DIVISION 23

SECTION 23 05 66

UVC Emitter Ultraviolet Disinfection

For IAQ: HVAC Mold, Bacteria Control

PART 1 GENERAL

1.01 RELATED WORK SPECIFIED IN OTHER SECTIONS:

A. Motor starters, disconnects, power wiring of HVAC equipment, variable frequency drives and UVC Emitters: Division 16.

1.02 QUALITY ASSURANCE:

A. **UL** Compliance: Comply with **UL** Standard **1995 5th** Edition as applicable to usage of UVC Emitters in HVAC Equipment.

B. ISO Certification: Fixtures must be manufactured in an **ISO 9001:2015** and **ISO 14001:2015** registered facility.

1.03 DELIVERY, STORAGE AND HANDLING:

A. Store UVC Emitters in a clean dry place and protect from weather and construction traffic. Handle UVC Emitters carefully to avoid damage to components, enclosures, and finish. Leave factory-shipping covers in place until installation and only when called for in the installation instructions. Do not install damaged components; replace and return damaged components to the equipment manufacturer.

B. Comply with manufacturer's installation instructions placement, wiring and testing.

PART 2 – PRODUCTS

2.01 UVC EMITTERS

A. GENERAL

1. Acceptable Manufacturers:

a. Steril-Aire, Inc. Model **DE**, **ESE**, **EGTS**, **RIK** or **KIT SERIES** as shown on Schedule or Drawings.

b. Substitutions: (10) day prior approval is required and is to include documentation by a recognized Industry Independent Testing Lab on UVC Emitter performances. Performance results must meet or exceed the performance

for Emitters in an HVAC environment as detailed in Paragraphs A, 2.b, Paragraph B, Item 2, and Paragraph C, Items 3, 4 and 5.

2. Quality Assurance:

   a. Qualifications: Each component and product is to be inbound and outbound tested before shipment in accordance with **ISO 9001:2015** test procedures and shall be produced in a **ISO 140001: 2015** approved facility.

   b. Output Verification: Independent Certified Testing shall indicate that when DE Emitter first installed total output per one inch arc length shall not be less than 9 $\mu W/cm^2$, and SE, EGTS 7.5$\mu W/cm^2$ at one meter, in a 400 fpm (2 meters/sec) airstream of 50 °F (10 °C).

   c. Intensity: Initial UVC Intensity on the coil face shall not be less than 1,225 $\mu W/cm^2$ and at end of manufactures tube warrantee period, or 9000 hours, whichever is longer, intensity on the extreme corners of the coil face must exceed 750$\mu W/cm^2$.

3. Warranty:

   a. Fixture and Emitter shall be 100% warranted to be free from factory defects for a period of one year. The Power Supplies shall be warranted for 3 years.

   b. The Coil shall be substantially free of Mold at the end of the manufacturer's Emitter warrantee period, or 9000 hours, whichever is longer.

B. DESIGN REQUIREMENT

1. Irradiation – UVC Emitters and fixtures are to be installed down stream of the coil horizontally across the full face of the coil in sufficient quantity and in such an arrangement to provide an equal distribution of UVC energy on the coil and in the drain pan. UVC Emitter lamps shall be installed horizontally across the full width of the face of the coil (i.e., perpendicular to the coil fins) to minimize the shadowing effect of the coil fins.

2. Intensity- Intensity shall be measured by a UVC Radiometer that is accurate to ± 3% radiometric and photometric for NIST transfer standards in the monochromatic irradiance at 254nm. The Radiometer shall have a full cosine response filter.

C. EQUIPMENT

1. Units shall be high output, HVAC-type, germicidal UVC light sources, factory assembled and tested. Components shall include a housing, reflector if specified, high efficiency electronic power source, Emitter sockets and Emitter tube, all constructed to withstand HVAC environments.

2. Units having electrical connectors on both ends to simplify gang wiring and wiring to power shall include mounting holes to assist in securing the fixtures.DE reflectors shall be constructed of high spectral finished aluminum alloy with a minimum 85% reflectance of 254 nm UVC energy.

3. High efficiency electronic power supplies shall be a Class P2 with a power factor greater than 0.98 and a power conversion of greater than 90%. The power supply design shall include RF and EMI suppression. The power supply shall be designed to maximize photon production, irradiance, and reliability in cold airstreams of 0-140 °F, 100% RH. The power supply shall be available in 120-277 V, 50/60 Hz, single phase. Power sources shall be UL listed to comply with UL Standard 1995.

4. UVC Emitter germicidal lamp tube shall be a hot cathode of T5 diameter that produces UVC at 253.7 nm and no ozone or other secondary contaminants. The UVC Emitter germicidal DE lamp shall be tested by an independent test laboratory to provide UVC of 253.7 nm output per one-inch arc length of no less than 9 $\mu W/cm^2$ and SE lamp 7.5 $\mu W/cm^2$ @ 1 meter in a 400 fpm (152 meters/min) airstream of 50 °F (10 °C). The UVC Emitter lamp shall be designed to maximize photon production, irradiance, and reliability in cold or moving airstreams of up to 2000 fpm and 4 temperatures of 35-140 °F (2 60 °C) and 100% RH UVC Emitters shall produce no ozone or other secondary contamination. UVC Emitter germicidal lamp tube shall be a hot cathode of T5 diameter that produces UVC at 253.7 nm and *no ozone or other secondary contaminants.* System Design Performance

D. DESIGN SYSTEM PERFORMANCE:

1. Each UVC system shall be designed to deliver minimum and average intensities ($\mu W/cm^2$) on irradiated surfaces as listed in the UVC Emitter Germicidal Lamp Disinfection Schedule (SEE ATTACHED SCHEDULE A) in Mechanical Drawings Section.

2. Initial UVC Intensity on the coil face shall not be less than 1,225 $\mu W/cm^2$. End of life intensity must exceed 750 $\mu W/cm^2$ at the four extreme corners (extreme position is defined as one square centimeter of irradiated surface at one corner of the area covered by the lamp) of the irradiated surface. The supplier of the UVC system(s) shall provide documentation demonstrating the calculations for the specified minimum and average intensities for each UVC system as listed in the UVC Emitter Germicidal Lamp Disinfection Schedule during the submittal process.

E. SYSTEM MONITORING AND COMMISSIONING:

1. UVC system shall be monitored with radiometric sensor via cloud based platform and remotely accessible dashboard capable of Real time, customizable alerts that can be sent via SMS, push notification or email.

2. Radiometric Sensor shall verify intensity level for each UVC system demonstrating that it has met or exceeded the minimum and average UVC intensities as specified in the UVC Emitter Germicidal Lamp Disinfection Schedule in the Mechanical Drawings Section. The commissioning and monitoring shall be performed upon installation of UVC system for each AHU during operating conditions.

3. Points of measurements for intensity shall be demonstrated based on design parameters. Each sensor reading shall meet or exceed specified intensity as defined in the UVC Emitter Germicidal Lamp Disinfection Schedule. Additionally, points of measurements shall be taken across the face of the coil or within the air stream where required.

4. Intensity shall be measured by a sensor with no visible light influence, and peak response spectrum λp=254nm with a high measurement accuracy resolution of 0.1 $\mu W/cm^2$. Sensor shall have wide operating temperature range: 0°C~+80°C and transmission Distance: NLoS: 2-3km or LoS: 6-8km with OTA (Over The Air) firmware updates. Ultra-low power consumption, less than 0.5W.

5. UVC Sensor and Cloud-Based Platform with Dashboard will be

capable of monitoring and producing reports regarding UVC System function, UVC Intensity, Pathogen Disinfection Dosage, Emitter life, Runtime, and Component function.

6. Upon completion of UVC System and Sensor with Cloud Based Platform, the commissioning report demonstrating and verifying design intensity levels, actual recorded levels, and measurement locations shall be presented with submission of an Operation and Maintenance Manual. UVC system shall be commissioned by manufacturer field representative.

PART 3. – INSTALLATION

3.01 INSTALLATION OF UVC EMITTERS

A. Coordinate with installation of HVAC equipment and install Emitters as indicated after such equipment is properly installed.

B. Provide an interlock switch on the access to the UVC Emitters to turn the lights off when the access is opened.

C. If specified to include a Steril-Aire radiometric sensor with monitoring via cloud based platform gateway and adjust and set in accordance with manufacturer recommendations.

D. Install provided Caution Labels on all accesses to the Emitters.