

GENERAL UV SPECIFICATION – AQUATICS

GENERAL

Ultraviolet Disinfection Equipment shall operate within the UVC electromagnetic spectrum emitting wavelengths in the range of 200nm to 400nm. These required wavelengths will provide constant disinfection/inactivation of bacteria, algae, molds, viruses and destruction of Monochloramines, Trichloramines, and Dichloramines. Ultraviolet Lamp/Chamber and Spectra Control Panel by Neptune Benson | Xylem. Any deviation/exception must be provided in writing to and approved by the designer no later than 10 days prior to the bid date.

The UV Equipment shall have a MET or equivalent (ETL, CSA, or UL) listing, be NSF-50 2016 certified and listed to NSF/ANSI/CAN 50 for Secondary Disinfection.

Equipment General Description

The Ultraviolet Equipment shall be provided in a complete package to include a Stainless-Steel Chamber, Spectra Control System located in a NEMA 12 (IP52) rated panel, Medium Pressure Bulb(s) designed to emit wavelengths within the UVC electromagnetic spectrum, automatic wiper system, stainless steel pipe shields for PVC pipe UV protection, and equipment commissioning by a Factory Certified ETS-UV Ultraviolet Technician.

UNIT TYPES – Wafer (WF) Units

Ultraviolet manufacturer to offer unit capability of a horizontal OR vertical installation application using state of art design and direct flow through characteristics. Unit shall be a medium pressure system with a flow rating of ____ US GPM @ 94% UVT. Any systems validated or designed for flows based above 94% UVT are not acceptable.

Ultraviolet systems shall be sized to deliver a minimum UV dose of 60 mJ/cm² at End of Lamp Life (EOLL), assuming 9,000 hours of operation, while treating the full design recirculation flow rate.

Published and submitted flow rates shall be based on a maximum design UV transmittance (UVT) of 94% at 254 nm in accordance with Model Aquatic Health Code (MAHC) guidance.

Systems sized, quoted, or validated at doses below 60 mJ/cm², at end-of-lamp-life conditions, or at UVT values exceeding 94% shall not be acceptable.

Chamber and Control Cabinet shall be as indicated on the drawings.

ULTRAVIOLET LAMP

Ultraviolet lamp shall be medium pressure high intensity. Each lamp shall be designed to emit continuous Ultraviolet wavelengths in the range of 200nm to 400nm. This will provide optimal disinfection benefits and destruction of the Monochloramine, Dichloramine, and Trichloramine compounds. The lamp(s) must remain unaffected by temperature variance of 0 degrees F (-17C) to 200 degrees Fahrenheit (93 degrees Celsius).

The lamp system must provide a constant calculated dose of not less than 60 mJ/cm² for aquatic applications measured and maintained at End of Lamp Life, and this must be based on constantly treating the full recirculating flow rate, not on a side stream treatment.

The system must be equipped with infinitely variable power control of the lamp intensity & dose. Power stepping not acceptable. The lamps shall be capable of turndown to 30% of the nominal rated power.

The lamp shall be connected via means of a plug connector and shall have a mechanical interlock to prevent lamp removal when lit for safety reasons.

UV REACTOR

The unit shall be constructed of 316L stainless steel electropolished and passivated to prevent corrosion within the harsh pool environment.

The Ultraviolet chamber shall come complete with the following equipment:

- Ultraviolet intensity monitor shall be factory calibrated to provide intensity in W/m². The NSF50 standard for Secondary Disinfection does not allow use of relative, inferred, or percentage-based output monitoring methods which shall not be acceptable
- Built-in alarm system to notify operator when output level drops below required level of 60 mJ/cm².

Calculated UV dose shall be continuously derived from real-time or peak fixed flow rate, measured UV intensity, and validated reactor dose-response models, and displayed in mJ/cm².

UV Reactor will be a validated system with third party testing to a recognized international standard such as the USEPA DGM.

Ultraviolet temperature monitoring system shall be provided to maintain system integrity in the event of flow interruptions to the chamber.

Ultraviolet chamber shall come complete with annealed quartz sleeve with "O" ring seals for water tightness. System shall be complete with advanced seal arrangement to reduce risk of quartz over-compression on the seal face.

PVC PIPE UV PROTECTION

Where Schedule 80 PVC or other thermoplastic piping materials are installed upstream or downstream of the UV reactor, the UV system manufacturer shall provide factory-engineered stainless-steel pipe shields to prevent long-term degradation to the adjacent piping connections caused by UV-C radiation.

Pipe shields shall be installed immediately upstream and downstream of the reactor in the region where reflected and refracted UV energy is most concentrated.

Pipe shields shall insert directly into standard PVC pipe or fittings, match the nominal pipe diameter, and shall not require extended straight pipe runs or changes in piping material.

Field-applied coatings, reliance on distance alone, or substitution of alternate piping materials shall not be considered acceptable alternatives.

UV CONTROL SYSTEM - 1

Control cabinet shall be a SPECTRA III control unit and or pre-approved equal.

The delivered lamp power must infinitely variable between 30-100% based on real time interface with changes in UVT, Flow Rate or Combined Chloramines.

Modes of operation shall be password protected to secure system critical setup functions. Control system shall have clearly identifiable start, stop, and reset controls (suitable for gloved operation) with Running and Fault LCD indicators.

The display shall include the following:

- Ultraviolet calculated dose (derived from flow and intensity inputs)
- Ultraviolet intensity (as a % and W/m²)
- Lamp Power
- Flow rate
- Chamber temperature

- Operation hour meter
 - Fault indicators
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UV CONTROL SYSTEM – INTERFACES

The Control system shall have a minimum of the following system interface control: • Remote operation • Process interrupt features (from valves, flow meters)

- Low UV dose (configurable to shut down or alarm only)
- Flow meter input • Auto-Restrike
- Low to full power Ultraviolet setting with 24 hour/7 day settable timer
- Variable power/Dose pacing interface

Control system shall have built in data-logging capabilities to record the following information:

- Ultraviolet intensity required
- Ultraviolet intensity measured
- Lamp current
- Chamber temperature
- Flow rate (if flow meter is connected)
- Time and date stamp, all alarms generated.

Control system must be able to be interfaced with a Chemistry Controller that can measure Total or Combined Chloramines in order to maintain the proper dosage required during the life of the lamp • Control System must be able to interface with the Defender® filtration controller. • Control System must be capable of interfacing with a SCADA system including Modbus.

AUTOMATIC WIPER SYSTEM

An automatic cleaning system shall be provided for cleaning of quartz sleeve and Ultraviolet monitor probe. The system shall travel the entire length of the quartz sleeve twice per desired cleaning cycle. Precision molded wiper rings shall be provided to ensure thorough quartz tube cleaning and quartz tube protection. Wiper cycle shall be

user selectable and adjustable within a range of 1 minute to 24 hours depending on anticipated application and deposit build-up. At a minimum the Automatic Wiper system shall have the following characteristics:

- System shall utilize direct drive with square faced coupling and acme threaded shaft to prevent slippage and pin shearing. Systems utilizing shear pins or complicated gear boxes will be unacceptable.
- Wiper power supply shall be 24-volt DC for improved safety. Higher voltage not acceptable.
- System shall incorporate Direct Shaft Encoding for positional location. Systems relying on external limit switches or internally located magnets will be unacceptable.
- Wiper interval shall be operator selectable with optional override switch.
- Wiper faults are to be indicated on the control system display.
- Wiper System to utilize "Intelligent Operation" for automatic start-up commissioning.

Records wiper position at chamber ends. Position must be fixed and not dependent on a timed interval or component striking end of chamber.

Establish a travel run without using limit switches to ensure system integrity and longevity.

QUALITY ASSURANCE

UV reactor, control system, pipe shields, monitoring devices, and automatic cleaning systems shall be supplied, validated, and warranted by a single manufacturer.

The EQUIPMENT SUPPLIER shall have at least twenty (20) year experience providing medium pressure UV systems to the Aquatics market.

The EQUIPMENT SUPPLIER shall design, develop, manufacture and test the SYSTEM in a facility that is assessed and registered as conforming to the requirements of ISO 9001:2008 quality management system.

WARRANTY

A factory trained representative of the manufacturer shall perform all warranty work.

Manufacturer to warranty Ultraviolet chamber and Spectra Control panel for a period of 5 years (subject to any contractual maintenance requirements) excluding lamps, quartz and seals.

Medium pressure Ultraviolet bulbs shall be warranted for a period of 8,000 hours.

Intermittently operated lamps (≤ 1 on/off cycles per day) will be replaced free of charge should failure occur prior to 4,000 hours and replacement will be prorated between 4,000 and 8,000 hours.

Manufacturers must maintain spare or replacement parts in the USA for same day or no longer than next day delivery in North America, other areas based on expedited delivery available.

Annual Service Agreement from a qualified factory certified distributor shall be available to initiate the service in order to maintain the five-year warranty.

SUBSTITUTIONS

Any deviation/exception must be provided in writing to and approved by the designer no later than 10 days prior to the bid date.

Proposed substitutions shall demonstrate equivalency in all of the following areas:

- Minimum delivered UV dose of 60 mJ/cm² at End of Lamp Life
- Validation at $\leq 94\%$ UVT
- Absolute UV intensity monitoring (W/m²)
- Integrated PVC pipe UV protection measures
- Published NSF/ANSI 50 Secondary Disinfection certified flow ratings

Failure to meet any one requirement shall constitute grounds for rejection.

BASIS OF DESIGN

Basis of design shall be a Wafer® medium-pressure ultraviolet reactor sized for 60 mJ/cm² minimum UV dose at End of Lamp Life, validated to NSF/ANSI 50 for Secondary Disinfection and USEPA UVDGM standards, and equipped with stainless steel pipe shields to protect PVC piping from UV-C degradation.