

**GLASCO UV WILL PROVIDE A VCS-40-HO x 2 UV SYSTEM AS PER THE FOLLOWING:
November 17, 2017 - Updated
ULTRAVIOLET DISINFECTION EQUIPMENT**

PART 1 GENERAL

1.1 WORK INCLUDED

Glasco UV will supply a fully functional UV disinfection system with all required and specified components.

1. Two (2) Vertically oriented UV modules. Each module will have 40 low-pressure high output lamps. Module has UV monitoring system.
2. PLC will be capable of taking a 4-20mA flow signal and cycling modules.
3. Fixed level control weir
4. Spare parts
5. Start up testing, personnel training
6. Automatic quartz cleaning

1.1.1 ENGINEER REVIEW

1. Each UV module weighs 320 lbs (See attached cut sheets for Hoists as a recommendation)
2. Electrical Schematics are attached. Ethernet in is not required but a flow meter signal is whether it is via an ethernet or a 4-20ma is required to run the UV system in Auto Mode. A Phone Line / Auto dialer is not provided as mentioned on the markups
3. The PDC/SCC requires 240V 1 Phase – 2 Wire, 30 AMP power. The air compressor can be powered by the PDC/SCC or via a dedicated 120V receptacle. If powered from the PDC/SCC this will be the responsibility of the contractor to make the connection. Glasco will provide a 10 amp breaker inside the panel to wire to.

1.2 PROJECT DESCRIPTION

The City of Thorne Bay will convert their existing chlorine contact chamber to a vertical UV disinfection system for disinfecting water as described in this document. The equipment, which will be supplied by Glasco UV, will be designed to work outdoors.

1.3 EQUIPMENT QUOTE PROPOSAL (as already submitted).

An in depth proposal has already been provided to the City. This accepted proposal is the basis of this submittal.

1.4 SYSTEM DESIGN CRITERIA:

Flow Type:	Open Channel
UV Style:	Vertical
Installation location:	Outdoors
Number of units:	2 (1 duty, 1 redundant)
Channel width:	24"
Channel depth:	Existing

Facility design peak: 0.420 mgd
Facility design avg: 0.140 MGD
TSS: <30 mg/l
BOD: <30 mg/l
UV Transmittance: 65%
Fecal coliform: 200/100 ml average
800/100 ml max day
Water temperature: 8 to 20 C
Air temperature min: -4F
Air temperature max: 90F

2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. General

The UV disinfecting system will be furnished complete with low pressure high output vertical UV modules, stainless steel mounting brackets, power distribution center, automatic level controller, UV intensity monitoring system and automatic wiping system.

An Allen Bradley PLC will be provided to perform flow pacing in relation to a 4- 20mA plant flow signal.

- B. Glasco UV will provide all the specified equipment.
- C. Glasco UV has been manufacturing this system for 15 years.
- D. UV system will be vertical in a uniform staggered array.
- E. System has been designed to treat a peak flow of .42 MGD as described in this document.
- F. The system will be retro-fitted into an existing chlorine contact chamber.
- G. All metal components not in contact with plant effluent and/or UV light will be Type 304L SS.
- H. All wiring that is exposed to UV will be coated in Teflon.
- I. All metal components exposed to or in contact with plant effluent, including all anchoring hardware, will be Type 304L or 316L SS. All materials exposed to UV light shall be unaffected by prolonged exposed to same and shall be Type 304L or 316L SS, Type 214 quartz, Viton, EPDM or Teflon.
- J. All welded metal in contact with the effluent will be type 316 stainless steel.
- K. The UV system will be able to continuously provide disinfection while replacing UV lamps, quartz sleeves, and ballasts and while cleaning the UV lamp sleeves.

2.2 SYSTEM PERFORMANCE

- A. The UV dosage provided will be 50 mJ with a 65% UV transmittance at end of lamp life with fouling.
- B. The system has been based on the following calculations as outlined in the US EPA UV Design Manual (EPA/635/1-86-021).
 - 1. UV Transmission: 65% UVT
 - 2. UV end of lamp life: 90%
 - 3. Quartz fouling: 0.90
- C. The retention time is not less than 0.9 time the theoretical retention.

2.3 UV LAMPS

A. Glasco will provide low-pressure high output (GHO36T5L style) lamps for this project.

The UV lamps being provided have the following characteristics:

1. 90% of the UV emission will be in the 254 nm range.
2. The minimum UV intensity will be 370 microwatts per square cm at a distance of 1 meter.
3. Maximum power consumption on the 85-watt lamps.
4. The UV lamps have a rated UV output of 27.0 UVC watts.
5. The UV lamps have an arc length of 29", which will be submerged to insure proper disinfection.
6. Lamp life is 13,000 hours.
7. The UV lamp bases will be constructed of metal and ceramic, which are resistant to UV light and ozone.

B. UV LAMP GUARANTEE:

1. UV supplier warrants that after 13,000 hours of operation the average UV lamp output will be no less than 90% of a new lamp (after 100 hours initial burn-in).
2. The number of UV lamps required will be as determined sufficient by the UV manufacturer to meet the required disinfection standard and the minimum UV dosage specified.
3. The UV lamps will be warranted for 13,000 hours of useful life and the warranty is to be pro-rated against actual lamp use.

2.4 UV LAMP SLEEVES

- A. Sleeves will be clear fused quartz circular tubing as by GE Type 214. Sleeves will be rated for transmittance of 94 percent or more and sleeve will not be subject to solarization over its life.
- B. One end of each sleeve will be closed and the other end sealed by a lamp end seal and compressed O-ring. The closed end of the sleeve will be held in place by means of a retaining O-ring. The sleeve will not come in contact with any steel in the frame.

The size of the quartz material will be 25 mm x 28 mm.

2.5 UV LAMP MODULE

- A. The UV module shall be fitted in a vertical position within the effluent flow channel.
- B. Each UV module consists of forty (40) lamps with each lamp placed in their individual quartz sleeve. In the event that a quartz sleeve breaks no other lamps will be exposed to the effluent.
- C. Each module is constructed from Type 316 stainless steel and with a modified NEMA 4X rating. The module is electropolished.
- D. Modules are constructed in a manner not to allow UV light to radiate above the

channel when the lamp modules are energized and fully immersed in the effluent. Modules shall be designed such that operating personnel at the plant can change the lamps and quartz sleeves with other modules in the channel still operating.

- E. The modules shall be directly wired to the power center in a UL watertight flexible conduit. Each channel shall require stainless steel wireways as provided by the UV manufacturer.
- F. The modules will be removed by lifting out of channel by hoist as supplied by others.
- G. The sleeve nut does not require special tools for removal.
- H. Automatic Cleaning System has been provided.
- I. All lamp connections will be made by Glasco UV and tested.
- J. Ballast Cooling System
 - 1. The UV module has been designed to be used in an outdoor environment. Ballasts will be cooled by a closed loop cooling system.

2.6 UV INTENSISTY SENSOR

- A. Each module will have one (1) UV intensity sensor.
- B. The sensor will be enclosed in a watertight stainless steel probe that will be placed into its own Quartz sleeve and cleaned.
- C. The UV sensor is enclosed in its own sleeve.
- D. Sensor is able to be removed without system shut down to inspect.
- E. The sensor will be solar blind and shall measure only the germicidal spectrum wavelength (254 nm).
- F. The UV intensity shall be displayed in the UV module window kit through a digital meter with a 0 to 100% output reading.

2.7 AUTOMATIC CLEANING SYSTEM

- A. An automatic quartz cleaning system has been integrated. Glasco will provide an air compressor to actuate the automatic cleaning system.
- B. Module does not need to be removed for maintenance.
- C. The UV wiping system is fully functional and allows for disinfection. All lamps are on during the cleaning process.
- D. Cleaning cycles are user definable and allow for the selection of when to clean and then for how long to clean.
- E. The UV wiper integrates EPDM wiper material. This is in contact with the sleeves. No metal is in contact with the sleeves.

- F. Cleaning controls are capable of being remotely actuated.
- G. UV system has been provided with a pneumatic cleaning system. Air compressor shall be sized for a minimum air flow of 5 cfm @ 40 psi.
- H. Air compressor will be independently powered by the customer.
 - 1. Control of the air compressor will be via pressure switch mounted on the air receiver.
 - 2. Air outlet will be ¼" FNPT.
 - 3. Air compressor will be v-belt driven.
 - 4. Accessories
 - a) Air Receiver
 - i Air receiver will be 13 gallon, cast iron construction.
 - 5. Motor
 - a) Motor will be 2 HP, 120 VAC, 50/60hz, 1ph – 15 amps
 - 6. The air compressor discharge piping shall include:
 - a) ASME safety valve
 - b) Festo Filter/Regulator
 - c) Norgren Excelon 74 Desiccant Compressed Air Dryer

2.8 Level Control Weir

- A. Glasco will provide a level control weir to be manufactured from Type 304 stainless steel.
- B. The effluent water level shall be maintained at 29.5" (+/- 1.5") and will be installed in the discharge end of the channel.

2.9 ELECTRICAL

- A. The UV disinfection system will be divided into electrical sub-systems. There will be two (2) UV disinfection modules. Each module is capable of 100% of the flow. Therefore, there is 100% redundancy.
- B. All electrical panels are 304L stainless steel modified NEMA 4x for outdoor use.
- C. The modules will connect to the remote Power Distribution Center in pre wire and pre conduited cables.
- D. All terminations between the UV equipment and modules will be as done by Glasco. Contractor will be responsible for brining protected power to the Power Distribution Center.
- E. All critical components have been designed for the elements.

2.10 POWER DISTRIBUTION CENTER (PDC)

- A. The Power Distribution Center (PDC) has sealed receptacles, which allow for the connection of cables to the UV modules.
- B. The PDC will be a NEMA 4x modified enclosure as shown on the attached drawings.
- C. The Power Distribution Center will be NEMA 4x – 304L enclosure by Hoffman.

2.11 INSTRUMENTATION AND CONTROLS:

A. System Control Center (SCC)

- 1. One Power Distribution Center (PDC) complete with System Control Center (SCC) PLC and HMI will be provided. The floor mounted PDC is a NEMA 4X and will be conveniently located as shown on the drawings. The minimum size of the PDC is 60 inches in height, 36 inches width, and 12 inches depth.
 - 2. The SCC will gather data form the modules, control lamps and distribute information to the plant operators. The PDC SCC will have the following:
 - a. One (1) HOA per module
 - b. Circuit breakers per module
 - c. Allen Bradley MicroLogix 1400 PLC
 - d. Rohtek touch screen operator user inteface
 - 3. The SCC will display the following:
 - a. Module (on/off status)
 - b. UV intensity
 - c. Module temperature status
 - 4. The SCC will provide volt free contacts for remote monitoring. The auto dialer being used in the Sensaphone Express II.
 - The dialer shall be capable of storing a minimum of eight (8) telephone, pager, or cell phone numbers.
 - Dialer shall be capable of conveying a minimum of four (4) prerecorded messages - indicating the specific system failure.
 - Automatically redials for busy or unanswered numbers.
 - Remote turn off feature allows termination of activated channel.
 - EEPROM memory retains program despite power loss.
 - Listen in verification allows two way voice communication.
 - Provide with necessary power supply.
 - Dialer is provided with Built in line seizure.
- A. UV major alarm - this alarm shall be triggered if any one (1) of the following conditions occur:
- i. UV intensity low low
 - ii. UV module high temperature
 - iii. High lamp hours
 - iv. UV module failure
- B. UV minor alarm - this alarm shall be triggered if any one (1) of the following conditions occur:
- i. UV intensity low

ii. Either module is switched to Manual Off

5. In the event of failure, the redundant module will be automatically powered on.

2.12 MANUALS

A. Glasco UV will provide 4 detailed operation and maintenance data for each component of the system. The instructions manual shall include:

1. Safety Precautions
2. Protective Equipment and Clothing
3. Technical Data, including detailed descriptions of SYSTEM operation, and each component.
4. Installation data, procedures and recommendations
5. Operation instructions, including startup and shutdown procedures and sequence.
6. Service and Maintenance data, include all information and instructions required by plant personnel to keep equipment properly cleaned, lubricated and adjusted so that it functions economically throughout its full design life.
7. Illustrations or drawings.
8. Project Parts List.
9. Name, address and phone number of manufacturer and manufacturer's local service representative.

2.13 SPARE PARTS AND SAFETY EQUIPMENT

- | | |
|------------------|---|
| 1. Lamps | 8 |
| 2. Sleeves | 8 |
| 3. Ballasts | 4 |
| 4. Wiper seals | 8 |
| 5. Wiper rings | 8 |
| 6. Operators kit | 1 |

3 EXECUTION

3.1 SHIPPING AND EQUIPMENT DELIVERY

A. All equipment and materials shall be inspected against approved Shop Drawings at time of delivery. Equipment and materials damaged or not meeting requirements of the approved Shop Drawings shall be immediately returned to GLASCO for replacement or repair.

B. The CONTRACTOR will handle and store the equipment and materials in a dry location and protect them from the elements according to the manufacturer's instructions

3.2 COMMISSIONING AND START UP

A. Glasco UV will inspect equipment installation, piping and wiring to ensure proper installation of each component in accordance with approved submittals. CONTRACTOR shall make at its own cost any modifications required to meet GLASCO's installation recommendations. A written statement certifying that the equipment has been properly installed and interconnected shall be provided by GLASCO.

B. Glasco UV will coordinate commissioning of the system and verify that each component of the UV System is ready for operation. UV System commissioning will include testing and calibration of each component of the system. A written statement certifying that the UV System has been commissioned and is ready for operation shall be provided.

C. Glasco UV will coordinate initial UV System start-up to ensure operating procedures are followed in accordance with approved submittal's instructions manuals.

D. Glasco UV will provide start up.

3.3 TRAINING

A. Glasco UV will provide operator training at the site for a period no less than one (1) 8-hr day. Training will include operation, maintenance and trouble shooting for each component of the UV System.

3.4 WARRANTY

A. The UV System will be free from defects in materials and workmanship for a period of 24 months from Final Acceptance of the system.

B. Lamps will be warranted for a period of 13,000 hours operating time under normal operating conditions.

1. The lamp warranty will cover the full replacement cost for the first 1,000 hrs of operation.

2. The lamp warranty will cover the lamp replacement cost on a prorated basis after 1,000 hrs operation.

END