
   2. Owner training.

1.04 QUALITY ASSURANCE

A. As specified in Section 40_61_05 - Packaged Control System.

B. Provide instruments manufactured at facilities certified to the quality standards of ISO 9001.

C. Examine the complete set of Contract Documents and verify that the instruments are compatible with the installed conditions including:
   1. Process conditions: Fluids, pressures, temperatures, flows, materials, etc.

2. Physical conditions:
    a. Installation and mounting requirements.
    b. Location within the process.
    c. Accessories: Verify that all required accessories are provided and are compatible with the process conditions and physical installation.

1.05 DELIVERY, STORAGE, AND HANDLING

A. As specified in Section 40_61_05 - Packaged Control System.

1.06 PROJECT OR SITE CONDITIONS

A. As specified in Section 01_81_50 - Design Criteria.

1.07 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
    1. Notify the Engineer if any installation condition does not meet the instrument manufacturer's recommendations or specifications.

1.08 WARRANTY

A. As specified in Section 01_78_36 - Warranties and Bonds.

PART 2 PRODUCTS

2.01 GENERAL

A. Provide all instruments identified in the Contract Documents.

2.02 DESIGN AND PERFORMANCE CRITERIA

A. Provide instruments suitable for the installed site conditions including, but not limited to, material compatibility, site altitude, site seismic conditions, humidity, and process and ambient temperatures.

2.03 MANUFACTURERS

A. One of the following or equal:
    1. Endress+Hauser, Micropilot M.
    2. Siemens/Milltronics, LR250.
    3. Ohmart Vega, VegaPuls.
    4. Ametek Drexelbrook, DR7000 Series.

2.04 MANUFACTURED UNITS

A. As specified in this Section including Attachment A - ISA Data Sheet - Level Measurement: Radar Pulse Time of Flight (PTOF).

B. Pulse Time of Flight:
   1. General:
      a. Instrument emits radar pulses via a transmitter, with a frequency range of 6.3 GHz to 26 GHz.
      b. The pulses reflect from the surface being measured and are received back at the instrument via a sensor.
      c. The instrument measures the pulse travel time between the transmitter, surface, and receiver to calculate the level.
      d. Safety:
         1) Shall not generate frequency waves with power levels hazardous to humans.
   2. Performance requirements:
      a. Accuracy: Level:
         1) 0.25-inch.
   3. Element:
      a. Level element must conform to the process material compatibility as required for installation in the ultraviolet (UV) disinfection channels as indicated on the Drawings.
      b. Connections:
         1) Process: The antenna design shall be suitable for mounting in a UV disinfection channel.
         2) The design shall be such that product condensation on the antenna shall not affect the performance of the gauge. It shall be possible to choose between parabolic-, cone-, or rod-shaped antennas.
   4. Transmitter:
      a. Microprocessor-based signal converter/transmitter.
      b. Power supply:
         1) 24 VDC - 2-wire loop powered or 120VAC – 4-wire externally powered (selection based upon UV system supplier recommendations).
         2) Power consumption: 15 VA maximum.
      c. Outputs:
         1) Isolated 4-20 mA DC with HART communication protocol.
         2) Provided with two Form C programmable dry contacts for remote indication of separate low and high level setpoint alarms.
      d. Backlit digital display for level or volume.
      e. Self-diagnostics and automatic data checking.
      f. Signal integrity:
         1) Immune to radio frequency and electromagnetic interference with field strength of 15 volts/meter or less over a frequency range of 50 Hz to 460 MHz.
         2) Able to ignore momentary level spikes or momentary loss of echo and indicate loss of echo condition on indicating transmitter unit.
      g. Protected terminals and fuses in a separate compartment, which isolates field connection from electronics:
         1) Indication: Local - 5-digit display.
      h. Enclosure:
         1) Non-hazardous area:
            a) NEMA Type 4X.
      i. Electrical connection: 1/2-inch male NPT.

2.05 ACCESSORIES

A. Software: Provide Windows based PC software for configuration and echo mapping.

B. Provide one hand-held programming unit. Hand-held programming unit shall be utilized by the ICSC (as defined in Section 40_61_05 - Packaged Control System) for start-up and commissioning of each new radar level transmitter. After successful completion of commissioning for all new radar level transmitters, hand-held programming unit shall be transferred to the Owner.

2.06 FINISHES (NOT USED)

2.07 SOURCE QUALITY CONTROL

A. Factory calibrate each level transmitter at a facility that is traceable to NIST.

B. Provide complete documentation covering the traceability of all calibration instruments.

C. FM approval certification or equal when installed in classified areas.

PART 3 EXECUTION

3.01 EXAMINATION

A. UV supplier shall inspect each installation location for each radar instrument and verify that the instrument will work properly at the installed location as installed by the ICSC specified in Section 40_61_05 - Packaged Control System.

3.02 INSTALLATION

A. Field installation performed by the ICSC as specified in Section 40_61_05 - Packaged Control System.

3.03 COMMISSIONING

A. As specified in Section 01_75_17 - Commissioning.

B. Owner Training: Include training for new radar level transmitters as part of the complete supplied UV system as specified in Section 40_61_05 - Packaged Control System and in accordance with the requirements specified below:
   1. Perform Owner training as specified in Section 01_75_17 - Commissioning.

3.04 ADJUSTING

A. Verify factory calibration of all instruments in accordance with the manufacturer's instructions:
   1. Return factory calibrated devices to the factory if they do not meet the field verification requirements for calibration.

3.05 SCHEDULES

A. The provided information does not necessarily include all required instruments. Provide all instruments identified in the Contract Documents:
   1. Instruments may be indicated on the Drawings, specified in the Specifications or both.

END OF SECTION

SECTION 40_80_01

COMMISSIONING FOR INSTRUMENTATION AND CONTROLS

TABLE OF CONTENTS

PART 1 GENERAL

1.01 SUMMARY

A. Section includes:
   1. Testing requirements that apply to process control and instrumentation systems for the entire Project.

1.02 REFERENCES

A. As specified in Technical Specification Sections.

B. Definitions:
   1. Complete End-to-End Testing (CEET) - Signals are tested from the field device through the PLC program, Ultraviolet (UV) disinfection system equipment package HMI, the network, and all the way to the plant operator's SCADA node graphic screens.
   2. Loop validation tests - Signals are tested from the field device to the PLC.
   3. Platform testing: Testing of the UV disinfection system equipment package PLC and HMI at the manufacturer's shop to demonstrate the program's functionality based upon specified and designed control requirements.
   4. Permanent link: The fixed portion of cabling installed between an equipment outlet and its immediate distributor or between 2 distributors.

C. Standards:
   1. Electronics Industries Alliance (EIA).
   2. Telecommunications Industry Association (TIA).

1.03 SUBMITTALS

A. Furnish submittals as specified in Section 01_33_00 - Submittal Procedures.

B. General:
   1. Reference additional submittal and prerequisite requirements as specified in the Technical Specification Sections.

C. Overall test plan:
   1. Develop the PCIS system test submittals as specified herein and as specified in Sections 40_61_05 - Packaged Control System and 46_66_85 - Ultraviolet Disinfection System.
   2. Develop and submit an overall testing plan for the PCIS. The overall test plan to be reviewed and approved by the Engineer before detailed test plans, procedures, and forms will be reviewed.
   3. Describe the test phases as they apply specifically to this Project and each process system.
   4. Provide a preliminary testing schedule to show the sequence of tests and commissioning as they apply to each process system and each UV system package PLC.
   5. Provide a description of factory tests. Describe what equipment will be included, what testing equipment will be used, and the simulator that will be used.

6. Provide examples of proposed forms and checklists.

D. Test procedures:
   1. Develop and submit detailed factory test procedures to demonstrate that the UV system package is capable of communicating with the Owner's plant SCADA system.
   2. Provide a statement of test objectives for each test.
   3. Prepare specific procedures for each process system.
   4. Describe sequentially the steps to be followed in verifying the correct operation of each process system, including all features described in the loop descriptions, control strategies, and shown in the P&IDs. Implied or generic test procedures are not acceptable.
   5. Specify who will perform the tests, specifically what testing equipment will be used (including serial numbers and NIST-traceable calibration), and how the testing equipment will be used.
   6. Describe the expected role of the Engineer, as well as any requirements for assistance from Owner's staff.
   7. Provide the forms and checklists to be used.

E. Test forms:
   1. Submit completed calibration forms, test forms, and checklists:
      a. Test forms shall include the detailed test procedures or shall include clear references to separate pages containing the complete test procedure applicable to each form. If references to procedures are used, the complete procedure shall be included with each test binder.
      b. Every page of each test form shall include project name, date, time, name of person conducting the test, signature of person conducting the test, and for witnessed tests, place for signature of person (Engineer and Owner) witnessing the test.
      c. Sample test forms at the end of this Section show the minimum required content:
         1) The sample test forms have not been customized for this Project.
         2) Contractor shall develop and submit test forms customized for the Project and meeting the specified test and submittal requirements.

F. FAT procedure additional minimal requirements:
   1. Prepare and submit a FAT procedure which includes:
      a. Control system testing block diagram.
      b. Estimated test duration.

G. Details on the simulator construction, components, and operation. Testing binders:
   1. Sub-system to be tested, provide and submit a test binder containing all test procedures and individual test forms for the test. References to other documents for test procedures and requirements are not acceptable.
   2. Fill out in advance headings and all other information known before the test.
   3. Include applicable test plan information, as well as a list of all test prerequisites, test personnel, and equipment.
   4. Include or list reference material and provide separately at the time of the test.
   5. Record test results and verify that all test requirements and conditions have been met.

H. Furnish commissioning submittals listed below and specified in this Section as specified in Section 01_75_17 - Commissioning:
   1. Manufacturer's representative qualifications.
   2. Owner training.

I. Test reports:
   1. At the conclusion of each test, submit a complete test report, including all test results and certifications.
   2. Include all completed test binders, forms, and checklists.
   3. Submission, review, and acceptance of each test report is required before the start of the sub-system.

J. Furnish 4 CD/DVD copies of the following:
   1. Application software:
      a. Finalized fully annotated copy of programmed PLC logic in its native format.
      b. Cross-referenced index of all PLC registers or points.

1.04 QUALITY ASSURANCE

A. Test personnel:
   1. Furnish qualified technical personnel to perform all calibration, testing, and verification. The test personnel are required to be familiar with this Project and the equipment, software, and systems before being assigned to the test program.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 EXAMINATION (NOT USED)

3.02 INSTALLATION

A. Installation supervision:
   1. Provide as specified in Technical Specification Sections.

3.03 COMMISSIONING

A. As specified in Section 01_75_17 - Commissioning.

B. Testing and training phase:
   1. Source testing:
      a. Manufacturer services: Provide as specified in the table below.

Section Number	Section Title	Source Testing (Witnessed or Non-Witnessed)
40_61_05 - Packaged Control System	Packaged Control System	Witnessed
46_66_85 - Ultraviolet Disinfection System	Ultraviolet Disinfection System: Open Channel Wastewater/Reuse	Witnessed
40_80_01 - Commissioning for Instrumentation and Controls	Commissioning for Instrumentation and Controls	Witnessed

b. Prerequisite requirements:
   1) Engineer approval of the hardware and equipment source testing submittal, Manufacturer Certificate of Source Testing, is required before proceeding to Preliminary FAT.

c. Preliminary FAT (Pre-FAT):
   1) The purpose of the Pre-FAT is to provide assurance that the UV package system HMI system is ready for the full, witnessed FAT, in terms of both stability and functionality:
      a) Debugging of software and troubleshooting of hardware shall occur during and before the pre-FAT, not during the FAT.
      b) Supplier shall fully test the HMI system and fix all deficiencies found before the FAT.
   2) Conduct utilizing test procedures approved by Engineer.
   3) Owner shall have the right to witness any or all of the Pre-FAT testing and shall be notified in writing 20 days before the start of the pre-FAT.
   4) Submit a letter, signed by the Contractor's project manager or company officer, certifying that integrated system hardware and software has been tested and confirmed to be fully operational and in compliance with the requirements specified in the Contract Documents and is fully ready for the full, witnessed FAT:
      a) Attach the completed pre-FAT test forms, signed by the Contractor's staff.
   5) Engineer approval of the pre-FAT submittal is required before proceeding to FAT.

d. FAT hardware and communications testing:
   1) Perform tests to show that the integrated system hardware and software is fully operational and in compliance with the requirements specified in the Contract Documents.
   2) The complete PCIS system including operator stations, network equipment, PLCs, LCPs, communications equipment, and other HMI equipment, shall be assembled, connected, and software loaded for a fully functional FAT of the integrated system.

3) For any fault tolerant networks such as ring topology networks, disconnect each segment of the network individually to demonstrate proper failover and alarming at the HMI.
4) Testing simulation:
    a) Inputs and outputs shall be simulated and proper control and system operation shall be validated.
    b) Whenever supplied equipment is available, such as devices internal to the control panel, test input and output signals using the equipment. Simulation is not acceptable.
    c) FAT shall make use of simulators that contain switches, pilot lights, variable analog signal generators, and analog signal level displays, which shall be connected to the I/O points within the UV system package master control panel (MCP)system:
        (1) The simulator may consist of a PLC, operating under a HMI/SCADA software package provided by the UV system package supplier, or other approved software that has its I/O points wired to PLC's I/O points.
        (2) Software operating on a PC may then act as the switches, pilot lights, variable analog signal generators, and analog signal level displays.
5) Additional source tests are specified in other sections of the Instrumentation and Control Specifications.
6) Owner shall have the right to witness any or all of the FAT testing and shall be notified in writing 20 days before the start of the FAT.
7) Panel inspections:
    a) Engineer will inspect each control panel for completeness, workmanship, fit and finish, and compliance with the Contract Documents and the accepted shop drawings:
        (1) Inspection to include, as a minimum: Layout, mounting, wire and data cable routing, wire tags, power supply, components and wiring, I/O components layout (including terminals, wiring and relays), device layout on doors and front panels, and proper ventilation operation.
    b) Inspection forms:
        (1) Provide panel inspection forms as part of the FAT procedures submittal.
        (2) A sample FAT control panel form has been provided at the end of this Section.
8) I/O test:
    a) Engineer will verify that I/O is properly wired to field terminals and is properly mapped into the PLC and the rest of the UV system package system, including all operator interface devices.
    b) Test methodology:
        (1) Discrete inputs:
            (a) Apply appropriate input from simulator at panel terminal, observe input card indicator, observe data value at each indicated data address, and observe data received at field wiring terminals or operator interface screen.

(2) Discrete outputs:
(a) Issue commands from operator interface screen or PLC, verify output card indicator light, and measure response at field wiring terminals or multimeter.
(3) Analog inputs:
(a) Apply appropriate analog input signal at panel terminals on simulator, observe data value at each indicated data address, and observe data properly received at field wiring terminals or operator interface screen.
(b) Check each point at 0 percent, 25 percent, 50 percent, and 100 percent of scale.
(4) Analog outputs:
(a) Enter scaled values in the output buffer file, observe the output data file value, and measure appropriate response at field wiring terminals or multimeter.
(b) Check each point at 0 percent, 25 percent, 50 percent, and 100 percent of scale.

c) Test forms to include, but not be limited to the following data:
(1) PLC and panel number.
(2) I/O type.
(3) I/O tag name.
(4) Rack/slot/number of I/O point.
(5) Check-off for correct response for each I/O point.
(6) Comments field.
(7) Initials of individual performing test.
(8) Date test was performed.
(9) Witness signature lines.

9) System configuration test:
a) Demonstrate and test the setup and configuration of operator stations.
b) Demonstrate the proper operation of peripheral hardware.
c) Demonstrate general HMI/SCADA functions.
d) Demonstrate proper operation of log-on and other security access functions.
e) Demonstrate the proper operation of all historical data storage, trend, display, backup, and report functions.
f) Test automatic fail over of redundant equipment.
g) Demonstrate the proper operation of the alarm display and acknowledgement functions.
h) For any fault tolerant networks, such as ring topology networks, disconnect each segment of the network individually to demonstrate proper failover and alarming.
i) Test forms:
(1) For each test, list the specification page and paragraph of the function demonstrated, and provide a description of the function.
(2) List the specific tests and steps to be conducted.

(3) For each function, list all of the different sub-functions or ways the function can be used, and provide a test check-off for each:
(a) Include signature and date lines.

10) Engineer approval of the FAT Communication Testing activities is required before proceeding to FAT Platform Testing.

e. FAT Platform Testing - Control logic test:
1) Verify the PLC, HMI and simulated SCADA system provides monitoring and control functionality based upon specified and designed control requirements.
2) Testing requirements:
a) Demonstrate each function described in the Control Strategies developed by the UV system supplier.
b) Demonstrate in detail how each function operates under a variety of operating scenarios:
(1) Test to verify the application of each general control strategy function to each specific control strategy or loop description.
c) Demonstrate the proper operation of the programming and configuration for each control strategy or loop description:
(1) Test each strategy or loop description on a sentence by sentence and function by function basis.
(2) Loops with similar or identical logic must each be tested individually.
(3) Test the boundaries of each numeric operator input by entering values outside of the allowable range.
d) Demonstrate the proper operation of all digital communication links and networks:
(1) Verify each digital communication I/O point.
e) Failure testing: Demonstrate how the system responds to and recovers from abnormal conditions including, but not limited to: equipment failure, operator error, communications subsystem error, communications failures, simulated/forced software lockups, power failure (both utility power and power to HMI and/or SCADA hardware), process equipment failure, and high system loading conditions.
3) Test forms:
a) Submit completed test forms for each loop including but not limited to the fully revised and approved control strategy.
b) Identify the cause and effect as each I/O point is toggled through the simulator:
(1) Identify and track proper and/or improper operation of the loop.
c) Note any deficiencies or operational changes on the forms for correction and documentation:
(1) Include signature and date lines.
4) Engineer approval of the FAT submittal is required prior to shipment of system components.

2. Owner Training:
a. Perform Owner training as specified in Section 001_75_17 - Commissioning.

Table 1			
Course Title	**Minimum Course Length (hours per session)**	**Personnel (Estimated Number of Students)**	**Minimum Number of Sessions**
System Overview	8	10	1
Operator Training - Basic	24	10	2
Operator Training - Advanced	16	5	2
HMI Software	**40**	**3**	**1**
PLC Hardware	16	4	1
PLC Software	32	6	1
LOI Hardware and Software	16	5	1
Network Equipment	16	4	1
Follow-Up Training	8	5	5

3. Training course requirements:
   a. System overview training:
      1) Furnish training courses that give the Owner's supervisory level personnel and overview of all elements of the PCIS system that focus on the overall functional aspect of elements of the control system and provide an understanding of the interaction of the various components.
      2) Furnish a training course that gives the Owner's supervisory level personnel and overview of the new Contractor-provided elements of the PCIS system. Focus on the overall functional aspects of each new elements of the control system, particularly the mechanical system vendor-provided control packages.
   b. Operator training:
      1) Furnish training courses that instruct system operators in the efficient operation of all aspects of the PCIS that include not only the general operation of the control system but also the operation of specific system features.
      2) Furnish training courses that instruct system operators in the efficient operation of Contractor-provided aspects of the PCIS that include not only the general operation of each control system but also the operation of specific system features.
      3) Operator's training shall include the following for each vendor package and programmable device:
         a) Control system overview: Architecture, equipment functions, software components, etc.
         b) Display navigation, overview, and types of displays.
         c) Process and equipment monitoring and control: Basic principles and operation.

d) Logging ON and OFF the system and description of the security and access system.
e) Alarm subsystem.
f) Trending: Provide a thorough session on how to use all trending functions.
g) Reports: How to access, print, and review content.
h) Control strategies: Present an average 15-minute review of each control strategy, including a hands-on demonstration of screens and operator functions for each.
i) Instruction on the use of all operational functionality alarm logging, trending, displays, database, reports, and control software developed for the Project and incorporated in the installed PCIS system.

c. HMI software training:
1) Furnish training courses that will enable the Owner's staff to develop and maintain all aspects of the operator interface system applications.
2) Include topics:
a) Operating systems and utilities such as virus protection software.
b) Point (tag) database development and modification.
c) Graphic screen creation and editing.
d) Scripting.
e) I/O servers, drivers, etc.
f) PLC interface functions and software.
g) Displays, scripts conventions, and documentation.
h) Trending.
i) Alarms and events.
j) System security, access levels, and areas of responsibility.
k) General system maintenance, including backups, history data archive, version control, file naming and cataloging conventions, and system file housekeeping.
3) Address not only the procedures associated with the control system's standard software packages, but in addition include material explaining the specific conventions used in developing the Project's system applications (graphics, PLC/RTU interface, scripts, control strategies, trends, etc.). In addition, provide instruction in the use of techniques for developing and maintaining current, comprehensive documentation for all installed system applications.

d. PLC software training:
1) Furnish training on PLC software.
2) Two types of training are required, basic and project-specific:
a) Basic PLC software training covers the principles of PLC programming and the specific features and function of the PLC products used on this Project, provided by one of the PLC manufacturer's certified trainers.
b) Project-specific PLC software training covers the programming conventions, new standardized software modules, specific control strategy programs, and documentation created for the Work performed under this Contract. This training includes the specific knowledge needed to modify, expand, duplicate,

troubleshoot, and repair the PLC programs provided under this Contract, provided by the UV system package supplier who is thoroughly familiar with the delivered system, and is one of the senior programmers who programmed the PLCs for this Project.

e. LOI hardware and software training:
   1) Provide the following:
      a) Overview of hardware and firmware, including starting, stopping, and PLC interface.
      b) Configuration of tag database.
      c) Creating, editing, and saving display screens.
      d) Troubleshooting.

f. Network equipment training:
   1) Furnish basic training on all network hardware, switch and router configuration and software, and network monitoring software.
   2) Include a detailed description and explanation of the installed network architecture, media, and functions.
   3) Furnish an overview of the function and operation of each piece of network equipment.
   4) Furnish training on network maintenance troubleshooting and repair.
   5) Furnish training on how to install spare or off-line backup equipment.
   6) Basic network overview:
      a) Discuss a basic network overview for each site.
      b) Discuss the architecture (loop, star, etc.), media redundancy, and items that are not readily apparent to staff.
      c) Discuss how to monitor the network health through the HMI network screen.
      d) Discuss both enterprise level networks, the PCS communications network, and the field network.
   7) Ethernet switches:
      a) Discuss the various types of switches (Layer 2, Layer 3, etc.).
      b) Discuss switch health monitoring through the HMI.
      c) Discuss the VLAN configuration (what ports should be used for what network, etc.).
      d) Discuss testing procedures.
   8) Field networks:
      a) General:
         (1) Discuss general principles behind likely device failures and actions to take to resolve such failures for each type of field network.
      b) DLR networks:
         (1) Discuss how to add non-DLR equipped devices to a DLR network.
         (2) Discuss how to monitor and test DLR network health through an ETAP module or DLR capable switch.

g. Follow-up training:
   1) Provide a series of on-site follow-up training classes beginning after process start-up of the UV system equipment in conjunction with operation with the Owner's plant SCADA/PCIS system. The intent for these classes is to provide the Owner's personnel the opportunity for a review and "refresher" of the training topics and material after they have had some experience using the system.

2) Mutually schedule and develop the content of these classes with the Owner no later than 1 month before the beginning of the first session:
   a) Schedule at the Owner's discretion on non-consecutive days spaced out over the process start-up and warranty period.

4. Installation testing:
   a. Calibration:
      1) Performed by Contractor and ICSC.
      2) Calibrate and adjust all instruments, devices, valves, and systems, in conformance with the component manufacturer's instructions and as specified in these Contract Documents.
      3) Replace either individually or within a system, defective elements that cannot achieve proper calibration or accuracy:
         a) Calibration for discrete devices:
            (1) Calibrate and adjust devices for reliable operation and to avoid nuisance tripping.
         b) Calibration for ultrasonic and radar level devices:
            (1) Provide Echo Transmission and signal quality on level transmitters including guided and unguided units:
               (a) Submit printout of the actual transmission and parameters.
            (2) Adjust mounting, as required, to obtain accurate readings.
            (3) Post mounting: Provide any additional calibration required by manufacturer.
         c) Calibrating analog transmitters:
            (1) Components having adjustable features are to be set accurately for the specific conditions and applications of this installation.
            (2) Test and verify that components and/or systems are within the specified limits of accuracy.
            (3) Calibration points:
               (a) Calibrate each analog instrument at 0 percent, 25 percent, 50 percent, 75 percent, and 100 percent of span, using test instruments with accuracies traceable to NIST.
            (4) Field verify calibration of instruments including units that have been factory-calibrated to determine whether any of the calibrations are in need of adjustment.
         d) Analyzer calibration:
            (1) Calibrate and test each analyzer system as a workable system after installation. Follow the testing procedures directed by the manufacturers' technical representatives.
            (2) Submit completed instrument calibration sheets for every field instrument and analyzer.
            (3) Calibration tags:
               (a) Attach a calibration and testing tag to each instrument, piece of equipment, or system.
               (b) Sign the tag when calibration is complete.
         e) Calibration for industrial networking test equipment.
         f) Submit calibration documentation.
   b. Loop check:
      1) Performed by the Contractor.

2) Cabling installed, terminated, and labeled.
3) Perform continuity check of wiring to each field device through intermediate devices to field terminals in the cabinet.
4) Complete loop check form for each device.
5) Submit loop check test results before proceeding to the next step.

c. Loop validation tests:
1) Performed by the Contractor, ICSC, and manufacturer's representative, working together, and witnessed by the Owner or Owner's representative.
2) Perform tests on the signal from each field device through intermediate devices to the I/O module on the PLC:
a) The PLC may or may not be connected to the network.
3) Engineer approval of the loop validation test submittal is required before proceeding to CEET.

d. Industrial network testing:
1) General test requirements.

e. Complete End-to-End Testing (CEET):
1) Performed by Contractor, ICSC, manufacturer's representative, and plant SCADA system Programmer (Programmer) working together, with assistance from the Owner or the inspection staff, as needed:
a) The participants need to be dedicated full-time to CEET.
b) Programmer will provide staff to verify input signals at, and create output signals from, an HMI or Engineering Workstation.
c) Contractor and ICSC will be responsible for creating field signals and verifying proper operation of final control elements.
2) Prerequisites:
a) CEET cannot begin until the successful completion of the preceding tests:
(1) Calibration.
(2) Loop check.
(3) Loop validation tests.
(4) Copper Ethernet cable acceptance testing.
(5) Industrial network testing.
3) Testing description:
a) This testing is to ensure all I/O signals operate to the intent of the design from the field device to the HMI and all other auxiliary controls and indicators in the PCS.
b) Connect PLC to the network to test signals from the field device through the PLC program, the network, and to the operator’s HMI graphic screens. The outputs will be energized for a duration long enough to verify proper operation of the final control element.
c) SCADA screens:
(1) Test and record operator commands and signal readouts to each operator device where there is more than one operator interface point.
(2) For each signal, perform separate tests for SCADA computer screens, local operator interface (LOI) screens, and local control panels.
(3) Retest any loop following any necessary corrections.

4) Check control loops under simulated operating conditions by causing a range of input signals at the primary control elements and observing appropriate responses of the respective control and monitoring elements, final control elements, and the graphic displays associated with the HMI/SCADA system:
    a) Use actual process inputs wherever available.
    b) Issue commands from the HMI/SCADA system and verify proper responses of field devices:
        (1) Test SCADA system inputs from field device to SCADA system operator workstations:
            (a) Track responses through trend charts in the HMI/SCADA system.
        (2) Test SCADA system outputs from SCADA operator workstations to field devices and equipment.
5) Discrete device testing:
    a) Exercise each field device providing a discrete input to the HMI/SCADA system in the field and observe the proper operation shall be observed at the operator workstation:
        (1) Test limit switches, set limits mechanically, and observe proper operation at the operator workstation.
        (2) Exercise starters, relay contacts, switch contacts, and observe proper operation.
        (3) Calibrate and test instruments supplying discrete inputs and observe proper operation.
    b) Test each device accepting a discrete output signal from the HMI/SCADA. Perform the appropriate operator action at the SCADA operator stations (including LOIs, if present) and confirm the proper operation of the field device:
        (1) Stroke valves through outputs from the HMI/SCADA system, and confirm proper directional operation. Confirm travel limits and any feedback signals to the HMI/SCADA system.
        (2) Exercise motors starters from the HMI/SCADA system and verify proper operation through direct field observation.
        (3) Exercise solenoids and other field devices from the HMI/SCADA system and verify proper operation through direct field observation.
6) Analog device testing:
    a) Apply continuously variable up and down analog inputs to verify the proper operation and setting of discrete devices (signal trips, etc.).
    b) Apply provisional settings on controllers and alarm setpoints.
7) Analog input:
    a) Exercise each field device monitoring the analog signal, through the HMI/SCADA system:
        (1) Apply simulated sensor inputs corresponding to 0 percent, 25 percent, 50 percent, 75 percent, and 100 percent of span for networks that incorporate analog elements and monitor the resulting outputs to verify compliance to accuracy tolerance requirements.

8) Analog output:
   a) Exercise each field device requiring an analog command signal, through the HMI/SCADA system:
      (1) Vary the output from the PLC HMI/SCADA system and measure the end device position, speed, etc., to confirm the proper operation of the device for the supplied analog signal.
      (2) Manually set the output from the HMI/SCADA screen at 0 percent, 25 percent, 50 percent, 75 percent, and 100 percent and measure the response at the final device and at any intermediate devices.
9) Submit completed test forms:
   a) Discrete instrument input devices:
      (1) Switch setting, contact action, and dead band.
      (2) Valve position switches:
         (a) Response in the PLC as the valve is stroked from the PLC.
         (b) Field observed actual valve position, and valve indicator position as the valve is stroked from the PLC.
      (3) Operator interface switches (control stations and other pilot devices) and associated response.
      (4) Starter and drive auxiliary device contact response.
      (5) Response of all other discrete inputs to the PLC.
      (6) Test equipment used and associated serial numbers.
   b) Discrete output devices:
      (1) Observed response of field device to the discrete output from the PLC.
      (2) Observe the proper operation of Open, Close, Start, Stop, On, Off, etc.
      (3) Test equipment used and associated serial numbers.
   c) Analog input devices:
      (1) Calibration range.
      (2) Calibration data: Input, output, and error at each test value.
      (3) Analog input associated PLC register address.
      (4) Value in PLC register at each test point.
      (5) Value displayed at each operator interface station (local operator interface displays and SCADA workstations).
      (6) Test equipment used and associated serial numbers.
   d) Analog output devices:
      (1) Calibration range.
      (2) Test value at each test point.
      (3) Analog output associated PLC register address.
      (4) Control variable value at field device at each test point.
      (5) Physical device response at each test point:
         (a) Response to be actual valve position, or motor speed, etc.
      (6) Test equipment used and associated serial numbers.
10) Failure testing:
   a) Demonstrate how the system reacts and recovers from abnormal conditions including, but not limited to:
      (1) Equipment failure.

(2) Communications sub-system error.
(3) Power failure.
(4) Process equipment failure.
(5) High system loading conditions.

11) Engineer approval of the CEET submittals is required before proceeding to Functional Testing.

5. Functional testing:
   a. General:
      1) Testing to demonstrate proper operation of systems with process equipment operating over full operating ranges under conditions as closely resembling actual operating conditions as possible.
      2) Performed by Contractor, ICSC, manufacturer's representative, and Programmer working together, with assistance from the Owner or the inspection staff, as needed.
      3) Additional tests are specified in other Instrumentation and Control Sections.
      4) Follow approved detailed test procedures and check lists for Functional Test activities.
   b. Control logic operational validation:
      1) The purpose of control logic validation is to field test the operation of the complete control system, including all parts of the HMI/SCADA system, all control panels (including vendor control panels), all control circuits, all control stations, all monitored/controlled equipment, and final control elements.
      2) Demonstrate control functionality shown on the P&IDs, control schematics, and other drawings, and specified in the loop descriptions, control strategies, Electrical Specifications, and Mechanical Equipment Specifications.
      3) Test in detail on a function-by-function and sentence-by-sentence basis.
      4) Thoroughly test hardware and software functions.
      5) Including all hardwired and software control circuit interlocks and alarms.
      6) Test final control elements, controlled equipment, control panels, and ancillary equipment under startup, shut down, and steady-state operating conditions to verify all logic and control is achieved.
      7) Control logic validation tests to include, but not limited to: a repeat of all control logic tests from the FAT, modified and expanded to include all field instruments, control panels, circuits, and equipment.
   c. Loop tuning:
      1) Optimally tune all electronic control stations and software control logic incorporating proportional, integral, or derivative control. Apply control signal disturbances at various process variable levels and adjusting the gain, reset, or rate settings as required to achieve proper response.
      2) Verify the transient stability of final control elements operating over the full range of operating conditions, by applying control signal disturbances, monitoring the amplitude and decay rate of control parameter oscillations and making necessary controller adjustments as required to eliminate excessive oscillatory amplitudes and decay rates. As a minimum, achieve 1/4-wave amplitude decay ratio

damping (subsidence ratio of 4) under the full range of operating conditions.

3) If excessive oscillations or system instability occur, as determined by the Engineer, continue tuning and parameter adjustments, or develop and implement any additional control algorithms needed to achieve satisfactory control loop operation.
4) Functional validation sheets:
    a) Document each Functional test on an approved test form.
    b) Document loop tuning with a report for each loop, including two-pen chart recordings showing the responses to step disturbance at a minimum of 3 setpoints or process rates approved by the Engineer. Show tuning parameters on the charts, along with time, date, and sign-off by Contractor and Engineer.
    c) Include on the form, functions which can be demonstrated on a loop-by-loop basis:
        (1) Loop number and P&ID number.
        (2) Control strategy, or reference to specification tested.
        (3) Test procedures: Where applicable, use the FAT function-by-function, sentence-by-sentence loop test checklist forms modified to meet the requirements of the Functional test. Otherwise, create new forms.
    d) For functions that cannot be demonstrated on a loop-by-loop basis (such as overall plant power failure), include on the test form a listing of the specific steps and tests to be conducted. Include with each test description the following information:
        (1) Specification page and paragraph of function demonstrated.
        (2) Description of function and/or text from specification.
        (3) Test procedures: use the FAT loop test checklist forms modified to meet the specific testing conditions of the Functional test.
5) Functional certification:
    a) Provide Manufacturer's Certificate of Installation and Functionality Compliance as specified in Section 01_75_17 - Commissioning:
        (1) Including all test forms with test data entered, submitted to the Engineer with a clear and unequivocal statement that all Functional test requirements have been satisfied.

C. Process Start-up Phase:
    1. Process Start-up:
        a. Programmer shall be onsite to support Process Start-up activities and provide functional changes as required:
            1) ICSC shall be available as needed.
        b. ICSC shall be onsite to support Process Start-up activities and provide functional changes as required.
    2. Process Operation Period:
        a. Programmer shall be available to support Process Operational Period and provide functional changes as required:
            1) ICSC shall be available as needed.

b. ICSC shall be available to support Process Operational Period and provide functional changes as required.

3. PCIS Optimization and Fine-Tuning:
   a. General:
      1) After the Process Operational Period, test PCIS system for additional 60 days as specified in this Section to identify issues and make corrections, as needed.
      2) This is part of the Work that must be completed as a condition of substantial completion and final completion for the entire Project.
      3) The complete PLC control and HMI/SCADA system must run continuously for the duration of the PCIS Optimization and Fine-Tuning.
      4) Test and use the entire process control system under standard operating conditions.
      5) Exercise all system functions.
      6) Log failure, any system interruption and accompanying component, subsystem, or program failure including time of occurrence, duration of each failure, failure classification, and cause:
         a) Provide a competently trained technician or programmer on call for the Project Site during all normal working days and hours from the start of the PCIS Optimization and Fine-Tuning until final acceptance of the system:
            (1) Response time to the Project Site: 24 hours or less, for a major failure.
   b. SCADA system testing:
      1) Exercise each system function, e.g., status report, alarms, logs, and displays several times at a minimum, and in a manner that approximates "normal" system operation.
      2) Failure of the HMI/SCADA system during testing shall be considered as indicating that the programs and operating system do not meet the requirements of the specifications:
         a) Corrective action is required before restarting the PCIS Optimization and Fine-Tuning.
      3) Only those components, sub-systems, and systems covered in this Section and supplied under this Contract shall be considered for this acceptance test. Problems and failures of other systems shall not be considered as part of this test, except as they display the capabilities of this system to detect failures.
      4) Failures:
         a) Classify failures as either major or minor:
            (1) Minor failure:
               (a) A small and non-critical component failure or software problem that can be corrected by the Owner's operators.
               (b) Log this occurrence but this is not a reason for stopping the test and is not grounds for nonacceptance.
               (c) Should the same or similar component failure occur repeatedly, this may be considered as grounds for non-acceptance.

(d) Failure of one printer or operator station is considered a minor failure providing all functions can be provided by backup equipment, i.e., alternate printers and operator station, and repairs can be made, and equipment returned to service within 3 working days.

(2) Major failure:

(a) Considered to have occurred when a component, subsystem, software control, or program fault causes a halt in or improper operation of the system and/or when a technician's work is required to make a repair or to re-initiate operation of the system.

(b) Cause termination of the PCIS Optimization and Fine-Tuning.

(c) Start a new acceptance test when the causes of a major failure have been corrected.

(d) A failure is also considered major when failure of any control system that results in an overflow, underflow, overdose, or underdose condition occurs.

5) Technician report:

a) Each time a technician is required to respond to a system malfunction, they must complete a report, which includes details concerning the nature of the complaint or malfunction and the resulting repair action required and taken.

b) If a malfunction occurs which clears itself or which the operator on duty is able to correct, no report is required or logged as specified above.

c) If a technician has performed work but no report is written, then a major failure is considered to have occurred.

d) Each report shall be submitted within 24 hours to the Engineer and the Owner, or its representative.

3.04 SCHEDULES

A. Example test forms:

1. Example test forms are attached at the end of this Section. They may be used as a starting point for the development of Project-specific test forms for this Project.
2. The example test forms are not intended to be complete or comprehensive. Edit and supplement the forms to meet the requirements for testing and test forms specified in this Section and other Contract Documents.

END OF SECTION

ATTACHMENT A - FACTORY ACCEPTANCE TEST - CONTROL PANELS

	FACTORY ACCEPTANCE TEST - CONTROL PANELS	

1. GENERAL INSPECTION

A. Structural Inspection

- ☐ Verify Lifting Lugs Installed
- ☐ Verity enclosure has lock and lock is functional
- ☐ Confirm that seismic bracing components are provided per manufacturer's installation instructions

B. Exterior Inspection

- ☐ Cabinet exterior is clean, scratch, and dent free
- ☐ Inspect externally for corrosion and damage
- ☐ Verify enclosure door opens and closes easily
- ☐ Verify enclosure has a 3-point latch
- ☐ Verify enclosure has a flange mounted disconnect (where voltages greater than 120 VAC enter the cabinet)
- ☐ Verify enclosure has the appropriate NEMA rating (1, 1G, 12, 3R, 4, 4X, etc.)
- ☐ Verify enclosure is the appropriate size (not grossly larger than design, and will still fit in the plant)

Nameplates

- ☐ Cabinet has identification nameplate
- ☐ All door labels are straight, spelled correctly, and match the tagging defined in the Contract
- ☐ Cabinet has a nameplate that includes the following:
  - ☐ Power source(s)
  - ☐ Integrator's Logo
  - ☐ Circuit ID(s)
  - ☐ Short Circuit KAIC ratings
- ☐ If labels are screwed to door, silicone was utilized to cover screw holes (Labels screwed to the door of a NEMA 4/4X panel technically violates the NEMA rating.)

Door Devices

- ☐ All devices penetrating the outside of panel have gaskets, silicone or both
- ☐ All door devices are installed (HMIs, Pilot Devices, etc.)
- ☐ Door mounted equipment is mounted straight and square
- ☐ All exterior or door mounted equipment present and accounted for, installed and securely fastened
- ☐ NEMA classification has not been violated due to penetrations
- ☐ Door mounted equipment has the same NEMA rating as the panel
- ☐ All door mounted equipment installed at the correct height
- ☐ All door mounted equipment installed in the correct positions and order (layout of door mounted equipment is grouped properly and in a logical manner)
- ☐ Doors with multiple penetrations have adequate bracing (if needed)
- ☐ Visually check condition of indicators , controllers and annunciators
- ☐ Check that pilot lights illuminate correctly
- ☐ Check the Push-To-Test function
- ☐ Ensure correct pilot light color

Peripheral Devices

- ☐ Horn / Beacon is installed (where required)
- ☐ Silence and Reset pushbutton

PROJECT NAME:		TEST DATE:	
FACILITY NAME:		TESTED BY:	
PROCESS AREA:		COMPANY:	
NETWORK ID:		PAGE:	
WITNESSED BY:		SIGNATURE:	

	FACTORY ACCEPTANCE TEST - CONTROL PANELS	

1. GENERAL INSPECTION (continued)

C. Interior Inspection

- ☐ Cabinet is cleaned of marks and dirt.
- ☐ Inspect internally for corrosion and damage.
- ☐ Back panel is clean of marks and dirt.
- ☐ Interior of panel vacuumed and shall be free of all debris.
- ☐ Check that the panel roof is clean and clear of foreign materials.
- ☐ Bottom of panel has been cut out (where bottom entry is required), with angle iron welded around the bottom perimeter. Re-painting has been performed.
- ☐ If internal light door limit switch is provided, ensure the light automatically turns "on" when the doors are open.
- ☐ Check that a document pocket has been provided.
- ☐ Intrusion alarms (where required).

Interior Labeling

- ☐ All panel mounted equipment has identification labeling, by using either a Brothers or Phenolic type tags.
- ☐ Verify that door mounted components are mounted square and symmetrical.
- ☐ Verify that nameplates are straight, legible, and spelled correctly.
- ☐ All terminal blocks are identified/labeled with permanent labels including tight end blocks and caps.
- ☐ All wiring shrink labeled and or phased correctly to the specifications.
- ☐ All wire labels shrunk completely rotated and aligned alike for easy identification.
- ☐ All fuses and circuit breakers are labeled with ID and current rating.
- ☐ System Integrator’s label or labels installed on door.
- ☐ Panel manufacturer model/serial number tag is present.
- ☐ All required safety/warning tags installed and straight.
- ☐ Correct UL (typically UL 508) or cUL tag installed and registered and all other associated tags installed and straight (the UL tag might not be installed in the panel at the factory test. If the panel is modified due to changes during the factory test or a punch list generated from the factory test, the UL labeling would need to be re-applied. Some UL shops do not apply the UL label until the panel is released to be shipped.).

Wireways

- ☐ Plastic wire way covers installed properly.
- ☐ Plastic wireways have no sharp edges.
- ☐ No wire Ties inside the wireways.
- ☐ No sharp edges on wire ties.
- ☐ Separation: White duct is used for DC voltages, Gray duct is used for AC voltages.
- ☐ Ensure wiring duct is not over-full, includes provision for 20% more wiring and the cover may easily be installed. Panduit recommends 50% duct fill, but 40% is a better practice.

PROJECT NAME:		TEST DATE:	
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1. GENERAL INSPECTION (continued)

C. Interior Inspection (continued)

Wiring

- ☐ Visually check terminals and condition of internal wirings
- ☐ Verify that the control panel has been assembled and wired as designed
- ☐ Verify that all components are operational and perform the functions intended
- ☐ Verify that all components are sized appropriately for the application
- ☐ Verify that equipment control circuits function as intended
- ☐ Back of door wiring is labeled and neatly formed
- ☐ Back panel to door wiring has sufficient bending radius with spiral wrap
- ☐ Wire connection has been verified wired to correct points within the panel
- ☐ Individual wires have been given a pull test to verify a good terminal connection
- ☐ Wire and cable minimum bending radius have not been violated
- ☐ All equipment installed straight and square to back panel
- ☐ Wire colors are correct:
  - ☐ Black and White > AC hot and neutral, respectively
  - ☐ Red > AC control signals
  - ☐ Blue > DC power and control (Blue w/White stripe for DC ground)
  - ☐ Yellow > Foreign voltages (those still present when panel power is disconnected)
  - ☐ Green > AC equipment ground
  - ☐ Black > TSP (+)
  - ☐ White> TSP(-)
- ☐ Analog wiring shields are continuous (connected by a dedicated terminal block for such shields)
- ☐ Analog shield wires are grounded within the panel, where not otherwise grounded at the transmitter itself
- ☐ Discrete inputs are separately fused or protected by a circuit breaker on a “per loop” basis
- ☐ Intrinsic Safety Wiring
  - ☐ Ensure wiring associated with intrinsic safety circuits or intrinsic safety barriers is kept away from all other wiring by UL minimum distances or by a physical (grounded metal) barrier preventing non-intrinsically safe wiring from coming in contact with intrinsically safe circuits or wiring
- ☐ Verify all spare terminals are installed according to the percentage listed in the specifications

Grounding

- ☐ Equipped with “Blackburn” or other grounding type lug
- ☐ Lug is securely fastened to the panel structure
- ☐ Verify Grounding bar is installed
- ☐ Verify Isolated ground bar is installed

PROJECT NAME:		TEST DATE:	
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2. POWER TEST

A. AC Power

- ☐ AC Power is routed correctly within the panel, and is isolated from DC and network wiring.
- ☐ All fuses are installed and sized properly.
- ☐ All breakers are installed and sized properly.
- ☐ 24 VDC Power Supplies are functional.
- ☐ 24 VDC Power fail contacts are functional.
- ☐ 24 VDC power supplies are redundant, and have diode modules enabling the hot swap-over between supplies.
  - ☐ 24 VDC supplies are equipped with dry contact failure alarms, wired as PLC inputs to signal failure of any DC power supply. Such alarm inputs to the PLC have been tested as being functional.
- ☐ Dedicated receptacle is wired to receive a dedicated AC supply.
- ☐ Verify continuity for all DC commons, ground and AC neutrals.
- ☐ Verify that the CP temporary input power is connected correctly and is the correct voltage.
- ☐ Close the CP main circuit breaker(s).
- ☐ Verify that voltages at subsequent circuit breakers are correct.
- ☐ Close circuit breakers.
- ☐ Verify that power feeding interruptible and uninterruptible power supplies is correct.
- ☐ Turn on power supplies if they are not already on.
- ☐ Verify that voltages at distribution terminals are correct.
- ☐ Energize any remaining hardware such as the PLC.

B. Uninterruptible Power Supply (UPS)

- ☐ Mounted appropriately within the cabinet, on a dedicated shelf, or rear of a swing-out sub panel.
- ☐ Is equipped with maintenance bypass switch (or at least plug/receptacle means for bypassing the unit).
- ☐ Test all UPS alarms (on inverter, failure, battery failure etc.)
- ☐ Turn off the AC power supply and verify that the UPS will be switched on to supply the designated vital loads in the control panel.

3. CONTROLS & AUXILIARY DEVICES TEST

- ☐ Verify all interposing and auxiliary relays are functioning.
- ☐ Verify panel lights are functioning.

Ventilation and Heating

- ☐ If ventilation fans are fitted, check the fans operate correctly any associated air filters are clean and not blocked.
- ☐ Verify components are installed in the correct orientation for proper air flow.

4. HARDWIRED INTERLOCK AND SAFETY TEST

- ☐ Verify that hardwired interlocks through the control panel as shown on schematic drawings are functioning. For example, outlet high pressure switch interlock to a pump.
- ☐ Verify that all hardwired safety devices through the control panel is functioning. For example, the pull cord emergency stops of conveyors.

PROJECT NAME:		TEST DATE:	
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5. PLC TEST

A. Components

☐ PLC interior High Temperature alarm is installed, wired to the PLC, and is shown to be functional.

☐ Relays have transient suppression across their coils. This is particularly important for DC coil relays, where diodes in reverse polarity are often used.

☐ TVSS is installed across the main incoming 120 VAC.

PLC and PLC Rack

☐ Verify all cards are securely seated.

☐ Ensure clearance around PLC rack has been met, such that convective heat transfer is not impeded by devices erroneously mounted in the “no encroachment” area. Confirm with manufacturer clearance recommendations.

B. PLC I/O Test

☐ Furnish **I/O test forms** and test all the listed input and output points as follows:

☐ Discrete Inputs: Simulate a field contact closure by “shorting” across the appropriate terminal blocks. Observe the transition between a logical “0” and “1” in the PLC software.

☐ Discrete Outputs: Force the output bit to toggle between logical “0” and logical “1” using the PLC software. Measure contact resistance at the wired terminal blocks using a digital meter selected for the “ohms” setting.

☐ Analog Inputs: Connect a signal generator to the appropriate terminal blocks. Tailor the connection depending on whether a 2-wire or 4-wire simulation is required. Modulate the 4-20mA signal. Observe the associated PLC internal memory register to transition between 0-65535 or if scaled in engineering units, between 0 and the maximum scaled engineering unit. The latter method is preferred.

☐ Analog Outputs: Force the output register to a value between 0-65535 or 0-100%, if the scaling block can be manipulated. Observe the measured 4-20mA value increment and decrement using a digital ammeter.

C. Redundant Controllers (where required) Test

☐ Remove Communication cable from primary PLC to verify switching to backup PLC

☐ Remove Communication cable from backup PLC to verify switching back to primary PLC

☐ Remove Power cable from primary PLC to verify switching to backup PLC

☐ Remove Power cable from backup PLC to verify switching back to primary PLC

D. PLC Control Logic Verification

☐ The PLC control strategy is verified by following the Control Logic Verification Form based on the specifications. Each control strategy will be verified by simulating the process and checking the state or value of PLC outputs. The results of equipment status and alarms and process instrument values and trends shall also be verified on the Plant SCADA graphic screens stored in a temporary SCADA computer. Since all PLC input and output wiring has been verified and some field devices are not available during Factory Acceptance Testing, certain inputs will be simulated either by means of additional hardware and/or software as described below.

☐

☐

☐ DI states are either simulated by hardwired switches or forced inputs using a programming terminal.

☐ For example, when starters and drives are not provided as part of the contract, jumpers may be installed from the output call relays to the running confirmation inputs to simulate the running state of the motors.

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5. PLC TEST (continued)

D. PLC Control Logic Verification (continued)

Typical Fault Logic

- ☐ If the fault input is high and the disable (if applicable) for the fault is not high and the common disable (if applicable) is not high begin timing. If any of these conditions changes, stop timing and reset the timer. If the timer reaches its preset, activate the alarm output. If the fault alarm is a shutdown alarm stop the associated motor and latch the alarm so that it remains present even if the condition clears.
- ☐ The fault condition must return to normal and the alarm must be reset for a latched alarm to clear.

Typical Fail to Start Logic

- ☐ If the motor is called to run (call output high) and no running feedback is received (running input is low) and the fail to start and common alarm disables (if applicable) are not high start timing. If any of these conditions changes, stop timing and reset the timer. If the timer reaches its preset, activate the alarm output, stop calling the motor and latch the alarm.

6. HMI OR OIT TEST

HMI / OIT Functionality

- ☐ Communication with PLC
- ☐ Screen Layouts
- ☐ Screen Navigation
- ☐ Set Point Entry
- ☐ Animation
- ☐ Color Correctness (Green=Run, Red=Off, Amber=Alarm, or the agreed upon convention)
- ☐ Alarms
- ☐ Acknowledge and Reset
- ☐ Security / Access Levels / Passwords

7. NETWORK COMMUNICATION TEST

A. Network Components

- ☐ Fiber optic cabling terminates in a patch panel
- ☐ Media converters are installed and functional
- ☐ Terminating resistors have been installed for trunk/tap topologies or where required
- ☐ Wire and cable bending limitations have not been violated

B. Networking Functions

- ☐ Verify data transfer via the network to different PLCs as shown on the Network Block Diagrams
- ☐ Verify network traffic rate and error margin is acceptable

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8. FAT DOCUMENTATION AND RECORD

Panel Documentation

- ☐ As-built panel drawings showing actual panel construction and devices arrangement and c/w Bill of Material.
- ☐ Panel schematic and interconnection drawings.
- ☐ P&ID drawings and schematic drawings for the process area controlled by the panel that is to be tested.
- ☐ I/O list test forms of the process area to be tested.
- ☐ FAT procedure of the process area to be tested.
- ☐ Test record forms of the process area to be tested. Forms shall include area for signature of responsible test personnel.
- ☐ Hard copy of the PLC application program of the process area to be tested.
- ☐ Hard copy of the HMI/OIT graphic screens of the process area to be tested.

9. FAT TOOLS AND SOFTWARE

- ☐ Simulation software if required
- ☐ Digital volt meter Fluke 87
- ☐ Process meter Fluke 787
- ☐ Laptop computer with PLC application program
- ☐ Temporary SCADA computer with HMI software and applicable graphic screens
- ☐ Jumper wires

PROJECT NAME:		TEST DATE:	
FACILITY NAME:		TESTED BY:	
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ATTACHMENT B - INSTALLATION AND CERTIFICATION CHECKLIST DOCUMENTATION

	INSTALLATION AND CERTIFICATION CHECKLIST DOCUMENTATION	

INSTRUMENT LOOP NO. _____

SERVICE DESCRIPTION _____

A COPY OF LATEST ISSUE OF THE FOLLOWING DOCUMENTS ARE INCLUDED IN THIS INSTRUMENT INSTALLATION CERTIFICATION FILE:

☐ INSTRUMENT SPECIFICATION SHEETS (FOR ALL INSTRUMENTS IN THE LOOP)

☐ INSTRUMENT INSTALLATION DETAILS (FOR ALL INSTRUMENTS IN THE LOOP)

☐ INSTRUMENT LOOP WIRING DIAGRAMS

☐ INSTRUMENT INSTALLATION CERTIFICATION CHECKLIST

☐ SIZING CALCULATIONS

☐ INSTRUMENT INSTALLATION SCHEDULE (APPLICABLE PART)

☐ NAMEPLATE SCHEDULE (APPLICABLE PART)

☐ VENDOR LITERATURE CALIBRATION INFORMATION

	☐ No	☐ Yes
INSTRUMENT LOOP IS PART OF EQUIPMENT START-UP/SHUTDOWN INTERLOCKS?		

REMARKS: _____

CHECKED BY (COMPANY) _____ ACCEPTED BY (COMPANY) _____

SIGNATURE _____ SIGNATURE _____

DATE _____ DATE _____

ATTACHMENT C - SWITCHES INSTALLATION AND CALIBRATION CHECKLIST

	SWITCHES INSTALLATION AND CALIBRATION CHECKLIST	

INSTRUMENT LOOP NO. _____

SERVICE DESCRIPTION _____

CHECK BELOW, WHEN COMPLETED:

☐ BENCH CALIBRATED PER SPECIFICATION SHEET NO. _____

☐ VERIFIED PER P&ID NO. _____

☐ CORRESPONDS TO SPECIFICATION SHEET NO. _____

☐ WIRING CORRECT PER INSTRUMENT LOOP DRAWING NO. _____

☐ INSTALLATION CORRECT PER DETAIL NO. _____

☐ ACCESSORIES ARE PRESENT AND PROPERLY INSTALLED

☐ INSTRUMENT IS ACCESSIBLE FOR MAINTENANCE OR REMOVAL

☐ ENGRAVED LAMINATED NAMEPLATE (NO SPELLING ERRORS) PERMANENTLY INSTALLED

	☐ No	☐ Yes
INSTRUMENT LOOP IS PART OF EQUIPMENT START-UP/SHUTDOWN INTERLOCKS?		

FIELD CALIBRATION CHECK

CONTACT NO.	FUNCTION	FOR SIGNAL	CONTACT IS TO	AT SPECIFIED VALUE FOR	ACTUAL TRIP POINT WAS
1	☐ ALARM	☐ INCR	☐ OPEN	SET PT = _____	SET PT = _____
	☐ S/D PERM	☐ DECR	☐ CLOSE	RESET = _____	RESET = _____
2	☐ ALARM	☐ INCR	☐ OPEN	SET PT = _____	SET PT = _____
	☐ S/D PERM	☐ DECR	☐ CLOSE	RESET = _____	RESET = _____
3	☐ ALARM	☐ INCR	☐ OPEN	SET PT = _____	SET PT = _____
	☐ S/D PERM	☐ DECR	☐ CLOSE	RESET = _____	RESET = _____
4	☐ ALARM	☐ INCR	☐ OPEN	SET PT = _____	SET PT = _____
	☐ S/D PERM	☐ DECR	☐ CLOSE	RESET = _____	RESET = _____

NOTE: PERM IS ABBREVIATION FOR PERMISSIVE

	SWITCHES INSTALLATION AND CALIBRATION CHECKLIST	

REMARKS: _____

CHECKED BY (COMPANY) _____ ACCEPTED BY (COMPANY) _____

SIGNATURE _____ SIGNATURE _____

DATE _____ DATE _____

ATTACHMENT D - TRANSMITTER/CONTROLLER/INDICATOR INSTALLATION AND CALIBRATION CHECKLIST

	TRANSMITTER/CONTROLLER/INDICATOR INSTALLATION AND CALIBRATION CHECKLIST	

☐ ☐

INSTRUMENT LOOP IS PART OF EQUIPMENT START-UP/SHUTDOWN INTERLOCKS? No Yes

INSTRUMENT TYPE ☐ TRANSMITTER ☐ CONTROLLER ☐ INDICATOR

☐ OTHER DESCRIPTION _____

INSTRUMENT TAG NO. _____ SERIAL NO. _____

SERVICE DESCRIPTION _____

BENCH CALIBRATION CHECK

INPUT RANGE = _____ OUTPUT RANGE = _____

HEAD CORRECTION = _____ ☐ LINEAR

CALIBRATED SPAN = _____ ☐ SQUARE ROOT

% CALIB SPAN	DESIRED VALUE	ACTUAL VALUE	EXPECTED VALUE	ACTUAL VALUE
0				
50				
100				

CHECK BELOW, WHEN COMPLETED:

☐ BENCH CALIBRATED PER SPECIFICATION SHEET NO. _____

☐ VERIFIED PER P&ID NO. _____

☐ CORRESPONDS TO SPECIFICATION SHEET NO. _____

☐ WIRING CORRECT PER INSTRUMENT LOOP DRAWING NO. _____

☐ INSTALLATION CORRECT PER DETAIL NO. _____

☐ ACCESSORIES ARE PRESENT AND PROPERLY INSTALLED

☐ INSTRUMENT IS ACCESSIBLE FOR MAINTENANCE OR REMOVAL

☐ ENGRAVED LAMINATED NAMEPLATE (NO SPELLING ERRORS) PERMANENTLY INSTALLED

FIELD CALIBRATION CHECK

INPUT RANGE = _____ OUTPUT RANGE = _____

% CALIB SPAN	DESIRED VALUE	ACTUAL VALUE	EXPECTED VALUE	ACTUAL VALUE
0				
50				
100				

	TRANSMITTER/CONTROLLER/INDICATOR INSTALLATION AND CALIBRATION CHECKLIST	

☐ DIRECT ☐ REVERSE

☐ ACTION VERIFIED AT 50% SPAN

☐ ACTION VERIFIED AT _____ SPAN

CONTROLLER SETTINGS								
SETTING	**GAIN**	**PB**	**RESET (INTEGRAL)**	**DERIV. (RATE)**	**HIGH LIMIT**	**LOW LIMIT**	**ELEV. ZERO**	**ZERO SUPP**
PRE-TUNE								
POST-TUNE								

PRE-TUNE SETTINGS					
	GAIN	**PB**	**RESET (REPEAT/MIN)**	**RESET (MIN/REPEAT)**	**DERIVATION (MINUTES)**
FLOW	1.0	100	10	0.1	N/A
LEVEL	1.0	100	MIN.	MAX.	N/A
PRESSURE	2.0	50	2.0	0.5	N/A
TEMP.	4.0	25	0.1	10	OFF

REMARKS _____

CHECKED BY (COMPANY) _____ ACCEPTED BY (COMPANY) _____

SIGNATURE _____ SIGNATURE _____

DATE _____ DATE _____

ATTACHMENT E - ANALYZERS INSTALLATION AND CALIBRATION CHECKLIST

	ANALYZERS INSTALLATION AND CALIBRATION CHECKLIST	

☐ No ☐ Yes

INSTRUMENT LOOP IS PART OF EQUIPMENT START-UP/SHUTDOWN INTERLOCKS?

TYPE OF INSTRUMENT _____

INSTRUMENT TAG NO. _____ SERIAL NO. _____

SERVICE DESCRIPTION _____

CHECK BELOW, IF TRUE

☐ BENCH CALIBRATED PER SPECIFICATION SHEET NO. _____

☐ VERIFIED PER P&ID NO. _____

☐ CORRESPONDS TO SPECIFICATION SHEET NO. _____

☐ WIRING CORRECT PER INSTRUMENT LOOP DRAWING NO. _____

☐ INSTALLATION CORRECT PER DETAIL NO. _____

☐ ACCESSORIES ARE PRESENT AND PROPERLY INSTALLED

☐ INSTRUMENT IS ACCESSIBLE FOR MAINTENANCE OR REMOVAL

☐ ENGRAVED LAMINATED NAMEPLATE (NO SPELLING ERRORS) PERMANENTLY INSTALLED

REMARKS _____

CHECKED BY (COMPANY) _____ ACCEPTED BY (COMPANY) _____

SIGNATURE _____ SIGNATURE _____

DATE _____ DATE _____

ATTACHMENT F - CONTROL VALVES
INSTALLATION AND CALIBRATION CHECKLIST

	CONTROL VALVES INSTALLATION AND CALIBRATION CHECKLIST	

☐ No ☐ Yes

INSTRUMENT LOOP IS PART OF EQUIPMENT START-UP/SHUTDOWN INTERLOCKS?

☐ VALVE TAG NO. _____ SERIAL NO. _____

☐ TRANSDUCER TAG NO. _____ SERIAL NO. _____

☐ SOLENOID TAG NO. _____ SERIAL NO. _____

☐ VOLUME BOOSTER TAG NO. _____ SERIAL NO. _____

☐ POSITIONER _____ SERIAL NO. _____

SERVICE DESCRIPTION _____

TRANSDUCER CHECK					
INPUT RANGE =			OUTPUT RANGE =		
CALIBRATED SPAN =			CALIBRATED SPAN =		
BENCH					
SPAN	DESIRED	ACTUAL	SPAN	EXPECTED	ACTUAL
0%			0%		
50%			50%		
100%			100%		
FIELD					
SPAN	DESIRED	ACTUAL	SPAN	EXPECTED	ACTUAL
0%			0%		
50%			50%		
100%			100%		

CHECK BELOW, IF TRUE:

☐ BENCH CALIBRATED PER ABOVE _____

☐ VERIFIED PER P&ID NO. _____

☐ CORRESPONDS TO SPECIFICATION SHEET NO. _____

- ☐ VALVE SPECIFICATION NO. _____
- ☐ TRANSDUCER SPECIFICATION NO. _____
- ☐ SOLENOID SPECIFICATION NO. _____

☐ WIRING CORRECT PER INSTRUMENT LOOP DRAWING NO. _____

☐ INSTALLATION CORRECT PER INSTRUMENT INSTALLATION DETAILS _____

- ☐ VALVE DETAIL NO. _____
- ☐ TRANSDUCER DETAIL NO. _____
- ☐ SOLENOID DETAIL NO. _____

	CONTROL VALVES INSTALLATION AND CALIBRATION CHECKLIST	

☐ ACCESSORIES ARE PRESENT AND PROPERLY INSTALLED

☐ INSTRUMENT IS ACCESSIBLE FOR MAINTENANCE OR REMOVAL

☐ ENGRAVED LAMINATED NAMEPLATE (NO SPELLING ERRORS) PERMANENTLY INSTALLED

VALVE CHECK			
FLOW CHECK	☐ PROCESS FLOW DIRECTION THROUGH THE VALVE IS CORRECT		
SAFETY CHECK	ON LOSS OF AIR VALVE FAILS ☐ OPEN ☐ CLOSE	ON LOSS OF POWER SOLENOID FAILS ☐ TO VENT ☐ TO VALVE	
TRAVEL CHECK	FULL OPEN AT _____ PSI	FULL CLOSED AT _____ PSI	MEASURED TRAVEL _____ INCHES
SEATING CHECK	☐ ON BENCH ☐ IN-LINE	RESULTS	ACTUATOR BENCH SET
POSITIONER CHECK			
VALVE FULL OPEN AT _____ PSI TO POSITIONER			
VALVE FULL CLOSED AT _____ PSI TO POSITIONER			
VOLUME BOOSTER CHECK			
BYPASS VALVE (GAIN) ADJUSTING SCREW BACKED OUT _____ TURNS FROM CLOSED TO ENSURE QUICK BUT STABLE OPERATION (TYPICALLY 1-1/2 TO 2 TURNS)			

REMARKS _____

CHECKED BY (COMPANY) _____ ACCEPTED BY (COMPANY) _____

SIGNATURE _____ SIGNATURE _____

DATE _____ DATE _____

SECTION 46_05_10

COMMON WORK RESULTS FOR MECHANICAL EQUIPMENT

PART 1 GENERAL

1.01 SUMMARY

A. Section includes:
   1. Mechanical equipment requirements for:
      a. Basic design and performance criteria.
      b. Prescriptive requirements for common components.
      c. Installation requirements.

1.02 REFERENCES

A. American Bearing Manufactures Association (ABMA):
   1. 9 - Load Ratings and Fatigue Life for Ball Bearings.
   2. 11 - Load Ratings and Fatigue Life for Roller Bearings.

B. American Gear Manufacturer's Association (AGMA) Standards.

C. ASTM International (ASTM):
   1. A193 - Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications.
   2. A194 - Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both.
   3. A320 - Standard Specification for Alloy-Steel and Stainless Steel Bolting for Low-Temperature Service.
   4. F593 - Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
   5. F594 - Standard Specification for Stainless Steel Nuts.

D. Hydraulic Institute (HI):
   1. 9.6.8 - Guideline for Dynamics of Pumping Machinery.

E. International Concrete Repair Institute (ICRI):
   1. Guideline No. 310.2R, Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays, and Concrete Repair.

F. National Electrical Manufacturers Association (NEMA):
   1. MG-1 - Motors and Generators.

G. Society for Protective Coatings (SSPC):
   1. SP-1-Solvent Cleaning.

1.03 DEFINITIONS

A. These definitions shall be applied to equipment other than pumps, unless otherwise specified in technical sections.

B. Resonant Frequency:
   1. The frequency of a periodic excitation force that is close to the natural frequencies of an object. Also known as critical frequency, critical speed, or resonant speed.
   2. An undamped resonant frequency within the separation margin is always considered harmful under Level 1 analysis.
   3. A resonant frequency that occurs within a separation margin of 15 percent above or below the operating speed range and has a log decrement greater than +0.3 is considered harmful under Level 2 and Level 3 analysis.

C. Separation Margin:
   1. The span of operating speeds within which interference between excitation orders and resonant frequencies indicate the possibility of harmful vibrations.
   2. The separation margin for a specific application extends 15 percent above and 15 percent below the span of operating speed required for the specified performance conditions.

1.04 NOT USED

1.05 SUBMITTALS

A. Items in this Section are components of equipment or systems specified in other sections:
   1. Include data for this Section’s components with the equipment or system submittal.

PART 2 PRODUCTS

2.01 DESIGN AND PERFORMANCE CRITERIA

A. General:
   1. Equipment manufacturer's responsibility extends to selection and mounting of gear drive units, motors or other prime movers, accessories, and auxiliaries to provide a complete, operable unit.
   2. Manufacturer shall analyze all rubber-bearing vertical-column pumps, and equipment identified as non-reversing in the technical sections for reverse rotation and provide non reversing motor ratchets.
   3. Equipment that prevents reverse rotation shall be capable of both:
      a. Handling 150 percent of the maximum torque at maximum operating speed.
      b. 150 percent of torque that will be generated in reverse direction due to equipment shutoff head as calculated by the manufacturer.
   4. The motor shall be designed to run safely in the reverse direction at up to 140 percent times the reverse runaway speed under shutoff head conditions.

2.02 BEARINGS

A. Oil or grease lubricated, ball or roller antifriction type, of standard manufacture:
   1. Design lubrication system based on the equipment location to operate in the temperatures as specified in Section 01_81_50 - Design Criteria:
      a. Design lubrication system to safely start after being shut off for 24 hours and operate safely:
         1) Suitable for the outdoor winter temperature as specified in Section 01_81_50 - Design Criteria.

B. Oil-lubricated bearings:
   1. Provide either pressure lubricating system or separate oil reservoir splash-type system as specified in the Technical Section.
   2. Design oil-lubrication system to safely absorb heat energy generated in bearings when equipment is operating in the following conditions:
      a. With the highest load and the temperature 15 degrees Fahrenheit above the outdoor summer temperature as specified in Section 01_81_50 - Design Criteria.

C. Grease lubricated bearings, except those specified to be factory sealed:
   1. Fit with easily accessible grease supply, flush, drain, and relief fittings.
   2. Lubrication lines and fittings:
      a. Lines: Minimum 1/4-inch diameter stainless steel tubing.
      b. Multiple fitting assemblies: Mount fittings together in easily accessible location.
      c. Use standard hydraulic-type grease supply fittings:
         1) Manufacturers: One of the following or equal:
            a) Alemite.
            b) Zerk.

D. Ratings: Rated in accordance with ABMA 9 or ABMA 11 L10 life for bearings rating life of not less than 50,000 hours.

2.03 ASSEMBLY FASTENERS

A. General service: Stainless steel, Type 316:
   1. Bolts: In accordance with ASTM F593, Alloy Group 2.
   2. Nuts: In accordance with ASTM F594, Alloy Group 2.
   3. Washers: Alloy group matching bolts and nuts.

B. High-temperature service or high-pressure service: Stainless steel, Type 316:
   1. Bolts: In accordance with ASTM A193, Grade B8M, Class 1, heavy hex.
   2. Nuts: In accordance with ASTM A194, Grade 8, heavy hex.
   3. Washers: Alloy group matching bolts and nuts.

C. Low-temperature service: Stainless steel, Type 316:
   1. Bolts: In accordance with ASTM A320, Grade B8M, Class 1, heavy hex.
   2. Nuts: In accordance with ASTM A194, Grade B8M, heavy hex.
   3. Washers: Alloy group matching bolts and nuts.

2.04 SHOP FINISHES

A. Manufacturer's standard primer and finish coatings:
   1. Primer only if field coatings are to be applied.

2.05 MOUNTING AND LIFTING PROVISIONS FOR EQUIPMENT

A. Equipment bases and base plates:
   1. Provide equipment bases with machined support pads, dowels for alignment for mating of adjacent items, openings for electrical conduits, and openings to facilitate grouting.
   2. Provide jacking screws in bases and supports for equipment and for equipment weighing 500 pounds or more.
   3. Materials:
      a. Match equipment material or steel.
      b. Coating: Match equipment.

B. Steel support frames:
   1. Carbon steel:
      a. At exterior locations, and at interior wet or moist locations, provide continuous welds on both sides to close seams and edges between steel members.
      b. Grind closure welds smooth.

C. Lifting lugs or eyes:
   1. Equipment units weighing 50 pounds or more:
      a. Provide with lifting lugs or eyes to allow removal with lifting device.

2.06 NAMEPLATES

A. Fastened to equipment at factory in an accessible and visible location.

B. Metal engraved or stamped with text, holes drilled or punched for fasteners.

C. Material: Aluminum or stainless steel.

D. Fasteners: Number 4 or larger oval head stainless steel screws or drive pins.

E. Text:
   1. Manufacturer’s name, equipment model number, equipment serial number, and identification tag number.
   2. Additional items indicated in the Technical Sections.
   3. Indicate the following additional information as applicable:
      a. Maximum and normal rotating speed.
      b. Service class per applicable standards.
   4. Include for pumps:
      a. Rated total dynamic head in feet of fluid.
      b. Rated flow in gallons per minute.
      c. Impeller, gear, screw, diaphragm, or piston size.
   5. Include for motors:
      a. Drive speed.

b. Motor horsepower with rated capacity.

6. Include for gear reduction units:
   a. AGMA class of service.
   b. Service factor.
   c. Input and output speeds.

2.07 SHIPPING

A. Prior to shipment of equipment:
   1. Bearings (and similar items):
      a. Pack separately or provide other protection during transport.
      b. Greased and lubricated.
   2. Gear boxes:
      a. Oil filled or sprayed with rust preventive protective coating.
   3. Fasteners:
      a. Inspect for proper torques and tightness.

PART 3 EXECUTION

3.01 PRE-INSTALLATION

A. Field measurements:
   1. Prior to shop drawings preparation, take measurements and verify dimensions indicated on the Drawings.
   2. Ensure equipment and ancillary appurtenances fit within available space.

B. Sequencing and scheduling:
   1. Coordinate details of equipment with other related parts of the Work, including verification that structures, piping, wiring, and equipment components are compatible.
   2. Equipment anchoring: Obtain anchoring material and setting drawings from equipment manufacturers in adequate time for templates to be constructed and anchors to be cast-in-place.

3.02 LUBRICATION LINES AND FITTINGS (TO BE COMPLETED UNDER INSTALLATION CONTRACT)

A. Support and protect lines from source to point of use.

B. Fittings:
   1. Bring fittings to outside of equipment in manner such that they are readily accessible from outside without necessity of removing covers, plates, housings, or guards.
   2. Mount fittings together wherever possible using factory-mounted multiple fitting assemblies securely mounted, parallel with equipment lines, and protected from damage.
   3. Fittings for underwater bearings: Bring fittings above water surface and mount on edge of structure above.

3.03 ALIGNMENT OF DRIVERS AND EQUIPMENT (TO BE COMPLETED UNDER INSTALLATION CONTRACT)

A. Where drive motors or other drivers are connected to driven equipment by flexible coupling, disconnect coupling halves and align driver and equipment after driven equipment has been leveled on its foundation.

B. Comply with procedures of appropriate HI, AGMA Standards, alignment tolerances of equipment manufacturers and the following requirements to bring components into angular and parallel alignment:
   1. Maximum total coupling offset (not the per-plane offset): Not to exceed 0.5 mils per inch of coupling length for spacer couplings based on coupling length (not dial separation).
   2. Utilize jacking screws, wedges, or shims as recommended by the equipment manufacturer and as specified in the equipment sections.

C. Use reverse-indicator arrangement dial-type or laser-type alignment indicators: Mount indicators on the driver/coupling flange and equipment/coupling flange. Alignment instrumentation accuracy shall be sufficient to read angular and radial misalignment at 10 percent or less of the manufacturer's recommended acceptable misalignment.

D. Alignment and calculations shall include measurement and allowance for thermal growth, spacer coupling length, indicator separation, and axial spacing tolerances of the coupling.

E. When alignment satisfies most stringent tolerance of system components, grout between base and foundation:
   1. Allow minimum 48 hours for grout to harden.
   2. After grout hardens, remove jacking screws, tighten anchor bolts and other connections, and recheck alignment.
   3. Correct alignment as required.

3.04 EQUIPMENT SUPPORT AND ANCHORING TO STRUCTURES (TO BE COMPLETED UNDER INSTALLATION CONTRACT)

A. Anchor equipment to structures as indicated on the Drawings and as specified.

B. Obtain final anchor bolt layouts for equipment prior to:
   1. Detailing reinforcement for equipment pads.
   2. Preparation of shop drawings for metal structures supporting equipment.

C. Anchor bolt templates:
   1. Provide templates as specified in the Technical Sections.
   2. Use final anchor bolt layout to construct templates for setting anchor bolts.
   3. Make templates:
      a. Rigid, and non-deformable during use.
      b. With longitudinal axes of anchors parallel.
      c. With longitudinal axes of anchors perpendicular to surface supporting the equipment.

4. Templates may be reused for multiple locations of the same equipment only if:
    a. Templates are in "like-new" condition prior to each reuse.
    b. The anchor layout has not been deformed or damaged by previous installation, removal, or handling of templates.
5. Sequence:
    a. Set and support templates prior construction of structures surrounding anchors.
    b. Position anchors in templates to provide designated embedment in supporting structure, with required projection for installation of grout, base plates, and hardware for tightening.
    c. Construct concrete or masonry around anchors using methods that preserve required anchor positions and alignment, and clearances to edges of supports or structures.

D. Anchor adjustment sleeves:
1. Use of adjustment sleeves around anchors:
    a. Is at the option of the Contractor.
    b. Does not relieve Contractor of obligation to construct and use templates for setting of anchors.
    c. May required increased anchor embedment length to develop the strength of the anchor in the embedded length below the adjustment sleeve.
2. Submittal requirements for anchor adjustment sleeves:
    a. Provide within sufficient time for Engineer approval and not less than 10 working days before setting those items.
    b. Proposed locations of sleeves.
    c. Details and dimensions of sleeves.
    d. Sleeve materials of construction, and coatings.
    e. Information on sleeve filler material and means of filler removal.
    f. Type, details, and dimensions of anchor bolts or anchor rods to be used with sleeves.
    g. Calculations showing development of anchor load capacity below the bottom of the sleeve.
    h. Plan for removal of sleeve fillers, if any.
    i. Plan for placement and consolidation of flowable grout inside sleeves and to a level equal to top of concrete slab or equipment pad surrounding the sleeve.

3.05 GROUTING UNDER EQUIPMENT BASES, BASE PLATES, SOLE PLATES, AND SKIDS (TO BE COMPLETED UNDER INSTALLATION CONTRACT)

A. General:
1. Comply with equipment manufacturer's installation instructions including:
    a. Tolerances for level.
    b. Tolerances for vertical and horizontal alignment.
    c. Requirements or recommendations for grouting spaces and grout installation.
    d. Recommendations for tightening of equipment anchors after grout has cured.
2. Install equipment over grout as indicated on the Drawings or specified only after:
    a. Equipment is leveled and in proper alignment.

b. Piping connections are complete and in alignment with no strain transmitted to equipment.

3. Install flowable grout, as specified in Section 03_60_00 – Grouting (Not included in this contract), placed with forms and head boxes:
   a. Use flowable, non-shrink grout.
   b. Use flowable, non-shrink epoxy grout, only where indicated on the Drawings, where specified in Technical Sections, or when approved in advance by the Engineer.
   c. Grouting with dry-pack materials is not permitted.

B. Prepare equipment bases, base plates, soleplates, and skids for grouting:
   1. Concrete equipment bases:
      a. Roughen surface in accordance with ICRI, Guideline No. 310.2R, Surface Preparation Profiles CSP-3 and CSP-4.
      b. Clean roughened concrete surfaces:
   2. Base plates, soleplates, and skids:
      a. Clean surfaces in accordance with SSPC-SP-1-Solvent Cleaning, to remove dirt, dust, oil, grease, paint, and other material.

C. Level equipment for grouting:
   1. Use removable jack screws, or removable steel wedges and shims to support and level equipment bases, base plates, sole plates, and skids:
      a. Do not use leveling nuts placed on equipment anchors to support or level equipment bases, base plates, sole plates, and skids.
   2. Removable jack screws:
      a. Provide number, size, and locations of jack screws required to support and level equipment in accordance with manufacturer's recommendations.
      b. Drill and tap equipment base plates, sole plates, and skids for jack screws.
      c. Support jack screws on circular steel plates that have been epoxy bonded to the equipment foundation:
         1) Provide plates fabricated from Type 316 stainless steel where edges of support plates will have grout side cover of 3 inches or less in the finished work.
      d. Make provision for removal of jack screws after grouting:
         1) Prevent grout from bonding to jack screws by wrapping jack screw threads that will be in contact with grout with multiple layers of tape or other material acceptable to Engineer.
      e. Place and cure grout.
      f. After grout is placed and cured:
         1) Remove jack screws and material used to prevent grout from bonding to jack screws.
         2) Provide jack screws to Owner for future use.
         3) Fill jack screw holes with grout.
         4) Cure grout as specified.
   3. Removable steel wedges and shims:
      a. Use for equipment bases, base plates, sole plates, and skids where it is not practical to use jack screws.

b. Provide number, size, and locations of wedges and shims required to support and level equipment in accordance with manufacturer's recommendations.
c. Make provision for removal of wedges and shims after grouting:
    1) Prevent grout from bonding to wedges and shims by wrapping wedges and shims that contact grout with multiple layers of tape or other material acceptable to Engineer.
    2) Locate and orient wedges and shims to allow for removal after grouting, and to facilitate placement of grout in the remaining voids.
d. Place and cure grout.
e. After grout is placed and cured:
    1) Remove wedges and shims, and material used to prevent grout from bonding to them.
    2) Fill jack screw holes with grout.
    3) Cure grout as specified.

D. Construct grout forms:
1. Provide forms:
    a. Rigid with adequate strength to withstand placement of grout.
    b. With surfaces that will produce a smooth, uniform finish for grout edges exposed in the finished work.
    c. That allow grout to flow horizontally beyond the perimeter of the equipment base plate a distance not less than the thickness of the grout, and not less than 1 inch.
2. Install forms:
    a. Seal form cracks and joints with elastomeric sealant to make form watertight.
    b. Line form surfaces in contact with grout with polyethylene film, or coat with two coats of heavy-duty paste wax.
3. Construct grout "head box" over entire length of one side of form:
    a. Make head box height sufficient to force grout to flow under full dimensions of equipment base and to the surrounding form faces.

E. Pre-grouting procedures:
1. Concrete surfaces receiving flowable, non-shrink grout:
    a. Saturate concrete surface in contact with grout and concrete surfaces extending not less than least 6 inches beyond limits of grout with clean water for a minimum of 24 hours prior to grouting.
    b. Just prior to grout placement, remove standing water using clean rags or oil-free compressed air. Provide "saturated surface dry" (SSD) concrete for grout placement.
2. Concrete surfaces receiving flowable, non-shrink epoxy grout:
    a. Do not saturate concrete prior to grout placement.

F. Grout placement and curing:
1. Place and cure grout as specified in Section 03_60_00 – Grouting (Not included in this contract), and in this Section.
2. Grouting:
    a. Keep level of grout in head box above bottom of equipment bases, base plates, sole plates, and skids always to drive flow under base.

b. Maintain continuous grout flow from head box to opposite sides of forms without trapping air or forming voids.
c. Vibrate, rod, or chain grout to facilitate grout flow, to consolidate grout, and to remove entrapped air.

3. After grout sets, remove forms and trim grout edges at 45-degree angle from bottom edge of equipment bases, base plates, sole plates, and skids.
4. Cure grout as specified in Section 03_60_00 – Grouting (Not included in this contract).

G. After grout is cured:
1. Remove jack screws or wedges and shims, and material used to prevent grout from bonding to leveling devices.
2. Fill pockets from removed leveling devices with grout.
3. Cure filled voids as specified in Section 03_60_00 - Grouting.
4. Tighten equipment anchors in accordance with equipment manufacturer requirements.

3.06 FIELD FINISHES (TO BE COMPLETED UNDER INSTALLATION CONTRACT)

A. When touchup or repair is required, apply primer and coating systems as recommended by the equipment manufacturer.

END OF SECTION

SECTION 46_66_75

TEMPORARY ULTRAVIOLET DISINFECTION SYSTEM

TABLE OF CONTENTS

PART 1 GENERAL

1.01 SUMMARY

A. Section includes: Equipment associated with the Temporary Ultraviolet (UV) Disinfection System that will be used during the construction phase of this project. The Supplier who is selected to supply the UV equipment specified in Section 46_66_85 is responsible for supplying a temporary UV disinfection system, specified herein, that will be used to disinfect the effluent discharge during construction.

1.02 REFERENCES

A. See Section 46_66_85, Article 1.02.

1.03 TERMINOLOGY

A. See Section 46_66_85, Article 1.03.

1.04 SUBMITTALS

A. Product Data and Shop Drawings: Supplier shall submit the following:
   1. Product data, including, but not limited to, the following:
      a. Descriptive information including catalog cuts and Supplier's specifications for components.
      b. Written field electrical termination requirements and instructions as required for the Contractor to install a complete and operational system.
      c. Third-Party Reactor Validation Testing results and corresponding Engineering Report(s).
      d. Number of lamps per module.
      e. Number of modules per bank.
      f. Total number of UV lamps.
   2. General Shop drawing submittal including, but not limited to:
      a. Details of the UV module/bank, ballast enclosure, power distribution system with transformers as required, and control system.
      b. Dimensions and installation requirements.
      c. Information on the channel dimensions.
   3. Electrical, Instrumentation and Controls data and shop drawings specified in the Contract Documents, including but not limited to:
      a. Front exterior and interior panel layout drawings with bill of materials for electrical and control panels.
      b. Control schematics with wire numbers.
      c. Detailed interface and interconnection drawings that indicate UV system and external component and equipment connections.
      d. Detailed electrical wiring diagrams as required for the Contractor to install a complete operational system including, but not be limited to:
         1) Source power feeder conductor quantities and sizes.
         2) Control wiring quantities and sizes.
         3) Signal cable quantities and sizes.
         4) Power (kW), power factor and apparent power (kVA) for each UV Bank and/or Power Distribution Center.

5) Master UV PLC power requirements.

e. Control philosophy narrative with integration of the Third-Party Reactor Validation Testing results, including the use of the sensors to monitor and alarm the combined effect of lamp aging and sleeve fouling and/or the use of the sensors to continuously monitor UV dose based on inputs of flow, UV sensor intensity, and UV transmittance (UVT). Process and Instrumentation Diagrams (P&IDs) shall accompany the narrative.

f. Provide a wiring diagram complete with inter-equipment wiring requirements.

g. Complete grounding requirements for each system component including any requirements for PLCs, process LANs, and Control System equipment.

4. List of spare parts.

5. UV Master Control Panel (MCP):

a. Proposed layout of mounted devices and terminals with dimensions within MCP.

b. Proposed MCP PLC programming printout with input/output (I/O) listing if available.

c. Complete I/O list:

1) A table showing the data available over EtherNet/IP communication protocol to the plant control system.

d. Proposed MCP LOI graphic display printouts.

e. Operating description for MCP:

1) Include detailed descriptions of logic and sequences of operation of control loops within the MCP controller, points monitored, available local and automatic control functions, and alarms.

2) Include a description of the controls interface and communication between the MCP and Plant PLC.

B. Operation and maintenance manuals:

1. Supplier shall submit an operation and maintenance manuals in accordance with Section 01_78_24 - Operation and Maintenance Manuals:

a. In addition to the requirements listed in the above referenced section, the Operation and Maintenance Manuals shall include:

1) Name, address, and telephone number of nearest Supplier and spare parts warehouse.

2) Special tools required for operation and maintenance.

3) Reproducible prints of the Contract diagrams, schematics, and installation drawings for electrical and instrumentation work.

2. Prerequisite to equipment approval: Engineer acceptance of the manual.

3. Supplier’s copy of complete manuals shall be available at the site of the work for use by field personnel and Engineer during Hydraulic, Alarm and Functional Testing, and Performance Testing of equipment.

4. Step by step instructions for operation and maintenance of equipment provided by Supplier.

5. Description of process control logic and process and instrumentation diagrams.

6. Drawings of control panels to include:

a. Electrical ladder diagram.

b. Interconnect to components outside the panel.

c. Door layout.

d. Interior layout.
e. Sample Operator Interface screens for the local panels and MCP.

7. Provide typical Operator interface screens with detailed descriptions.
8. Provide I/O listing for control panel PLCs.
9. Indicate scheduled maintenance requirements and routine inspections. Include maintenance summary forms.
10. Provide list of recommended spare parts and lubricants.
11. Provide a troubleshooting guide.
12. Provide the local sales representative contact information with the company name, contact person, phone number, address, and service provider.

C. Quality Certification:
1. Supplier shall submit Engineering Report of the proposed UV Disinfection System, including:
   a. Raw data used to justify the conclusions of the Third-Party Reactor Validation Testing.
   b. Test reactor configuration including tested parameters (e.g., flow rates, UV transmittance, number of reactors/lamps in operation, and type of water tested).
   c. Collimated beam results.
   d. Reactor validation results with regard to inactivation of the test organism.
   e. Test results from head loss testing.
   f. Recommended normalized lamp velocity range (flow/lamp) to meet the required Design UV dose.
   g. Delivered UV dose equation developed based on Supplier's Third-Party Reactor Validation Testing.
2. Supplier's UV equipment warranty including lamps, ballasts, quartz sleeves, wipers, and UV sensors, as specified in this Section.
3. Supplier's performance warranty as specified in this Section.
4. Documentation of the successful completion and results of the Underwriter's Laboratory (UL) or equivalent testing shall be provided.

D. Closeout submittals:
1. Written certification of proper UV system installation as specified in this Section.
2. One copy of UV PLC, operator interface, and other programs required for the maintenance of the UV system in native format on flash drive:
   a. PLC and LOI Programs:
      1) Provide complete electronic copies of the PLC and LOI programs and configuration files for equipment in the local control panels, in the native file format of each device, along with any supporting files.
      2) Programs shall be fully accessible for use by the Owner - programs that are locked, restricted, or contain hidden materials are not permitted.
   b. Provide a detailed description of control systems.
3. Provide panel drawings, wiring diagrams, specifications, and a detailed description of the local panels.
4. Update operation and maintenance manual documentation and drawings, as required, based on updates or changes made to the UV equipment or installation during startup and commissioning of the system.

E. Other qualification requirement submittals:
    1. A statement listing any deviations or exceptions taken to these specifications. Include specification reference and proposed alternative with reason stated for exception.

1.05 QUALITY ASSURANCE

A. Qualification requirements:
    1. Supplier shall demonstrate that the dose required in the performance specification can be met with the amount of equipment proposed:
        a. Supplier shall base sizing of UV system on a Third-Party Reactor Validation Testing calculation to meet the minimum UV design dose as specified in this Section.
        b. Supplier's data and results shall be reviewed by the Engineer.
        c. Engineer can apply the required correction factor to the Supplier's bioassay results.
        d. Engineer's review and opinion of the test protocol, pilot data, and pilot report conclusions shall be deemed final and shall be just cause for the rejection of the proposed equipment.
    2. A statement by the Supplier listing any deviations or exceptions taken to these Specifications shall be provided to the Engineer for the Engineer's review, opinion, and acceptance:
        a. The Engineer's final decision regarding the acceptance or denial of any deviations or exceptions shall be just cause for the rejection of the proposed equipment and require that the Supplier supply the disinfection equipment as specified in this Section.
    3. Provide equipment labeled and listed by UL or another nationally recognized testing laboratory, furnished by a single Supplier qualified and experienced in the production of similar equipment.

1.06 DELIVERY, STORAGE AND HANDLING

A. If required by the Contractor's schedule, the Supplier shall provide equipment in multiple separate freight shipments.

B. Provide notification in writing to the Owner and Contractor of approximate delivery date(s) 4 weeks before delivery:
    1. Notify same of actual delivery date at least 7 days before delivery.
    2. Provide description and approximate weight of shipping container and required equipment for unloading.
    3. Supplier shall coordinate delivery, unloading, and storage with Contractor.

C. Store products according to manufacturer instructions:
    1. Moisture sensitive products shall be stored in appropriate weather-proof enclosures or locations:
        a. Supplier will designate those items that need to be stored in this manner.
        b. Crates covered in tarps are not acceptable.

D. Supplier shall coordinate the delivery of equipment with Contractor:
    1. Supplier's shipping company shall notify the Contractor at least 48 hours prior to arrival on site.

2. Supplier shall revise schedule for delivering equipment packages if requested by Contractor without additional cost to Contractor.

E. Storage:
   1. General:
      a. Contractor shall store, and handle in accordance with the Supplier's printed instructions.
   2. Packing and shipping:
      a. Supplier shall deliver equipment to the project site in the original containers with seals unbroken and labeled with Supplier's identification and number.
   3. Delivery:
      a. Supplier shall deliver materials dry and undamaged to the Contractor. During the delivery process materials must be stored out of contact with the ground.

1.07 WARRANTY

A. Provide warranty as specified in Section 01_78_36 - Warranties and Bonds:
   1. Additionally, include costs associated with required site visits, inspections, equipment removal costs, and equipment installation costs:
      a. Provide warrantees and support directly by the Supplier.
   2. Special Warranty:
      a. Equipment Warranty:
         1) The equipment furnished under this Section shall be free of defects in materials and workmanship, including damages that may be incurred during shipping, storage, and installation, for the length of the construction period which is estimated to be 8 months. This covers the following components:
            a) Wiring.
            b) UV Lamps.
            c) UV Ballasts.
            d) UV Quartz Sleeves.
            e) UV Sensors.
      b. Performance Warranty:
         1) The equipment furnished under this Section, when operated within the conditions specified in the Contract Documents and Supplier's Operation and Maintenance Manual, will meet or exceed the performance requirements specified in this Section for the duration of the construction period.

1.08 DESIGN ASSISTANCE

A. Supplier shall provide Design Assistance to the Engineer and Owner as outlined below:
   1. Temporary UV system design workshop:
      a. Supplier shall participate in an in-person, half-day long workshop with the Engineer to discuss the temporary UV system design and installation.
      b. The installation design documents will be reviewed.
      c. Topics will include installation and electrical requirements for the temporary UV system, mechanical equipment layout, programming and

SCADA interface with the plant system, and any additional feature to complete the installation.

2. Product data and shop drawing submittal review workshop:
    a. Supplier shall participate in an in-person, half-day long workshop with the Engineer to review and discuss the temporary UV system submittal.
3. Bid set review:
    a. The amended final design submittal will be reviewed by the Supplier to confirm it complies with the Supplier requirements and warranty provisions.

1.09 WORK BY OTHERS

A. The following items are provided by the Contractor but shall be coordinated by the Supplier during the Design Assistance provided by Supplier to Engineer. These items will include:
    1. Structural:
        a. Foundation/housekeeping pads and additional housing for supplied UV disinfection equipment.
        b. Anchor bolts will be provided and installed by Contractor, anchor bolt design by UV Supplier.
    2. Mechanical:
        a. Motorized weir gates used to control the effluent level in each channel shall be supplied by the Supplier and installed by Contractor.
        b. Channel inlet gates shall be supplied by the Supplier and installed by the Contractor.
        c. Installation materials for instrumentation and automatic valves including but not limited to air/sample line tubing, fittings, and mountings.
        d. Installation of UV disinfection system components.
    3. Electrical:
        a. Electrical wiring interconnections (including wiring, conduit, cable trays, transformers, and other appurtenances required to provide power connections as needed) from the electrical power source to the UV disinfection equipment and system control panels:
            1) Contractor shall also be responsible for determining the correct wire sizing and coordinate this information with the UV Supplier.
        b. The lamp cables between the UV banks and Power Distribution Centers shall be supplied by the UV Supplier and will be run/pulled and terminated by the Contractor.
        c. Communication cabling between the Power Distribution Centers, Mater Control Panel and other electrical panels shall be provided by the Contractor based on the UV Supplier’s requirements.
        d. Ethernet communications connection to the Owner’s Plant Control System.
        e. Installation of enclosures for a complete UV disinfection system.
    4. Other:
        a. Receiving, unloading, and safe storage of equipment at site or a storage facility until ready for installation.
        b. Raw materials and utilities during equipment testing.
        c. Operating and maintenance personnel during equipment checkout, start up, testing and operations.
        d. Any onsite painting or touch-up painting of the equipment supplied.

PART 2 PRODUCTS

2.01 SYSTEM DESCRIPTION

A. Provide a temporary UV disinfection system complete with UV Banks, a control system, UV intensity sensors, automatic on-line cleaning system, power distribution system, level control gate, and accessories as specified in this Section or as required to have a complete and functioning system.

B. Furnish labor, materials, equipment, and appurtenances required to provide a low-pressure, high-output (LPHO) lamps, UV disinfection system complete with automatic cleaning system:
   1. The UV system is to be complete and operational with control and appurtenant equipment as indicated on the Drawings and specified in this Section.
   2. Supplier shall provide installation assistance, start-up, testing and operator-maintenance training for the UV system as specified in this Section.
   3. The Supplier shall assist with commissioning and performance testing for the UV system as specified in this Section.

C. Provide complete UV Disinfection System that meets the water quality requirements as set forth by the California Regional Water Quality Control Board, San Francisco Bay Region, Order No. R2-2022-0029 and NPDES Permit No. CA0038776:
   1. In the event of a conflict between regulations and this Section, the UV System Supplier shall meet the more restrictive standard.

D. Third-Party Reactor Validation Testing and the related Engineering Report for the UV reactor to be installed must be completed at the time of Proposal.

2.02 DESIGN CRITERIA

A. Supplier shall provide UV disinfection equipment which meets the Performance Requirements, specified in this Section, based on the following conditions:
   1. Influent Water Quality:
      a. Description: Tertiary effluent.
      b. Peak Design Flow: 6.0 million gallons per day (mgd).
      c. Average Flow: 2.0 mgd.
      d. Design Ultraviolet Transmittance (UVT) at 253.7 nm: 56 percent.
      e. Average UVT at 253.7 nm: 62 percent.
      f. Total Suspended Solids: 5 milligrams per liter (mg/L).
      g. The minimum T1 RED for the discharge must be based upon the delivered UV dose equation developed from the Supplier's bioassay results as determined by Third-Party Reactor Validation Testing per the IUVA Protocol:
         1) Engineer can apply the required correction factor to the Supplier's bioassay results based upon the Engineer's analysis of the Validation Testing and site conditions.

B. UV equipment shall be located as indicated on the Drawings:
   1. The UV channel will be located outdoors and at grade.
   2. The electrical enclosures with the electronic ballasts and master PLC will be located next to the UV channel outdoors.

C. Facility constraints:
    1. Components of the UV system must fit within a footprint approximately 12’ by 30’, including proper approach and exit lengths, electrical equipment, and reasonable operations and maintenance access.

2.03 PERFORMANCE REQUIREMENTS

A. The UV disinfection system performance shall be guaranteed by the Supplier to produce an effluent that meets or exceeds the following permit limits:
    1. Discharge NPDES permit limits:
        a. *E. coli*: 100 colony forming units (CFU)/100 mL, based on a six-week rolling geometric mean calculated weekly.
        b. *E. coli*: 320 CFU/100 mL, less than 10 percent of all samples collected in a calendar month shall exceed this limit.
    2. Grab samples shall be taken in accordance with the Microbiology Sampling Techniques found in Standard Methods for the Examination of Water and Wastewater, Latest Edition.

B. Minimum Discharge RED:
    1. Design the system to deliver a minimum T1 RED equal to or greater than 14 mJ/cm^2 specified in this Section at peak wet weather flow, the design UVT and under Attenuated Lamp Conditions.
    2. The basis for evaluating the dose delivered by the UV disinfection system shall be the Supplier’s bioassay results as determined by Third-Party Reactor Validation Testing per the IUVA Protocol.
    3. The Engineer can apply the required correction factor to the Supplier’s bioassay results.

2.04 SUPPLIERS

A. The UV Disinfection System shall be manufactured by the following equipment manufacturers:
    1. Trojan.
    2. WEDECO, a Xylem brand.

2.05 GENERAL PRODUCT REQUIREMENTS

A. Description of Work:
    1. The work under this Section shall cover furnishing a complete and operational temporary UV disinfection system:
        a. The system shall be complete with UV banks, power distribution, master control, UV detection system and automatic cleaning system as indicated on the Drawings and specified in this Section.
    2. The system shall utilize active dose control based on the Third-Party Reactor Validation Testing and using the following parameters:
        a. UV intensity, as measured by a calibrated sensor technology meeting USEPA/UVDGM standards.
        b. Water quality (UVT).
        c. Water flow (plant flow measured in each channel).
        d. Power (Ballast Power Level).

e. Based on these parameters, the system will either automatically vary the UV lamp power proportionally or turn banks on and off to continuously meet the dose requirement.

3. The system shall be capable of continuous disinfection while automatically cleaning the UV lamp sleeves without reducing or shadowing the output of the lamps.

B. General:
   1. Unless otherwise specified, components in contact with the effluent and/or UV light shall be Type 304 or 316 stainless steel, Type 214 quartz glass, Viton or Teflon™:
      a. Wiring exposed to UV light shall be Teflon™-coated.
   2. Fasteners in contact with the effluent shall be Type 304 or 316 stainless steel.
   3. Unless otherwise specified, metal components above the effluent shall be Type 304 stainless steel.
   4. Enclosures shall be Type 304 stainless steel - NEMA 4X, unless specified otherwise.

C. Master Control Panel (MCP) general requirements:
   1. Programming:
      a. Supplier shall provide control equipment and programming as required for a complete and functional UV control system:
         1) Supplier shall be responsible for preparing, writing, and testing PLC programming logic associated with the UV control system and shall provide a system block diagram complete with inter-equipment wiring requirements:
            a) Provide status, alarms, and process variable data to the plant SCADA system.
         2) Programming for the plant SCADA system shall be done by others hereby designated as the Programmer.
         3) Supplier shall include an allowance for an additional 8 hours total for the PLC and LOI to accommodate SCADA coordination programming:
            a) Execution of hours will be determined by Engineer and Owner as needed.
      b. Master Control Panel:
         1) The UV system Supplier shall provide a PLC-based Control Panel to monitor and control equipment associated with the UV Supplier's system:
            a) The UV MCP shall operate as an interface between the UV control system and the Plant PLC system.
            b) The Master UV PLC shall communicate to the Plant PLC system through Ethernet communications using Ethernet/IP protocol. The UV PLC shall be provided and programmed by the UV system Supplier.
            c) Provide communication capability for monitoring the UV system through the plant SCADA system as indicated on the Drawings and specified in this Section.
         2) MCP shall contain a dedicated PLC.
         3) The Ethernet switch inside the panel shall be provided as specified in Section 40_61_05 - Packaged Control System.

4) Main circuit breaker:
    a) Door-mounted operator:
        (1) Pad-lockable in the off position.
    b) Disconnects power to the panel.
    c) Interlock with the panel door:
        (1) Defeat mechanism.
    d) Properly sized for 22kAIC of available fault current based upon a 120VAC, single-phase power supply to the MCP.
5) Control power:
    a) Primary voltage:
        (1) 120 VAC, 1 phase, 60 hertz.
    b) Control and status points to the facility SCADA system: 120 volt.
    c) Secondary voltages:
        (1) Additional voltages as required by the application.
6) Control components:
    a) Terminal strips:
        (1) Provide terminal strips for landing external wiring.
    b) Relays, timers, and other components as required providing the specified functionality and remote monitoring connections.
7) Control system programming:
    a) Programming:
        (1) The Supplier shall be responsible for preparing, writing, and testing logic associated with the MCP.
8) Control devices:
    a) MCP shall be provided with start and stop, and hand-off-auto control of the entire UV system.
    b) A separate Hand-Off-Auto switch shall be provided on each Power Distribution Center (PDC).
    c) At a minimum, the UV control system shall have the following inputs:
        (1) UVT (Ultraviolet Transmittance) input (from SCADA), with hand input override from the LOI.
        (2) Level signal used to calculate flow wired to the UV MCP.
        (3) Motorized weir gate position indicator wired to the UV MCP.
        (4) Low Water level input from Supplier supplied water level measurement instruments.
        (5) UV Intensity Isolated analog 4 to 20 mA or 0 to 5 VDC input (from Supplier supplied UV Intensity sensor), 1 per bank.
        (6) Hand input operational UV dose from LOI.
9) Dedicated LOI:
    a) The LOI shall provide access to status and control functions for operations personnel.
    b) Provide and program the local LOI Panel as specified in this section.

2.06 TEMPORARY UV DISINFECTION SYSTEM

A. System construction:
    1. System shall include a stainless steel channel assembly, UV banks, motorized weir gate, automatic cleaning system, master system control panel, power distribution center, and accessories as specified.

B. Channel assembly:
   1. The 304 or 316 stainless steel channel assembly shall be comprised of an inlet box, channel section and outlet box.
   2. The inlet box must allow for a connection to a 20-inch ANSI B16.5 Class 150 flange.
   3. The outlet box must allow for a connection to a 24-inch ANSI B16.5 Class 150 flange.
   4. The channel assembly shall be self-supporting.

C. UV bank:
   1. Each UV bank will consist of UV lamps, quartz sleeves and an automatic cleaning system.

D. UV bank lifting device:
   1. The lifting device for UV banks will be supplied by the UV Manufacturer.

E. Automatic cleaning system:
   1. An automatic in-situ cleaning system will be provided to clean the quartz sleeves:
      a. Wiping sequence will be automatically initiated with capability for manual override.
   2. The cleaning system will be fully operational while UV lamps and modules are submerged in the effluent channel and energized.
   3. Cleaning sequence frequency will be field adjustable to enable optimization with effluent characteristics.
   4. The wipers shall travel the full length of the UV lamp arc.

F. UV intensity detection system:
   1. A submersible UV sensor will continuously monitor the UV intensity produced within each UV bank of UV lamps.
   2. The sensor shall measure only the germicidal portion of the light emitted by the UV lamps as measured at 254 nm:
      a. The sensor shall have sensitivity at 254 nm of greater than 90 percent.
   3. The UV intensity sensor shall be accurate within 20 percent.
   4. The UV intensity monitoring system shall be calibrated in the factory.
   5. The sensor shall be automatically cleaned at the same frequency as the lamp sleeves to prevent fouling of the sensor and resulting false alarms for low intensity.
   6. There shall be 1 UV sensor for every UV bank.

G. Electrical:
   1. Each UV bank shall be powered from the Power Distribution Center.
   2. Supplier to supply cabling between the lamps and ballasts.
   3. Contractor to perform terminations between lamps and ballasts based on direction from the Supplier.
   4. Electrical supply for the water level transmitters/switches will be provided by an external power supply.

H. Power Distribution Center (PDC):
   1. Electrical supply to each of Power Distribution Center(s) shall be 480/277 volts, 3-phase, 4-wire (plus ground) connection.

2. PDC enclosure material shall be Type 304 stainless steel and rated NEMA 4X.
3. Power Distribution Centers to be UL approved or equivalent.
4. Data concentration shall be through integrated circuit boards located inside the PDC.
5. PDCs shall be self-supporting.
6. Each PDC shall include its own main circuit breaker interlocked with the PDC door:
    a. The complete PDC unit, including the incoming main breaker shall have a minimum interrupting rating of 65 kA.
7. Network communication with MCP shall be over Modbus or Ethernet/IP protocol.

I. Master Control Panel:
1. Control requirements are specified in this Section.
2. The UV control system shall include 1 Master UV PLC and associated enclosure for control and monitoring of the entire UV system:
    a. The master UV PLC shall be located as indicated on the Drawings.
    b. The master UV PLC shall be provided and programmed as indicated on the Drawings, and this Section.
3. Electrical supply to the MCP shall be 120 volts, 1 phase:
    a. Where Supplier's equipment requires other voltages, Supplier shall provide any transformers necessary for proper system operation.
4. UV System control and monitoring shall be provided through display touchscreen to allow complete operator interface:
    a. Hardwired panel devices and meters shall not be permitted.
5. The Master UV PLC control panel shall be provided with a LOI.
    a. Operator interface shall be menu-driven with automatic fault message windows appearing upon alarm conditions.
6. Bank status shall be capable of being placed either in Manual (ON/OFF) or Automatic mode.
7. Banks shall be cycled in a lead/lag rotation through automatic control at the Master UV PLC for equal wear and timed off to minimize bank cycling.
8. Elapsed time of each bank shall be recorded and displayed at the LOI when prompted.
9. Master UV PLC Panel shall be UL approved, Type 304 stainless steel and rated NEMA 4X.
10. The Master UV PLC shall be provided with networking equipment required to properly receive and communicate information to and from the plant SCADA system.

2.07 ACCESSORIES

A. Face shields:
1. Quantity: 1.
2. Design: Block UV light wavelengths between 200 and 400 nm.

B. Water level sensors:
1. One ultrasonic level sensor (analog), provided by the Supplier, shall be included as indicated on the Drawings. The level sensor shall be installed upstream of the UV channel's level control gate. The signals from these sensors shall be used to control the effluent level in the channel. These level

sensors shall also generate a low-level signal (dry-contact) that is wired to the PDCs to turn the lamps off when a low-level condition is present.

2. During manual, automatic, and remote modes of system operation, the water level sensor shall ensure that the automatic cleaning system is disabled if the water level in the channel drops below an acceptable value.

2.08 OUTLET LEVEL CONTROL GATES

A. The level control gate shall be designed and provided by the Supplier.

B. Design:
   1. Located in the channel assembly.
   2. Designed to maintain a minimum channel effluent level to keep lamps submerged and comply with the hydraulic constraints set in this Section.
   3. Design flow per design criteria in this Section.
   4. Downward opening level control gate as specified in Section 40_05_59.20 - Low-Head Fabricated Stainless Steel Slide Gates.
   5. Motorized operator in accordance with Section 40_05_57.24 - Electric Actuators:
      a. The motorized operator will interface with the UV MCP so that the UV PLC can monitor and control the level gate.
      b. “Or Equal” operators will be considered for the temporary system. Control and communication compatibility must be demonstrated during the submittal process.

C. Materials:
   1. As specified in Section 40_05_59.20 - Low-Head Fabricated Stainless Steel Slide Gates.
   2. Anchor bolts and other fasteners:
      a. Type 316 stainless steel.

2.09 INSTRUMENTATION AND CONTROLS

A. General:
   1. Control system shall utilize a PLC-based control panel. Supplier system shall communicate with the Plant PLC using a dedicated network connection that shall be isolated from the Supplier field control network.
   2. Provide signals over network communication protocol as indicated on the Drawings. Plant PLC monitoring I/O shall be over the network connection.
   3. Supplier system shall be completely prewired, preprogrammed, and factory tested for proper operation prior to shipment.
   4. Supplier is responsible for providing the necessary control hardware, software, and components as required for a fully functional and operational installation.

B. Control system and strategy:
   1. Programming:
      a. The Supplier shall be responsible for preparing, writing, and testing all ladder logic associated with the UV control system.
   2. Components:
      a. Supplier will provide PLC-based MCP with operator interface and interconnects for monitoring the system through the plant control system.

b. The PLC outputs to the plant control system shall be via Ethernet/IP communication.
c. Provide required hardware, software and programming.

3. The system's LOIs for the Master UV PLC shall provide manual-auto control of the UV system.
4. Provide a separate manual-off-auto switch on each PDC enclosure. The PDC manual-off-auto switch shall override the control of any other remote device.
5. UV system control philosophy:
   a. Final control philosophies are subject to approval by the Engineer and Owner.
   b. Monitored parameters including UV transmittance, flow, and UV intensity shall be used to operate each channel to deliver the setpoint dose.
   c. UV transmittance shall be monitored by an existing UVT analyzer and the signal will be sent to the UV PLC via SCADA.
   d. Flow shall be monitored by the UV system.
   e. UV intensity shall be monitored for each UV bank.
   f. Control philosophies shall use the dose equation included in the Engineering Report of the proposed UV Disinfection System, to continuously calculate the delivered dose of the system and automatically vary the lamp power or turn banks on and off to control the UV dose.
   g. The dose equation and control philosophy shall be as follows:
      1) Dose as a function of flow, UVT, and UV intensity sensor value, directly in agreement with Third-Party Reactor Validation Testing results and approved by the Engineer:
         a) The control system shall generate an alarm when the delivered UV dose is less than the setpoint UV dose.

C. Control strategy: The UV control system shall be programmed to control the UV system as follows:
   1. General:
      a. The UV control system shall monitor and control equipment as specified in this Section to ensure that the target UV dose of the UV process is delivered for the given flow, UVT, and attenuated lamp conditions.
      b. The PLC program shall have the dose equation that is included in the Engineering Report of the proposed UV Disinfection System.
      c. The Master UV PLC shall execute the following for the entire UV system:
         1) Monitor the flow for the system.
         2) Monitor UV intensity at each bank.
         3) Monitor the level in the UV channel.
         4) Monitor the level in each channel and disable the UV lamps if the level drops below the channel minimum water level.
         5) Calculate the UV dose delivered in the channel as specified in this Section.
         6) Control all UV equipment in the channel to deliver the target UV dose in the channel.
         7) Control the automatic cleaning system.
         8) Control the level control gate.
         9) Monitor UVT.
         10) Display flow through the system.
         11) Signal UV banks to start-up and shutdown as required.

d. Level sensors provided must detect low water level in the channel. Level sensors are wired to the PDC and/or MCP.

2. Automatic control:
   a. With a minimum of 2 UV banks and the outlet gate in the channel set to Auto mode, the operator can place the UV system into "Auto" mode from the Master UV PLC.
   b. General:
      1) The lead bank shall always be on-line.
      2) Based on the flow, the Master UV PLC shall select the number of banks to be in service and the required power setting of each operating bank.
      3) The Master UV PLC shall monitor the power level (ballast power level or lamp current) of each bank and minimize the total power required to deliver the target dose.
      4) The number of ON/OFF cycles for any one UV bank shall not exceed 4 times per 24 hours, on average.

1. Start-up procedure of a bank:
      1) When a bank is required to be brought into service, the Master UV PLC will initiate the following Start-Up Procedure:
         a) The Master UV PLC will monitor the bank's effluent low-level signal. If the low-level signal is not in alarm then turn ON all lamps in the bank.
         b) If an effluent low-level alarm exists in the requested bank then generate a Major Alarm, "Low Effluent Level".
         c) If bank that was placed in service is replacing another bank, then wait until the new bank has completed the lamp warm-up stage before turning OFF the lamps in the off-line bank.
         d) After the new bank's lamp warm-up stage is completed, switch the Dose Pacing PID to Auto.
         e) The Master UV PLC shall optimize the percent ballast power level or lamp current to the UV lamps to deliver the target UV dose.

2. Shutdown procedure of a bank:
   a. When a bank is required to be taken out of service, the Master UV PLC shall initiate the following Shutdown Procedure to be executed by the Master UV PLC:
      1) The Master UV PLC shall calculate the new dose that will occur in the channel when the bank that is being taken off-line is completely out of service.
      2) If the number of operating banks is sufficient to treat the total flow with 1 less bank, then the Master UV PLC will move to the last step of this procedure.
      3) If the number of operating banks is not sufficient to treat the total flow with 1 less bank, then the Master UV PLC will maintain the current number of operating banks and display an informational warning.
      4) Upon verification that the operating banks can deliver the setpoint dose required for the current flow then the Master UV PLC shall turn the UV lamps OFF in the bank being taken out of service.

3. Control during filter backwash cycle:
   a. The Master UV PLC shall receive a filter backwash cycle signal prior to the initiation of the backwash cycle via SCADA.

b. When the backwash cycle signal is received the Master UV PLC shall force the ballast power level to 100 percent for the online UV banks.
c. Dose pacing control shall be placed into manual mode and the ballast power level will not change during this period.
d. When the backwash cycle signal is removed the Master UV PLC shall start an operator adjustable timer (initially set to 5 minutes). After the timer expires the dose pacing control will be placed into automatic mode and the Master UV PLC will determine the required ballast power level based on the operating conditions at that time.

4. Upon Major (HIGH priority) alarm:
   a. With the system in Auto mode, the Master UV PLC shall initiate the bank Shutdown Procedure specified in this Section under the following conditions after the next available bank has been placed in service:
      1) Major alarms generated by a bank will cause the next available bank to be placed in service and the bank with the Major alarm to be placed out of service.
      2) If another bank is not available then the bank with the Major alarm will remain on-line and the Master UV PLC will generate a Major alarm, "Not Enough Banks Available".
      3) If the other available banks have a Major alarm, then the entire UV system, banks, shall be placed on-line with the power to the lamps set to 100 percent.
   b. Upon loss of communication between Master UV PLC and PDC's, the PDC's shall remain in their last operational state.
5. Upon Low UVT alarm:
   a. The UV system shall continue operating.
   b. The Master UV PLC shall trigger a Low UVT alarm.
6. Upon Loss of SCADA Communication alarm:
   a. The Master UV PLC shall trigger a Loss of SCADA Communication alarm and set the UVT to the design value. The UV system shall continue to operate.
7. Upon Minor (Low priority) alarm:
   a. The Master UV PLC shall continue normal operation, monitoring and controlling the equipment as needed to deliver the target dose.
8. Power failure recovery:
   a. Following a power failure, loss of power at PDCs, the plant Master UV PLC shall initiate communications with the PDCs and restore the last state of operation prior to the power failure or energize the duty banks.
   b. The number of duty banks placed online after a power failure can also be based on an operator adjustable start-up flow.
9. Water level:
   a. During Manual and Automatic modes of system operation, the Master UV PLC shall ensure that the lamps in the channel extinguish automatically if the water level in the channel drops below an acceptable value:
      1) The acceptable water level is specific to each UV system and shall be specified by UV Manufacturer.
   b. During Manual and Automatic modes of system operation, the Master UV PLC shall ensure that the automatic cleaning system is disabled if the water level in the channel drops below an acceptable value specified by the UV Manufacturer.

10. With the UV system in Manual mode, the UV system shall be operated through the local Master UV PLC LOI:
    a. The operator shall have the ability to manually turn banks ON and OFF.
    b. The Master UV PLC shall continue to monitor the UV lamps and dose in manual mode.
    c. The safety devices shall continue to act as permissives in Manual mode to prevent any potential damages to the UV system.
11. Alarms and monitoring:
    a. Provide LOI alarms and monitoring required as specified in this Section and transmit monitored information and alarms to the plant SCADA system.
12. Monitoring and controls:
    a. Bank ON/OFF status for each bank, status, and action.
    b. Lamp Status and Alarm for each bank:
        1) ON.
        2) OFF.
        3) WARM-UP.
        4) FAILED.
        5) MULTIPLE LAMP FAILURE.
    c. Gate Open/Close status and action.
    d. UV Intensity (each bank) value.
    e. Elapsed time per bank.
    f. Number of starts per lamp.
    g. Cumulative number of ON/OFF cycles (each bank).
    h. Ballast power (lamp current) setpoint and value (each bank).
    i. UV transmittance value.
    j. Provide the operator the ability to override the UVT analyzer value and manually enter the UVT value based on laboratory testing.
    k. Setpoint UV dose.
    l. Flow rate.
    m. Filter backwash cycle status.
13. Major (High priority) alarms:
    a. Outlet Gate Fail – Position feedback does not match the control signal.
    b. UV Sensor Out of Range (intensity sensor reading is greater than 20 percent of the validated intensity value at the current operating conditions).
    c. LOW Dose (delivered RED dose drops below an operator adjustable setpoint accessible at the Master UV PLC).
    d. Channel LOW Water Level.
    e. Not Enough Banks Available FAIL.
    f. Multiple (Percent) Lamp FAIL (more than operator adjustable percentage setpoint lamps fail per bank):
        1) Default setpoint will be 10 percent.
    g. Power Fail:
        1) Alarm generated from external dry contact provided from the MCP.
    h. PDC High Temperature.
    i. Loss of UV Intensity Signal at PDC.
    j. Communication Fail, Master UV PLC to SCADA.
    k. Communication Fail, Master UV PLC to UV PDCs.

14. Minor (Low priority) alarms:
    a. LOW UVT (UV transmittance drops below an operator adjustable setpoint accessible at the UV LOI).
    b. Cleaning System Fail.
    c. Individual Lamp FAIL (include location of lamp by bank and position).
    d. MCP High Temperature.
15. Screen indicators:
    a. Inputs, monitoring and alarms listed in this Section must be shown visibly within the LOI screen. Additional items to be displayed on the LOI screen include:
        1) Outlet Gate Position Indication.
        2) Outlet Gate Manual/Automatic Status Indication.
        3) Channel Flow.
        4) UV Transmittance.
        5) Bank ON/OFF Status.
        6) Bank Manual/Automatic Status.
        7) Bank Warming-Up/Operating Status.
        8) Bank Elapsed Time.
        9) Bank Cleaning Status.
        10) Number of starts per bank.
        11) Dose Indication (process variable and setpoint).
        12) UV intensity sensor indications (for each bank).
        13) Ballast Power Level (for each bank).
        14) Operation Mode:
            a) Manual or automatic mode.

2.10 MAINTENANCE

A. Special tools:
    1. Provide 1 set of special tools required for operation and maintenance, and complete assembly or disassembly of the UV disinfection system.

B. Spare parts:
    1. The UV Disinfection System Supplier shall furnish, at a minimum, the following spare parts for each system provided:
        a. UV Lamps: 10 percent additional.
        b. UV Ballasts (complete): 5 percent additional.
        c. Quartz Sleeves: 10 percent additional.
        d. Lamp Sealing Rings or Holder Seals: 10 percent additional.
        e. Lamp Plug Assemblies: 5 percent additional.
        f. Lamp Cables: 6.
        g. Wiper or Wiper Rings: 20 percent additional.
        h. UV Sensors: 2.
        i. Cleaning Solution (if applicable): For 8 months of operation after acceptance of Initial Performance Test.
        j. Proprietary Printed circuit boards: 5 percent additional of each type supplied with a minimum quantity of 1.
        k. Fans: 5 percent additional of each type supplied with a minimum quantity of 1 of each type.

PART 3 EXECUTION

3.01 INSTALLATION

A. Installation of the UV equipment shall be by the Contractor in accordance with the Contract Documents, and Supplier's engineering drawings and instructions:
   1. Supplier shall supervise the installation of the UV equipment.
   2. Contractor, in accordance with the Contract Documents and the Supplier's engineering drawings and instructions, shall install the equipment provided by the Supplier.
   3. Temporary equipment will be installed outdoors.

3.02 FIELD EQUIPMENT CHECKS

A. Equipment checks:
   1. Prior to the Field Testing (as detailed below, including Hydraulic, Alarm and Functional Testing, Initial Performance Test, and other testing), the Supplier shall check that equipment is installed properly, and functions as specified in this Section.
   2. The equipment checks shall include, but not be limited to:
      a. Proper installation and alignment of UV support structure defined as the structure used to support and secure the channel assembly containing the UV banks and associated mounting brackets.
      b. Water tightness of submerged equipment.
      c. Proper placement of UV lamp banks to assure specified water levels relative to the lamps.
      d. Electrical wiring and connections.
      e. Proper operation of instrumentation, alarms, and operating indicators associated with the UV equipment.
      f. Proper placement and operation of lamp driver/ballast and other equipment in the control panels.
      g. Adequate cooling of the control panels.
      h. Proper operation of lamp bank shut-off switches.

B. Upon completion of equipment checks, the Supplier shall submit to the Owner written certification that UV equipment and accessory equipment associated with the UV disinfection system have been properly installed, are in good condition, are functioning properly, and are in accordance with the Contract Documents.

3.03 FIELD TESTING

A. Following the Supplier's calibration of test instruments, the Supplier shall perform Component, System, and Operational Tests on the UV disinfection equipment system:
   1. It is the responsibility of the Supplier and Contractor to jointly coordinate and arrange the times for testing and start up activities; however, the Contractor must confirm that these times are acceptable to the Owner.

B. Calibration:
   1. Supplier to ensure all instrumentation associated with testing is calibrated within 180 days prior to the field testing.

2. If retesting is required, the Supplier shall recalibrate instruments associated with the retest if they have not been calibrated within the previous 240 days and submit that information to the Engineer prior to retesting.

C. Data Collection:
   1. Direct readings from the instruments shall be used in the calculations to determine conformance with the guaranteed performance requirements.
   2. Readings shall be obtained from digital trends from the UV disinfection equipment system PLC and by manually recording the values directly from the instrument.
   3. Record (and round if necessary), to the level of accuracy of the instrument before any calculations.
   4. Collect manual instrument readings before and after sampling during the Initial Performance Test.
   5. There shall be no adjustment to readings or calculations due to random or systematic instrumentation error or accuracy limitations.
   6. The Supplier shall document modifications, changes, or additions and amend the operations and maintenance manuals and record drawings to reflect the modifications.

D. Retesting:
   1. The Supplier shall be responsible for retesting.
   2. Supplier shall recalibrate test instrumentation associated with the retest as specified in this Section, if the instrumentation has not been calibrated within the 240 days immediately prior to the retest:
      a. Reimburse the Owner for Owner’s costs associated with the retesting, including engineering fees and administration costs.

3.04 HYDRAULIC, ALARM AND FUNCTIONAL TESTING

A. After the Owner accepts the Supplier's written certification of proper installation of the Temporary UV System as specified in this Section, the Hydraulic, Alarm and Functional Testing shall be performed to determine whether the equipment meets the hydraulic, alarm and control function conditions specified in this Section.

B. Separate protocols for the Hydraulic Testing and the Alarm and Functional Testing shall be submitted to the Engineer for approval a minimum of 30 days prior to the scheduled UV system start up:
   1. Hydraulic, Alarm and Functional Testing will occur over a period of several days and shall be performed by the Supplier and Contractor with the assistance of the Owner.
   2. Channel Level Control Tests: Water level in the channel shall be measured and plotted showing flow rate in MGD on the horizontal axis and water level in inches of water on the vertical axis.
   3. The level between the downstream bank of lamps and the level control gate shall be used to verify the level data compared to the Supplier's specifications:
      a. A minimum of 4 water level measurements shall be taken during this test at approximately 25, 50, 75, and 100 percent of the design flow rate.
   4. Alarm and functional testing shall include simulation of flow and water quality change, lamp and bank failures, sensor performance alarms and the proper

maintenance of the minimum UV dose over a range of flow and water quality conditions, as specified in this Section:

a. This test shall also include automatic control of the UV banks, start-up and shutdown of UV banks, bank rotation based on operator selection and high priority alarms, and other control functions as specified in this Section.

3.05 INITIAL PERFORMANCE TEST

A. Following completion of the Hydraulic, Alarm and Functional Testing and calibration of instruments, the Supplier and the Contractor shall conduct the Initial Performance Test (IPT):
   1. The IPT shall be conducted to determine whether or not the equipment meets the Performance Test Requirements specified in this Section.

B. Supplier shall submit a detailed protocol to be followed for the IPT for both the reuse and discharge effluents at least 30 days in advance:
   1. This protocol requires written approval by the Owner/Engineer before initiating the tests.
   2. The protocol shall specifically detail the operational mode of the system, sampling program, method and schedule, equipment and system monitoring data to be collected with each sampling, the daily (manual) log format, and sampling and analytical procedures.
   3. Upon acceptance of the protocol and the recommended laboratory by the Owner/Engineer, the Supplier shall commence the performance test.
   4. The Supplier shall collect and process duplicate influent and effluent samples two times per day for a total of 3 days:
      a. Additional samples shall be collected for total suspended solids and UV transmittance for each test.

C. Supplier and the Contractor shall provide the IPT Report within 10 working days of completion of each test period.

D. To perform the test, the Supplier and the Contractor shall operate the system continuously over a 3-day test period, and collect and summarize data to demonstrate that the system meets the following Performance Test Requirements:
   1. Net production capacity:
      a. System meets average daily flow and peak flow rate requirements as specified in this Section.
   2. Minimum design dose:
      a. System can deliver the minimum design UV dose as specified in this Section.
   3. UV Disinfected Effluent Water Quality:
      a. UV Disinfection system produces an effluent in complete compliance with requirements as specified in this Section.
   4. Cleaning:
      a. The on-line, automatic cleaning system cleans the lamps as thoroughly and frequently as is required for the system to deliver the minimum design dose.

5. No major changes in equipment or apparatus will be permitted during this test period:
    a. However, minor adjustments of equipment that would normally be expected during regular operation of the equipment in plant use may be made.

E. Successful completion of the IPT shall be defined as continuous operation over the IPT test period without a major failure in the system and demonstration that the system meets performance requirements established in this Section.

F. Downtime resulting from Owner's operation will not be counted against the criteria of "continuous days of operation".

G. If during the IPT, the system fails or shuts down, the IPT shall then be rerun, as described above, and additional testing, labor, materials, equipment, etc., associated with correcting deficiencies in the UV system, including the repeated performance test, shall be borne by the Supplier:
    1. Each repetition of the IPT shall be for a continuous period unless failure to meet performance requirements as specified in this Section has been documented and modifications have been accomplished.

H. During the IPT, the Owner shall have the option of collecting samples for independent analyses to confirm measurements and analyses conducted by the Supplier and the Contractor:
    1. The Engineer and the Owner shall have the option of witnessing testing performed by the Supplier and the Contractor.
    2. Supplier shall notify the Engineer a minimum of 2 weeks in advance of testing.

I. If the UV disinfection equipment system fails to successfully complete the IPT, the Supplier shall have the option of repeating the test 2 more times, with costs borne by the Supplier.

J. Consequences to the Supplier for failure to successfully complete the IPT are that the disinfection capacity of the system is derated.

3.06 TRAINING OF OWNER'S PERSONNEL AND SUPPORT SERVICES

A. General requirements:
    1. Provide operations and maintenance training for items of mechanical, electrical and instrumentation equipment:
        a. Utilize Supplier's personnel to conduct training sessions.
    2. Coordinate training sessions to prevent overlapping sessions.
    3. Provide Draft Operation and Maintenance Manual for specific pieces of equipment or systems prior to training session for that piece of equipment or system.
    4. Satisfactorily complete Hydraulic, Alarm and Functional Testing before beginning operator training.
    5. Following Owner’s acceptance of Certificate of Proper Installation, the Supplier shall perform training of Owner’s personnel at the site, or a classroom designated by the Engineer.

6. The training provided by the Supplier's representative shall consist of both classroom and field training based upon Owner's schedule.
7. The Supplier shall give the Owner a minimum of 30 days' notice prior to initiation of training.
8. The Supplier shall designate and provide 1 or more persons to be responsible for coordinating and expediting training duties:
    a. The person or persons so designated shall be present at training coordination meetings with the Owner.
9. The Supplier's coordinator shall coordinate the training periods with Owner personnel and shall submit a training schedule for each component of the UV disinfection equipment system for which training is to be provided:
    a. Such training schedule shall be submitted not less than 30 calendar days prior to the time that the associated training is to be provided and shall be based on the current plan of operation.

B. Specific requirements:
1. In addition to the time necessary to complete the requirements established elsewhere within these Specifications, the Supplier's representative shall also provide onsite services at times designated by the Owner, for the minimum person-days listed below, travel time excluded.
2. Installation Supervision and Inspection:
    a. Minimum 5 person-days to handle various requests by the Owner, including during the unloading of UV disinfection equipment system and for providing installation assistance for the UV disinfection equipment system (assume 1 trip).
3. Start-up and field-testing:
    a. Minimum 6 person-days to handle various requests by the Owner, for assistance during start up activities (assume 2 trips).
4. Operator training:
    a. Training shall consist of a minimum of total of 8 hours (1 trip) of hands-on lectures on the UV disinfection equipment system operation and the maintenance requirements, and replacement and repair processes for lamps, ballasts, wipers, sleeves, and ancillary equipment.
5. Maintenance Service - Service Scheduling:
    a. By Owner request any time during warranty period as specified on the Warranty Form.
    b. Factory representatives of the Supplier who have complete knowledge of the proper operation and maintenance of the equipment, shall be provided to instruct representatives of Owner on the proper start-up, operation, and maintenance.

C. Supplier shall include in the proposal a price for the time and expenses listed above.

D. Supplier's representative shall be a qualified individual who has previously provided onsite services for the installation, testing, and start-up of the Supplier's identical system at a minimum of 5 wastewater treatment plants of similar size.

E. Telephone:
   1. Include the following support during the construction period, estimated to be 8 months in duration, in lump sum price:
      a. Provide telephone support by means of a toll-free phone number.
      b. Provide a list of 3 or more names of individuals qualified to support operation and provide cell phone numbers for these individuals.
      c. At least 1 of the listed individuals shall be available at all times including nights, weekends, and holidays in the event of an emergency.

F. Service scheduling:
   1. By Owner, on request any time during warranty period as specified.
   2. Factory representatives of the Supplier who have complete knowledge of the proper operation and maintenance of the equipment, shall be provided to instruct Owner on the proper start-up, operation, and maintenance.

END OF SECTION

SECTION 46_66_85

ULTRAVIOLET DISINFECTION SYSTEM

TABLE OF CONTENTS

PART 1 GENERAL

1.01 SUMMARY

A. Section includes: Equipment associated with the Ultraviolet (UV) Disinfection System.

B. Equipment will be prepurchased by the Owner and installed by a separate installation contractor to be selected in a later procurement. Prepurchase equipment will be assigned to the installation contractor. Equipment submittal will be reviewed during the installation design phase based on the selected prepurchase equipment suppliers bid.

C. The UV system is to be complete and operational with all control and appurtenant equipment as shown on the Drawings and specified herein. UV Disinfection System Supplier (hereafter called Supplier) shall provide design assistance including workshop participation, installation assistance, start-up, and operator-maintenance training as described in this Section under a separate Contract with the Installation Contractor. The Supplier shall assist with commission and performance testing as described in this Section.

1.02 REFERENCES

A. ASTM International (ASTM):
   1. A380 - Metals and Alloys in the Unified Numbering System (UNS).

B. California Code of Regulations (CCR):
   1. Title 22, DIV 4, Chapter 3, Article 1, 60301.

C. Institute of Electrical and Electronics Engineers (IEEE):
   1. Standard 519 - IEEE Recommended Practice and Requirements for Harmonic Control in Electric Power Systems.

D. International Society of Automation (ISA).

E. International Ultraviolet Association (IUVA):
   1. Uniform Protocol for Wastewater UV Validation Applications, IUVA News, 13 (2), 26–33. 2011.

F. National Electrical Manufacturers Association (NEMA):
   1. 250 - Enclosures for Electrical Equipment.

G. National Institute for Standards and Technology (NIST).

H. National Water Research Institute (NWRI):
   1. Ultraviolet Disinfection Guidelines for Drinking Water and Water Reuse, Third Edition, 2012.

I. Underwriters Laboratories, Inc. (UL).

J. United States Environmental Protection Agency (EPA):
   1. Clean Water Act, Section 402 – National Pollutant Discharge Elimination System (NPDES).
   2. Ultraviolet Disinfection Guidance Manual (UVDGM).

1.03 TERMINOLOGY

A. The words and terms listed below, are not defined terms that require initial capital letters, but, when used in this Section have the indicated meaning.

B. Lamp age factor:
   1. Reduction in available UV output at the end of the UV lamp life, as compared to a new UV lamp after 100 hours burn-in.

C. Lamp life:
   1. Total guaranteed operational time that the UV lamp can deliver a UV output that is greater than or equal to the lamp age factor.

D. Normalized lamp velocity:
   1. Flow velocity across a lamp (in gpm per lamp), calculated by the total expected flow in a UV channel (in gpm) divided by the total number of lamps in only 1 bank in the channel.

E. Project manager:
   1. UV Disinfection System Supplier's (hereafter called Supplier) personnel having a minimum of 5 years of experience in design and execution of wastewater UV systems to utilities.

F. Sleeve fouling factor:
   1. The sleeve fouling factor is a measure of the sleeve's loss of irradiance over time (expressed as a percentage of the irradiance from a new and clean quartz sleeve).
   2. Periodic automatic and manual cleaning of the system is performed to achieve a factor greater than the sleeve fouling factor.

G. UV bank:
   1. One or more UV modules that the entire reactor train flow must pass through. Each bank consists of:
      a. High purity, quartz sleeves (1 sleeve per lamp) to protect lamps from direct contact with the wastewater.
      b. Each UV Bank shall be connected to its ballasts by means of a multi-conductor cable fitted with a waterproof plug.
      c. UV intensity sensors to provide continuous monitoring of the reactor performance.
      d. Automatic on-line cleaning system for periodic cleaning of the quartz sleeves.
      e. Interconnection of electrical and control cabling between the UV lamps, sensors, cleaning mechanism, and the reactor ballast enclosures.

H. UV channel (synonymous with UV train):
    1. The independent combination of the UV banks, and inlet and outlet level controlling arrangements located in a concrete channel.

I. UV disinfection equipment system (synonymous with UV Disinfection System):
    1. The combination of UV channels with associated controls and instrumentation.

J. UV dose:
    1. Reduction Equivalent Dose (RED):
        a. The dose that is assigned to the UV reactor under a given set of operating conditions that is based on Third-Party Reactor Validation Testing.
        b. The RED is equivalent to that measured with the collimated-beam apparatus for the same degree of inactivation of the test microorganism.
        c. RED is typically reported in millijoules per square centimeter (mJ/cm^2).
    2. Design RED:
        a. The RED delivered for a specific log inactivation of the test microorganism at the peak design flow at the design UVT and attenuated lamp conditions.
        b. The test microorganism shall be MS2 bacteriophage (MS2) and T1 bacteriophage (T1).
        c. The design RED is used to size the UV Disinfection System.

K. UV intensity (UVI):
    1. The power per unit area passing through an area perpendicular to the direction of propagation.
    2. UV intensity is used to describe the magnitude of UV light in a UV reactor or in a bench-scale UV test.

L. UV intensity control:
    1. The use of calibrated UV sensors, meeting the recommendations of the United States Environmental Protection Agency's (USEPA) Ultraviolet Disinfection Guidance Manual (UVDGM) (2006), to continuously monitor UV intensity within the reactor.
    2. The measured UV intensity is used to indicate relative lamp output due to effluent quality, lamp aging, fouling, and ballast power settings, and is used as an input for UV dose-pacing algorithm programmed into the UV system's PLC.
    3. For some UV systems, the sensor reading is not utilized for dose pacing, the use of the sensors to monitor and alarm the combined effect of lamp aging and sleeve fouling can be sufficient. Attenuated Lamp Conditions:
        a. Conditions where the lamps are at the end of their guaranteed lives and the quartz sleeves are fouled (i.e., consistent with the lamp age factor and sleeve fouling factor).

M. UV module:
    1. The basic building block of a UV disinfection system. It is comprised of more than one UV lamp with a common electrical feed and/or cleaning system.

N. UV reactor:
    1. An independent combination of single or multiple UV bank(s) in series with a common mode of failure (e.g., electrical, cooling, cleaning system, etc.).

O. UV testing, reports and references:
    1. Bioassay:
        a. A microbiological procedure used to determine the inactivation of a specific microorganism after exposure to UV light through a specific UV reactor.
    2. Engineering report:
        a. The report is in accordance with Third-Party Reactor Validation Testing:
            1) The report summarizes the results of the third-party bioassay testing and documents the dose equation used to size and operate the proposed UV Disinfection System.
            2) A bioassay testing report prepared and stamped by an independent, third-party licensed civil engineer, registered in the United States.
    3. Hydraulic, alarm and functional testing:
        a. Third-Party Reactor Validation Testing Guidelines require that testing shall be completed to verify that alarms, control functions, head loss, and hydraulics specifications are met.
        b. To ensure this, tests shall be run at minimum, average, and peak flow over the range of channel operating conditions specified in this Section.
    4. Initial Performance Test:
        a. A 7-day continuous tests to demonstrate the installed UV Disinfection System meets the performance test requirements specified in this Section and produces an effluent in complete compliance with requirements as specified in this Section.
    5. Third-Party Reactor Validation Testing:
        a. Testing completed on a pilot scale or full-scale UV system in accordance with a test protocol per Third-Party Reactor Validation Testing, in compliance with the NWRI UV Guidelines (2012), the US EPA's UVDGM (2006), and IUVA Protocol (2011).
        b. Testing is conducted to develop reactor dose delivery for various operational conditions.
        c. A third-party licensed civil engineer in the United States must perform the testing.

P. UV transmittance (UVT):
    1. A measure of the fraction of incident light transmitted through the water column. The UVT is the ratio of the light entering the effluent to that exiting the effluent. UVT is represented as a percentage.
    2. UVT is typically quantified by spectrophotometric measurement at a wavelength of 253.7 nanometer (nm) using a one-centimeter path length.

1.04 PROJECT MANAGEMENT AND QUALITY ASSURANCE

A. Supplier shall assign a qualified and experienced project manager for the duration of the project from initial selection through start-up:
    1. This project manager shall remain the same throughout the duration of the project.
    2. Any change in the Supplier's project management will require approval from the Owner and Engineer after they review the qualifications of the proposed candidates.
    3. The project manager shall act as the main point of communication between Owner, Engineer, Contractor, and Supplier regarding but not limited to the

administration of the procurement contract, payment requests, interpretations of contract terms and conditions, warranty, technical aspects of the UV disinfection equipment system, Including design criteria, materials selection, equipment, control systems, and coordination between Supplier and other parties during the design, bidding, shop drawing submission and reviews, RFIs, and scheduling deliveries, field inspections, start-up, and performance testing during construction.

1.05 SUBMITTALS

A. Product Data and Shop Drawings: Supplier shall submit the following:
   1. Product data, including, but not limited to, the following:
      a. Complete description in sufficient detail to permit an item-by-item comparison with the Specifications.
      b. Descriptive information including catalog cuts and Supplier's specifications for components.
      c. Written field electrical termination requirements and instructions as required for the Contractor to install a complete and operational system.
      d. Third-Party Reactor Validation Testing results and corresponding Engineering Report(s).
      e. Number of lamps per module.
      f. Number of modules per bank.
      g. Total number of UV lamps.
   2. General Shop drawing submittal including, but not limited to:
      a. Details of the UV module/bank, ballast enclosure, power distribution system with transformers as required, and control system.
      b. Dimensions and installation requirements.
      c. Information on the channel configuration, including but not limited to: Widths, depths, lengths, and any other items necessary to confirm the proposed system will fit into the proposed UV channels.
   3. Electrical, Instrumentation and Controls data and shop drawings specified in the Contract Documents, including but not limited to:
      a. Front exterior and interior panel layout drawings with bill of materials for electrical and control panels.
      b. Control schematics with wire numbers.
      c. Detailed interface and interconnection drawings that indicate UV system and external component and equipment connections.
      d. Detailed electrical wiring diagrams as required for the Contractor to install a complete operational system including, but not be limited to:
         1) Source power feeder conductor quantities and sizes.
         2) Control wiring quantities and sizes.
         3) Signal cable quantities and sizes.
         4) Power (kW), power factor and apparent power (kVA) for each UV Bank and/or Power Distribution Center.
         5) Master UV PLC power requirements.
         6) Cut sheets for each electrical power and control device.
      e. Control philosophy narrative with integration of the Third-Party Reactor Validation Testing results, including the use of the sensors to monitor and alarm the combined effect of lamp aging and sleeve fouling and/or the use of the sensors to continuously monitor UV dose based on inputs of flow,

UV sensor intensity, and UV transmittance (UVT). Process and Instrumentation Diagrams (P&IDs) shall accompany the narrative.

f. Provide a wiring diagram complete with inter-equipment wiring and conduit requirements.
g. Complete grounding requirements for each system component including any requirements for PLCs, process LANs, and Control System equipment.
h. Requirements for physical separation between control system components and 120 VAC, 480 VAC, and medium voltage power cables.
i. UPS and battery load calculations to show that the backup capacity and time meet the specified requirements.
j. Thermal management calculations for supplied panels.
k. Provide a data sheet for each control system component together with a technical product brochure or bulletin, which include:
    1) The manufacturer's model number or other identifying product designation.
    2) Tag and loop number.
    3) System to which it belongs.
    4) Site to which it applies.
    5) Input and output characteristics.
    6) Requirements for electric power.
    7) Device ambient operating requirements.
    8) Materials of construction.
l. Electronic copy on a flash drive of the UV PLC system program.
m. Electronic copy on a flash drive of the Local Operator Interface (LOI) program.

4. List of spare parts.
5. UV Master Control Panel (MCP):
    a. Proposed layout of mounted devices and terminals with dimensions within MCP.
    b. Proposed MCP PLC programming printout with input/output (I/O) listing if available.
    c. Complete I/O list:
        1) A table showing the data available over EtherNet/IP communication protocol to the plant control system.
    d. Proposed MCP LOI graphic display printouts.
    e. Operating description for MCP:
        1) Include detailed descriptions of logic and sequences of operation of control loops within the MCP controller, points monitored, available local and automatic control functions, and alarms.
        2) Include a description of the controls interface and communication between the MCP and Plant PLC.
        3) Provide a more detailed description of these functions than is described in these Specifications.
6. PLC cabinet:
    a. Panel exterior and internal elevations with detailed bill of materials.
    b. PLC power schematic and I/O shop drawings.
    c. Product data for panel and components.
    d. PLC memory and spare I/O calculations.

B. Operation and maintenance manuals:
   1. Supplier shall submit an operation and maintenance manuals in accordance with Section 01_78_24 - Operation and Maintenance Manuals:
      a. In addition to the requirements listed in the above referenced section, the Operation and Maintenance Manuals shall include:
         1) Name, address, and telephone number of nearest Supplier and spare parts warehouse.
         2) Special tools required for operation and maintenance.
         3) Reproducible prints of the Contract diagrams, schematics, and installation drawings for electrical and instrumentation work.
   2. Prerequisite to equipment approval: Engineer acceptance of the manual.
   3. Supplier's copy of complete manuals shall be available at the site of the work for use by field personnel and Engineer during Hydraulic, Alarm and Functional Testing, and Performance Testing of equipment.
   4. Step by step instructions for operation and maintenance of equipment provided by Supplier.
   5. Description of process control logic and process and instrumentation diagrams.
   6. Drawings of control panels to include:
      a. Electrical ladder diagram.
      b. Interconnect to components outside the panel.
      c. Door layout.
      d. Interior layout.
      e. Sample Operator Interface screens for the local panels and MCP.
   7. Operating description for the MCP:
      a. Provide a copy of the software ladder logic covering logic and sequences of operation.
      b. Provide a soft copy of documented PLC code on flash drive. Provide a list of instrument settings:
         1) In the event that a soft copy of the PLC code cannot be provided to the Owner, provide 1 spare pre-programmed PLC or microprocessor/CPU.
   8. Provide a detailed description of the data collection and monitoring software.
   9. Provide typical Operator interface screens with detailed descriptions, the various tattletale monitors, preventative maintenance items, and data logging features.
   10. Provide I/O listing for control panel PLCs.
   11. Indicate scheduled maintenance requirements and routine inspections. Include maintenance summary forms.
   12. Provide list of recommended spare parts and lubricants.
   13. Provide a troubleshooting guide.
   14. Provide the local sales representative contact information with the company name, contact person, phone number, address, and service provider.

C. Quality Certification:
   1. Supplier shall submit Engineering Report of the proposed UV Disinfection System, including:
      a. Raw data used to justify the conclusions of the Third-Party Reactor Validation Testing.

b. Test reactor configuration including tested parameters (e.g., flow rates, UV transmittance, number of reactors/lamps in operation, and type of water tested).
c. Collimated beam results.
d. Reactor validation results with regard to inactivation of the test organism.
e. Test results from head loss testing.
f. Recommended normalized lamp velocity range (flow/lamp) to meet the required Design UV dose.
g. Delivered UV dose equation developed based on Supplier's Third-Party Reactor Validation Testing.

2. Hydraulic calculations demonstrating compliance with the hydraulic constraints specified in this Section.
3. Representative harmonic analysis calculations and reports for both voltage and current at the point of common coupling, as defined as the input terminals to the power distribution center:
   a. Certification that voltage and current harmonic distortion levels are within IEEE 519 Standard limits at the point of common coupling when powered from utility power supply in accordance with Article 1.05 Paragraph D.4.
4. Supplier's UV equipment warranty including lamps, ballasts, quartz sleeves, wipers, and UV sensors, as specified in this Section.
5. Supplier's performance warranty as specified in this Section.
6. Documentation of the successful completion and results of the Underwriter's Laboratory (UL) or equivalent testing shall be provided.
7. Initial Performance Test protocol to fulfill requirements as specified in this Section.

D. Closeout submittals:
1. Written certification of proper UV system installation as specified in this Section.
2. One copy of UV PLC, operator interface, and other programs required for the maintenance of the UV system in native format on flash drive:
   a. PLC and LOI Programs:
      1) Provide complete electronic copies of the PLC and LOI programs and configuration files for equipment in the local control panels, in the native file format of each device, along with any supporting files.
      2) Programs shall be fully accessible for use by the Owner - programs that are locked, restricted, or contain hidden materials are not permitted.
   b. Provide a detailed description of control systems.
3. Provide panel drawings, wiring diagrams, specifications, and a detailed description of the local panels.
4. Update operation and maintenance manual documentation and drawings, as required, based on updates or changes made to the UV equipment or installation during startup and commissioning of the system.

E. Other qualification requirement submittals:
1. A statement listing any deviations or exceptions taken to these specifications. Include specification reference and proposed alternative with reason stated for exception.

1.06 QUALITY ASSURANCE

A. Qualification requirements:
   1. Supplier shall demonstrate that the dose required in the performance specification can be met with the amount of equipment proposed:
      a. Supplier shall base sizing of UV system on a Third-Party Reactor Validation Testing calculation to meet the minimum UV design dose as specified in this Section.
      b. Supplier's data and results shall be reviewed by the Engineer.
      c. Engineer can apply the required correction factor to the Supplier's bioassay results.
      d. Engineer's review and opinion of the test protocol, pilot data, and pilot report conclusions shall be deemed final and shall be just cause for the rejection of the proposed equipment.
      e. In addition, bioassay calculations shall use 1 method for the calculation of gpm per lamp for data, as specified in this Section as the "Normalized Lamp Velocity".
   2. A statement by the Supplier listing any deviations or exceptions taken to these Specifications shall be provided to the Engineer for the Engineer's review, opinion, and acceptance:
      a. The Engineer's final decision regarding the acceptance or denial of any deviations or exceptions shall be just cause for the rejection of the proposed equipment and require that the Supplier supply the disinfection equipment as specified in this Section.
   3. Provide equipment labeled and listed by UL or another nationally recognized testing laboratory, furnished by a single Supplier qualified and experienced in the production of similar equipment.

1.07 DELIVERY, STORAGE AND HANDLING

A. If required by the Contractor's schedule, the Supplier shall provide equipment in multiple separate freight shipments.

B. Provide notification in writing to the Owner and Contractor of approximate delivery date(s) 4 weeks before delivery:
   1. Notify same of actual delivery date at least 7 days before delivery.
   2. Provide description and approximate weight of shipping container and required equipment for unloading.
   3. Supplier shall coordinate delivery, unloading, and storage with Contractor.

C. Store products according to manufacturer instructions:
   1. Moisture sensitive products shall be stored in appropriate weather-proof enclosures or locations:
      a. Supplier will designate those items that need to be stored in this manner.
      b. Crates covered in tarps are not acceptable.

D. Supplier shall coordinate the delivery of equipment with Contractor:
   1. Supplier's shipping company shall notify the Contractor at least 48 hours prior to arrival on site.
   2. Supplier shall revise schedule for delivering equipment packages if requested by Contractor without additional cost to Contractor.

E. Storage:
    1. General:
        a. Contractor shall store, and handle in accordance with the Supplier's printed instructions.
    2. Packing and shipping:
        a. Supplier shall deliver equipment to the project site in the original containers with seals unbroken and labeled with Supplier's identification and number.
    3. Delivery:
        a. Supplier shall deliver materials dry and undamaged to the Contractor. During the delivery process materials must be stored out of contact with the ground.

1.08 WARRANTY

A. Provide warranty as specified in Section 01_78_36 - Warranties and Bonds:
    1. Additionally, include costs associated with required site visits, inspections, equipment removal costs, and equipment installation costs:
        a. Provide warrantees and support directly by the Supplier.
    2. Special Warranty:
        a. Equipment Warranty:
            1) The equipment furnished under this Section shall be free of defects in materials and workmanship, including damages that may be incurred during shipping, storage, and installation, for a period of 2 years which shall commence from the date of Substantial Completion for the Project.
        b. Wiring Warranty:
            1) Wiring in the channel exposed to UV light shall be warranted for 15 years by the Supplier. If the wiring fails before 15 years have elapsed, the Supplier shall be responsible for the replacement of the wires and the labor.
        c. Replacement Parts Guarantee:
            1) Supplier shall guarantee that for components manufactured by the Supplier, replacement parts shall continue to be available to the Owner for a minimum of 25 years from date of successful completion of Initial Performance Test.
            2) Supplier shall guarantee that, if Supplier or Supplier's product line is sold, Supplier shall make provisions such that guarantees, warrantees, and bonds will remain in effect and that replacement parts and operational support shall continue to be available to the Owner for the time period specified above.
        d. Non-Prorated Warrantees:
            1) The component warrantees listed in this Section shall not be prorated for the initial warranty period. Prorated warrantees can commence after the initial warranty period has expired for each component.
        e. UV Lamp Warranty:
            1) The UV lamps shall be warranted by the Supplier against lamp failure as specified in this Section:
                a) Lamp failure occurs when the ratio of the available UV light output of the lamp to the UV light output of a new lamp after 100 hours of burn-in is less than the lamp age factor.

b) Supplier shall provide a warranty for the performance of the UV lamp for a minimum period of operating hours per lamp as stated as “Guaranteed Lamp Life, hours” in Attachment A – Minimum Equipment Requirements, which shall commence from the date of Substantial Completion.

2) Supplier shall replace any lamp that fails before the end of the operating hours per lamp as stated in Attachment A – Minimum Equipment Requirements, at no cost to the Owner, with freight and insurance paid by Supplier:
   a) Installation of the replacement lamp can be performed by the Owner.
3) This guarantee shall be limited by the guaranteed number of start/stop cycles:
   a) The guaranteed lamp start/stop cycle shall be 4 stop/start cycles per 24-hour period, on average, over the life of the lamp.
   b) The automation associated with the UV equipment shall be programmed to prevent more than 4 start/stop cycles per day:
      (1) Additionally, the automation system must log the operational hours for each individual lamp.
4) The guaranteed lamp life shall not be limited by time periods when the plant is not in operation and/or when the UV system is shut down.
5) Supplier shall ensure returned UV lamps (old/new) are recycled upon receipt at the manufacturing headquarters for the life of the UV Disinfection System. Only lamps purchased directly from the Supplier can be returned for recycling.

f. UV Ballast Warranty:
   1) Supplier shall guarantee ballasts against failure for a minimum period of 5 years, which shall commence from the date of Substantial Completion.
   2) Supplier shall replace any ballast that fails before the end of the designated warranty period at no cost to the Owner, with freight and insurance paid by Supplier:
      a) Installation of the replacement ballast can be performed by Owner.

g. UV Quartz Sleeves Warranty:
   1) Supplier shall guarantee quartz sleeves against failure for a minimum period of 5 years, which shall commence from the date of Substantial Completion:
      a) Sleeve failure is defined as permanent loss of 10 percent sleeve transmittance relative to new sleeve transmittance.
   2) Supplier shall replace any quartz sleeve that fails before the end of the designated warranty period at no cost to the Owner, with freight and insurance paid by Supplier:
      a) Installation of the replacement quartz sleeve can be performed by Owner.

h. UV Sensor Extended Warranty:
    1) Supplier shall guarantee UV sensors against failure for a minimum period of 3 years, which shall commence from the date of Substantial Completion:
        a) Sensor is deemed to have failed when the sensor no longer measures UV intensity or sensor does not meet the specified accuracy of less than 20 percent.
    2) Supplier shall replace any UV sensor that fails before the end of the warranty period at no cost to the Owner, with freight and insurance paid by Supplier:
        a) Installation of the replacement UV sensor can be performed by Owner.

i. Performance Warranty:
    1) The equipment furnished under this Section, when operated within the conditions specified in the Contract Documents and Supplier's Operation and Maintenance Manual, will meet or exceed the performance requirements specified in this Section for a period of 3 years which shall commence from the dated of Substantial Completion.
    2) If the UV equipment fails to meet design and performance criteria, the Supplier shall modify, change, or add equipment as necessary to meet performance criteria:
        a) Supplier shall be responsible for any additional costs to Contractor or Owner due to changes (including but not limited to piping, mechanical, structural, or electrical changes) or additional equipment as necessary to meet performance requirements:
            (1) This includes design, engineering, construction, as well as equipment.
    3) Owner shall make available the UV Disinfection System electronic data records of historical performance for Supplier's review:
        a) The automation system shall log performance data and store it in the historical database.
    4) If the system fails to meet specified performance criteria during the Initial Performance Test, or the warranty period following the date of successful completion of the Initial Performance Test, and the Supplier is unable to modify the system through the addition of UV banks or other elements, then the Supplier shall be responsible for complete removal of non-conforming system and subsequent installation of UV disinfection products that are capable of meeting specified performance conditions.

j. Power Consumption Warranty:
    1) The Supplier shall furnish a warranty stating that the installed UV system shall not exceed the maximum power consumption as specified in Attachment A – Minimum Equipment Requirements, to the end of the system's life.
    2) If this maximum power usage is exceeded due to system modifications by Supplier or by design, the Supplier agrees to pay Owner the cost of upgrading any portion of the electrical system to accommodate the new maximum power consumption:
        a) This includes material, labor, and engineering costs.

B. End of Warranty Inspection:
    1. Inspection:
        a. Supplier's representative shall perform a minimum of 1-day (8 hours) inspection of Supplier's UV equipment, at least 30 days prior to the 2-year anniversary date of the Substantial Completion date (warranty period).
        b. Supplier shall ascertain or appraise the following:
            1) Status of equipment and installation after normal usage.
            2) Electrical wiring and connections.
            3) Replacement parts, inventory spare parts.
            4) Calibration of duty UV intensity sensors using reference UV sensors.
            5) Performance review.
            6) Cleaning system performance.
            7) Quality of sleeve cleaning and recommended sleeve cleaning interval.
            8) Check power consumption.
            9) Adherence to Supplier's recommended maintenance and operation of equipment.
            10) Operation of alarms and controls.
            11) UV transmittance monitor operation.
        c. Supplier shall make adjustments as necessary to restore equipment within original tolerances.
        d. Supplier shall submit a written letter report to the Owner covering the inspection items and including recommendations where applicable.

1.09 DESIGN ASSISTANCE

A. Supplier shall provide Design Assistance to the Engineer and Owner as outlined below:
    1. Project design workshop:
        a. Supplier shall participate in an in-person, day long workshop with the Engineer to discuss the installation design.
        b. The installation design documents will be reviewed.
        c. Topics will include retrofit of the existing UV channel, structural requirements and layout, mechanical equipment layout, electrical and instrumentation design, programming and SCADA interface with the plant system, and any additional feature for a complete installation design.
    2. Product data and shop drawing submittal review workshop:
        a. Supplier shall participate in an in-person, half-day long workshop with the Engineer to review and discuss UV equipment submittal.
    3. Bid set review:
        a. The amended final design submittal will be reviewed by the Supplier to confirm it complies with the Supplier requirements and warranty provisions.

1.10 WORK BY OTHERS

A. The following items are provided by the Contractor but shall be coordinated by the Supplier during the Design Assistance provided by Supplier to Engineer. These items will include:
    1. Structural:
        a. Concrete channels for UV reactors.

b. Foundation/housekeeping pads and additional housing for supplied UV disinfection equipment.
c. Anchor bolts will be provided and installed by Contractor, anchor bolt design by UV Supplier.

2. Mechanical:
   a. Motorized weir gates used to control the effluent level in each channel shall be supplied by the Supplier and installed by Contractor.
   b. Channel inlet gates shall be supplied by the Supplier and installed by the Contractor.
   c. Installation materials for instrumentation and automatic valves including but not limited to air/sample line tubing, fittings, and mountings.
   d. Installation of UV disinfection system components.
3. Electrical:
   a. Electrical wiring interconnections (including wiring, conduit, cable trays, transformers, and other appurtenances required to provide power connections as needed) from the electrical power source to the UV disinfection equipment and system control panels:
      1) Contractor shall also be responsible for determining the correct wire sizing and coordinate this information with the UV Supplier.
   b. The lamp cables between the UV banks and Power Distribution Centers shall be supplied by the UV Supplier and will be run/pulled and terminated by the Contractor.
   c. Communication cabling between the Power Distribution Centers, Mater Control Panel and other electrical panels shall be provided by the Contractor based on the UV Supplier's requirements.
   d. Ethernet communications connection to the Owner's Plant Control System.
   e. Installation of enclosures for a complete UV disinfection system.
4. Other:
   a. Receiving, unloading, and safe storage of equipment at site or a storage facility until ready for installation.
   b. Raw materials and utilities during equipment testing.
   c. Operating and maintenance personnel during equipment checkout, start up, testing and operations.
   d. Any onsite painting or touch-up painting of the equipment supplied.

PART 2 PRODUCTS

2.01 SUPPLIERS

A. The UV Disinfection System shall be manufactured by the following equipment manufacturers:
   1. Trojan UVSigna™ 2-Row System.
   2. WEDECO, a Xylem brand, Duron™ System.
   3. "Or Equal" which meets all specified requirements including Section 00_45_14.15 – UV Qualification Form.

2.02 SYSTEM DESCRIPTION

A. Provide a UV disinfection system complete with UV Banks, a control system, UV intensity sensors, automatic on-line cleaning system, power distribution system, level control gates, and accessories as specified in this Section or as required to have a complete and functioning system.

B. Furnish labor, materials, equipment, and appurtenances required to provide an open-channel, gravity-flow, low-pressure, high-output (LPHO) lamps, UV disinfection system complete with automatic cleaning system:
   1. The UV system is to be complete and operational with control and appurtenant equipment as indicated on the Drawings and specified in this Section.
   2. Supplier shall provide installation assistance, start-up, testing and operator-maintenance training for the UV system as specified in this Section.
   3. The Supplier shall assist with commissioning and performance testing for the UV system as specified in this Section.

C. Provide complete UV Disinfection System that meets all the water quality requirements as set forth by the State of California Title 22 water recycling criteria for unrestricted reuse applications, the National Water Research Institute's (NWRI) Ultraviolet Disinfection Guidelines for Drinking Water and Water Reuse (Third Edition, 2012) (referred to herein as the NWRI UV Guidelines), and the specifications in this Section:
   1. In the event of a conflict between regulations and this Section, the UV System Supplier shall meet the more restrictive standard.

D. Provide complete UV Disinfection System that meets the water quality requirements as set forth by the California Regional Water Quality Control Board, San Francisco Bay Region, Order No. R2-2022-0029 and NPDES Permit No. CA0038776:
   1. In the event of a conflict between regulations and this Section, the UV System Supplier shall meet the more restrictive standard.

E. Third-Party Reactor Validation Testing and the related Engineering Report for the UV reactor to be installed must be completed at the time of Proposal.

F. Upon successful installation, the UV system will be "subjected to a spot-check bioassay performance test" in accordance with the NWRI UV Guidelines, with the testing performed by the Engineer with the support of the Contractor and Supplier.

G. The minimum UV equipment requirement is specified in Attachment A - Minimum Equipment Requirements. Supplier must provide additional equipment (than recommended in Attachment A - Minimum Equipment Requirements) if necessary to meet the performance requirements in this Section. Provide information and costs for additional equipment required. This is a bid submission requirement.

H. Only Suppliers' UV system listed in Attachment A - Minimum Equipment Requirements shall be accepted.

I. The UV Disinfection System shall be able to continuously provide disinfection at the Maximum Day Flow rate, at the design UVT, and with attenuated lamp conditions, under the following circumstances:
   1. While one bank in each channel is out of service and the remaining banks are in service.
   2. While the automatic on-line cleaning system is in operation.
   3. While the UV lamps, quartz sleeves, and/or ballasts are being replaced in the out of service banks.

2.03 DESIGN CRITERIA

A. Supplier shall provide UV disinfection equipment which meets the Performance Requirements, specified in this Section, based on the following conditions:
   1. Influent Water Quality:
      a. Description: Tertiary effluent.
      b. Maximum Day Flow for Reuse: 2.5 million gallons per day (mgd).
      c. Average Flow for Reuse: 1.0 mgd.
      d. Peak Wet Weather Flow for Discharge: 20.0 mgd.
      e. Average Flow for Discharge: 4.0 mgd.
      f. Design Ultraviolet Transmittance (UVT) at 253.7 nm: 56 percent.
      g. Average UVT at 253.7 nm: 62 percent.
      h. Total Suspended Solids: 5 milligrams per liter (mg/L).
   2. The UV disinfection system shall meet the design criteria as specified in this Section and in Attachment A - Minimum Equipment Requirements:
      a. The minimum MS2 RED must be based upon the delivered MS2 RED equation developed from the Supplier's NWRI 2012 UV Guidelines validation testing results:
         1) Engineer can apply the required correction factor to the Supplier's bioassay results based upon the Engineer's analysis of the Validation Testing and site conditions.
      b. The minimum T1 RED for the discharge must be based upon the delivered UV dose equation developed from the Supplier's bioassay results as determined by Third-Party Reactor Validation Testing per the IUVA Protocol:
         1) Engineer can apply the required correction factor to the Supplier's bioassay results based upon the Engineer's analysis of the Validation Testing and site conditions.
      c. Hydraulic constraints:
         1) Supplier shall specify the maximum water surface elevation at which the UV system can operate (based on Third-Party Reactor Validation Testing).
         2) Supplier shall specify the minimum water surface elevation that must be maintained at times, in any channel that contains UV lamps that are turned "ON".
         3) Maximum acceptable normalized lamp velocity (gpm/lamp):
            a) To be specified by Supplier and shall not exceed maximum value proven effective during Third-Party Validation Testing.
         4) Minimum acceptable normalized lamp velocity:
            a) To be specified by Supplier and shall not be lower than the minimum value proven effective during Third-Party Validation Testing.

d. Minimum lamp life:
    1) As stated in Attachment A - Minimum Equipment Requirements.
e. Lamp age factor:
    1) As stated in Attachment A - Minimum Equipment Requirements.
    2) Maximum Value 0.86.
f. Sleeve fouling factor:
    1) As stated in Attachment A - Minimum Equipment Requirements.
    2) Maximum Value 0.94.
g. The UV sensors employed by Supplier must track the combined intensity loss due to lamp aging and sleeve fouling (attenuated lamp condition).
h. Number of channels:
    1) Channel requirement is specified in Attachment A - Minimum Equipment Requirements.
i. Banks per channel:
    1) Banks requirement is specified in Attachment A - Minimum Equipment Requirements.
j. Maximum Total Power Consumption requirement is specified in Attachment A - Minimum Equipment Requirements.

B. UV equipment shall be located as indicated on the Drawings:
    1. The UV channels will be in a building located below grade.
    2. The electrical enclosures with the electronic ballasts and master PLC will be located next to the UV channels in the building.

C. Facility constraints:
    1. Components of the UV system must fit within the footprint as indicated in the Drawings, including proper approach and exit lengths, electrical equipment, and reasonable operations and maintenance access.

2.04 PERFORMANCE REQUIREMENTS

A. The UV disinfection system performance shall be guaranteed by the Supplier to produce an effluent that meets or exceeds the following permit limits:
    1. Reuse Title 22 permit limits:
        a. Total Coliform: 2.2 Most Probable Number (MPN)/100 milliliters (mL), based on a 7-day median.
        b. Total Coliform: 23 MPN/100 mL, more than once in any 30-day period.
        c. Total Coliform: 240 MPN/100 mL, maximum at any time.
        d. 5-$\log_{10}$ poliovirus reduction.
    2. Discharge NPDES permit limits:
        a. *E. coli*: 100 colony forming units (CFU)/100 mL, based on a six-week rolling geometric mean calculated weekly.
        b. *E. coli*: 320 CFU/100 mL, less than 10 percent of all samples collected in a calendar month shall exceed this limit.
    3. Grab samples shall be taken in accordance with the Microbiology Sampling Techniques found in Standard Methods for the Examination of Water and Wastewater, Latest Edition.

B. Minimum Reuse RED:
   1. Design the system to deliver a minimum MS2 RED equal to or greater than 102 mJ/cm^2 specified in this Section at maximum day flow, the design UVT and under Attenuated Lamp Conditions.
   2. The basis for evaluating the dose delivered by the UV disinfection system shall be the Supplier's bioassay results as determined by Third-Party Reactor Validation Testing per the NWRI 2012 UV Guidelines.
   3. The Engineer can apply the required correction factor to the Supplier's bioassay results.

C. Minimum Discharge RED:
   1. Design the system to deliver a minimum T1 RED equal to or greater than 14 mJ/cm^2 specified in this Section at peak wet weather flow, the design UVT and under Attenuated Lamp Conditions.
   2. The basis for evaluating the dose delivered by the UV disinfection system shall be the Supplier's bioassay results as determined by Third-Party Reactor Validation Testing per the IUVA Protocol.
   3. The Engineer can apply the required correction factor to the Supplier's bioassay results.

D. The power factor shall be 98 percent or greater.

E. Harmonic distortion shall be measured with UV banks at 100 percent rated load in accordance with a general system classification meeting the recommended maximum harmonic distortion levels in IEEE 519-2014 Tables 1, and 2 at the Point of Common Coupling (PCC):
   1. The PCC is defined as the load side of 1 Power Distribution Center (PDC).
   2. The short-circuit current (I_{SC}) to load current (I_L) ratio for the plant at the PCC is greater than 20 at 480 volts.

F. The requirements stated in Attachment A - Minimum Equipment Requirements are minimum requirements:
   1. If the UV Supplier determines more equipment is needed then the UV Supplier must provide the additional equipment to meet the performance requirement.

2.05 GENERAL PRODUCT REQUIREMENTS

A. Description of Work:
   1. The work under this Section shall cover furnishing a complete and operational open-channel, gravity-flow, UV disinfection system:
      a. The system shall be complete with UV banks, power distribution panels, master control panel, UV detection system and automatic cleaning system as indicated on the Drawings and specified in this Section.
   2. The system shall utilize active dose control based on the Third-Party Reactor Validation Testing and using the following parameters:
      a. UV intensity, as measured by a calibrated sensor technology meeting USEPA/UVDGM standards.
      b. Water quality (UVT).
      c. Water flow (plant flow measured in each channel).
      d. Power (Ballast Power Level).

e. Based on these parameters, the system will automatically vary the UV lamp power proportionally to continuously meet the dose requirement.

3. The dose delivered by the UV system shall be linearly variable within a minimum range of 50 to 100 percent of maximum power in both manual and automatic operating modes:
   a. If the variability differs between modes, the automatic mode of operation shall be the sole mode considered.
4. The system shall be capable of continuous disinfection while automatically cleaning the UV lamp sleeves without reducing or shadowing the output of the lamps:
   a. For systems that require batch chemical cleaning, system redundancy can be used during the batch cleaning process to maintain the required dose.
5. The UV sensor technology employed by the Supplier must continuously track the combined intensity loss due to lamp aging and sleeve fouling and alarm when the intensity level is outside of the acceptable tolerance based on the predicted UV sensor value from the validation report for the same operating conditions.

B. General:
   1. Unless otherwise specified, components in contact with the effluent and/or UV light shall be Type 316 stainless steel, Type 214 quartz glass, Viton or Teflon™:
      a. Wiring exposed to UV light shall be Teflon™-coated.
   2. Fasteners in contact with the effluent shall be Type 316 stainless steel.
   3. Unless otherwise specified, metal components above the effluent shall be Type 304 stainless steel.
   4. Enclosures located in the same building as the UV channels shall be Type 304 stainless steel - NEMA 4X, unless specified otherwise:
      a. Enclosures located in environmentally controlled buildings shall be Type 304 stainless steel - NEMA 12, unless specified otherwise.
   5. Stainless steel components and welds in stainless steel subassemblies shall be cleaned, pickled, and passivated to protect the stainless steel:
      a. Following shop fabrication of stainless steel members, clean and passivate fabrications.
      b. Finish requirements:
         1) Remove free iron, heat tint oxides, weld scale and other impurities, and obtain a passive finished surface.
      c. Provide quality control testing to verify effectiveness of cleaning agents and procedures and to confirm that finished surfaces are clean and passivated:
         1) Conduct sample runs using test specimens with proposed cleaning agents and procedures as required to avoid adverse effects on surface finishes and base materials.
      d. Pre-clean, chemically descale (pickle), and final clean fabrications in accordance with the requirements of ASTM A380 to remove deposited contaminants before shipping:
         1) Passivation by citric acid treatment is not allowed.
         2) If degreasing is required before cleaning to remove scale or iron oxide, cleaning (pickling) treatments with citric acid are permissible:
            a) These treatments shall be followed by inorganic cleaners such as nitric-hydrofluoric acid.

3) Provide acid descaling (pickling) in accordance with Table A1.1 of Annex A1 of ASTM A380.
4) After pickling, final cleaning of stainless steel shall conform to Part II of Table A2.1 of Annex A2 of ASTM A380.

e. After cleaning, inspect using methods specified for "gross inspection" in ASTM A380.

f. Improperly or poorly cleaned and passivated materials shall not be shipped and will not be accepted at the job site.

C. Master Control Panel (MCP) general requirements:

1. Programming:

a. Supplier shall provide control equipment and programming as required for a complete and functional UV control system that performs functions described in this Section and as indicated on the Project P&IDs, with the exception of programming required for the plant SCADA system:

1) Supplier shall be responsible for preparing, writing, and testing PLC programming logic associated with the UV control system and shall provide a system block diagram complete with inter-equipment wiring and conduit requirements:

a) Provide status, alarms, and process variable data to the plant SCADA system.

b) Control signals shall also be accepted from the plant SCADA system. Coordinate tagging and memory mapping with the Contractor and follow the Engineer’s direction.

2) Programming for the plant SCADA system shall be done by others hereby designated as the Programmer.

3) Supplier shall coordinate with the Contractor and the Programmer while developing the software design.

4) Supplier shall include an allowance for an additional 8 hours total for the PLC and LOI to accommodate SCADA coordination programming:

a) Execution of hours will be determined by Engineer and Owner as needed.

b. Master Control Panel (MCP):

1) MCP shall be provided as specified in this Section and Section 40_61_05 - Packaged Control System.

2) The UV system Supplier shall provide a PLC-based Control Panel to monitor and control equipment associated with the UV Supplier’s system:

a) The UV MCP shall operate as an interface between the UV control system and the Plant PLC system.

b) The Master UV PLC shall communicate to the Plant PLC system through Ethernet communications using Ethernet/IP protocol. The UV PLC shall be provided and programmed by the UV system Supplier.

c) Provide communication capability for monitoring and controlling the UV system through the plant SCADA system as indicated on the Drawings and specified in this Section.

3) MCP shall have a UPS with 1.5 safety factor and 30-minute runtime:

a) The UPS shall be provided by the Supplier as specified in Section 40_61_05 - Packaged Control System.

4) The MCP shall utilize a 120 VAC non-UPS power source for providing power for other panel appurtenances.
5) MCP shall contain a dedicated PLC:
    a) Provide PLC hardware as specified in Section 40_61_05 - Packaged Control System.
6) The Ethernet switch inside the panel shall be provided as specified in Section 40_61_05 - Packaged Control System.
7) Main circuit breaker:
    a) Door-mounted operator:
        (1) Pad-lockable in the off position.
    b) Disconnects power to the panel.
    c) Interlock with the panel door:
        (1) Defeat mechanism.
    d) Properly sized for 22kAIC of available fault current based upon a 120VAC, single-phase power supply to the MCP.
8) Control power:
    a) Primary voltage:
        (1) 120 VAC, 1 phase, 60 hertz.
    b) Control and status points to the facility SCADA system: 120 volt.
    c) Secondary voltages:
        (1) Additional voltages as required by the application.
9) Control components:
    a) Terminal strips:
        (1) Provide terminal strips for landing external wiring.
    b) Relays, timers, and other components as required providing the specified functionality and remote monitoring connections.
10) Control system programming:
    a) Programming:
        (1) The Supplier shall be responsible for preparing, writing, and testing logic associated with the MCP.
        (2) Supplier shall be responsible for attending a programming meeting with the Programmer prior to beginning the program process:
            (a) The purpose of the meeting will be to review the Programmer requirements for coordination between Supplier and Programmer.
11) Control devices:
    a) MCP shall be provided with start and stop, and hand-off-auto control of the entire UV system.
    b) A separate Hand-Off-Auto switch shall be provided on each Power Distribution Center (PDC).
    c) At a minimum, the UV control system shall have the following inputs:
        (1) Remote START/STOP via SCADA.
        (2) UVT (Ultraviolet Transmittance) input (from Supplier supplied UVT analyzer), with hand input override from the LOI or SCADA.
        (3) Level signal used to calculate flow wired to the UV MCP.
        (4) Motorized weir gate position indicator wired to the UV MCP.
        (5) High and Low Water level input from Supplier supplied water level measurement instruments.

(6) UV Intensity Isolated analog 4 to 20 mA or 0 to 5 VDC input (from Supplier supplied UV Intensity sensor), 1 per bank.
(7) Hand input operational UV dose from LOI or SCADA.

12) Dedicated LOI:
a) Provide LOI hardware as specified in Section 40_61_05 - Packaged Control System.
b) The LOI shall provide access to status and control functions for operations personnel:
(1) With password access to limit change options dependent on authority.
(2) It shall also provide access to diagnostic information, e.g., I/O status, and PID and control functions for the commissioning engineer to allow changes to be made with appropriate password without the need for a programming terminal.
c) Provide and program the local LOI Panel as specified in this Section 40_61_05 - Packaged Control System.

2.06 OPTION A: TROJAN UVSIGNA™ 2 ROW SYSTEM

A. Manufacturer: The following no equal:
1. Trojan Technologies.

B. System construction:
1. System shall include automatic mechanical/chemical cleaning, master system control panel, remote LOI, power distribution center, hydraulic system center, and accessories as specified.

C. Lamp array configuration:
1. The lamp array configuration will be in a staggered inclined arrangement.
2. The system will be designed for complete submersion of the UV lamps under flow conditions including both electrodes of the lamp arc:
a. Both lamp electrodes shall operate at the same temperature and be cooled by the effluent.
3. To maximize performance and ensure safety, bank light locks will be used in each bank to prevent potential short circuiting over the top of the lamps.

D. UV lamps:
1. Lamps will be high powered low-pressure, high-output amalgam design.
2. The filament shall be significantly rugged to withstand shock and vibration.
3. Electrical connections for the lamp will consist of 4 pins at one end of the lamp only. Lamp wiring shall be Teflon™ insulated stranded wire.
4. Lamps will be rated to produce zero levels of ozone.
5. The lamp shall withstand a minimum of 4 on/off cycles per day without reducing lamp life, warranty or causing any damage to the lamp.
6. Lamps will be operated by electronic lamp drivers/ballasts with variable output capabilities ranging from 30 percent to 100 percent of nominal power:
a. The lamp assembly incorporates active filament heating to enable operation at optimum lamp efficiency across varying water temperatures and lamp power levels.

E. Lamp plugs:
   1. Each lamp plug will be accessible from the top of the UV bank to facilitate lamp removal without moving the UV banks or any other components.
   2. A light emitting diode (LED) visual indicator on the lamp plug will continuously indicate on/off status for each lamp.
   3. An integral safety interlock in the lamp plug will prevent removal of energized lamps.
   4. The lamp plug shall be rated NEMA 6P.

F. Quartz sleeves:
   1. Quartz sleeves will be clear fused quartz circular tubing containing 99.9 percent silicon dioxide.
   2. Sleeves will have minimum UV transmittance at 254 nm of 87 percent (2.5 millimeters wall thickness).
   3. Sleeves will be open at one end only and domed at the other end.

G. UV bank:
   1. Each UV bank will consist of UV lamps, quartz sleeves and an automatic mechanical/chemical cleaning system.
   2. Each lamp will be enclosed in its individual quartz sleeve, one end of which will be closed, and the other end sealed by a lamp end seal.
   3. The closed end of the quartz sleeve will be held in place by a retaining o-ring:
      a. The quartz sleeve will not come in contact with any steel in the frame.
   4. Each UV bank will contain a wall on each side to prevent possible short circuiting at the side walls of the reactor.
   5. Each UV bank will be rated NEMA 6P.
   6. To minimize maintenance, equipment must be provided by the UV manufacturer to enable lifting a complete bank of lamps from the channel at once for inspection and/or servicing:
      a. When the banks are lifted out of the channel, the maximum height of both the lifting device and the bank (at the service position) must not exceed 10.4 feet.

H. Light locks:
   1. Light locks will be provided to force effluent through the UV treatment zone maximizing disinfection performance.
   2. The entire length of the lamp arc will remain submerged to maximize UV dose delivered to the effluent and to prevent any UV exposure above the water free surface.

I. UV bank lifting device:
   1. The lifting device for UV banks will be supplied by the UV Manufacturer.
   2. An Automatic Raising Mechanism (ARM) will be designed and supplied to facilitate lifting a UV bank from the channel without use of ancillary equipment.
   3. The ARM will be integrated into the UV bank for simple and seamless operation.
   4. The UV bank will be raised from the channel for easier access and maintenance.
   5. The ARM design will provide access to components without having to break electrical connections thus reducing wear on connectors.

J. Automatic cleaning system:
   1. An automatic in-situ cleaning system will be provided to clean the quartz sleeves using both mechanical and chemical methods:
      a. Wiping sequence will be automatically initiated with capability for manual override.
   2. The cleaning system will be fully operational while UV lamps and modules are submerged in the effluent channel and energized.
   3. To minimize maintenance, UV System will be designed such that cleaning solution replacement can be performed while the UV bank and lamps are in place and operational in the channel.
   4. Cleaning sequence frequency will be field adjustable to enable optimization with effluent characteristics.
   5. Cleaning system operation will be remote auto (default) or remote manual.
   6. The cleaning system will be provided with the required solutions necessary for initial equipment testing and for equipment start-up.
   7. The wipers shall travel the full length of the UV lamp arc:
      a. Designs in which the wipers only travel part way along the sleeves will not be acceptable.

K. UV intensity detection system:
   1. A submersible UV sensor will continuously monitor the UV intensity produced within each UV bank of UV lamps.
   2. The sensor shall measure only the germicidal portion of the light emitted by the UV lamps as measured at 254 nm:
      a. The sensor shall have sensitivity at 254 nm of greater than 90 percent.
   3. The UV intensity sensor shall be accurate within 20 percent.
   4. The UV intensity monitoring system shall be calibrated in the factory:
      a. When the sensor is being used for dose pacing, the UV System Supplier shall supply an additional spare intensity sensor for reference checks (in addition to number listed in spare parts).
   5. The UV sensor shall be factory-calibrated to NIST:
      a. Sensors requiring field-calibration are not acceptable.
   6. The sensor shall be digitally calibrated to ensure calibration accuracy.
   7. Sensors will be designed such that reference sensor readings can be taken without interrupting disinfection and without removing UV lamps or sleeves.
   8. The sensor shall be automatically cleaned at the same frequency as the lamp sleeves to prevent fouling of the sensor and resulting false alarms for low intensity.
   9. There shall be 1 UV sensor for every UV bank.

L. Electrical:
   1. Each UV bank shall be powered from the Power Distribution Center.
   2. Each lamp ballast shall drive 2 low-pressure, high-output lamps.
   3. Power factor shall not be less than 98 percent.
   4. Supplier to supply cabling between the lamps and ballasts.
   5. Contractor to perform terminations between lamps and ballasts based on direction from the Supplier.
   6. Electrical supply for the water level transmitters/switches will be provided by the MCP or an external power supply.
   7. Harmonic distortion shall be measured with UV banks in channels at 100 percent rated load in accordance with a general system classification

meeting the recommended maximum harmonic distortion levels in IEEE 519 2014 Tables 1, and 2 at the PCC:

a. If these levels cannot be achieved at the installed site, the Supplier shall furnish and install necessary active filters as manufactured by TCI or Schneider Electric series AccuSine filters in accordance with IEEE 519-2014 at no additional cost to the Owner.

M. Power Distribution Center (PDC):
1. Electrical supply to each of Power Distribution Center(s) shall be 480/277 volts, 3-phase, 4-wire (plus ground) connection.
2. PDC enclosure material shall be Type 304 stainless steel and rated NEMA 12.
3. Power Distribution Centers to be UL approved or equivalent.
4. Each ballast cabinet shall be equipped with a temperature control device, which will shut off this part of the UV system in case of surpassing the critical limit of 122 degrees Fahrenheit.
5. Data concentration shall be through integrated circuit boards located inside the PDC.
6. Fusing and ground detection circuits shall be located inside the PDC.
7. PDCs shall be self-supporting.
8. Each PDC shall include its own main circuit breaker interlocked with the PDC door:
   a. The complete PDC unit, including the incoming main breaker shall have a minimum interrupting rating of 65 kA.
9. PDCs that are used to power multiple UV banks must be capable of electrically isolating the individual banks that they power.
10. Network communication with MCP over Modbus protocol.

N. Lamp ballast:
1. Each lamp ballast will independently power 2 UV lamps:
   a. Failure of 1 lamp will not affect operation of the other lamp.
2. The lamp ballast will be programmed-start type utilizing filament pre-heat followed by a high voltage pulse to ignite the lamp.
3. During lamp operation, variable filament heating current shall be provided according to a predetermined curve to maintain optimum filament temperature and amalgam temperature to ensure maximum lamp life and optimum lamp efficiency across varying water temperatures and lamp power levels.
4. A ground fault in the output circuit shall be detected and communicated as a warning to the external controls system while the corresponding lamp operates undisturbed.
5. Local visual diagnostic will be provided with LEDs for lamp ballast status, lamp status (on, idle, preheat, fault), power and communication status.
6. For reliability and to facilitate troubleshooting, at a minimum, the following external indicators (protections, status, warnings, and alarms) shall be provided:
   a. Lamp status, ballast status, ballast high temperature, input voltage out of range, lamp arc circuit open/short/out of range, lamp filament open circuit/out of range, end of lamp life (EOLL), ground fault, lamp circuit leakage (water in the sleeve), communication time-out.
7. The lamp ballast shall be capable of varying power between 30 to 100 percent of nominal lamp power.

O. Master Control Panel (MCP):
   1. Control requirements are specified in this Section and in Section 40_61_05 - Packaged Control System.
   2. The UV control system shall include 1 Master UV PLC and associated enclosure for control and monitoring of the entire UV system:
      a. The master UV PLC shall be an Allen-Bradley ControlLogix PLC with memory capacity per requirements specified in Section 40_61_05 - Packaged Control System.
      b. The master UV PLC shall be located as indicated on the Drawings.
      c. The master UV PLC shall be provided and programmed as indicated on the Drawings, and this Section.
   3. Electrical supply to the MCP shall be 120 volts, 1 phase:
      a. Furnish an uninterruptible power supply (UPS) installed inside the PLC enclosure as required.
      b. UPS shall conform to the requirements as specified in Section 40_61_05 - Packaged Control System.
      c. Where Supplier's equipment requires other voltages, Supplier shall provide any transformers necessary for proper system operation.
   4. A separate 120 VAC power source will be provided as non-UPS source to power air conditioners, fans, thermostat, and other panel appurtenances.
   5. UV System control and monitoring shall be provided through display touchscreen to allow complete operator interface.
   6. The Master UV PLC control panel shall be provided with an Allen-Bradley PanelView Plus 7 – 15-inch LOI with memory capacity per requirements specified in Section 40_61_05 - Packaged Control System:
      a. Operator interface shall be menu-driven with automatic fault message windows appearing upon alarm conditions.
   7. Bank status shall be capable of being placed either in Manual (ON/OFF) or Automatic mode.
   8. Banks shall be cycled in a lead/lag rotation through automatic control at the Master UV PLC for equal wear and timed off to minimize bank cycling.
   9. Elapsed time of each bank shall be recorded and displayed at the LOI when prompted.
   10. Master UV PLC Panel shall be UL approved, Type 304 stainless steel and rated NEMA 12.
   11. Enclosure temperature switch:
      a. Manufacturers: One of the following or equal:
         1) Hoffman ATEMNC.
         2) Pfannenberg FLZ.
      b. Provide wall-mounted bimetallic switch transmitter (to measure internal cabinet temperature in enclosures) containing electrical components such as PLCs, RTUs, RIO, and VFDs.
      c. Sensor and electronic enclosure.
      d. Accuracy:
         1) Within 2 degrees Fahrenheit.
   12. Status relays and discrete inputs for switches, power supplies, and fieldbus devices (if applicable):
      a. Provide as indicated on the Drawings or as specified.
   13. The Master UV PLC shall be provided with networking equipment required to properly receive and communicate information to and from the plant SCADA system.

P. Hydraulic Systems Center (HSC):
   1. Electrical supply to the Hydraulic System Center shall be 480V, 3-phase, 3 wire (plus ground) connection.
   2. HSC shall be designed with minimum 65kAIC interrupting rating.
   3. The HSC houses the components required to operate the automatic cleaning system and bank Automatic Raising Mechanism (ARM).
   4. HSC enclosure material will be Type 304 stainless steel (NEMA 4X, IP 55).
   5. The HSC will contain hydraulic power unit complete with pump, fluid reservoir, manifolds, valves and filter.
   6. Hosing and tubing shall be rubber and piping shall be Type 316 stainless steel.

2.07 OPTION B: WEDECO, A XYLEM BRAND, DURON™ SYSTEM

A. Manufacturer: The following no equal:
   1. Xylem.

B. System construction:
   1. System shall include automatic mechanical cleaning, MCP, power distribution centers, and accessories as specified.

C. Lamp array configuration:
   1. The lamp array configuration shall be a staggered inclined arrangement.
   2. The single array pattern shall be continuous and symmetrical throughout the reactor.
   3. The system will be designed for complete submersion of the UV lamps under flow conditions including both electrodes of the lamp arc:
      a. Both lamp electrodes shall operate at the same temperature and be cooled by the effluent.

D. UV lamps:
   1. Lamps shall be low-pressure, high-output amalgam type and must be the same lamp that was used during system validation testing.
   2. The lamp filaments shall be pre-heated prior to striking of the arc in order to promote lamp longevity.
   3. Each lamp shall be tested in UV-output, lamp current and lamp voltage from supplier:
      a. Results shall be stored in a database referencing to the individual batch number:
         1) The lamp batch number shall be printed on the lamp surface.
   4. Lamps will be operated by electronic lamp ballasts with variable output capabilities ranging from approximately 50 percent to 100 percent of nominal power.
   5. The filament of the lamp shall be clamped design, significantly rugged to withstand shock and vibration.
   6. Lamps shall not produce any ozone.
   7. Each lamp base shall incorporate a dielectric barrier or pin isolator:
      a. The pin isolator shall consist of a non-conductive divider placed between the lamp pins to prevent direct arcing across the pins in moist conditions.
      b. The barrier shall be dielectrically tested for 2,500 volts.

E. UV modules:
   1. The UV modules shall be designed for submergence without causing failures or damage to the system or components:
      a. Lamp ballasts for powering UV lamps shall be located in electrical enclosures located away from the channel.
   2. Electrical connectors and motors located on the UV module and above the nominal channel water level shall either rated at NEMA 6P (IP67) or located within NEMA 6P (IP67) enclosures suitable for temporary submersion.
   3. Each UV module shall be equipped with an interlock switch that will automatically disconnect power to its associated UV bank if the module is raised from the UV channel or the quick disconnect plug is removed.
   4. The UV module design and mounting shall provide plug and socket quick disconnect facilities enabling non-technical personnel to carry out lamp replacement, wiper insert replacement, etc. without the need for any tools or special isolation procedures.
   5. Lamp shall be removable with the quartz sleeve and wiper system remaining in place.
   6. The UV lamp sleeve shall be a single piece of clear fused quartz circular tubing, which shall not be subject to degradation over the life of the system.
   7. The lamp socket shall be centered against the inside of the quartz sleeve and shall be retained by a cap nut with a ribbed exterior surface providing a positive handgrip for tightening/loosening without the need for any tools:
      a. This connection includes a self-contained O-ring, sealing the lamp and socket module (independently from the quartz sleeve).
   8. Each module shall be designed to allow lifting from the operating position in the channel to a maintenance/storage position above the channel using an integral electric motor.
   9. Actuation mechanism(s) for lifting the module from that channel shall be driven by an electric motor.

F. Automatic cleaning system:
   1. Each UV module shall be equipped with an automatic wiping system with selectable wiping frequency.
   2. The cleaning elements shall be stainless steel brushes that maintain uniform wiping tension and clean the quartz sleeve over the lamp's complete arc length.
   3. The wiping system shall be controlled by the UV system controller and provide a fully automatic, unattended operation.
   4. The number of wiping strokes per interval shall be factory preset to 2 strokes for optimum effect, with time intervals being user adjustable.
   5. Actuation mechanism for the automatic wiping system shall be driven by an electric motor integral with the UV module.
   6. When in the raised position, module wetted components shall be accessible.
   7. The wiper system shall have the capability of being operated in either manual or automatic mode:
      a. In automatic mode, the cleaning wipers shall be initiated and controlled by the operator interface.
   8. Provide NEMA 4X enclosure with necessary pushbutton to operate the system locally.

9. The cleaning system enclosure shall be located in the same location as the UV channels and shall be designed to operate in environmental conditions specified in the Contract Documents.
10. Lift system:
    a. Provide necessary lift system for each UV module.
    b. Provide NEMA 4X enclosure with necessary pushbuttons to operate the system locally.
    c. The lift system enclosure shall be located in the same location as the UV channels and shall be designed to operate in environmental conditions specified in the Contract Documents.

G. UV intensity detection system:
1. A submersible UV sensor shall continuously sense the UV intensity produced in each bank of UV modules.
2. The sensor shall be according to ÖNORM M 5873-1 and shall measure only the germicidal portion of the light emitted by the UV lamps as measured at 254 nm.
3. The UV intensity monitoring system shall be calibrated in the factory:
    a. When the sensor is being used for dose pacing, the UV Supplier shall supply an additional spare intensity sensor for reference checks (in addition to number listed in spare parts).
4. The measured UV intensity signal shall be fed into the UV System Controller and used for continuous monitoring and control of the UV dose:
    a. In automatic mode, the UV Control System shall automatically adjust the lamp power to draw the minimum electrical power while maintaining the dose setpoint.
5. The UV intensity sensor shall be accurate within 20 percent.
6. The UV intensity shall be displayed on the operator interface as an absolute value in milliwatts per square centimeter (mW/cm^2).
7. The sensor shall be automatically cleaned at the same frequency as the lamp sleeves to prevent fouling of the UV sensor.
8. The UV sensor design shall be such that sensor removal can be easily conducted without removal of the UV module from the channel.
9. The UV intensity sensor shall be accurate within 20 percent.
10. There shall be 1 UV sensor for every UV bank.

H. Electrical:
1. Each UV bank shall be powered from the Power Distribution Center.
2. Each lamp ballast shall drive 2 low-pressure, high-output lamps.
3. Power factor shall not be less than 98 percent.
4. Supplier to supply cabling between the lamps and lamp drivers.
5. Contractor to perform terminations between lamps and ballasts based on direction from the Supplier.
6. Electrical supply for the water level transmitters/switches will be provided by the MCP or an external power supply.
7. Harmonic distortion shall be measured with UV banks in channels at 100 percent rated load in accordance with a general system classification meeting the recommended maximum harmonic distortion levels in

IEEE 519 2014 Tables 1, and 2 and as specified in Article 1.05 Paragraph D.4 at the PCC:

a. If these levels cannot be achieved at the installed site, the Supplier shall furnish and install necessary active filters as manufactured by TCI or Schneider Electric series AccuSine filters to comply with IEEE 519 2014 at no additional cost to the Owner.

I. Power Distribution Center (PDC):
   1. Electrical supply to each of Power Distribution Center shall be 480/277 volts, 3-phase, 4-wire (plus ground) connection.
   2. 2 independent PDCs shall be provided per UV channel.
   3. Each PDC shall house control gear, and electronic ballasts associated with 2 or 3 UV banks.
   4. PDC enclosure material shall be Type 304 stainless steel and rated NEMA 12.
   5. Power Distribution Centers to be UL approved or equivalent.
   6. Each ballast cabinet shall be equipped with a cooling system and temperature monitoring that will cause the equipment within the cabinet to shut off if the internal temperature surpasses the critical limit of 122 degrees Fahrenheit.
   7. Data concentration shall be through integrated circuit boards located inside the PDC.
   8. Fusing and ground detection circuits shall be located inside the PDC.
   9. PDCs shall be self-supporting.
   10. Each PDC shall include its own main circuit breaker interlocked with the PDC door:
      a. The complete PDC unit, including the incoming main breaker shall have a minimum interrupting rating of 65 kA.
   11. PDCs that are used to power multiple UV banks must be capable of electrically isolating the individual banks that they power.
   12. Network communication with MCP over EtherNet/IP protocol.

J. Lamp ballast:
   1. The ballasts shall be electronic microprocessor controlled, designed as slot cards fitting into a rack system with a plug connector for ease of maintenance.
   2. Each ballast shall drive a pair of lamps with independent control and monitoring circuits and provide individual lamp status information to the system control.
   3. The ballast shall detect lamp failure and initiate a re-strike sequence, independently from any external influence:
      a. The ballast shall attempt 3 restarts before shutting off.
   4. The ballast shall incorporate a galvanic separation of the 2 circuits:
      a. In case of the secondary circuit operating in abnormal conditions regarding voltage and/or amperage, the ballast shall shut off the lamp concerned:
         1) Equipment without this feature shall be equipped with ground fault protection.
   5. The ballast shall incorporate a pre-heat circuit to heat lamp filaments prior to striking the lamp arc in order to promote lamp longevity.
   6. The ballast shall be capable of varying power between 50 to 100 percent proportional to a 4-20 mA control signal.

K. Master Control Panel (MCP):
   1. Control requirements are specified in this Section and as specified in Section 40_61_05 - Packaged Control System.
   2. The UV control system shall include 1 Master UV PLC and associated enclosure for control and monitoring of the entire UV system:
      a. The master UV PLC shall be an Allen-Bradley ControlLogix PLC with memory capacity as specified in Section 40_61_05 - Packaged Control System.
      b. The master UV PLC shall be located as indicated on the Drawings. The Master UV PLC shall be provided and programmed as indicated on the Drawings, and this Section.
   3. Electrical supply to the MCP shall be 120 volts, 1 phase. Furnish an uninterruptible power supply (UPS) installed inside the PLC enclosure as required:
      a. UPS shall conform to the requirements as specified in Section 40_61_05 - Packaged Control System.
      b. Where Supplier's equipment requires other voltages, Supplier shall provide any transformers necessary for proper system operation.
   4. A separate 120 VAC power source will be provided as non-UPS source to power air conditioners, fans, thermostat, and other panel appurtenances.
   5. UV System control and monitoring shall be provided through display touchscreen to allow complete operator interface.
   6. The Master UV PLC control panel shall be provided with an Allen-Bradley PanelView Plus 7 – 15-inch LOI with memory capacity as specified in Section 40_61_05 - Packaged Control System:
      a. Operator interface shall be menu-driven with automatic fault message windows appearing upon alarm conditions.
   7. Bank status shall be capable of being placed either in Manual (ON/OFF) or Automatic mode.
   8. Banks shall be cycled in a lead/lag rotation through automatic control at the Master UV PLC for equal wear and timed off to minimize bank cycling.
   9. Elapsed time of each bank shall be recorded and displayed at the LOI when prompted.
   10. Master UV PLC Panel shall be UL approved, Type 304 stainless steel and rated NEMA 12. Panel shall be free standing.
   11. Enclosure temperature switch:
      a. Manufacturers: One of the following or equal:
         1) Hoffman ATEMNC.
         2) Pfannenberg FLZ.
      b. Provide wall-mounted bimetallic switch transmitter (to measure internal cabinet temperature in enclosures) containing electrical components such as PLCs, RTUs, RIO, and VFDs.
      c. Sensor and electronic enclosure.
      d. Accuracy: Within 2 degrees Fahrenheit.
   12. Status relays and discrete inputs for switches, power supplies, and fieldbus devices (if applicable):
      a. Provide as indicated on the Drawings or as specified.
   13. The Master UV PLC shall be provided with networking equipment required to properly receive and communicate information to and from the plant SCADA system.

2.08 ACCESSORIES

A. Face shields:
   1. Quantity: 3.
   2. Design: Block UV light wavelengths between 200 and 400 nm.

B. Water level sensors:
   1. Three (3) radar level sensors (analog), provided by the supplier, shall be included as described in Section 40_72_24 and as indicated on the Drawings. One (1) level sensor shall be installed in the UV system influent basin. The other two (2) level sensors shall be installed upstream of each UV channel's respective level control gate. The signals from these sensors shall be used to control the effluent level in the corresponding channel. These level sensors shall also generate a low-level signal that is wired to the channel's Level Control Box, or PDCs. The analog signals will be wired to the UV Master PLC and the low-level signals (dry contact) will be wired to the Level Control Box or PDCs:
      a. Wiring of the level sensor shall ensure that each PDC is independently operated.
   2. The radar level sensor installed upstream of the UV channels, in the influent basin, shall monitor the effluent level and produce a high-level alarm.
   3. During manual, automatic, and remote modes of system operation, the water level sensor shall ensure that the automatic cleaning system is disabled if the water level in the channel drops below an acceptable value.
   4. The number, function and type of sensors shall be as shown on the P&IDs.

C. On-line UV transmittance (UVT) monitor:
   1. Provided by Supplier from one of the following manufacturers:
      a. Sensorex.
      b. Hach.
      c. YSI.
   2. General requirements:
      a. UV transmittance meter systems shall measure the UV transmittance of wastewater.
      b. Integrated in channel with the radiation source immersed in water.
      c. UV measurement device:
         1) Type 316 stainless steel, quartz or equal 1.4571/316Ti/quartz.
   3. Performance requirements:
      a. 2 percent full scale accuracy.
   4. Element:
      a. UV radiation source.
      b. UV sensors:
         1) Calibrated selectivity greater than 90 percent at 254 nanometer. Non-aging, temperature stability up to 70 degrees Celsius for continuous operation.
      c. UV transmission measurement range: 0 to 100 percent.
      d. No battery backup required.
      e. Neither pump nor pipe work required.
      f. Direct in-channel measurement without the need of a filter.
   5. Transmitter:
      a. NEMA Type 4X/IP65 thermoplastic cabinet with instrumentation window.

b. Wall mounting.
c. Display of UV transmission (percent).
d. Analog output, selectable 0 to 20 milliamperes (mA) or 4 to 20 mA.
e. Maximum distance to junction box: 26 feet:
1) Power supply: The following per the supplier's recommendation:
a) 24 VDC.
b) 120 VAC.
2) Outputs:
a) Isolated 4 to 20 mA DC signal.

6. Components:
a. Virtually maintenance free via automatic wiper system.
7. Accessories:
a. Provide sunshades for outdoor installations.
8. Supplier shall supply components necessary for mounting the UVT monitor as specified.

D. Bank support brackets:
1. UV modules shall be suspended/supported on Type 316 stainless steel brackets:
a. The support brackets shall be held in place by brackets anchored to the channel walls.

E. Inlet baffle plate:
1. Provide inlet baffle on upstream end of each UV channel at location as indicated on the Drawings and as designed by the Supplier.
2. Design:
a. Designed to promote plug flow to the UV banks.
b. Located at upstream end of UV channel as indicated on the Drawings.
c. Designed to be removable with 2 lifting handles or eyes and structurally stiffened.
d. Designed with round openings with approximately 50 percent porosity. The plate shall have 2-inch holes.
e. Maximum head loss: 3.0 inches at Peak Flow.
3. Materials:
a. Plates:
1) Type 316 stainless steel.
b. Guides:
1) Type 316 stainless steel.
c. Anchor bolts and other fasteners:
1) Type 316 stainless steel.

2.09 INLET GATES

A. The isolation control gates shall be designed and provided by the Supplier.

B. Design:
1. Located at the inlet of the channels as indicated on the Drawings.
2. Isolation gate as specified in Section 40_05_59.20 - Low-Head Fabricated Stainless Steel Slide Gates.

3. Motorized operator in accordance with Section 40_05_57.24 - Electric Actuators:
    a. The motorized operator will interface with the UV MCP so that the UV PLC can monitor and control the gate.

C. Materials:
1. As specified in Section 40_05_59.20 - Low-Head Fabricated Stainless Steel Slide Gates.
2. Anchor bolts and other fasteners:
    a. Type 316 stainless steel.

2.10 OUTLET LEVEL CONTROL GATES

A. The level control gates shall be designed and provided by the Supplier.

B. Design:
1. Located at end of channels as indicated on the Drawings.
2. Designed to maintain a minimum channel effluent level to keep lamps submerged and comply with the hydraulic constraints set in this Section.
3. Design flow per design criteria in this Section.
4. Downward opening level control gate as specified in Section 40_05_59.20 - Low-Head Fabricated Stainless Steel Slide Gates.
5. Motorized operator in accordance with Section 40_05_57.24 - Electric Actuators:
    a. The motorized operator will interface with the UV MCP so that the UV PLC can monitor and control the level gate.

C. Materials:
1. As specified in Section 40_05_59.20 - Low-Head Fabricated Stainless Steel Slide Gates.
2. Anchor bolts and other fasteners:
    a. Type 316 stainless steel.

2.11 INSTRUMENTATION AND CONTROLS

A. General:
1. Control system shall utilize a PLC-based control panel. Supplier system shall communicate with the Plant PLC using a dedicated network connection that shall be isolated from the Supplier field control network.
2. Furnish instruments and other components performing similar functions of the same type, model, or class, and from 1 manufacturer:
    a. Coordinate with Contractor to align make and model with Contractor furnished equipment.
3. Instrumentation used in the UV disinfection system control or monitoring shall be circuit breaker protected to minimize the effects of any single point of failure.
4. Provide signals over network communication protocol as indicated on the Drawings. Plant PLC monitoring I/O shall be over the network connection.
5. Provide access to control parameters and settings.
6. Provide security lock out capability for vital settings and functions.
7. Provide real time clock within the PLC to select and initiate unit start times.

8. Supplier system shall be completely prewired, preprogrammed, and factory tested for proper operation prior to shipment.
9. Supplier is responsible for providing the necessary control hardware, software, and components as required for a fully functional and operational installation.

B. Common control functions:
   1. Control functions as specified in this Section and in Section 40_61_05 - Packaged Control System.

C. Control system and strategy:
   1. Programming:
      a. The Supplier shall be responsible for preparing, writing, and testing all ladder logic associated with the UV control system.
   2. Components:
      a. Supplier will provide PLC-based MCP with operator interface and interconnects for monitoring the system through the plant control system.
      b. The PLC outputs to the plant control system shall be via Ethernet communication.
      c. Provide required hardware, software and programming.
   3. The system's LOIs for the Master UV PLC shall provide manual-auto control of entire UV system.
   4. Provide a separate manual-off-auto switch on each PDC enclosure. The PDC manual-off-auto switch shall override the control of any other remote device.
   5. UV Disinfection System monitoring and control system shall be as specified in this Section and Division 40 sections.
   6. Electrical, instrumentation and controls as specified in Divisions 26 and 40 sections of the Specifications and meet the requirements of the Project P&IDs:
      a. Control and Instrumentation including documentation and labels as specified in Division 40.
   7. UV system control philosophy:
      a. Final control philosophies are subject to approval by the Engineer and Owner.
      b. The Master UV PLC shall control the channels of the UV disinfection system.
      c. Monitored parameters including UV transmittance, flow, and UV intensity shall be used to operate each channel to deliver the setpoint dose.
      d. UV transmittance shall be monitored by a UVT analyzer as indicated on the Drawings.
      e. Flow shall be monitored by the UV system.
      f. UV intensity shall be monitored for each UV bank.
      g. Control philosophies shall use the dose equation included in the Engineering Report of the proposed UV Disinfection System, to continuously calculate the delivered dose of the system and automatically vary the lamp power and control the system as required to minimize energy use and deliver the target dose.
      h. The dose equation and control philosophy shall be as follows:
         1) Dose as a function of flow, UVT, and UV intensity sensor value, directly in agreement with Third-Party Reactor Validation Testing results and approved by the Engineer:
            a) The control system shall generate an alarm when the delivered UV dose is less than the setpoint UV dose.

2) Operator shall have the capability of increasing the number of duty channels by 1 via a pushbutton on the UV LOIs or SCADA:
   a) The Operator shall also be able to remove this additional duty channel from the operation sequence.

D. Control strategy: The UV control system shall be programmed to control the UV system as follows:
   1. General:
      a. The UV control system shall monitor and control equipment as specified in this Section to ensure that the target UV dose of the UV process is delivered in each channel for the given flow, UVT, and attenuated lamp conditions.
      b. The PLC program shall have the dose equation that is included in the Engineering Report of the proposed UV Disinfection System.
      c. The target UV dose setpoint and organism shall be an operator adjustable:
         1) The allowable target UV dose shall range from 50 percent of the design dose to 200 percent of the design dose.
         2) The design MS2 RED for reuse is 102 mJ/cm^2.
         3) The design T1 RED for discharge is 14 mJ/cm^2.
      d. The Master UV PLC shall execute the following for the entire UV system:
         1) Monitor the flow for the system.
         2) Monitor UV intensity at each bank.
         3) Monitor the level in each UV channel.
         4) Bring an additional channel online, if available, if the water level in the influent basin exceeds the HIGH LEVEL.
         5) Monitor the level in each channel and disable the UV lamps if the level drops below the channel minimum water level.
         6) Calculate the UV dose delivered in each channel as specified in this Section.
         7) Control all UV equipment in the channel to deliver the target UV dose in the channel.
         8) Control the automatic cleaning system.
         9) Control the inlet gate of each channel.
         10) Control the level control gate of each channel.
         11) Monitor UVT.
         12) Display flow through the system and through each channel.
         13) Signal UV channels/banks to start-up and shutdown as required:
            a) The Master UV PLC shall alternate the call sequence of the UV channels.
            b) The channels shall be sequenced in a “last on, first off” basis.
            c) If a channel fails to meet the target dose, the call sequence shall automatically proceed to the next available channel.
            d) If no additional channels are available then the system shall alarm.
         14) When one channel is to be taken off-line, the Master UV PLC shall first determine whether the total influent flow can be treated in the remaining channels prior to taking a channel off-line.
         15) The Master UV PLC shall open and close the inlet gates and shall startup standby UV banks and channels as required.

e. Level sensors provided must detect low water level in the channel. Level sensors are wired to the PDC and/or MCP.

2. Automatic control: With all the devices in at least 1 channel (inlet gate, UV banks and level control gate) set to Auto mode, the operator can place the UV system into “Auto” mode from the Master UV PLC or plant SCADA. This allows the Master UV PLC to control the UV system to deliver the target UV dose:
   a. General:
      1) The lead channel shall always be on-line.
      2) Based on the measured flow through each channel, the Master UV PLC shall select the number of banks to be in service and the required power setting of each operating bank. The Master UV PLC shall be able to select the minimum and maximum flow through a channel in automatic mode. The selection of the service channels must be based upon the utilization of all channels in the service rotation.
      3) The Master UV PLC shall monitor the power level (ballast power level) of each UV lamp and minimize the total power required to deliver the target dose in the channel.
      4) The number of ON/OFF cycles for any one UV bank shall not exceed four (4) times per 24 hours, on average.
   b. Start-Up Procedure of a Channel: When a channel is required to be brought into service, the Master UV PLC will initiate the following Start-up Procedure:
      1) If an additional channel is required, the level control gate of that channel shall close, if not already in the closed position.
      2) The Master UV PLC will monitor the channel effluent low level signal. If the low-level signal is not in alarm then turn ON all banks of lamps. The Master UV PLC shall initiate an automatic cleaning cycle on the banks that have been placed on-line.
         After the lamp warm-up mode expires open the inlet gate.
         After the inlet gate open limit switch is made then enable the level control gate to start controlling the channel level.
      3) The Master UV PLC will monitor the channel effluent low level signal. If the effluent low level alarm exists in any of the Banks in the channel then crack open the inlet gate based on an operator adjustable timer in the UV PLC.
         Once the channel low level alarm clears then turn ON all banks of lamps and close the inlet gate.
         The Master UV PLC shall initiate an automatic cleaning cycle on the banks that have been placed on-line.
         After the lamp warm-up mode expires open the inlet gate.
         After the inlet gate open limit switch is made then enable the level control gate to start controlling the channel level.
      4) If an effluent low-level alarm exists in any of the Banks in the channel after the inlet gate is fully open, then generate a Major Alarm, “Minimum Level Not Reached During Warm-up”.
      5) If channel that was placed in service is replacing another channel then after the inlet gate is fully open, close the inlet gate of the

channel going offline. After the inlet gate is fully closed, close the level control gate:

a) The Master UV PLC shall initiate an automatic cleaning cycle on the banks that have been placed off-line.
After the level control gate is fully closed, turn OFF all banks of lamps within the channel that is going off-line after an operator adjustable delay-off timer expires. The timer default setting is 5 minutes.

6) If the inlet gate for the channel that is being placed into service fails to open, then a fail status shall be generated at SCADA and the Master UV PLC. “Inlet Gate Position Failed” alarm is a Major alarm, ensure that another channel is placed on-line.
7) If the level control gate for the channel that is being placed into service fails to operate, position feedback does not correspond with the channel level, then a fail status shall be generated at SCADA and the Master UV PLC. "Level Control Gate Position Failed" alarm is a Major alarm, ensure that another channel is placed on-line.
8) After the inlet gate is fully open, switch the Dose Pacing PID to Auto. The Master UV PLC shall optimize the percent ballast power level to the UV lamps to deliver the target UV dose.

c. Shutdown Procedure of a Channel: When a channel is required to be taken out of service, the Master UV PLC shall initiate the following Shut-down Procedure to be executed by the Master UV PLC:
1) The Master UV PLC shall calculate the new flow that will occur in each available channel when the channel that is being taken off-line is completely out of service AND isolated from the influent flow.
2) If the number of operating channels is sufficient to treat the total flow with one less channel then the Master UV PLC will initiate the channel Shutdown Procedure detailed herein.
3) If the number of operating channels is not sufficient to treat the total flow with one less channel then the Master UV PLC will maintain the current number of operating channels.
4) After each remaining channel is delivering the setpoint dose required for the current flow plus additional flow, the inlet gate of the channel being taken off-line shall close. After the inlet gate is fully closed the level control gate shall close.
5) After the Master UV PLC has sent the close command to the outlet gate, the Master UV PLC shall initiate an automatic cleaning cycle on the banks that have been taken off-line.
6) Upon verification that the inlet and level control gates have been closed, the Master UV PLC shall turn the UV lamps OFF in the channel being taken out of service after an operator adjustable delay-off timer expires. The timer default setting is 5 minutes.

d. Control During Filter Backwash Cycle:
1) The Master UV PLC shall receive a filter backwash cycle signal prior to the initiation of the backwash cycle. When the backwash cycle signal is received the Master UV PLC shall force the ballast power level to 100 percent for all online UV banks. Dose pacing control shall be placed into manual mode and the ballast power level will not change during this period.

2) When the backwash cycle signal is removed the Master UV PLC shall start an operator adjustable timer (initially set to 5 minutes). After the timer expires the dose pacing control will be placed into automatic mode and the Master UV PLC will determine the required ballast power level based on the operating conditions at that time.

e. Upon major (High priority) alarm:
   1) With the system in Auto mode, the Master UV PLC shall initiate the channel Shutdown Procedure specified in this Section under the following conditions after the next available channel has been placed in service:
      a) All Major alarms generated by the Channel and their respective banks will cause the next available channel to be placed in service and the channel with the Major alarm to be placed out of service.
      b) If the Major alarm is a low-level alarm then the respective bank of lamps will automatically turn off:
         (1) Any Major alarm generated by the Channel is a Channel shutdown alarm.
         (2) The next available channel is placed in service and the channel with the Major alarm is placed out of service.
      c) If another channel is not available then the channel with the Major alarm will remain on-line and the Master UV PLC will generate a Major alarm, “Not Enough Channels Available”.
      d) If the other channel has a Major alarm then the entire UV system, all banks, shall be placed on-line with the power to all the lamps set to 100 percent.
   2) Upon loss of communication between Master UV PLC and PDC’s, the PDC’s shall remain in their last operational state.

f. Upon Low UVT alarm:
   1) The UV system shall continue operating.
   2) The Master UV PLC shall trigger a Low UVT alarm (initially set at 55 percent) at Plant SCADA.
   3) A Plant operator shall take a direct sample of effluent in the UV channels and shall measure the UVT with a portable UVT analyzer:
      a) If UVT measured by the UVT analyzer in the channel is verifiable by the portable UVT analyzer, the UV system shall continue operating without modification.
      b) If the UVT measured by the UVT analyzer is not verifiable by the portable UVT analyzer, the Plant operator shall, at the Master UV PLC, manually input the UVT value to be used to operate the UV system. The operator shall then select to operate the UV system with the Default UVT at the Master UV PLC. The Default value of the manually entered UVT shall be 56 percent.

g. Upon minor (Low priority) alarm:
   1) The Master UV PLC shall continue normal operation, monitoring and controlling the equipment as needed to deliver the target dose.

h. Power failure:
   1) Power failure as indicated by Power Failure Relay PLC Inputs.

i. Power failure recovery:
   1) Following a power failure, loss of power at all PDCs, the plant Master UV PLC shall initiate communications with all PDCs and restore the last state of operation prior to the power failure.

j. Channel out-of-service (maintenance) mode:
   1) When initiated at the Master UV PLC, the Master UV PLC shall execute the Shutdown Procedure as specified in this Section:
      a) In Auto mode, the lead channel must remain on-line.
      b) If there are an insufficient number of banks in the remaining channels to treat the total flow then the Shutdown Procedure shall not continue.
      c) If there are sufficient number of banks in the remaining channels to treat the total flow then the Shutdown Procedure shall continue.
   2) While in Out-of-Service mode, the UV control system shall disregard all alarms associated with that channel and treat the channel as off-line with respect to monitoring and reporting values.

k. Water level:
   1) During manual and automatic modes of system operation, the Master UV PLC shall ensure that the lamps in the channel extinguish automatically if the water level in the channel drops below an acceptable value. The acceptable water level is specific to each UV system and shall be specified by UV Manufacturer.
   2) During manual and automatic modes of system operation, the Master UV PLC shall ensure that the automatic cleaning system is disabled if the water level in the channel drops below an acceptable value specified by the UV Manufacturer.

l. Alarms and monitoring:
   1) Provide LOI alarms and monitoring required as specified in this Section and on the P&IDs and transmit all monitored information and alarms to the plant SCADA system.
   2) All analog alarm values (setpoints) shall be operator adjustable via the UV LOIs and via the plant SCADA system.

m. Monitoring and controls:
   1) Bank ON/Off status for each bank, status, and action.
   2) Lamp Status and Alarm for each bank:
      a) ON.
      b) OFF.
      c) WARM-UP.
      d) FAILED.
      e) MULTIPLE LAMP FAILURE.
   3) Gate Open/Close status and action.
   4) Level Control Gate status and position.
   5) UV Intensity (each bank), alarm setpoints, and value.
   6) Elapsed time per bank.
   7) Lamp run time for each lamp with the ability to reset counter.
   8) Number of starts per lamp.
   9) Cumulative number of ON/OFF cycles (each bank).
   10) Bank power setpoint (each bank).
   11) UV transmittance value.

12) Provide the operator the ability to set the UVT value to manual and manually enter the UVT value based on laboratory testing.
13) Setpoint UV dose.
14) Flow rate (each channel and system).

n. Major (High priority) alarms:
1) Inlet Gate FAIL – Fail to Open/Close.
2) Level Control Gate Position FAIL.
3) Module FAIL (circuit breaker/GFI trip).
4) UV Sensor Out of Range (intensity sensor reading is greater than within 20 percent of the validated intensity value at the current operating conditions).
5) LOW UV dose (delivered UV dose drops below an operator adjustable setpoint accessible at the Master UV PLC or from the SCADA).
6) Inlet Basin HIGH water level.
7) Channel LOW water level.
8) Not Enough Banks Available FAIL.
9) Not Enough Channels Available FAIL.
10) Multiple (Percent) Lamp FAIL (more than operator adjustable percentage setpoint lamps fail per bank). Default setpoint will be 10 percent.
11) PDC High Temperature.
12) Loss of UV Intensity Signal at PDC.
13) Loss of UV transmittance Signal at MCP.
14) Communication Fail, Master UV PLC to SCADA.
15) Communication Fail, Master UV PLC to UV PDC's.

o. Minor (Low priority) alarms:
1) UV Sensor Warning (intensity sensor reading is greater than 15 percent of the validated intensity value at the current operating conditions).
2) LOW UVT (UV transmittance drops below an operator adjustable setpoint accessible at the UV LOIs of from the SCADA).
3) Cleaning system fail.
4) Loss of ultrasonic level sensor signal at MCP.
5) Individual lamp FAIL (include location of lamp by bank and position).
6) MCP high temperature.

p. Screen indicators:
1) All inputs, monitoring and alarms listed in this Section must be shown visibly within the LOI screen. Additional items to be displayed on the LOI screen include:
a) Inlet Gate Open and Closed Indications.
b) Inlet Gate Manual/Automatic Status Indication.
c) Level Control Gate Position Indication.
d) Level Control Gate Manual/Automatic Status Indication.
e) Total System Flow.
f) Channel Flow.
g) UV Transmittance.
h) Bank ON/OFF Status.
i) Bank Manual/Automatic Status.
j) Bank Warming-up/Operating Status.
k) Bank Elapsed Time.

l) Individual Lamp Run Time.
m) Number of starts per bank.
n) UV dose Indication (process variable and setpoint).
o) UV intensity sensor indications (for each bank).
p) Ballast Power Level (for each bank).
q) Operation mode:
    (1) Manual or Automatic mode.
r) Operation mode:
    (1) Plus One Additional Duty Channel.

2.12 MAINTENANCE

A. Special tools:
    1. Provide 1 set of special tools required for operation and maintenance, and complete assembly or disassembly of the UV disinfection system.

B. Spare parts:
    1. The UV Disinfection System Supplier shall furnish, at a minimum, the following spare parts for each system provided:
        a. UV Lamps: 10 percent additional.
        b. UV Ballasts (complete): 5 percent additional.
        c. Quartz Sleeves: 10 percent additional.
        d. Lamp Sealing Rings or Holder Seals: 10 percent additional.
        e. Lamp Plug Assemblies: 5 percent additional.
        f. Lamp Cables: 6.
        g. Wiper or Wiper Rings: 20 percent additional.
        h. UV Sensors: 2.
        i. Cleaning Solution (if applicable): For 1 full year of operation after acceptance of Initial Performance Test.
        j. Proprietary Printed circuit boards: 5 percent additional of each type supplied with a minimum quantity of 1.
        k. Fans: 5 percent additional of each type supplied with a minimum quantity of 1 of each type.
        l. Cabinet Air Intake Filters: 100 percent additional.
        m. Pump or Electric Motor with Gearbox used to drive cleaning system and/or UV module lift system: 1 of each type used, if required for system.
        n. Fuses: 5 of each type of fuse used in the UV system.
    2. Portable UV transmittance Meter: 1 each:
        a. Manufacturer: The following or equal:
            1) Real Tech, Model: P200.

PART 3 EXECUTION

3.01 INSTALLATION

A. Installation of the UV equipment shall be by the Contractor in accordance with the Contract Documents, and Supplier’s engineering drawings and instructions:
    1. Supplier shall supervise the installation of the UV equipment.

2. Contractor, in accordance with the Contract Documents and the Supplier's engineering drawings and instructions, shall install the equipment provided by the Supplier.

3.02 FACTORY ACCEPTANCE TESTING

A. Develop factory testing plan that meets the requirements specified in Section 01_75_17 - Commissioning.

B. Testing shall include the following:
   1. Hardware check including visual inspection, ground test, short-circuit test, incoming power test, component test, and other procedures.
   2. Short-circuit (high potential) test shall be done at one of the following voltage levels:
      a. AC: 2 times operating voltage + 1000 V for 60 seconds.
      b. DC: 1.414 times the AC value (2 times operating voltage + 1000 V) for 60 seconds.
   3. Testing after power up includes input/output signal test, lamp status test, manual and automatic operation test, cleaning and wiper (as applicable) test.
   4. LOI screen review and data test. This includes review of timers and setpoints.
   5. Plan shall note any modification required if the testing needs to be conducted virtually rather than in person.

C. The Owner or Owner's representatives shall participate in witness testing activities:
   1. This participation shall serve as a learning experience for operations and maintenance personnel and confirm compliance with specifications.
   2. One factory visit by 2 Owner's Personnel/ Representatives for a total of 5 days per person (including travel time) must be included to witness the testing activities:
      a. Supplier shall reimburse the Owner for travel and lodging expenses.

3.03 FIELD EQUIPMENT CHECKS

A. Equipment checks:
   1. Prior to the Field Testing (as detailed below, including Hydraulic, Alarm and Functional Testing, Electrical Testing, Initial Performance Test, and other testing), the Supplier shall check that equipment is installed properly, and functions as specified in this Section.
   2. The equipment checks shall include, but not be limited to:
      a. Proper installation and alignment of UV support structure defined as the concrete channel containing the UV banks and associated mounting brackets.
      b. Water tightness of submerged equipment.
      c. Proper placement of UV lamp banks to assure specified water levels relative to the lamps.
      d. Electrical wiring and connections.
      e. Proper operation of instrumentation, alarms, and operating indicators associated with the UV equipment.
      f. Proper placement and operation of lamp driver/ballast and other equipment in the control panels.
      g. Adequate cooling of the control panels.

h. Proper operation of lamp bank shut-off switches and ground fault circuit interrupters.

B. Upon completion of equipment checks, the Supplier shall submit to the Owner written certification that UV equipment and accessory equipment associated with the UV disinfection system have been properly installed, are in good condition, are functioning properly, and are in accordance with the Contract Documents.

3.04 FIELD TESTING

A. Following the Supplier's calibration of test instruments, the Supplier shall perform Component, System, and Operational Tests on the UV disinfection equipment system:
   1. It is the responsibility of the Supplier and Contractor to jointly coordinate and arrange the times for testing and start up activities; however, the Contractor must confirm that these times are acceptable to the Owner.

B. Calibration:
   1. Supplier to ensure all instrumentation associated with testing is calibrated within 180 days prior to the field testing.
   2. If retesting is required, the Supplier shall recalibrate instruments associated with the retest if they have not been calibrated within the previous 240 days and submit that information to the Engineer prior to retesting.

C. Data Collection:
   1. Direct readings from the instruments shall be used in the calculations to determine conformance with the guaranteed performance requirements.
   2. Readings shall be obtained from digital trends from the UV disinfection equipment system PLC and by manually recording the values directly from the instrument.
   3. Record (and round if necessary), to the level of accuracy of the instrument before any calculations.
   4. Collect manual instrument readings before and after sampling during the Initial Performance Test and at 0.5-hour intervals during the Power Consumption Test.
   5. There shall be no adjustment to readings or calculations due to random or systematic instrumentation error or accuracy limitations.
   6. The Supplier shall document modifications, changes, or additions and amend the operations and maintenance manuals and record drawings to reflect the modifications.
   7. Modifications required as a result of Initial Performance Test failure must be completed within 60 days of the start of the original testing period.

D. Retesting:
   1. The Supplier shall be responsible for retesting.
   2. Supplier shall recalibrate test instrumentation associated with the retest as specified in this Section, if the instrumentation has not been calibrated within the 240 days immediately prior to the retest:
      a. Reimburse the Owner for Owner's costs associated with the retesting, including engineering fees and administration costs.

3.05 HYDRAULIC, ALARM AND FUNCTIONAL TESTING

A. After the Owner accepts the Supplier's written certification of proper installation of the UV Disinfection System as specified in this Section, the Hydraulic, Alarm and Functional Testing shall be performed to determine whether or not the equipment meets the hydraulic, alarm and control function conditions specified in this Section.

B. Separate protocols for the Hydraulic Testing and the Alarm and Functional Testing shall be submitted to the Engineer for approval a minimum of 30 days prior to the scheduled UV system start up:
   1. Hydraulic, Alarm and Functional Testing will occur over a period of several days and shall be performed by the Supplier and Contractor with the assistance of the Owner.
   2. Channel Level Control Tests: Water level in the channel shall be measured and plotted showing flow rate in MGD on the horizontal axis and water level in inches of water on the vertical axis.
   3. The level between the downstream bank of lamps and the level control gate shall be used to verify the level data compared to the Supplier's specifications:
      a. A minimum of 5 water level measurements shall be taken during this test at approximately 25, 50, 75, 100 and 120 percent of the design peak flow rate per channel.
   4. Head loss tests:
      a. Head loss through the channel shall be measured and plotted on a curve showing flow rate in MGD on the horizontal axis and head loss in inches of water on the vertical axis.
      b. The level upstream of the first bank of lamps and the level downstream of the last bank of lamps shall be used to verify the estimated channel head loss specified in Attachment A - Minimum Equipment Requirements:
         1) A minimum of 5 head loss measurements shall be taken during this test at approximately 25, 50, 75, 100 and 120 percent of the design peak flow rate per channel.
   5. Alarm and functional testing shall include simulation of flow and water quality change, lamp and bank failures, sensor performance alarms and the proper maintenance of the minimum UV dose over a range of flow and water quality conditions, as specified in this Section:
      a. This test shall also include automatic control of the UV banks, start-up and shutdown of UV channels/banks, channel rotation based on timers, operator selection and high priority alarms, and other control functions as specified in this Section.

3.06 INITIAL PERFORMANCE TEST

A. Following completion of the Hydraulic, Alarm and Functional Testing and calibration of instruments, the Supplier and the Contractor shall conduct the Initial Performance Test (IPT):
   1. The IPT shall be conducted to determine whether or not the equipment meets the Performance Test Requirements specified in this Section.

B. Supplier shall submit a detailed protocol to be followed for the IPT for both the reuse and discharge effluents at least 30 days in advance:
   1. This protocol requires written approval by the Owner/Engineer before initiating the tests.
   2. The protocol shall specifically detail the operational mode of the system, sampling program, method and schedule, equipment and system monitoring data to be collected with each sampling, the daily (manual) log format, and sampling and analytical procedures.
   3. Upon acceptance of the protocol and the recommended laboratory by the Owner/Engineer, the Supplier shall commence the performance test.
   4. The Supplier shall collect and process duplicate influent and effluent samples two times per day for a total of 7 days:
      a. Additional samples shall be collected for total suspended solids, turbidity and UV transmittance for each test.

C. Supplier and the Contractor shall provide the IPT Report within 10 working days of completion of each test period.

D. To perform each test, the Supplier and the Contractor shall operate the system continuously over two 7-day test periods (one for reuse testing and one for discharge testing), and collect and summarize data to demonstrate that the system meets the following Performance Test Requirements:
   1. Net production capacity:
      a. System meets average daily flow and peak flow rate requirements as specified in this Section.
   2. Minimum design dose:
      a. System can deliver the minimum design UV dose as specified in this Section.
   3. UV Disinfected Effluent Water Quality:
      a. UV Disinfection system produces an effluent in complete compliance with requirements as specified in this Section.
   4. Cleaning:
      a. The on-line, automatic cleaning system cleans the lamps as thoroughly and frequently as is required for the system to deliver the minimum design dose:
         1) The cleaning system maintains the sleeve fouling factor.
   5. Chemical cleaning:
      a. One UV bank shall be chemically cleaned at the end of the IPT period.
      b. This cleaning shall restore the UV sleeves to their state of cleanliness at the onset of the IPT test.
      c. This shall be quantified by comparing the UV intensity measured at this bank at the onset and end of the IPT and after the chemical cleaning.
   6. No major changes in equipment or apparatus will be permitted during this test period:
      a. However, minor adjustments of equipment that would normally be expected during regular operation of the equipment in plant use may be made.

E. Successful completion of the IPT shall be defined as continuous operation over the IPT test period without a major failure in the system and demonstration that the system meets performance requirements established in this Section.

F. Downtime resulting from Owner's operation will not be counted against the criteria of "continuous days of operation”.

G. If an individual train has a production capacity below 75 percent of its design production capacity for more than 6 hours, the IPT will be considered a failure.

H. If during the IPT, the system fails or shuts down, the IPT shall then be rerun, as described above, and additional testing, labor, materials, equipment, etc., associated with correcting deficiencies in the UV system, including the repeated performance test, shall be borne by the Supplier:
   1. Each repetition of the IPT shall be for a continuous period unless failure to meet performance requirements as specified in this Section has been documented and modifications have been accomplished.

I. During the IPT, the Owner shall have the option of collecting samples for independent analyses to confirm measurements and analyses conducted by the Supplier and the Contractor:
   1. The Engineer and the Owner shall have the option of witnessing testing performed by the Supplier and the Contractor.
   2. Supplier shall notify the Engineer a minimum of 2 weeks in advance of testing.

J. If the UV disinfection equipment system fails to successfully complete the IPT, the Supplier shall have the option of repeating the test 2 more times, with costs borne by the Supplier.

K. Consequences to the Supplier for failure to successfully complete the IPT are specified in this Section.

3.07 ELECTRICAL ACCEPTANCE TESTS

A. Electrical Acceptance Tests:
   1. Pre-energization testing of all supplied circuit breakers operating at 480 volts shall be NETA tested by the Contractor’s third-party independent testing firm after delivery of the UV system equipment to the project location. Tested circuit breakers that yield deficient testing results shall be replaced by the UV system supplier at no additional cost to the Owner with any re-testing costs incurred by the Contractor to be paid by the UV system supplier.
   2. Verification of warranted power consumption shall be documented by electrical acceptance testing performed by the Supplier with the oversight of the Engineer.
   3. This acceptance testing is separate and independent from the operational acceptance test described above:
      a. Electrical acceptance test shall consist of consecutive 2-hour measurement of kW usage and power factor on the UV bank(s) by the Supplier.
      b. Test protocol:
         1) Banks or Modules of the UV system shall be operated with lamps in operation at 100 percent power.
         2) During this acceptance test, the power consumption, power factor and harmonic values at maximum power shall be measured at the

PCC and continuously recorded using a power meter/analyzer (provided by the Supplier for the duration of electrical testing):

a) The meters each shall provide accuracy of within 0.25 percent, shall operate at Frequencies between 47 to 63 hertz, and shall be furnished with a statement from the meter Supplier attesting to its accuracy.
b) The meters shall be connected to the PCC at a location acceptable to the Owner.
c) In the event that Supplier disputes results of the electrical acceptance testing Supplier shall bear the entire cost of retesting by a third party mutually acceptable to Owner and Supplier.

c. The electrical acceptance test protocol shall be submitted to the Engineer for approval a minimum of 21 days prior to the scheduled test commencing.
d. If maximum power consumption exceeds the values provided in Attachment A - Minimum Equipment Requirements, the Supplier shall make any and modifications necessary to cause the system to meet the requirements, without any additional cost to the Owner and meet the requirements of the Power Consumption Guarantee as specified in this Section.

4. If the power factor is less than that as specified in this Section, the Supplier shall provide any modifications necessary to adjust the power factor to meet the required power factor.
5. Measure the voltage and current harmonics at the PCC for a period of 2 hours under full load conditions:
   a. The harmonic testing report shall include the following data recorded every 30 minutes after lamp warm-up is completed:
      1) Total harmonic distortion.
      2) The largest individual harmonic distortion component.
      3) The calculated short-circuit to demand current ratio using measured demand current.
      4) Total demand distortion.
      5) The harmonic distortion contribution of the odd harmonic orders as shown in Table 2 of IEEE 519-2014.

3.08 TRAINING OF OWNER'S PERSONNEL AND SUPPORT SERVICES

A. General requirements:
   1. Provide operations and maintenance training for items of mechanical, electrical and instrumentation equipment:
      a. Utilize Supplier's personnel to conduct training sessions.
   2. Coordinate training sessions to prevent overlapping sessions.
   3. Provide Draft Operation and Maintenance Manual for specific pieces of equipment or systems prior to training session for that piece of equipment or system.
   4. Satisfactorily complete Hydraulic, Alarm and Functional Testing before beginning operator training.
   5. Following Owner’s acceptance of Certificate of Proper Installation, the Supplier shall perform a comprehensive training of Owner’s personnel at the site, or a classroom designated by the Engineer.

6. The training provided by the Supplier's representative shall consist of both classroom and field training based upon Owner's schedule.
7. The Supplier shall give the Owner a minimum of 30 days' notice prior to initiation of training.
8. The Supplier shall designate and provide one or more persons to be responsible for coordinating and expediting training duties:
    a. The person or persons so designated shall be present at training coordination meetings with the Owner.
9. The Supplier's coordinator shall coordinate the training periods with Owner personnel and shall submit a training schedule for each component of the UV disinfection equipment system for which training is to be provided:
    a. Such training schedule shall be submitted not less than 30 calendar days prior to the time that the associated training is to be provided and shall be based on the current plan of operation.

B. Specific requirements:
1. In addition to the time necessary to complete the requirements established elsewhere within these Specifications, the Supplier's representative shall also provide onsite services at times designated by the Owner, for the minimum person-days listed below, travel time excluded.
2. Installation Supervision and Inspection:
    a. Minimum 6 person-days to handle various requests by the Owner, including during the unloading of UV disinfection equipment system (assume 1 trip) and for providing installation assistance for the UV disinfection equipment system (assume 1 trip).
3. Start-up and field-testing:
    a. Minimum 8 person-days to handle various requests by the Owner, for assistance during start up activities (assume 2 trips).
4. Operator training:
    a. Training shall consist of a minimum of total of 16 hours (2 separate trips) of hands-on lectures on the UV disinfection equipment system operation and the maintenance requirements, including lamp chemical cleaning and replacement and repair processes for lamps, ballasts, wipers, sleeves, and ancillary equipment.
    b. Training shall take place before the Initial Performance Test and 6 months after Substantial Completion. The field training shall cover all shifts.
5. Maintenance Service - Service Scheduling:
    a. By Owner request any time during warranty period as specified on the Warranty Form.
    b. Factory representatives of the Supplier who have complete knowledge of the proper operation and maintenance of the equipment, shall be provided to instruct representatives of Owner on the proper start-up, operation, and maintenance.

C. Supplier shall include in the proposal a price for the time and expenses listed above.

D. Supplier's representative shall be a qualified individual who has previously provided onsite services for the installation, testing, and start-up of the Supplier's identical system at a minimum of 5 wastewater treatment plants of similar size.

E. Telephone:
   1. Include the following in lump sum price:
      a. Provide telephone support by means of a toll-free phone number for a minimum period of 3 years following installation and start-up.
      b. Provide a list of 3 or more names of individuals qualified to support operation and provide cell phone numbers for these individuals.
      c. At least 1 of the listed individuals shall be available at all times including nights, weekends, and holidays in the event of an emergency.

F. Service scheduling:
   1. By Owner, on request any time during warranty period as specified.
   2. Factory representatives of the Supplier who have complete knowledge of the proper operation and maintenance of the equipment, shall be provided to instruct Owner on the proper start-up, operation, and maintenance.

END OF SECTION

ATTACHMENT A - MINIMUM EQUIPMENT REQUIREMENTS

MINIMUM EQUIPMENT REQUIREMENTS

Parameters	Trojan UVSigna 2-Row	WEDECO Duron
Design Factors		
End of Lamp Life Factor	0.86	0.85
Fouling Factor	0.94	0.90
Configuration		
Number of Channels	2	2
Number of Duty Banks/Channel	2	5
Number of Standby Banks/Channel	1	1
Total Number of Banks/Channel	3	6
Number of Modules/Bank	1	1
Number of Lamps/Module	10	12
Total Number of Lamps	60	144
Number of UV Sensors	6	12
Number of Power Distribution Centers	4	4
Number of Master Control Panels	1	1
Number of Hydraulic System Centers	2	N/A
Maximum Total Power Consumption (kW)	69.5	97.0
Head Loss Across UV Banks (inches)	3.2	4.7
Lamp Type	**Low-Pressure/ High-Output**	**Low-Pressure/ High-Output**
Lamp Input, watts per lamp	1,000	600
Guaranteed Lamp Life, hours	15,000	14,000

ATTACHMENT B – UV PRE-PURCHASE DRAWINGS

CITY OF PACIFICA

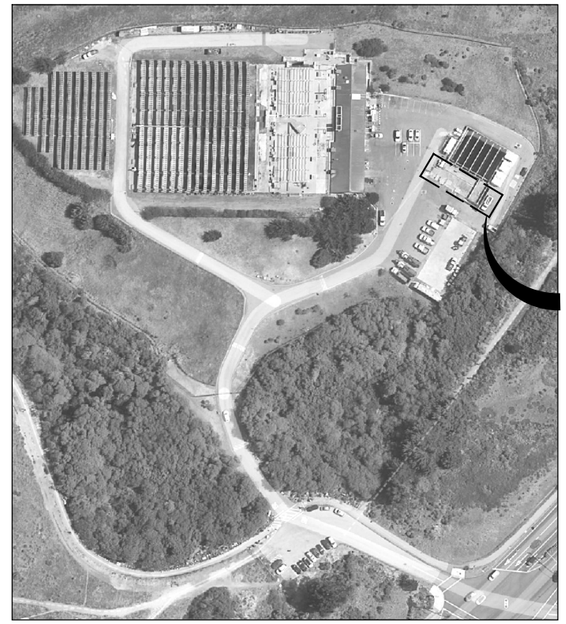
PACIFICA UV DISINFECTION SYSTEM REPLACEMENT

FEBRUARY 2023

UV PRE-PURCHASE DRAWINGS

NOT FOR CONSTRUCTION

VICINITY MAP



LOCATION MAP

REGISTERED PROFESSIONAL ENGINEER
BRYAN A. BURNITT
No. 83046
CIVIL
STATE OF CALIFORNIA

REGISTERED PROFESSIONAL ENGINEER
PAUL V. FRIEDLANDER
No. 55565
CIVIL
STATE OF CALIFORNIA

carollo®

JOB NO.
201447
DRAWING NO.
G01
SHEET NO.
1 OF XX

SHEET NO.	DWG NO.	DESCRIPTION
		(G) - GENERAL
	G01	COVER SHEET
	G02	DRAWING INDEX
		(M) - MECHANICAL
	M01	BOTTOM PLAN
	M02	TOP PLAN
	M03	SECTIONS
		(N) - INSTRUMENTATION
	40N01	P&ID: UV DISINFECTION OVERVIEW - TROJAN
	40N02	P&ID: UV CHANNEL NO. 1 - TROJAN
	40N03	P&ID: UV CHANNEL NO. 2 - TROJAN
	40N04	P&ID: UV DISINFECTION OVERVIEW - WEDECO
	40N05	P&ID: UV CHANNEL NO. 1 (1 OF 2) - WEDECO
	40N06	P&ID: UV CHANNEL NO. 1 (2 OF 2) - WEDECO
	40N07	P&ID: UV CHANNEL NO. 2 (1 OF 2) - WEDECO
	40N08	P&ID: UV CHANNEL NO. 2 (2 OF 2) - WEDECO

0

REV	DATE	BY	DESCRIPTION
			30% DESIGN SUBMITTAL NOT FOR CONSTRUCTION

DESIGNED AL
DRAWN GL
CHECKED
DATE JANUARY 2023

REGISTERED PROFESSIONAL ENGINEER BRYAN A. BURNTT No. 83046 CIVIL STATE OF CALIFORNIA

REGISTERED PROFESSIONAL ENGINEER PAUL V. FRIEDLANDER No. 55565 CIVIL STATE OF CALIFORNIA

carollo

CITY OF PACIFICA

CITY OF PACIFICA

PACIFICA UV DISINFECTION SYSTEM REPLACEMENT

GENERAL

DRAWINGS LIST

VERIFY SCALES
BAR IS ONE INCH ON ORIGINAL DRAWING
0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

JOB NO. 201447
DRAWING NO. G02
SHEET NO.
OF

PROJECT NO. 201447-100000 FILE NAME: 201447G02.dgn

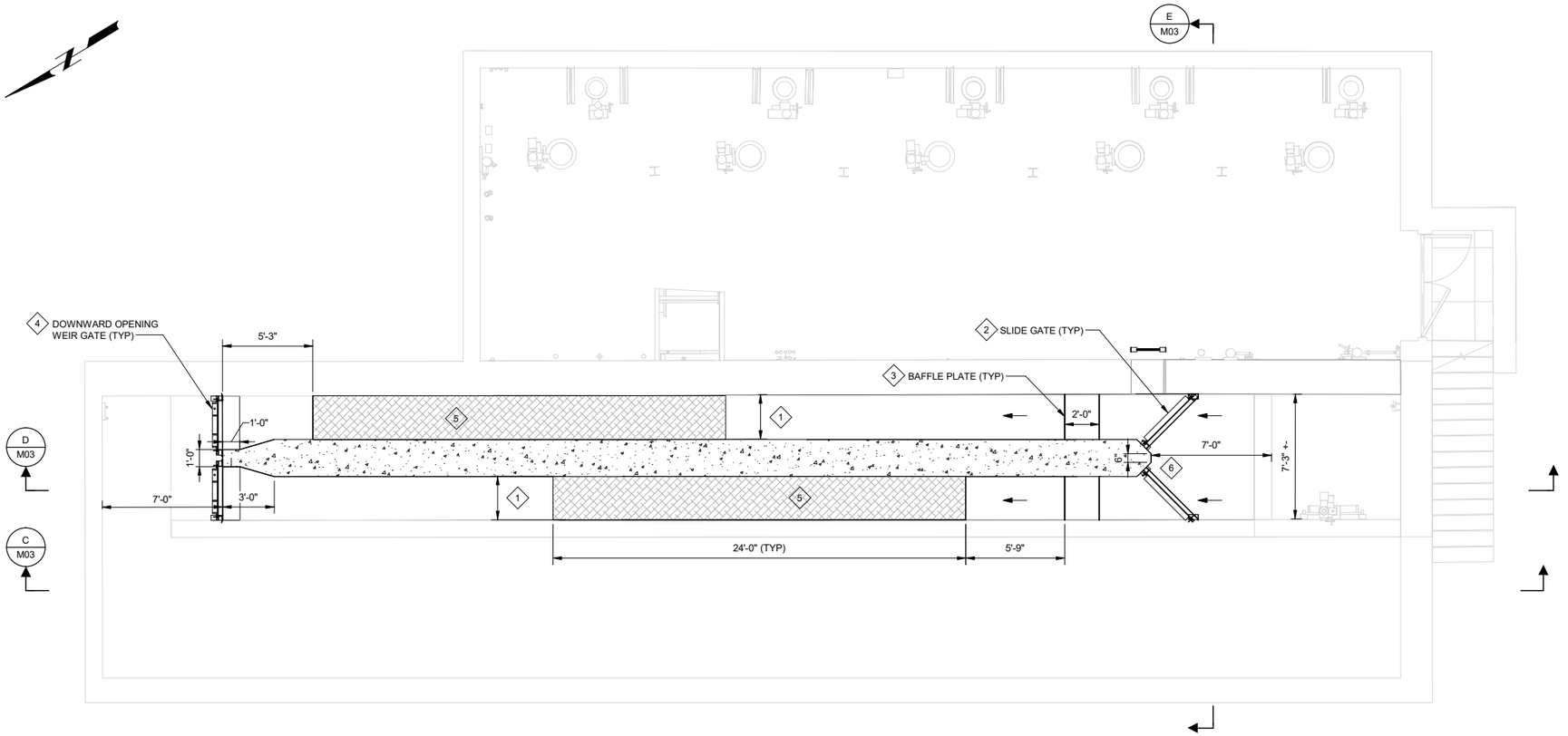
LAST SAVED BY: gleal Model: Layout1 ColorTable: gshade.ctb DesignScript: Carollo_Std_Pen_v0905.pen PlotScale: 2:1 User: svcPW Plot Date: 16-FEB-2023 2:22:53 PM

GENERAL NOTES:

1. MECHANICAL LAYOUT PROVIDED FOR CONCEPTUAL INSTALLATION BASED ON THE SPECIFIED UV EQUIPMENT IN SECTION 46_66_85. PROVIDE CONCEPTUAL INSTALLATION SHOP DRAWINGS DEMONSTRATING THE METHOD OF INSTALLATION AND IDENTIFYING REQUIRED MODIFICATION TO THE EXISTING FACILITY.
2. UNLESS OTHERWISE NOTED, ALL EQUIPMENT SHOWN IS TO BE PROVIDED UNDER THIS PROCUREMENT CONTRACT. REFERENCE TO SPECIFICATIONS ARE PROVIDED FOR ALL EQUIPMENT TO BE PROVIDED. EQUIPMENT INSTALLATION TO BE COMPLETED BY INSTALLATION CONTRACTOR IN COORDINATION WITH THE EQUIPMENT SUPPLIER.
3. FINAL GATE DIMENSIONS TO BE CONFIRMED AFTER UV EQUIPMENT SELECTION. ENGINEER AND GATE MANUFACTURER TO COORDINATE INSTALLATION DETAILS AND DIMENSIONS BASED ON SELECTED UV EQUIPMENT. ENGINEER WILL PRODUCE REVISED STRUCTURAL AND MECHANICAL DRAWINGS AFTER UV EQUIPMENT SELECTION.

(#) KEY NOTES:

1. CHANNEL WIDTH PER MANUFACTURER.
   TROJAN UV-SIGNA: 35.25"
   WEDECO DURON: 29.5"
2. SST ISOLATION CHANNEL-MOUNTED SLIDE GATE WITH ELECTRIC ACTUATOR, SEE SECTION 40_05_59.20.
3. SST INLET BAFFLE PLATE, SEE SECTION 46_66_85.
4. SST DOWNWARD OPENING WEIR GATE WITH ELECTRIC ACTUATOR. ESTIMATED WEIR WIDTH IS 33-INCHES BASED ON EXISTING CHANNEL DIMENSIONS, PROPOSED MODIFICATION, AND TYPICAL MOUNTING DETAILS. GATE TO BE CHANNEL-MOUNTED WITHOUT A BLOCKOUT ON EXISTING WALLS AND FACE-MOUNTED THE PROPOSED CENTER WALL AND RAISE FLOOR. PROPOSED GATE DESIGN TO BE SUBMITTED TO ENGINEER FOR COORDINATION AFTER UV EQUIPMENT IS SELECTED. SEE SECTIONS 46_66_85 AND 40_05_59.20.
5. UV BANK INSTALLATION AREA PER CHANNEL. MANUFACTURER TO INDICATE IF BANK INSTALLATION REQUIRES MORE THAN 20 FEET PER CHANNEL. MINIMIZE OVERLAP OF EQUIPMENT IN CHANNELS; 2'-0" SEE SECTION 46_66_85 FOR UV REQUIREMENTS.
6. FINAL MOUNTING LAYOUT TO BE DETERMINED ONCE UV MANUFACTURER IS SELECTED.



@ EL 60'-0"

A PLAN

SCALE: 1/4" = 1'-0"

REV	DATE	BY	DESCRIPTION
			30% DESIGN SUBMITTAL NOT FOR CONSTRUCTION

DESIGNED ARL
DRAWN GL
CHECKED Checker
DATE FEBRUARY 2023

REGISTERED PROFESSIONAL ENGINEER BRYAN A. BURNITT No. 83046 CIVIL STATE OF CALIFORNIA

REGISTERED PROFESSIONAL ENGINEER PAUL V. FRIEDLANDER No. 55565 CIVIL STATE OF CALIFORNIA

carollo®

CITY OF PACIFICA

CITY OF PACIFICA

PACIFICA UV DISINFECTION SYSTEM REPLACEMENT

Mechanical

BOTTOM PLAN

VERIFY SCALES
BAR IS ONE INCH ON ORIGINAL DRAWING
0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

JOB NO. 201447
DRAWING NO. M01
SHEET NO. OF XX

PLOT DATE: 2/16/2023 12:55:28 PM

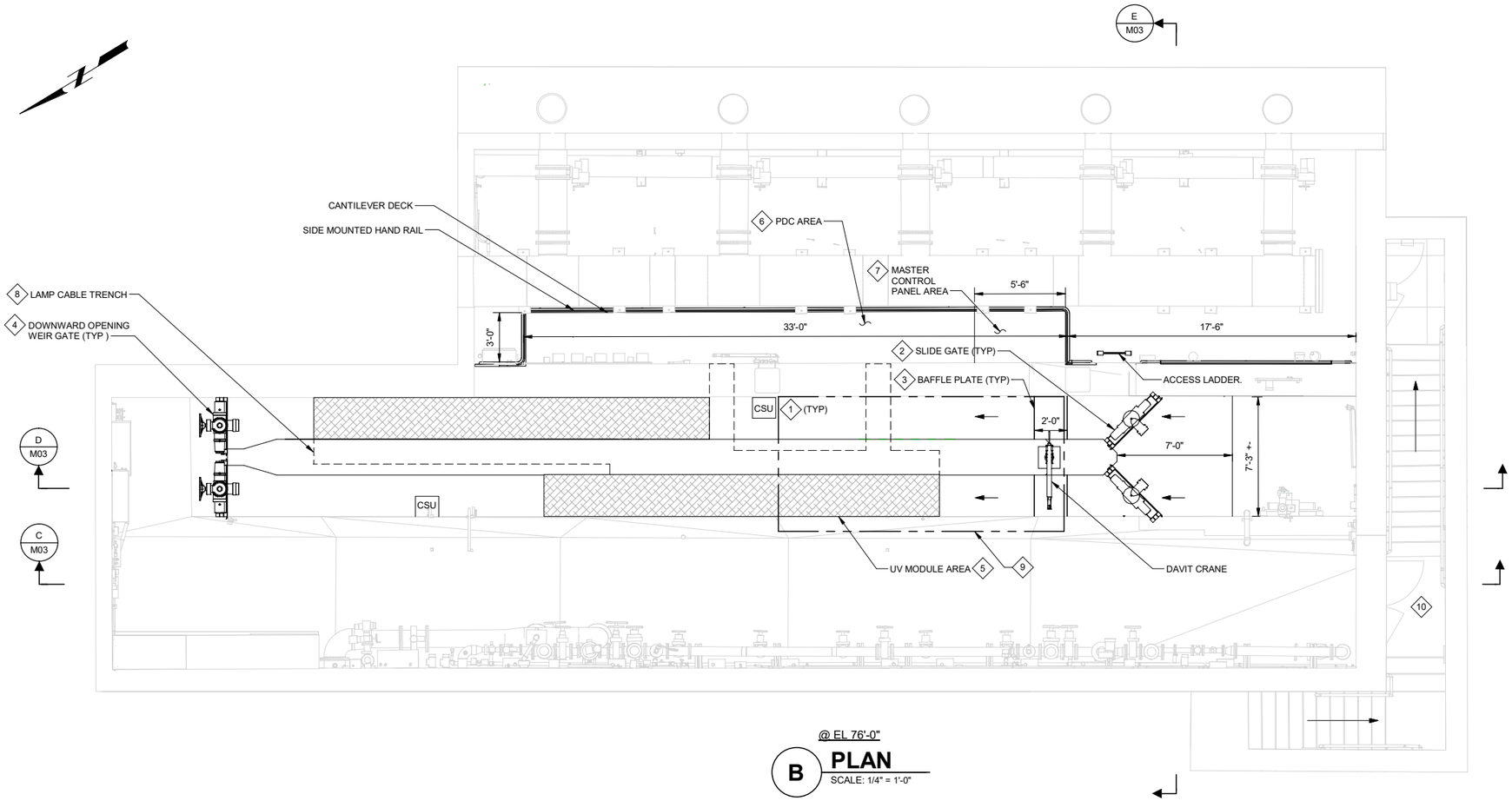
FILE NAME: R:\d0137217\201447M800.rvt

GENERAL NOTES:

1. SEE M01 FOR GENERAL NOTES.

◇# KEY NOTES:

1. APPROXIMATE LOCATION OF CLEANING SYSTEM UNITS IF REQUIRED BASED ON MANUFACTURER. ENGINEER WILL COORDINATE STRUCTURAL SUPPORT OVER THE CHANNEL AS NECESSARY FOR INCLUSION IN THE INSTALLATION CONTRACT.
2. SST ISOLATION CHANNEL-MOUNTED SLIDE GATE WITH ELECTRIC ACTUATOR, SEE SECTION 40_05_59.20.
3. SST INLET BAFFLE PLATE, SEE SECTION 46_66_85.
4. SST DOWNWARD OPENING WEIR GATE WITH ELECTRIC ACTUATOR. ESTIMATED WEIR WIDTH IS 33-INCHES BASED ON EXISTING CHANNEL DIMENSIONS, PROPOSED MODIFICATION, AND TYPICAL MOUNTING DETAILS. GATE TO BE CHANNEL-MOUNTED WITHOUT A BLOCKOUT ON EXISTING WALLS AND FACE-MOUNTED THE PROPOSED CENTER WALL AND RAISE FLOOR. PROPOSED GATE DESIGN TO BE SUBMITTED TO ENGINEER FOR COORDINATION AFTER UV EQUIPMENT IS SELECTED. SEE SECTIONS 46_66_85 AND 40_05_59.20.
5. UV BANK INSTALLATION AREA PER CHANNEL. MANUFACTURER TO INDICATE IF BANK INSTALLATION REQUIRES MORE THAN 24 FEET PER CHANNEL. SEE SECTION 46_66_85 FOR UV REQUIREMENTS.
6. POWER DISTRIBUTION CENTER (PDC) AREA IS APPROXIMATELY 3'-0" X 24'-6". PROPOSED LAYOUT IS NOT SHOWN, BUT INTENT IS TO HAVE FACING UNITS WITH ADEQUATE SPACING FOR OPERATOR ACCESS AND CODE CLEARANCE MINIMUMS. ENGINEER WILL COORDINATE FINAL LAYOUT ONCE UV EQUIPMENT IS SELECTED, SEE SECTION 46_66_85.
7. MASTER CONTROL PANEL AREA IS APPROXIMATELY 3'-0" X 5'-6". PANEL TO BE ORIENTED TO FACE THE CHANNELS WITH ADEQUATE SPACING FOR OPERATOR ACCESS AND CODE CLEARANCE MINIMUMS. ENGINEER WILL COORDINATE FINAL LAYOUT ONCE UV EQUIPMENT IS SELECTED, SEE SECTION 46_66_85.
8. LAMP CABLE TRENCHES ARE APPROXIMATELY 1' 6" WIDE BY 8" DEEP. PROPOSED LAYOUT SHOWN. ENGINEER WILL COORDINATE FINAL LAYOUT AND DETAILS ONCE UV EQUIPMENT IS SELECTED.
9. APPROXIMATE LOCATION OF OPENING IN CEILING. ALL EQUIPMENT MUST BE ABLE TO BE LIFTED AND FIT THROUGH THIS 8'X17' OPENING.
10. PERSONNEL ACCES BY 3'-6" WIDE STAIRWELL TO UV DECK AND PIPE GALLERY LEVELS.



@ EL 76'-0"

B PLAN

SCALE: 1/4" = 1'-0"

REV	DATE	BY	DESCRIPTION
			30% DESIGN SUBMITTAL NOT FOR CONSTRUCTION

DESIGNED ARL
DRAWN GL
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DATE FEBRUARY 2023

REGISTERED PROFESSIONAL ENGINEER BRYAN A. BURNITT No. 83046 CIVIL STATE OF CALIFORNIA

REGISTERED PROFESSIONAL ENGINEER PAUL V. FRIEDLANDER No. 55565 CIVIL STATE OF CALIFORNIA

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PACIFICA UV DISINFECTION SYSTEM REPLACEMENT

Mechanical

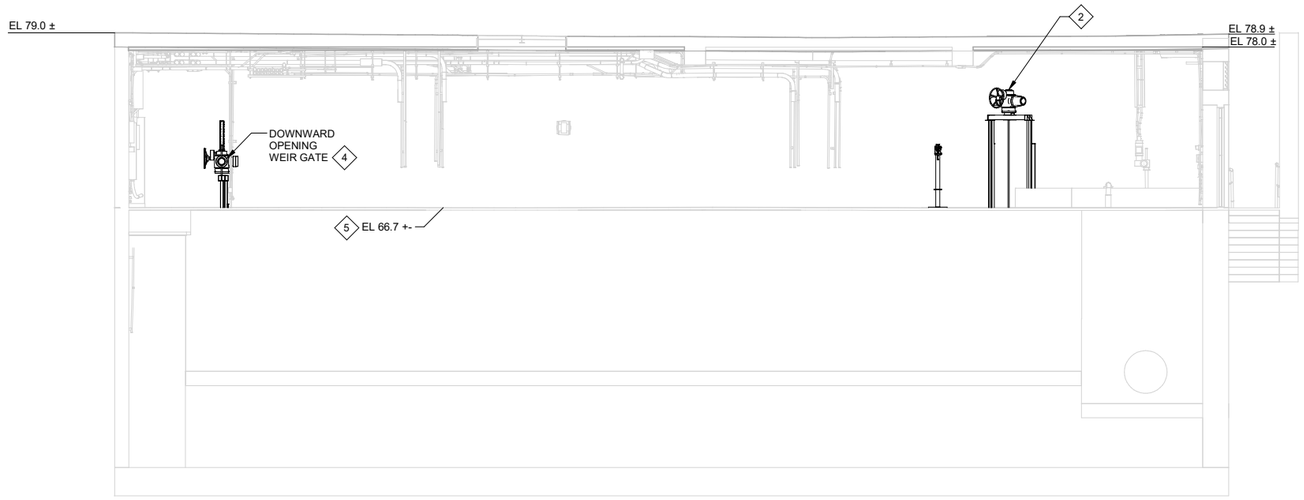
TOP PLAN

VERIFY SCALES
BAR IS ONE INCH ON ORIGINAL DRAWING
0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

JOB NO. 201447
DRAWING NO. M02
SHEET NO. OF XX

PLOT DATE: 2/16/2023 12:55:30 PM

FILE NAME: R:\d0137217\201447M800.rvt



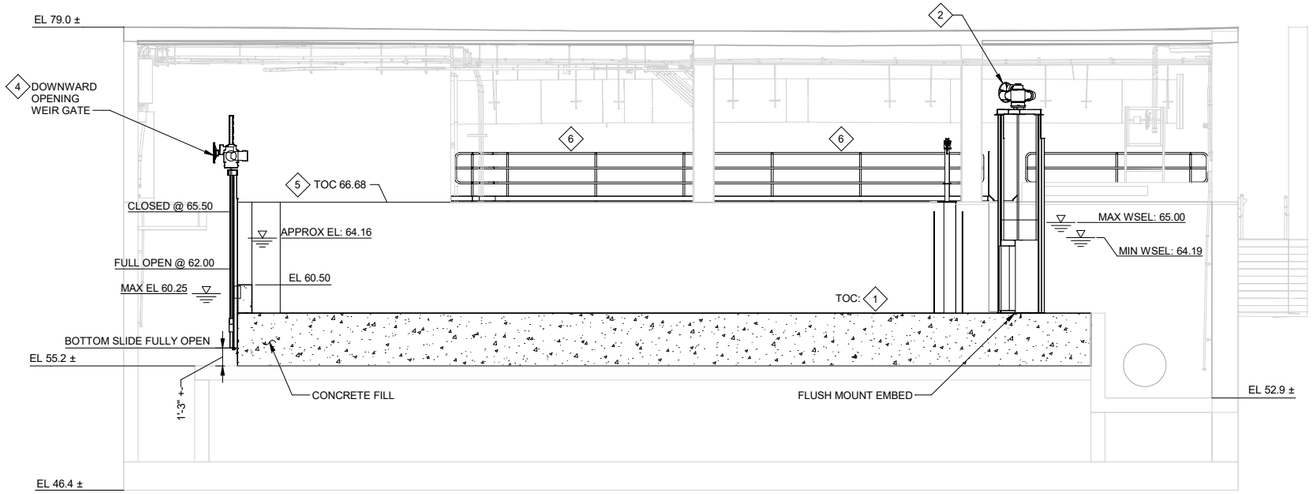
C SECTION
M01
SCALE: 3/16" = 1'-0"

GENERAL NOTES:

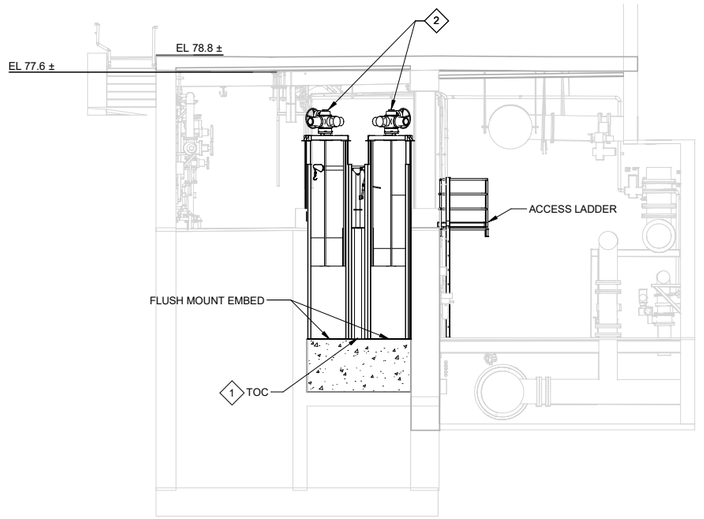
1. SEE M01 FOR GENERAL NOTES.

KEY NOTES:

1. CHANNEL INVERT PER MANUFACTURER.
   TROJAN UV-SIGNA: 58.88
   WEDECO DURON: 60.32
2. SST ISOLATION CHANNEL-MOUNTED SLIDE GATE WITH ELECTRIC ACTUATOR, SEE SECTION 40_05_59.20. SELF-CONTAINED GATE WILL BE MORE THAN 6-FEET ABOVE THE DECK LEVEL. PER SPECIFICATION SECTION 40_05_57.24, A REMOTE CONTROL STATION AND HAND WHEEL CHAIN WITH BE REQUIRED ON THE ACTUATOR.
3. SST INLET BAFFLE PLATE, SEE SECTION 46_66_85.
4. SST DOWNWARD OPENING WEIR GATE WITH ELECTRIC ACTUATOR. ESTIMATED WEIR WIDTH IS 33-INCHES BASED ON EXISTING CHANNEL DIMENSIONS, PROPOSED MODIFICATION, AND TYPICAL MOUNTING DETAILS. GATE TO BE CHANNEL-MOUNTED WITHOUT A BLOCKOUT ON EXISTING WALLS AND FACE-MOUNTED THE PROPOSED CENTER WALL AND RAISE FLOOR. PROPOSED GATE DESIGN TO BE SUBMITTED TO ENGINEER FOR COORDINATION AFTER UV EQUIPMENT IS SELECTED. SEE SECTIONS 46_66_85 AND 40_05_59.20. OPERATION ELEVATIONS SHOWN TO BE CONFIRMED AFTER UV EQUIPMENT SELECTION BUT ARE INCLUDED FOR BIDDING PURPOSES.
5. DECKING TO BE COORDINATED AFTER UV EQUIPMENT SELECTION. DECKING INSTALLATION AND MATERIALS ARE NOT PART OF THIS CONTRACT. UV BANKS AND FRAMES SHALL NOT COME WITHIN 4" OF THE TOP DECK ELEVATION.
6. POWER DISTRIBUTION CENTERS AND MASTER CONTROL PANEL NOT SHOWN.



D SECTION
M01
SCALE: 3/16" = 1'-0"



E SECTION
M01
SCALE: 3/16" = 1'-0"

REV	DATE	BY	DESCRIPTION
			30% DESIGN SUBMITTAL NOT FOR CONSTRUCTION

DESIGNED ARL
DRAWN GL
CHECKED Checker
DATE FEBRUARY 2023

REGISTERED PROFESSIONAL ENGINEER BRYAN A. BURNITT No. 83046 CIVIL STATE OF CALIFORNIA

REGISTERED PROFESSIONAL ENGINEER PAUL V. FRIEDLANDER No. 55565 CIVIL STATE OF CALIFORNIA

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PACIFICA UV DISINFECTION SYSTEM REPLACEMENT
Mechanical
SECTIONS

VERIFY SCALES
BAR IS ONE INCH ON ORIGINAL DRAWING
0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

JOB NO. 201447
DRAWING NO. M03
SHEET NO. OF XX

PLOT DATE: 2/16/2023 12:55:33 PM

FILE NAME: R:\d0137217\201447M800.rvt

NOTES:

1. INDICATED SYSTEM CONFIGURATION IS BASED UPON SYSTEM SUPPLY FROM TROJAN TECHNOLOGIES.

LEGEND:

*** FURNISHED BY UV SYSTEM SUPPLIER

40-MCP-01/PLANT SCADA

(E) ETHERNET SWITCH

VCP

120V

40-MCP-01 ***
UV SYSTEM
MASTER CONTROL PANEL

AIT XXX *** 120V

LYH XXX
LYL XXX
LIT XXX *** 120V

ZSO XXX
ZLO XXX
HS XXX
LOR
OSC
ZSC XXX
ZLC XXX
HS XXX
RESET
HS XXX

LYH XXX
LYL XXX
LIT XXX *** 120V

0-100%
ZIC XXX
ZSO XXX
ZLO XXX
HS XXX
LOR
OSC
ZSC XXX
ZLC XXX
HS XXX
RESET
HS XXX

LYH XXX
LYL XXX
LIT XXX *** 120V

0-100%
ZIC XXX
ZSO XXX
ZLO XXX
HS XXX
LOR
OSC
ZSC XXX
ZLC XXX
HS XXX
RESET
HS XXX

FIELD

AE XXX *** UVT

LE XXX ***

M 480V
40-G-11-FEF ***
UV CHANNEL NO.1
INLET GATE

INLET BAFFLE PLATE

UV CHANNEL NO.1
(SEE DWG 40N02)

LE XXX ***

M 480V
40-G-12-FE ***
UV CHANNEL NO.1
OUTLET WEIR GATE

FROM FILTERS

36" FEF

CLEARWELL
(TO REUSE AND DISCHARGE)

M 480V
40-G-21-FEF ***
UV CHANNEL NO.2
INLET GATE

INLET BAFFLE PLATE

40-UV-11
UV CHANNEL NO.1
UV BANK NO.1
***

40-UV-12
UV CHANNEL NO.1
UV BANK NO.2
***

40-UV-13
UV CHANNEL NO.1
UV BANK NO.3
***

40-UV-14
UV CHANNEL NO.1
UV BANK NO.4
(FUTURE)

UV CHANNEL NO.2
(SEE DWG 40N03)

LE XXX ***

M 480V
40-G-22-FE ***
UV CHANNEL NO.2
OUTLET WEIR GATE

40-UV-21
UV CHANNEL NO.2
UV BANK NO.1
***

40-UV-22
UV CHANNEL NO.2
UV BANK NO.2
***

40-UV-23
UV CHANNEL NO.2
UV BANK NO.3
***

40-UV-24
UV CHANNEL NO.2
UV BANK NO.4
(FUTURE)

REV	DATE	BY	DESCRIPTION
			30% DESIGN SUBMITTAL NOT FOR CONSTRUCTION

DESIGNED TB
DRAWN BEI
CHECKED xxx
DATE JANUARY 2023

REGISTERED PROFESSIONAL ENGINEER TODD A. BEECHER E014712 Exp. 6/30/23 ELECTRICAL STATE OF CALIFORNIA

Beecher Engineering, Inc.

carollo

CITY OF PACIFICA

CITY OF PACIFICA
PACIFICA UV DISINFECTION SYSTEM REPLACEMENT
INSTRUMENTATION
P&ID: UV DISINFECTION OVERVIEW - TROJAN

VERIFY SCALES
BAR IS ONE INCH ON ORIGINAL DRAWING
0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

JOB NO. 201447
DRAWING NO. 40N01
SHEET NO. OF

PROJECT NO. 201447 FILE NAME: 201447_40N01.dwg

PLOT DATE: 2/16/2023 5:30:26 AM
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COLOR TABLE:CAROLLO_STD_H_V0905.CTB
PLOT SCALE:1:2
PAGE SETUP: ---
LAST SAVED BY: tbeecher

NOTES:

1. INDICATED SYSTEM CONFIGURATION IS BASED UPON SYSTEM SUPPLY FROM TROJAN TECHNOLOGIES.

LEGEND:

*** FURNISHED BY UV SYSTEM SUPPLIER

40-MCP-01/PLANT SCADA

(E) ETHERNET SWITCH

ETHERNET

VCP

120V

40-MCP-01 ***
UV SYSTEM
MASTER CONTROL PANEL

MODBUS 485

MODBUS 485

MODBUS 485

40-HSC-11 480V
UV CHANNEL NO.1
HYDRAULIC
SYSTEM CENTER ***

40-PDC-11 480V
UV CHANNEL NO.1
PDC NO.1 ***

40-PDC-12 480V
UV CHANNEL NO.1
PDC NO.2 ***

FIELD

AIT xxx ***
AE xxx ***
UV INT
ZSC xxx ***
BANK IN-PLACE

M
INLET BAFFLE PLATE

40-G-11-FEF
UV CHANNEL NO.1
INLET GATE ***

40-UV-11
UV CHANNEL NO.1
UV BANK NO.1 ***

40-UV-12
UV CHANNEL NO.1
UV BANK NO.2 ***

40-UV-13
UV CHANNEL NO.1
UV BANK NO.3 ***

40-UV-14
UV CHANNEL NO.1
UV BANK NO.4
(FUTURE)

40-G-12-FE
UV CHANNEL NO.1
OUTLET WEIR GATE ***

4" D

TO
PLANT DRAIN

REV	DATE	BY	DESCRIPTION
			30% DESIGN SUBMITTAL NOT FOR CONSTRUCTION

DESIGNED TB
DRAWN BEI
CHECKED xxx
DATE JANUARY 2023

REGISTERED PROFESSIONAL ENGINEER
TODD A. BEECHER
E014712
Exp. 6/30/23
ELECTRICAL
STATE OF CALIFORNIA

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PACIFICA UV DISINFECTION SYSTEM REPLACEMENT

INSTRUMENTATION

P&ID: UV CHANNEL NO.1 - TROJAN

VERIFY SCALES
BAR IS ONE INCH ON ORIGINAL DRAWING
0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

JOB NO. 201447
DRAWING NO. 40N02
SHEET NO. OF

PROJECT NO. 201447 FILE NAME: 201447_40N02.dwg

NOTES:

1. INDICATED SYSTEM CONFIGURATION IS BASED UPON SYSTEM SUPPLY FROM TROJAN TECHNOLOGIES.

LEGEND:

*** FURNISHED BY UV SYSTEM SUPPLIER

40-MCP-01/PLANT SCADA

(E) ETHERNET SWITCH

ETHERNET

VCP

120V

40-MCP-01 ***
UV SYSTEM
MASTER CONTROL PANEL

MODBUS 485

MODBUS 485

MODBUS 485

40-HSC-21
UV CHANNEL NO.2
HYDRAULIC
SYSTEM CENTER
***

480V

40-PDC-21
UV CHANNEL NO.2
PDC NO.1
***

480V

40-PDC-22
UV CHANNEL NO.2
PDC NO.2
***

480V

FIELD

AIT xxx ***

AE xxx ***

UV INT

ZSC xxx ***

BANK IN-PLACE

M

INLET BAFFLE PLATE

40-G-21-FEF
UV CHANNEL NO.2
INLET GATE
***

40-UV-21
UV CHANNEL NO.2
UV BANK NO.1
***

40-UV-22
UV CHANNEL NO.2
UV BANK NO.2
***

40-UV-23
UV CHANNEL NO.2
UV BANK NO.3
***

40-UV-24
UV CHANNEL NO.2
UV BANK NO.4
(FUTURE)

40-G-22-FE
UV CHANNEL NO.2
OUTLET WEIR GATE
***

4" D

TO
PLANT DRAIN

REV	DATE	BY	DESCRIPTION
			30% DESIGN SUBMITTAL NOT FOR CONSTRUCTION

DESIGNED TB
DRAWN BEI
CHECKED xxx
DATE JANUARY 2023

REGISTERED PROFESSIONAL ENGINEER
TODD A. BEECHER
E014712
Exp. 6/30/23
ELECTRICAL
STATE OF CALIFORNIA

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PACIFICA UV DISINFECTION SYSTEM REPLACEMENT

INSTRUMENTATION

P&ID: UV CHANNEL NO.2 - TROJAN

VERIFY SCALES
BAR IS ONE INCH ON ORIGINAL DRAWING
0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

JOB NO. 201447
DRAWING NO. 40N03
SHEET NO.
OF

PROJECT NO. 201447 FILE NAME: 201447_40N03.dwg

PLOT DATE: 2/16/2023 5:31:14 AM USER: BEI COLOR TABLE:CAROLLO_STD_H_V0906.CTB PAGE SETUP: ---- PLOT SCALE:1:2 LAST SAVED BY: tbeecher

NOTES:

1. INDICATED SYSTEM CONFIGURATION IS BASED UPON SYSTEM SUPPLY FROM WEDECO, A XYLEM BRAND.

LEGEND:

*** FURNISHED BY UV SYSTEM SUPPLIER

40-MCP-01/PLANT SCADA

(E) ETHERNET SWITCH

VCP

120V

40-MCP-01 ***
UV SYSTEM
MASTER CONTROL PANEL

AIT xxx *** 120V

LIT xxx *** 120V

LYH xxx
LYL xxx

ZSO xxx
ZLO xxx
HS xxx LOR
ZSC xxx
ZLC xxx
HS xxx OSC
HS xxx RESET

UVT
AE xxx ***
LE xxx ***

FIELD

FROM FILTERS

36" FEF

M 480V

40-G-11-FEF ***
UV CHANNEL NO.1
INLET GATE

INLET BAFFLE PLATE

UV CHANNEL NO.1
(SEE DWGS 40N05 AND 40N06)

40-G-21-FEF ***
UV CHANNEL NO.2
INLET GATE

UV CHANNEL NO.2
(SEE DWGS 40N07 AND 40N08)

40-G-12-FE ***
UV CHANNEL NO.1
OUTLET WEIR GATE

40-G-22-FE ***
UV CHANNEL NO.2
OUTLET WEIR GATE

CLEARWELL
(TO REUSE AND DISCHARGE)

ZIC xxx 0-100%

40-UV-1A UV CHANNEL NO.1 UV BANK A ***
40-UV-1B UV CHANNEL NO.1 UV BANK B ***
40-UV-1C UV CHANNEL NO.1 UV BANK C ***
40-UV-1D UV CHANNEL NO.1 UV BANK D ***
40-UV-1E UV CHANNEL NO.1 UV BANK E ***
40-UV-1F UV CHANNEL NO.1 UV BANK F ***
40-UV-1G UV CHANNEL NO.1 FUTURE UV BANK G ***

40-UV-2A UV CHANNEL NO.2 UV BANK A ***
40-UV-2B UV CHANNEL NO.2 UV BANK B ***
40-UV-2C UV CHANNEL NO.2 UV BANK C ***
40-UV-2D UV CHANNEL NO.2 UV BANK D ***
40-UV-2E UV CHANNEL NO.2 UV BANK E ***
40-UV-2F UV CHANNEL NO.2 UV BANK F ***
40-UV-2G UV CHANNEL NO.2 FUTURE UV BANK G ***

REV	DATE	BY	DESCRIPTION
			30% DESIGN SUBMITTAL NOT FOR CONSTRUCTION

DESIGNED TB
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CHECKED xxx
DATE JANUARY 2023

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PACIFICA UV DISINFECTION SYSTEM REPLACEMENT
INSTRUMENTATION
P&ID: UV DISINFECTION OVERVIEW - WEDECO

VERIFY SCALES
BAR IS ONE INCH ON ORIGINAL DRAWING
0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

JOB NO. 201447
DRAWING NO. 40N04
SHEET NO.
OF

PROJECT NO. 201447 FILE NAME: 201447_40N04.dwg

PLOT DATE: 2/16/2023 5:35:24 AM
USER: BEI
COLOR TABLE:CAROLLO_STD_H_V0905.CTB
PLOT SCALE:1:2
PAGE SETUP: ---
LAST SAVED BY: tbeecher

NOTES:

1. INDICATED SYSTEM CONFIGURATION IS BASED UPON SYSTEM SUPPLY FROM WEDECO, A XYLEM BRAND

LEGEND:

*** FURNISHED BY UV SYSTEM SUPPLIER

40-MCP-01/PLANT SCADA

(E) ETHERNET SWITCH

ETHERNET

VCP

40-MCP-01 ***
UV SYSTEM
MASTER CONTROL PANEL

ETHERNET TCP/IP

40-PDC-11 ***
UV CHANNEL NO.1
POWER DISTRIBUTION CENTER NO.1

480V

40-EWC-11
UV CHANNEL NO.1
ELECTRIC WIPE
CONTROLS NO.1 ***

40-MLC-11 ***
UV CHANNEL NO.1
MODULE LIFT
CONTROLS NO.1

AIT xxx ***

LOW LIFT ZS xxx ***

MODULE LIFTED ZS xxx ***

WIPER AT REST ZS xxx ***

WIPER AT END ZS xxx ***

UV INT AE xxx ***

HIGH LIFT ZS xxx ***

FIELD

M

INLET BAFFLE PLATE

MODULE LIFT DEVICE

40-G-11-FEF
UV CHANNEL NO.1
INLET GATE
***

40-UV-1A
UV CHANNEL NO.1
UV BANK A
***

40-UV-1B
UV CHANNEL NO.1
UV BANK B
***

40-UV-1C
UV CHANNEL NO.1
UV BANK C
***

4" D

40N06 A

REV	DATE	BY	DESCRIPTION
			30% DESIGN SUBMITTAL NOT FOR CONSTRUCTION

DESIGNED TB
DRAWN BEI
CHECKED xxx
DATE JANUARY 2023

REGISTERED PROFESSIONAL ENGINEER TODD A. BEECHER E014712 Exp. 6/30/23 ELECTRICAL STATE OF CALIFORNIA

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PACIFICA UV DISINFECTION SYSTEM REPLACEMENT

INSTRUMENTATION

P&ID: UV CHANNEL NO.1 - WEDECO (1 OF 2)

VERIFY SCALES
BAR IS ONE INCH ON ORIGINAL DRAWING
0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

JOB NO. 201447
DRAWING NO. 40N05
SHEET NO.
OF

PROJECT NO. 201447 FILE NAME: 201447_40N05.dwg

PLOT DATE: 2/16/2023 5:35:47 AM
USER: BEI
PAGE SETUP: ---- PLOT SCALE:1:2 COLOR TABLE:CAROLLO_STD_H_V0905.CTB
LAST SAVED BY: tbeecher

NOTES:

1. INDICATED SYSTEM CONFIGURATION IS BASED UPON SYSTEM SUPPLY FROM WEDECO, A XYLEM BRAND

LEGEND:

*** FURNISHED BY UV SYSTEM SUPPLIER

40-MCP-01/PLANT SCADA

VCP

40-MCP-01 ***
UV SYSTEM
MASTER CONTROL PANEL

ETHERNET TCP/IP

40-PDC-12 ***
UV CHANNEL NO.1
POWER DISTRIBUTION CENTER NO.2

480V

40-EWC-12
UV CHANNEL NO.1
ELECTRIC WIPE
CONTROLS NO.2 ***

40-MLC-12 ***
UV CHANNEL NO.1
MODULE LIFT
CONTROLS NO.2

AIT XXX ***

LOW LIFT
ZS XXX ***

MODULE LIFTED
WIPER AT REST
WIPER AT END
UV INT
HIGH LIFT
ZS XXX ***
AE XXX ***

FIELD

MODULE LIFT DEVICE

MODULE LIFT DEVICE (FUTURE)

M

40-UV-1D
UV CHANNEL NO.1
UV BANK D
***

40-UV-1E
UV CHANNEL NO.1
UV BANK E
***

40-UV-1F
UV CHANNEL NO.1
UV BANK F
***

40-UV-1G
UV CHANNEL NO.1
FUTURE UV BANK G

40-G-12-FE
UV CHANNEL NO.1
OUTLET WEIR GATE
***

4" D

A 40N05

TO
PLANT DRAIN

REV	DATE	BY	DESCRIPTION
			30% DESIGN SUBMITTAL NOT FOR CONSTRUCTION

DESIGNED TB
DRAWN BEI
CHECKED xxx
DATE JANUARY 2023

REGISTERED PROFESSIONAL ENGINEER
TODD A. BEECHER
E014712
Exp. 6/30/23
ELECTRICAL
STATE OF CALIFORNIA

Beecher Engineering, Inc.

carollo

CITY OF PACIFICA

CITY OF PACIFICA

PACIFICA UV DISINFECTION SYSTEM REPLACEMENT

INSTRUMENTATION

P&ID: UV CHANNEL NO.1 - WEDECO (2 OF 2)

VERIFY SCALES
BAR IS ONE INCH ON ORIGINAL DRAWING
0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

JOB NO. 201447
DRAWING NO. 40N06
SHEET NO.
OF

PROJECT NO. 201447 FILE NAME: 201447_40N06.dwg

PLOT DATE: 2/16/2023 5:36:10 AM
USER: BEI
COLOR TABLE:CAROLLO_STD_H_V0905.CTB
PLOT SCALE:1:2
PAGE SETUP: ---
LAST SAVED BY: tbeecher

NOTES:

1. INDICATED SYSTEM CONFIGURATION IS BASED UPON SYSTEM SUPPLY FROM WEDECO, A XYLEM BRAND

LEGEND:

*** FURNISHED BY UV SYSTEM SUPPLIER

40-MCP-01/PLANT SCADA

VCP

40-MCP-01 ***
UV SYSTEM
MASTER CONTROL PANEL

ETHERNET TCP/IP

40-PDC-21 ***
UV CHANNEL NO.2
POWER DISTRIBUTION CENTER NO.1

480V

40-EWC-21
UV CHANNEL NO.2
ELECTRIC WIPE
CONTROLS NO.1 ***

40-MLC-21 ***
UV CHANNEL NO.2
MODULE LIFT
CONTROLS NO.1

AIT xxx ***
ZS xxx ***
LOW LIFT

ZS xxx ***
MODULE LIFTED

ZS xxx ***
WIPER AT REST

ZS xxx ***
WIPER AT END

AE xxx ***
UV INT

ZS xxx ***
HIGH LIFT

FIELD

M

INLET BAFFLE PLATE

MODULE LIFT DEVICE

40-G-21-FEF
UV CHANNEL NO.2
INLET GATE
***

40-UV-2A
UV CHANNEL NO.2
UV BANK A
***

40-UV-2B
UV CHANNEL NO.2
UV BANK B
***

40-UV-2C
UV CHANNEL NO.2
UV BANK C
***

4" D

40N08 (B)

REV	DATE	BY	DESCRIPTION
			30% DESIGN SUBMITTAL NOT FOR CONSTRUCTION

DESIGNED TB
DRAWN BEI
CHECKED xxx
DATE JANUARY 2023

REGISTERED PROFESSIONAL ENGINEER
TODD A. BEECHER
E014712
Exp. 6/30/23
ELECTRICAL
STATE OF CALIFORNIA

Beecher Engineering, Inc.

carollo

CITY OF PACIFICA

CITY OF PACIFICA

PACIFICA UV DISINFECTION SYSTEM REPLACEMENT

INSTRUMENTATION

P&ID: UV CHANNEL NO.2 - WEDECO (1 OF 2)

VERIFY SCALES
BAR IS ONE INCH ON ORIGINAL DRAWING
0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

JOB NO. 201447
DRAWING NO. 40N07
SHEET NO.
OF

PROJECT NO. 201447 FILE NAME: 201447_40N07.dwg

PLOT DATE: 2/16/2023 5:36:28 AM
USER: BEI
COLOR TABLE:CAROLLO_STD_H_V0905.CTB
PLOT SCALE:1:2
PAGE SETUP: ----
LAST SAVED BY: tbeecher

NOTES:

1. INDICATED SYSTEM CONFIGURATION IS BASED UPON SYSTEM SUPPLY FROM WEDECO, A XYLEM BRAND

LEGEND:

*** FURNISHED BY UV SYSTEM SUPPLIER

40-MCP-01/PLANT SCADA

VCP

120V

40-MCP-01 ***
UV SYSTEM
MASTER CONTROL PANEL

ETHERNET TCP/IP

480V

40-PDC-22 ***
UV CHANNEL NO.2
POWER DISTRIBUTION CENTER NO.2

40-EWC-22
UV CHANNEL NO.2
ELECTRIC WIPE
CONTROLS NO.2 ***

40-MLC-22 ***
UV CHANNEL NO.2
MODULE LIFT
CONTROLS NO.2

AIT XXX ***
LOW LIFT ZS XXX ***

MODULE LIFTED ZS XXX ***
WIPER AT REST ZS XXX ***
WIPER AT END ZS XXX ***
UV INT AE XXX ***
HIGH LIFT ZS XXX ***

FIELD

MODULE LIFT DEVICE
MODULE LIFT DEVICE (FUTURE)

M

40-UV-2D
UV CHANNEL NO.2
UV BANK D
***

40-UV-2E
UV CHANNEL NO.2
UV BANK E
***

40-UV-2F
UV CHANNEL NO.2
UV BANK F
***

40-UV-2G
UV CHANNEL NO.2
FUTURE UV BANK G

40-G-22-FE
UV CHANNEL NO.2
OUTLET WEIR GATE
***

4" D

(B) 40N07

TO PLANT DRAIN

REV	DATE	BY	DESCRIPTION
			30% DESIGN SUBMITTAL NOT FOR CONSTRUCTION

DESIGNED TB
DRAWN BEI
CHECKED xxx
DATE JANUARY 2023

REGISTERED PROFESSIONAL ENGINEER
TODD A. BEECHER
E014712
Exp. 6/30/23
ELECTRICAL
STATE OF CALIFORNIA

Beecher Engineering, Inc.

carollo

CITY OF PACIFICA

CITY OF PACIFICA

PACIFICA UV DISINFECTION SYSTEM REPLACEMENT

INSTRUMENTATION

P&ID: UV CHANNEL NO.2 - WEDECO (2 OF 2)

VERIFY SCALES
BAR IS ONE INCH ON ORIGINAL DRAWING
0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

JOB NO. 201447
DRAWING NO. 40N08
SHEET NO.
OF

PROJECT NO. 201447 FILE NAME: 201447_40N08.dwg

PLOT DATE: 2/16/2023 5:36:47 AM
USER: BEI
COLOR TABLE:CAROLLO_STD_H_V0905.CTB
PLOT SCALE:1:2
PAGE SETUP: ---
LAST SAVED BY: tbeecher

APPENDIX E

REMOVABLE PRECAST CONCRETE SLAB SHOP DRAWINGS

Sverdrup

Sverdrup Civil, Inc.
700 Coast Highway, Suite B
Pacifica, CA 94044

650 738 4660
FAX: 650 355 7256

City of Pacifica/Sverdrup Civil, Inc.
PROPOSED CHANGE ORDER (PCO) TABLE OF CONTENTS

Ref: City of Pacifica, Calera Creek Water Recycling Plant

PCO#: PCO 99

Subj: Precast Concrete Lids for Filter Building

Resolution: ☒ Resolved in Change Order Number 123
☐ Cancelled as of date: _____

TABULAR TABLE OF CONTENTS:

A. Correspondence

B. Authorization

C. Request for Proposal (RFP) to Contractor, requesting price, time estimate

D. Contractor's Response to RFP (estimate)

E. Construction Manager's Estimate

F. Record of Negotiation

G. Other Items: CO-123, T&M

Con#:98006423.SVC

WALSH

WALSH PACIFIC CONSTRUCTION
City of Pacifica/Sverdrup Civil, Inc.
CORRESPONDENCE FORM

Date: 4/24/98

To: Sverdrup Civil, Inc.
Perry Petersen
700 Coast Highway, Suite B
Pacifica, CA 94044

RECEIVED
APR 24 1998
By

From: Jeff Casey

Ref: City of Pacifica, Calera Creek Water Recycling Plant
Walsh Pacific Job 9698

Corr#: W-111

Subj: PCO # 99 Dimensions w/ regards to hatch.

Dear Perry:

We have had several conversations with the City on possible arrangements of monorail beams and hatches in the Roof Slab of the Filter Building and need confirmation on the following:

1. We have constructed the Lift Slab Blockout as depicted in the drawing associated with PCO #99.

2. The Upper Slab Hatch remaining is not moved per this PCO. Does the City desire this hatch to be located similar to the relocated hatch below it (see Sverdrup letter of 1/27/98, #S325). If so please confirm with a Sketch.

3. Locations of eye bolts can be installed per City direction at a future date once exact locations are known.

4. Monorail beams can be located per City direction at a future date once exact locations are known.

Please confer with the City and expedite a reply as the forming is well underway in this area.

Very Truly Yours,
Walsh Pacific Construction

Jeff Casey
Assistant Project Manager - Electrical / Instrumentation

cc: File 9698 1.3
Dublin/Read

Sverdrup Sverdrup Civil, Inc.
700 Coast Highway, Suite B
Pacifica, CA 94044

650 359-9777
FAX: 650 359-9778

City of Pacifica/Sverdrup Civil, Inc.
CORRESPONDENCE FORM

Date: May 11, 1998

To: Ron Probert
Walsh Pacific

From: Tom Buckman

Ref: City of Pacifica, Calera Creek Water Recycling Plant

Corr#: S366

Subj: PCO #99 Dimensions with Regards to Hatches
Response to Walsh letter W111

Dear Ron:

In response to your letter W111 requesting confirmation for information you received verbally from the City, the following is provided.

1. No comment

2. The City wants the upper and the lower hatches to line up. This information was provide in CDC #24.

3. The City wants the eye bolts left out. The City will install them at a later date.

4. The City wants the monorail to be centered on the lift points for the #3 and irrigation pumps.

If you have any questions, please contact me.

Sincerely,

T. Buckman

Tom Buckman
Resident Engineer

cc: Scott Holmes, Perry Petersen, Gary Rathunde

Con#:98006423.SVC

WALSH

WALSH PACIFIC CONSTRUCTION
City of Pacifica/Sverdrup Civil, Inc.
CORRESPONDENCE FORM

Date: 4/24/98

To: Sverdrup Civil, Inc.
Perry Petersen
700 Coast Highway, Suite B
Pacifica, CA 94044

RECEIVED
APR 24 1998
By

From: Jeff Casey

Ref: City of Pacifica, Calera Creek Water Recycling Plant
Walsh Pacific Job 9698

Corr#: W-111

Subj: PCO # 99 Dimensions w/ regards to hatch.

Dear Perry:

We have had several conversations with the City on possible arrangements of monorail beams and hatches in the Roof Slab of the Filter Building and need confirmation on the following:

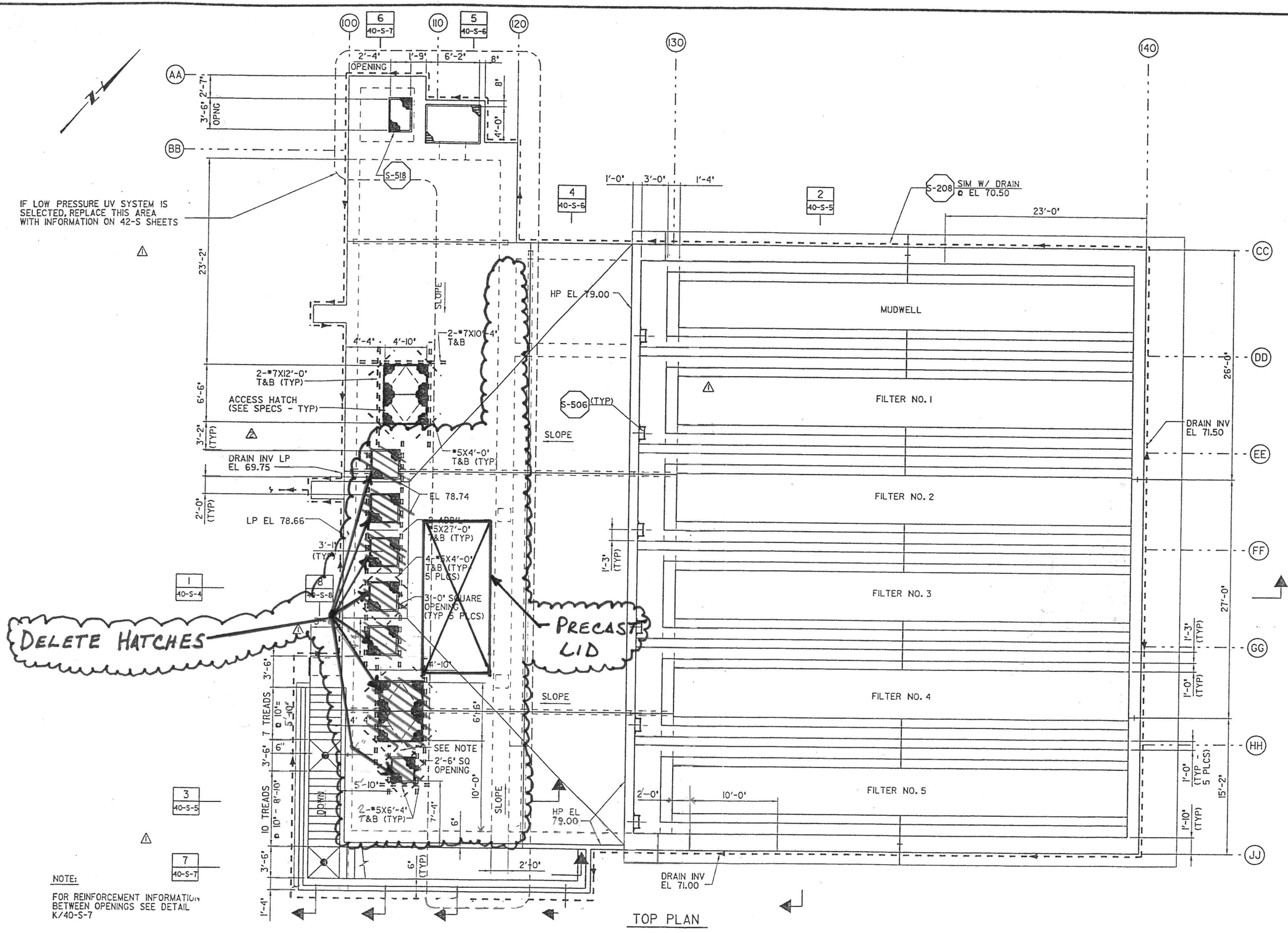
1. We have constructed the Lift Slab Blockout as depicted in the drawing associated with PCO #99.

2. The Upper Slab Hatch remaining is not moved per this PCO. Does the City desire this hatch to be located similar to the relocated hatch below it (see Sverdrup letter of 1/27/98, #S325). If so please confirm with a Sketch.
We want them to Line up
3. Locations of eye bolts can be installed per City direction at a future date once exact locations are known.
(Leave them out, the City will install them)
4. Monorail beams can be located per City direction at a future date once exact locations are known.
The monorail shall be centered on the lift points for the #3 and Irrigation Pumps
Please confer with the City and expedite a reply as the forming is well underway in this area.

Very Truly Yours,
Walsh Pacific Construction

Jeff Casey
Assistant Project Manager - Electrical / Instrumentation

cc: File 9698 1.3
Dublin/Read



TOP PLAN

REV	DATE	BY	DESCRIPTION
	9/96	JMS	CONFORMED DRAWING
2	8/7/96	JMS	ADDENDUM NO. 3
1	7/3/96	DMJ	STRUCTURAL MODIFICATION

SCALE: 3/8" = 1'-0"

WARNING 0 1/2 1 IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.

DESIGNED K. STACHL
DRAWN K. STACHL
CHECKED M. FORDHAM

SUBMITTED
PROJECT ENGINEER — C 043548 R. C. E. NO. — 5/17/96 DATE
MONTGOMERY WATSON — 30393 R. C. E. NO. — 5/17/96 DATE

MONTGOMERY WATSON
Walnut Creek, California

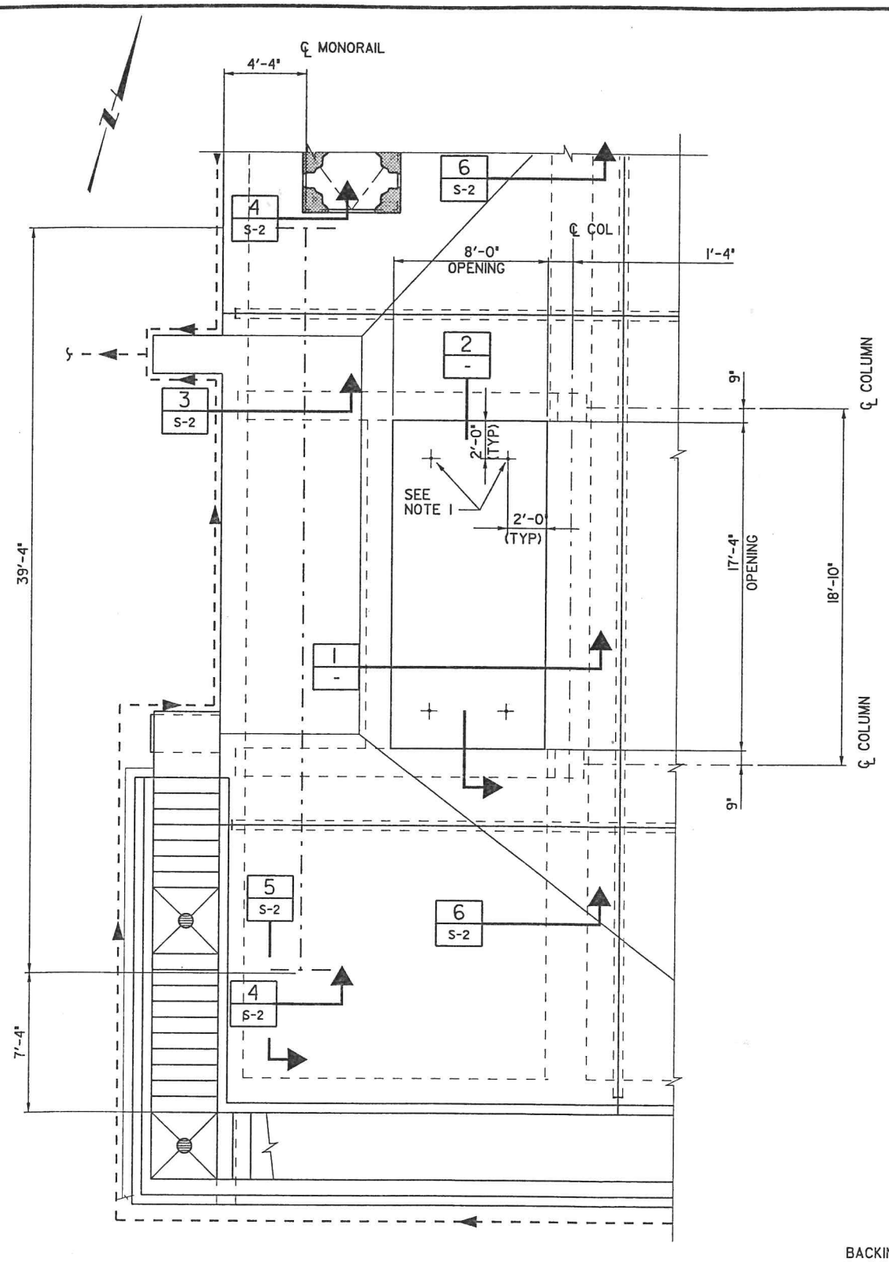
PCO#99-1

CITY OF PACIFICA
CALERA CREEK WATER RECYCLING PLANT
TERTIARY FILTER SYSTEM (TETRA OPTION)
TOP PLAN

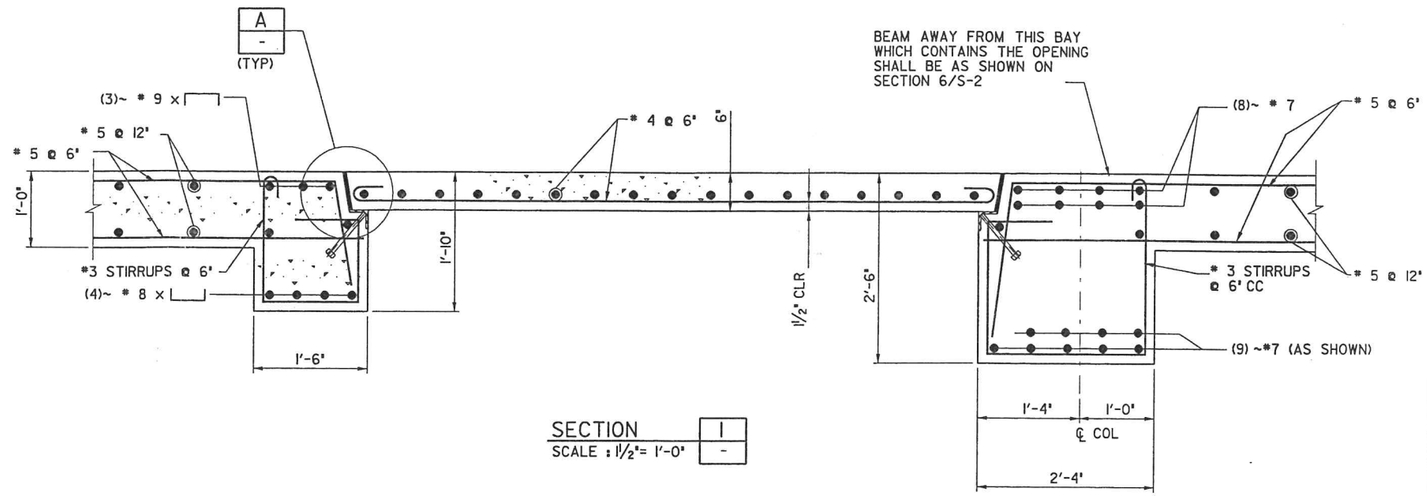
SHEET 40-S-3

REGISTERED PROFESSIONAL ENGINEER — JAMES M. STACHL — No. C 05581 — Exp. 6-30-96 — CIVIL — STATE OF CALIFORNIA

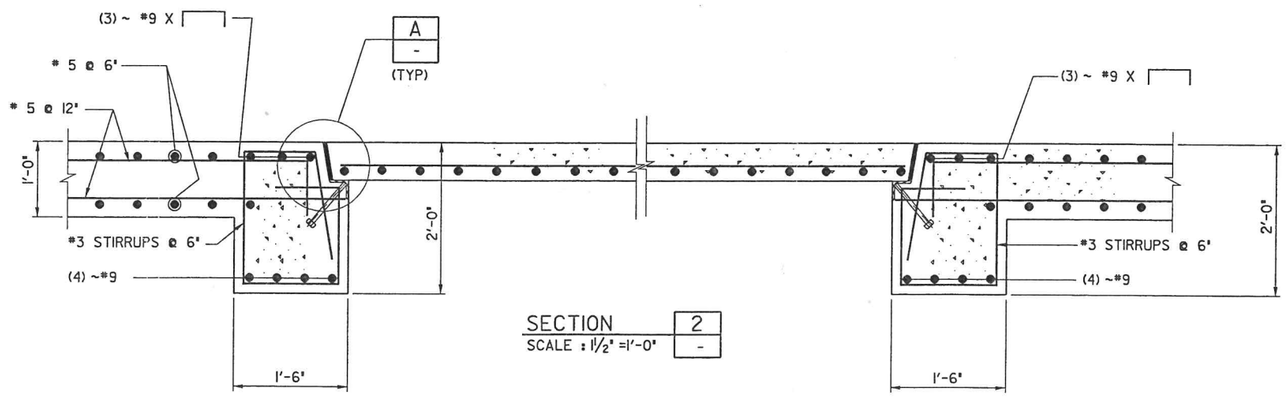
DATE: 20-SEP-1996
TIME: 08:27
FILE No. m:\pacifica\ccwrp\str\pcc40s03.dgn
username
JOB No.



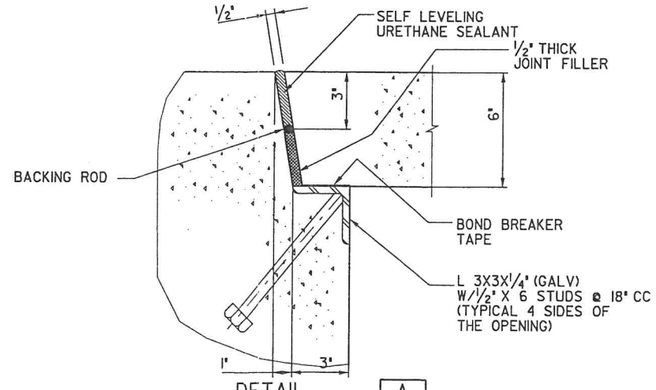
PLAN
SCALE : 1/4" -0"



SECTION 1
SCALE : 1½" = 1'-0" -



SECTION 2
SCALE : 1½" = 1'-0" -



DETAIL A
NO SCALE

NOTES:
1. THE REMOVABLE SLAB SHALL BE PROVIDED WITH (4)~ 1-INCH DIAMETER HOLES AS SHOWN FOR FUTURE LIFTING. HOLES SHALL BE PROVIDED WITH A NYLON PLUG TO SEAL IT FROM THE WEATHER.

REV	DATE	BY	DESCRIPTION

SCALE: AS NOTED

WARNING
0 1/2 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.

DESIGNED D. HOOLEY
DRAWN R. GARCIA
CHECKED K. MONROE

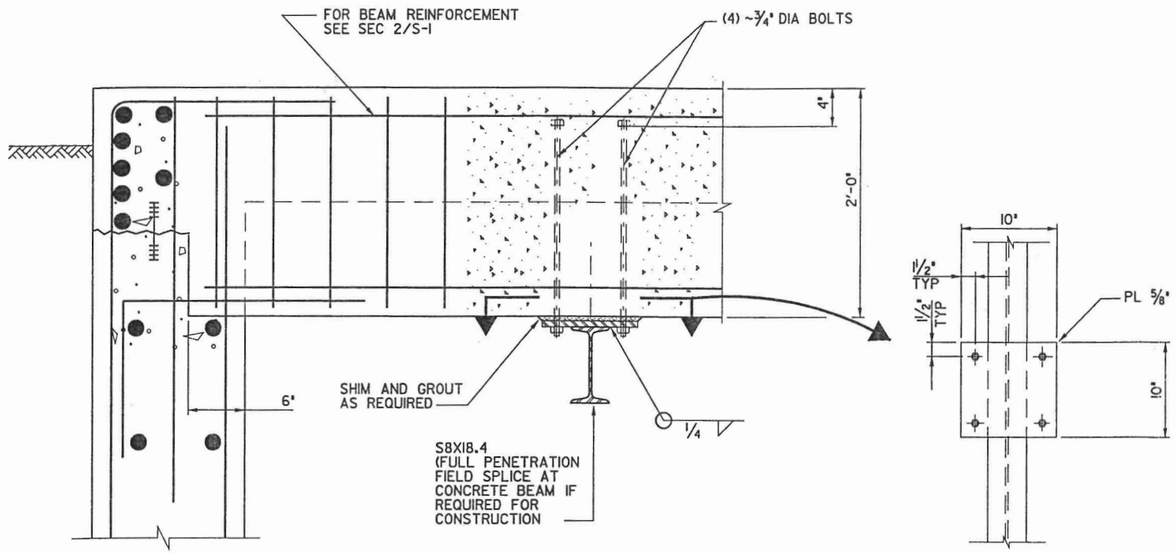
SUBMITTED
PROJECT ENGINEER R. C. E. NO. DATE
MONTGOMERY WATSON R. C. E. NO. DATE

MONTGOMERY WATSON
Walnut Creek, California

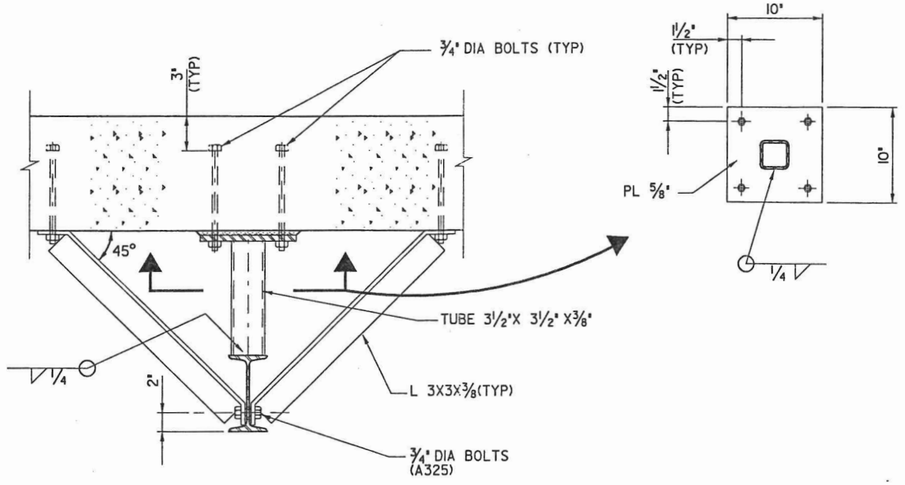
CITY OF PACIFICA
CALERA CREEK WATER RECYCLING PLANT
FILTER TOP SLAB MODIFICATION

SHEET S-1

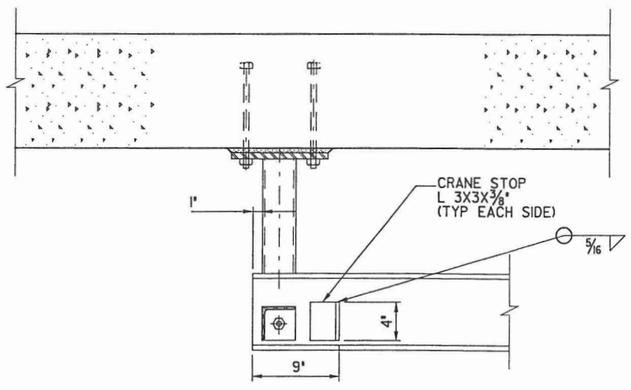
username
JOB No.
FILE No. $$$$$$$$$$$$$$$$directory/filename$$$$$$$$$$$$$$$$
TIME: 14:52
DATE: 27-FEB-1998



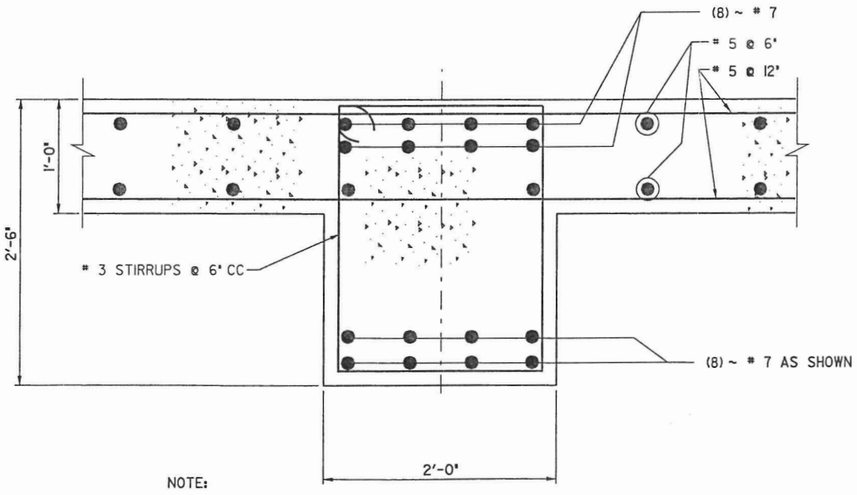
SECTION 3
SCALE : 1½" 1'-0" S-1



SECTION 4
SCALE : 1½" 1'-0" S-1



SECTION 5
SCALE : 1½" 1'-0" S-1



NOTE:

LAPS REQUIRED FOR THE #7 BARS SHALL BE AS FOLLOWS:
1) TOP BARS SHALL BE LAPPED AT BEAM MID-SPAN
2) BOTTOM BARS SHALL BE LAPPED AT THE COLUMN

SECTION 6
SCALE : 1½" 1'-0" S-1

REV	DATE	BY	DESCRIPTION

SCALE: AS SHOWN

WARNING 0 ½ 1 IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.

DESIGNED D. HOOLEY
DRAWN R. GARCIA
CHECKED K. MONROE

SUBMITTED
PROJECT ENGINEER R. C. E. NO. DATE
MONTGOMERY WATSON R. C. E. NO. DATE

MONTGOMERY WATSON
Walnut Creek, California

CITY OF PACIFICA
CALERA CREEK WATER RECYCLING PLANT
FILTER TOP SLAB MODIFICATIONS

SHEET S-2

DATE: 27-FEB-1998 TIME: 14:11 FILE No. $$$$$$$$$$$$$$$$$$directory\filename$$$$$$$$$$$$$$$$$$ username JOB No.

APPENDIX F

FACILITY PLANS WITH PHOTOS

BASIS OF ELEVATION:

ELEVATIONS ARE REFERENCED TO NAVD 29 AS DETERMINED LOCALLY BY PUBLISHED HT0462, WITH A NAVD 29 ELEVATION OF 67.94' FT.

BENCH MARK POINT IS A VERTICAL CONTROL DISK SET 1.05 MILES NORTH ALONG STATE HIGHWAY 1 FROM THE JUNCTION OF LINDA MAR BLVD AT PACIFICA, THENCE, .15 MILE SOUTHEAST ALONG ROCKAWAY BEACH AVE, AT THE JUNCTION OF BUEL AVE, 67.5 FEET SOUTHWEST OF THE CENTER LINE OF ROCKAWAY BEACH AVE, 23 FEET WEST OF THE CENTER LINE OF BUEL AVE, IN THE TOP AND 1.3 FEET NORTHEAST OF THE SOUTHWEST END OF THE SOUTHWEST CONCRETE WING WALL OF A CONCRETE BRIDGE OVER A CREEK, AND ABOUT .5 FOOT HIGHER THAN THE AVENUE.

BENCHMARK COORDINATES AND DATA SHEET:

N: 2049706.20'
E: 5984345.49'
EL: 67.94'

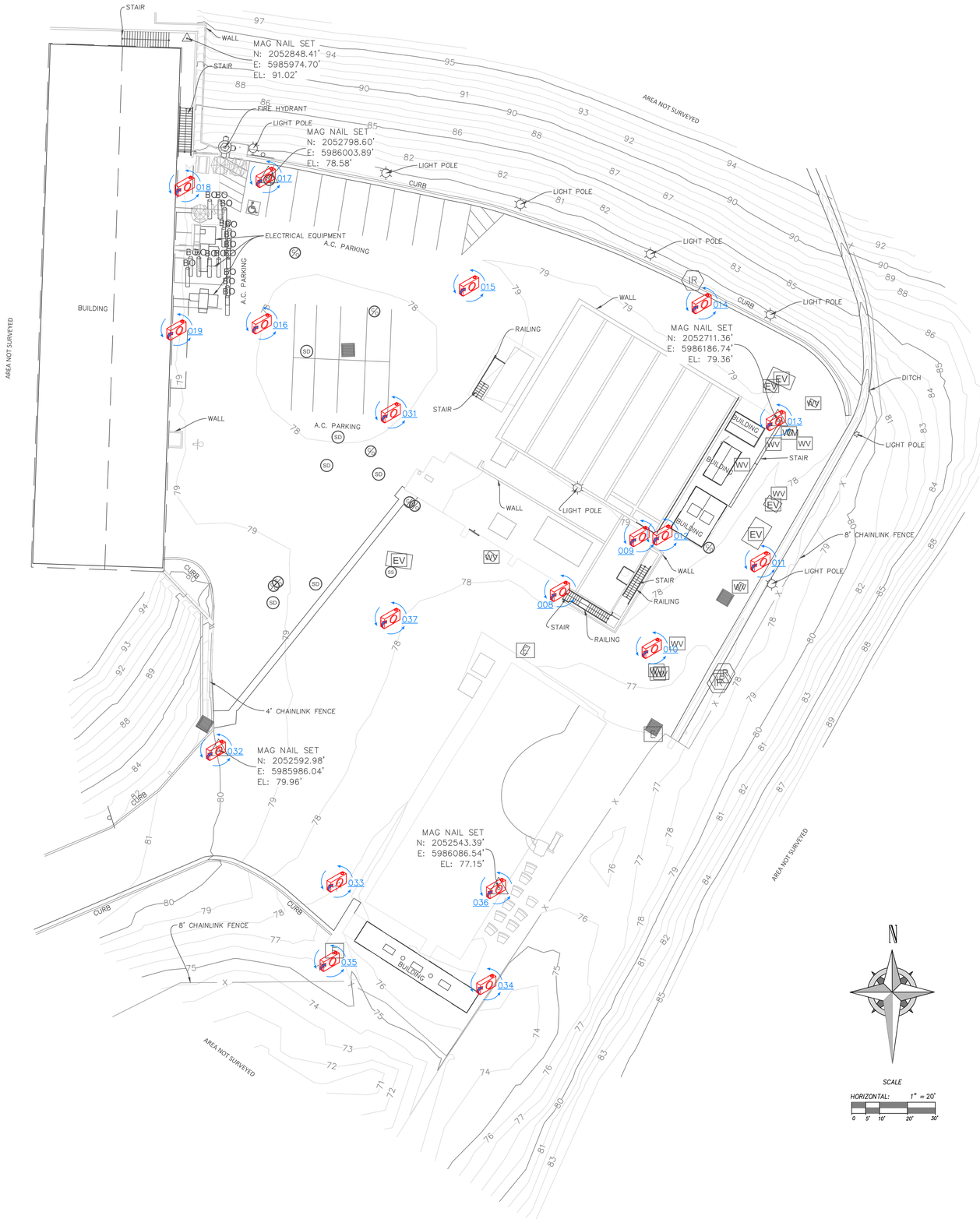
LINK TO MONUMENT DATA SHEET:

NOTES:

1. DISPLAYED CONTOURS ARE AT 1 FT INTERVALS
2. THE COORDINATES ARE REFERENCED TO CALIFORNIA STATE PLANE COORDINATE SYSTEM NORTH AMERICAN DATUM 1927 (NAD27), ZONE 3 WAS USED AS THE BASIS OF COORDINATES FOR THIS SURVEY.

LEGEND:

- PANORAMIC PHOTO LOCATION
- SEWER MANHOLE
- SEWER CLEANOUT
- IRRIGATION CONTROL BOX
- FIRE HYDRANT
- STORM DRAIN MANHOLE
- SIGN
- LIGHT POLE
- ELECTRICAL VAULT
- ELECTRICAL BOX
- WATER VAULT
- WATER METER
- STORM DRAIN DROP INLET BOX



PROJECT INFORMATION

CAROLLO - PACIFICA
2880 GATEWAY OAKS DR SUITE 300, SACRAMENTO, CA.
BOUNDARY SURVEY

REV.#	REVISION NOTES	DATE

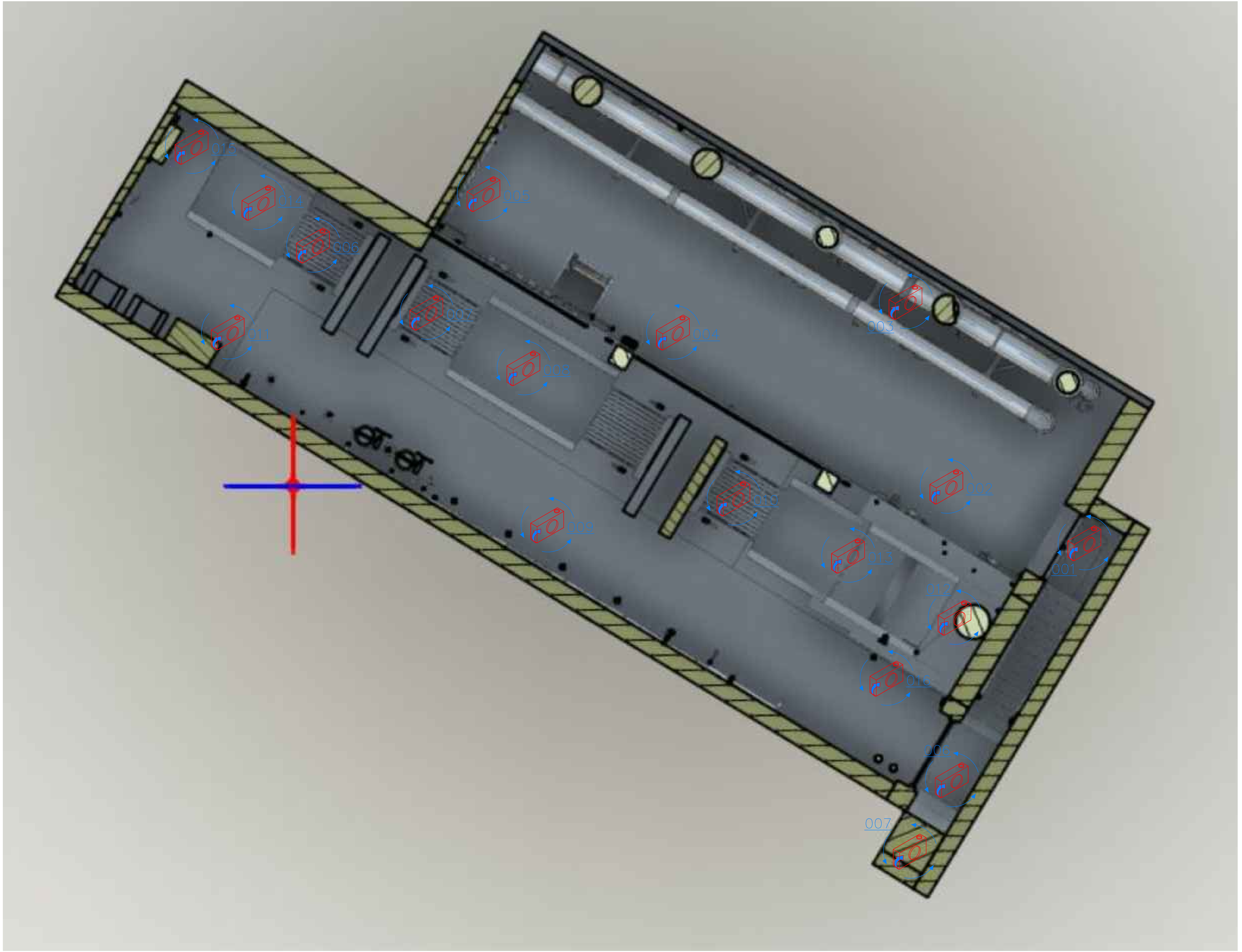
CLIENT INFO

VARA 3D
GEOSPATIAL SOLUTIONS
5693 S 675 E MURRAY, UT 84107
801-707-1012

PROJECT NO.	Sheet
22-CO-021	1
DATE: SEPTEMBER 2022	/
HORIZONTAL SCALE: 1" = 20'	1

0 0.5 1

SCALE MEASURES 1-INCH ON FULL SIZE(36x24) SHEETS
ADJUST ACCORDINGLY FOR REDUCED SIZE SHEETS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