SECTION 234312 - UV-C Germicidal Irradiation System for HVAC Equipment and ductwork

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Sections includes the following HVAC system components:
   1. UV-C Germicidal Irradiation System for Air Stream Disinfection mounted inside air handling units, packaged units, supply or return ducts
   2. Surface Treatment and Maintenance of Cooling Coils UV-C Germicidal Irradiation System for Surface Treatment and Maintenance of cooling coils mounted inside air handling units or packaged units

B. Related Work Specified in other sections:
   1) Section 233300.00 "Air Duct Accessories" for restoration of opened ducts and plenums with access doors.

1.3 REFERENCES

A. Current ASHRAE Handbook—HVAC Applications Chapter 60 – Ultraviolet Air and Surface Treatment

B. Current ASHRAE Handbook—HVAC Systems and Equipment Chapter 17 – Ultraviolet Lamps Systems

1.4 ACTION SUBMITTALS

A. Product Data: Manufacturer's literature for UV-C Fixtures indicated.
   1. Dimensions, weights, capacities and ratings.
   2. Wiring diagrams.
   3. Components and accessories.
   4. Catalog cuts, engineering data sheets, list of unit numbers, UV-C Fixtures output and power consumption

B. Installation, operation and maintenance manuals.

C. UV-C Fixture Selection and Performance Summary

D. Intensity Profiles
   1. Computation Modeling Software report, showing tabular and graphical representation of UV-C disinfection modeling calculations, irradiation, intensity, and UV dosage calculations used to determine fixture placement, energy distribution and projected disinfection rates of targeted pathogens.

E. ISO Certifications

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum 5 years of documented experience.

B. Competency of Supplier/Manufacturer/Installer

1. The supplier/local distributor of the UV-C Fixtures system to have a qualified service organization in active operation. The organization to have had a history of competent service experience in installing and maintaining the specific types of systems described in the specifications, and has on its payroll sufficient qualified, experienced personnel to guarantee satisfactory performance of the installation. All maintenance personnel used in fulfilling the requirements of the installation shall be qualified to maintain this type of equipment.

C. Built in accordance with ISO 9001 procedures

D. Product Qualifications:

1. NRTL (UL,ETL) Compliance:

a. UV-C Fixtures shall comply, meet or exceed ETL/UL Standards: 153, 1598 & 1995 respectively.

b. UV-C Fixtures to be factory tested and the design, construction and installation to be in accordance with all applicable regulations having jurisdiction.

2. The manufacturer shall have the following test and verification capabilities and shall be able to provide test reports, as required, for the following:

a. Testing for lamp life: verification that the UV-C lamps and power supplies will properly perform to the manufacturers rating.

b. The ability to test lamps for UV output under air flows up to 650 ft. per minute (198 m/min) and temperatures of 45 deg. F (7 Deg. C) to 135 deg. F (57 Deg. C) to validate performance in an HVAC system.

c. UV-C material degradation test chamber and testing capability and data bank of typical HVAC system materials performance under exposure to UV-C (ASHRAE 17.6)

3. The manufacturer shall have the capability to factory apply UV-C transparent polymer sleeves to lamps when specified.

E. Production Testing

1. The manufacturer shall apply power to each UV-C Fixture and test the operation of

power supply and lamp during production, data by date code for each UV-C Fixture.

2. Upon request, the manufacturer shall provide traceability and test data.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store UV-C Fixtures in a clean, dry place and protect from weather and construction traffic. Handle UV-C Fixtures carefully to avoid damage to components, enclosures and finish. Do not install any damaged components; instead replace them and return damaged components to equipment manufacturer.

B. Comply with manufacturers' installation instructions and drawings regarding fixture placement for proper energy distribution fixture placement for proper energy distribution.

1.7 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's stated limits.

1.8 WARRANTY

A. UV-C Fixtures shall be warranted to be free from defects in material and workmanship for a operation period of 1 year or 18 months from shipment, whichever occurs first.

B. Lamps shall provide the intensity needed to meet or exceed the specified inactivation rates for a minimum of 9000 hours of continuous operation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, acceptable manufacturers:
   1. Lumalier
   2. Evergreen UV

B. Substitutions: As approved

2.2 Design Requirements

A. Air Stream Disinfection

1. AHU or Packaged Unit

a. Irradiation – UV-C Germicidal Irradiation System is to be designed and installed in sufficient quantity perpendicular to the airflow inside the unit downstream of cooling coil so as to provide an optimum distribution of UV-C energy.

b. When installed, the intensity penetrating the entire moving air stream will be sufficient to disinfect the target micro-organism, Influenza and Coronavirus at a rate as scheduled on drawings upon the first pass.

2. Supply or Return Ducts

a. Irradiation – UV-C Germicidal Irradiation System is to be designed and installed in sufficient quantity perpendicular to the airflow inside the duct so as to provide an optimum distribution of UV-C energy.

b. When installed, the intensity penetrating the entire moving air stream will be sufficient to disinfect the target micro-organism, Influenza and Coronavirus at a rate as scheduled on drawings upon the first pass.

2.3 UV-C Germicidal Irradiation System

A. UV-C Germicidal Irradiation System shall consist of the UV-C Fixtures needed to meet the level of irradiance as scheduled on drawings.

B. The manufacturer shall use computation modeling software for selecting the appropriate number of UV-C Fixtures for the UV-C Germicidal Irradiation System of each HVAC unit. The software shall produce tabular and graphical representation of UV-C disinfection modeling calculations, irradiation, and UV dosage calculations to determine fixture placement, energy distribution and projected disinfection rates of targeted pathogens.

2.4 UV-C Fixtures

A. UV-C Fixtures shall be germicidal, high output, with factory assembled and tested housings and mounting structures. Each UV-C Fixture shall consist of a lamp, lamp socket(s), power supply and lamp wiring. Provide disconnect for 120 V power to the UV-C system located at the access door to the system.

B. Power Supply:
1. Power supply shall be of a high efficiency, high frequency, high power factor type with capability to operate with an input of 100-277VAC matched to the lamp and designed to maximize radiance and reliability.
2. The power supply shall be protected from failure in the event of lamp failure and capable of operation indefinitely when powered with no lamp or failed lamp.
3. The power supply shall be UL listed and designed for maximum UVC output and reliability.

4. The UV-C Fixture shall allow for installation of the power supplies in one of the following configurations:

a. In a drip proof enclosure inside the air handling unit, package unit or supply or return duct.

b. Within optional vertical or horizontal mounting struts inside the air handling unit, package unit or supply or return duct.

c. In a separate electrical enclosure outside the air handling unit, package unit or supply or return duct for indoor installations

d. Refer to the project details for mounting location

5. Lamp Sockets:

a. Sockets shall be constructed of UV-C resistant materials

b. The Lamp Socket shall accommodate a single ended four-pin UV-C lamp

c. Wires from the lamp socket to the power supply shall be coated with a Teflon-type UV resistant material and rated at 600 volts.

6. Lamp:

a. Lamp shall be a high output (nominal 825 800 milliamps), T-5 diameter, Compact Twin Tube bulb, hot cathode, low pressure UV-C lamp. Lamp tubes shall be constructed of Sodium Barium glass and internally coated, designed to extend lamp life and maintain output. Uncoated quartz lamp tubes shall not be acceptable.

b. Lamps shall be equipped with a four-pin lamp base.

c. When specified, lamps with UV-C transparent polymer sleeves shall be provided. Application of the polymer sleeve shall have the benefit of protecting the lamp and in the event of breakage, contain the glass and mercury for disposal.

7. Lamp life shall be a minimum of 9000 continuous hours of service.
   a. The lamp shall produce no less than 80% of its initial UV-C output at end of useful life.
   b. Manufacturer shall provide proof of testing data that shows lamp intensity at the end of useful lamp life.

8. Each lamp shall contain no more than 5.0 milligrams of mercury.

9. Lamps shall produce 254 nm UV energy at up to 590 ft/min (180 m/min) air velocity in temperatures from of 45 deg. F (7 Deg. C) to 135 deg. F (57 Deg. C) without production of ozone.

a. Performance curves of the lamp at system operating temperatures and air velocity shall be available from the system manufacturer and provided upon request.

C. System Monitoring [OPTIONAL]

1. A dry contact output from the current sensor indicating a reduction in current of the UV-C system performance shall be available to connect to the BMS system. abrupt drop in performance indicating trouble with one of the UV-C system lights or ballasts.

2. The current censor shall be installed on the outside surface of the AHU.

3. Current censor shall meet the following criteria:

    a. With dry contacts for connection to customer supplied BMS system
    b. Adjustable trip point 2.00 to 20.00A
    c. AC contact rating – Relay: 10A @240V
    d. Max in Rush Current 300A

2.5 Execution

A. Installation Of Upper Air Fixture
1. Install UV -C lamp systems according to manufacturer's installation manual and drawings unless otherwise indicated
2. Install UV lamps in each UV -C lamp system.
3. Install UV -C lamp systems in locations that are accessible and that will permit servicing and maintenance.
4. Provide six feet (6fy) of wiring loom to facilitate lamp connection to a remotely located power supply and/or power supply housing, such that lamp and loom can be mounted anywhere in the system.
5. Identify UV -C lamp systems with equipment labels.
6. After installation, adjust UV -C lamp systems and supports to maximize exposure to surfaces, before energizing system.

B. Electrical Connections:
1. Provide electrical power and service disconnects to products requiring electrical connections.
2. Install electrical devices furnished by manufacturer, but not factory mounted, according to NFPA 70 and NECA 1.

C. Switches and Circuit Breakers:
1. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems”

D. Operational Test:
1. After installing UV -C lamp systems, and after electrical circuitry has been energized, test units to confirm proper operation.
2. Confirm proper operation of safety interlock power switches

E. Cleaning
1. Wipe lamps clean using manufacturers' recommended cleaning methods and materials.

F. Demonstration
1. Engage a factory -authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain UV -C lamp systems.

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