1. **GENERAL**

## SECTION INCLUDES

### Custom air handling units.

1.2 RELATED SECTIONS

A. Section 23 07 13 Ductwork Insulation.

B. Section 23 31 13 Ductwork.

C. Section 23 33 00 Ductwork Accessories: Flexible duct connections.

D. Section 23 05 48 – HVAC Vibration Controls

1.3 REFERENCES

A. See Section 23 05 00.

1.4 SUBMITTALS

A. See Section 23 05 00.

1. Provide literature which indicates dimensions, weights, capacities, ratings, fan performance, gages and finishes of materials, and electrical characteristics and connection requirements.

2. Certified coil performance data. All coil performance data shall be computer generated.

3. Provide data of filter media, filter performance data, filter assembly, and filter frames.

4. Provide fan curves with specified operating point clearly plotted.

5. Submit sound power level data for all inlets, outlets, and casing radiation at rated capacity. Provide calculated sound power data based on AMCA 320 sound intensity test methods.

1.5 OPERATION AND MAINTENANCE DATA

A. See Section 23 05 00.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum five (5) years documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. See Section 23 05 00.

B. Deliver and store products in manufacturer's unopened packaging bearing the brand name and manufacturer's identification until ready for installation. Protect against corrosion, dirt, and damage.

C. Follow manufacturers rigging guidelines for movement and installation of equipment.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Do not operate units for any purpose, temporary or permanent, until ductwork is clean, filters are in place, bearings lubricated as needed, and fans have been test run under observation.

1.9 EXTRA MATERIALS

A. Provide one extra full replacement set of each type of filters for each unit scheduled.

1.10 WARRANTY

A. Unit manufacturer to warrant its product to be free of defects in materials and workmanship under normal use when installed and operated in accordance with factory recommendations for a period of 12 months after project substantial completion. Equipment found to be defective should be replaced or repaired to include all parts and labor. Component parts that require periodic replacement due to normal wear such as filters, fan belts, etc. are not covered by the warranty.

**2. PRODUCTS**

2.1 CUSTOM AIR HANDLING UNITS

A. GENERAL DESCRIPTION

1. The Contractor shall furnish and install the indoor custom air handling unit(s) as shown and scheduled on the plans. The units shall be installed in strict accordance with the specifications. All units shall be complete with fan section(s), coil section(s) and all accessories specified.

2. Configuration: As scheduled.

3. Performance Base: 1000 ft. altitude conditions.

4. Fabrication: Conform to AMCA 99 and ARI 430.

5. Manufacturer: Subject to compliance with all specified requirements, provide air handling units by one of the following manufacturers:

a. Air Enterprises (Basis of Design)

b. Nortek Air Solutions

c. Haakon

d. TMI Custom Air Systems.

e. Team Air.

f. Access Air

B. PERFORMANCE REQUIREMENTS

1. See schedule on Drawings for performance requirements.

2. Various manufacturers may be able to optimize air handling unit performance with more or less fans than scheduled, with slightly different coil fin spacing, etc. The following parameters will be used in the evaluation of custom air handling units:

3. Unit dimensions shall be less than or equal to those shown on the schedule.

4. Motor full load amperage shall be less than or equal to the value listed in the schedule.

5. Cooling coil capacity shall be greater than or equal to the total and sensible capacities listed in the schedule.

6. Heating coil capacity shall be greater than or equal to the total capacity listed in the schedule.

7. Humidifier capacity shall be greater than or equal to the total capacity listed in the schedule.

8. Sound levels (supply air outlet, exhaust air outlet, outside air inlet, return air inlet, and casing radiated) shall be 3 dB or less of each of the octave band sound power levels listed on the schedule.

9. Maximum leakage shall be less than or equal to the value shown in Paragraph 2.1.C.8.

10. All control points shown on the Drawings shall be able to be shared with the building EMCS.

11. Manufacturer shall verify that air handling unit will operate correctly with vibration controls specified in Section 23 05 48.

12. All requirements of this specification and the Drawing equipment schedule remain in full effect, regardless of manufacturer’s variations in number of fans.

C. CABINET

1. Air handling unit casing shall be built up from the unit base or floor with panels. The unit manufacturer shall be the manufacturer of the panel system. Panels shall be load bearing and capable of forming the enclosure without additional structural members. Panels shall be joined together with independent joining member and fastened with closed end aluminum rivets or stainless steel fasteners. Plated fasteners will not be accepted. Panel joints and seams shall be sealed with FDA approved sealant. Other sealing methods or materials must be approved by the Architect/Engineer/Owner in writing before application. All panels shall be double wall all-aluminum construction with interior liner of smooth, mill finish; exterior finish to be a low-reflective textured mill finish. Each panel shall contain an integral frame or be properly supported by a structural framing system. Panel shall have continuous tight seal at the interior and exterior skins completely encapsulating the insulation. Casing system shall be guaranteed to assure the owner that system capacity, performance, and cleanliness standards specified are not compromised. All casing walls shall be of panel construction, including but not limited to the fan discharge walls, mixing section walls and divider wall to the access corridor. Panel system shall incorporate an integral thermal break system downstream of cooling coil such that there is no through metal path between the interior and exterior surface of the unit casing at all locations. The thermal break shall consist of a minimum 1/2" structural epoxy bridge. Adhesive tapes or gaskets do not constitute an acceptable thermal break. Any equipment flashing, internal partitions or other attachments to the casing shall be made in such a way as to ensure a permanent leak-tight connection. Attachments that are bolted, screwed, or welded to or through the casing creating air bypass, air leakage or rust propagation areas are not acceptable. All ductwork penetrations through unit enclosure shall be provided with framed openings of size and arrangement as indicated on drawing. Pipe and conduit penetrations through the unit casings shall be provided by the unit manufacturer and be properly sealed prior to leaving the factory. Penetrations sealed by simply caulking around extension are not acceptable.

#  2. Insulation: The minimum panel thickness shall be 2-1/2” thick. with 3-pcf high density polyisocyanurate foam insulation. The panel R value shall be a minimum of 12 or greater. The insulation shall meet UL94 HF-1 requirements.

3. Interior liners: Liners shall be minimum .040 aluminum exposed smooth, mill finish; solid metal throughout the unit for the walls and roof. A finish bead of caulking will be applied between the liner and the interior panel seams to completely seal the panel.

4. Exterior liners: Liners shall be minimum .040 aluminum low-reflective textured mill finish t for the walls and roof. A finish bead of caulking will be applied between the liner and the interior panel seams to completely seal the panel.

5. Roof panels: On indoor units, panels shall be flat with smooth exteriors the same as the side panels.

6. Thickness of the panel skin, core density, rib structural frame spacing shall be regulated to eliminate panel pulsation and restrict the maximum deflection to 1/200 of any span at design load of 1-1/2 times the design positive or negative pressure plus snow and wind loading. External stiffeners shall not be allowed.

7. Provide safing between internal components and unit casing to prevent air bypass. Safing material shall match unit interior. All seams or voids between safing, components and unit casing shall be caulked and sealed airtight.

8. Provide hygienic unit design with interior suitable forwashing down. The use of support members framed within the unit casing which will allow for trapping of debris between the supports and casing will not be allowed. Unit insulation must be completely encapsulated.

9. Leakage to be guaranteed at no more than 1/2% of the design volume at 1-1/2 times the design operating pressure or 30 CFM, whichever is greater.

D. ACCESS DOORS

1. Provide minimum 24” wide access doors for access to all internal components. Access doors shall be installed to open against the greatest pressure relative to air pressure on each side of access door. Access doors shall be of the same construction as panels described above. The access doors shall incorporate two continuous separate gasket seals around the entire periphery of the door. Gasket material shall be UV-resistant, closed cell neoprene; gaskets shall be attached by adhesive and not mechanically held in place. Single gasket seals will not be accepted.

2. Doors shall be provided with a minimum (2) dual acting heavy duty metal latches through 48” high, (3) latches through 72” high. Latches shall be operable from both the interior and exterior of the unit. Door latches on doors into fan sections shall be provided with a hasp or other mechanism to facilitate locking of the doors. Provide 1” dia. test ports with screwed caps on casing upstream and downstream of all coils and filters for pressure and temperature measurement. Each access door shall be mounted with a corrosion-resistant continuous piano hinge.

3. Reduced door width will only be accepted with explicit approval by owner’s representative.

4. Doors shall be provided with double-pane glass or polycarbonate viewing windows as called out for on the unit drawings in the specifications. Minimum window size to be 9” x 9” with 12” x 12” provided door size permitting. Either round or square windows are acceptable.

5. Removable access panels shall be provided as indicated on the drawings for service and maintenance. Access panels shall be of the same construction as panels described above. Removable access panels shall be designed and constructed such that removal and replacement may be accomplished without disturbing adjacent panels. Airtight integrity must be maintained.

E. BASES

1. Unit bases shall be constructed from structural aluminum tubing or aluminum channel around the entire perimeter of the unit and provided with intermediate structural tubing, or channel as required to support all internal components. All tubing and channel joints shall be solid welded. Bolted or formed channel bases are not acceptable.

2. The unit base shall be covered with a full thermally isolated .100 aluminum tread-plate floor with continuously welded seams. Base shall be provided with removable lifting lugs minimum (4) per section, properly located to assure uniform loading. Maximum spacing between lifting lugs shall be 120”.

3. Base shall be insulated with 4” insulation under the base skin and covered with a minimum .040 aluminum liner. Insulation to meet same criteria as explained under the cabinet casing requirements.

4. Drain pans shall be 304 stainless steel double-walled construction with solid welded seams for complete water capture and containment. Pans under cooling coils shall extend a minimum 12” past the leaving face of the coil in direction of airflow. Drain pan headers and return bends shall be located over the drain pan for collection of all condensate forming on headers and return bends. Pans shall be IAQ double sloping to a single drain. Drain connection shall be a minimum 1-1/4” diameter MIPS thread extending out through the sidewall the same side as the coil connections unless otherwise indicated on the drawings. Pans shall be provided for cooling coils, preheat coils, energy reclaim coils, humidifiers, outside air intakes and under other components as required.

5. Provide one drain pan and drain pipe per coil. Provide one drain point through the unit housing per coil section.

6. All large openings (greater than one square foot) in the floor, including dampers openings, shall be covered with a removable powder coated heavy gauge steel grating bolted in place suitable for walking on which will prevent any personnel and large objects from falling through into the space below. Grating shall be capable of supporting minimum 300 pounds.

7. Provide a fully welded perimeter collar around the inner wall of the entire unit and around each floor opening to ensure unit is watertight. The entire base shall act as a secondary drain pan to hold a minimum of 1” of water and shall have drain fittings piped thru the sidewall of the unit, capped and accessible for emergency use.

8. All equipment within air handling unit shall be provided with a minimum 2" high base to raise equipment off unit floor for housekeeping. Equipment mounted directly on unit floor is unacceptable

F.  FAN ARRAY - ECM FANS – BASIS of DESIGN

1. Manufacturer: Ziehl-Abegg Series RH.C.C or owner approved Equivalent

2. Single-sided intake, rear-curved motor impeller, energy-optimized for operation spiral housing through special blade design with rotating, vaneless diffuser for high efficiency and with favorable acoustic behavior

3. Impeller: ø 250 – 630 mm in 9 frame sizes. Centrifugal impeller made of high-strength ZAmid composite material, with external rotor motor statically and dynamically balanced acc ISO 21940 Part 1.

4. Fitting position: horizontal and vertical

5. Impeller with rotating diffuser, 7 rear-curved, profiled blades

6. Galvanized inlet nozzle with volume flow rate measuring equipment

7. Design with integrated electronics, overtemperature protection of the device electronics through active temperature management

8. Protection class IP55, Thermal class 155, Reliable charge temperature: -20°C\* to +60°C

9. ISO 5801, Performance specifications comply with Precision Class 2 acc DIN 24166,motor efficiency class complies with IE5

10. Modbus integrated as standard, (alternate communication protocols available)

MEMBRANE WALL –(PRESSURE WALL)

1. 2” (51 mm) foam injected panels with extruded aluminum perimeter framing members mechanically bonded using “staked” extrusions utilizing alternating aluminum cleats, one inch on center along the perimeter of the panel. Panels shall be capable of operating pressures up to 20” w.c. with less than 1/240th span deflection.

2. Aluminum framing: Extruded aluminum framing shall be 6063-T5 or T6 alloy and temper.

3.. Panel Foam: The entire panel cavity shall be filled with two-part isocyanate rigid foam system, meeting all UL94HF-1 requirements .

a. Foam system properties:

b. Blowing agent: HFC-134a.

c. In place foam density: 2.40 pcf

d. K-Factor, Initial (BTU-in/hr/ft2/deg F): .15

e. R-Value = 6.67 per inch of door depth

4.. Panel Skins:

1. Skin Material 0.063 inch (1.6 mm) smooth aluminum,

5.. Panel joining members: T-style extruded aluminum joining members shall be provided at each panel joint. Joining members shall be an integral part of the membrane wall system and shall be provided by the Fan Array Manufacturer.

6. Securing hardware: ¼” aluminum structural angle, rivets and hardware as required shall be engineered and provided by the Fan Array Manufacturer to allow for a complete installation without the need for field supplied materials.

7.. Each fan shall be provided with an 1/8” x 1-1/2” x 1-1/2” structural aluminum angle “mounting shelf” rivetted to the membrane wall to assist in alignment and support of fans during installation or change-out.

8. Fans shall be secured to membrane wall using threaded RivNuts installed in the membrane wall by Fan Array Manufacturer. All mounting hardware (bolts, washers, etc). shall be provided as part of this bid.

9. All fan inlet openings in membrane wall shall be capped with aluminum angle or flashing to encapsulate foam and provide a solid metal edge around the entire perimeter of the fan inlet.

10. Membrane walls that utilize “pan-in pan” (non-framed walls) or single wall broken sheet metal walls will not be permitted

MOTOR CIRCUIT PROTECTION – SINGLE POINT POWER PANELS

1. Each fan array shall be provided with a single-point power panel. Panel shall consist of the following:

a. NEMA1 enclosure with hinged door and keyed lock

b. Face mounted lockable disconnect switch

c. Individual adjustable manual motor starter/circuit breakers, one per fan for fan isolation

d. Grounding terminal strip

 BACKDRAFT DAMPERS

1. Each fan shall be supplied with a backflow damper to eliminate short cycling in case fan failure

2.. Damper shall be TAMCO Series 7600 CWA adjustable counterweighted heavy-duty backdraft damper (no equal)

3. Each damper shall be installed in and 20 ga. Galvanized steel sleeve, 6” deep and riveted to the membrane wall provided by the Fan Array Manufacturer

G. FAN ARRAY – FANS WITH VFD’s – DEDUCTIVE ALTERNATE

As an option to ECM FAN ARRAY the air handling unit manufacturer may offer a DEDUCTIVE ALTERNATE design as follows:

#### The fan array system shall consist of multiple, direct driven, arrangement 4 plenum fans constructed per AMCA requirements for the duty specified, (Class II, or III). All fans shall be selected to deliver the specified airflow quantity at the specified operating total static pressure and specified fan/motor speed. The fan array shall be selected to operate at a system total static pressure that does not exceed 90% of the specified fan’s peak static pressure producing capability at the specified fan/motor speed. Each housing or “cel shall be constructed of aluminum or stainless steel with perforated inner liner, melamine insulation, with either solid or perforated outer panels as required by application. Fan/motor assembly shall be mounted within the housing on an adjustable slide rail base. Fan/motor assembly must be capable of either horizontal or vertical application. All motors shall be standard pedestal mounted type, TEFC or TEAO, T-frame motors selected at the specified operating voltage, RPM, and efficiency as specified or as scheduled elsewhere. All motors shall include isolated bearings or shaft grounding. Each fan/motor cartridge shall be dynamically balanced to meet AMCA standard 204-96, category BV-5, to meet or exceed Grade 2.5 residual unbalance.

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a. Manufacturers must submit acoustical data for review and approval prior to the bid indicating that the proposed alternate equipment can meet all specified performance requirements without impacting the equipment performance or design features including duct connection location, unit weights, acoustical performance, or specified total fan HP for each fan array. Proposals submitted which indicate a higher full load motor amperage than specified or scheduled will not be accepted.

b. The fan array shall be configured such that the connected horsepower at reduced flow conditions may be less than the installed total horsepower of the fan array in order to achieve optimum system efficiency.

c. The entire fan array shall be wired to the unit exterior for field connection to VFDs or to the single point power panel for EC motors. Wire sizing shall be determined, and installed, in accordance with applicable NEC standards.

d. The fan array shall produce a uniform air flow profile and velocity profile within the airway tunnel of the air handling unit not to exceed the specified cooling coil and/or filter bank face velocity when measured at a point 12” from the intake side of the fan array intake plenum wall, and at a distance of 48” from the discharge side of the fan array intake plenum wall.

e. Each fan/motor assembly shall be removable through an appropriately sized, free area, access door located on the discharge side of the fan array pressure wall.

f. Provide equipment rail on the interior roof of each fan array discharge section to assist maintenance personnel with fan/motor replacement. Rail shall be designed to support the full weight on (1) fan/motor assembly, using a 50% safety factor.

g. Each fan/motor assembly applied in multiple fan applications shall be provided with an integral back flow prevention device that prohibits recirculation of air in the event a fan, or multiple fans, becomes disabled. The system effect for the submitted back flow prevention device shall be included in the calculation to determine the fan TSP for fan selection purposes, and shall be indicated as a separate line item static pressure loss in the submitted fan selection data. Fans submitted with discharge dampers will not be approved.

###  FAN ARRAY - ELECTRICAL

1. Provide a complete electrical and control system required to run the fan array system including all equipment, material, electrical enclosure, electrical components and electrical labor.

2. Fan array designs shall be in accordance with specific system requirements. Please see system requirements before electrical design of fan array system is to commence.

3. Fan array electrical designs shall be in accordance with the NEC, UL 508A, and local codes.

FAN ARRAY – VARIABLE FREQUENCY DRIVES

1. VFDs to be provided by the owner unless specified otherwise. VFD’s are to be installed and wired by the project electrical contractor. Each fan is to be controlled by separate VFD. Coordinate exact requirements with owner.

SHAFT GROUNDING

1. Refer to Section 23 05 13. When utilizing EC motor technology, shaft grounding is not required.

H. WATER COILS

1. Chilled water coils shall be of the aluminum plate ripple fin .010 extended surface rated in accordance with ARI 410 for water, steam or ethylene/propylene glycol water mixture. The tubes shall have a minimum .035-wall thickness of seamless copper expanded into the fin collars to provide a permanent mechanical bond. Return bends shall be a minimum of one tube thickness greater than the main tubes, brazed replaceable copper. Coil headers shall be non-ferrous seamless copper provided with brass or copper male pipe connections. Pipe connections shall be same end connections. Each coil supply & return connection shall be raised / lowered a minimum 6” from the bottom / top of the coil to allow room for piping connection hookup especially between stacked coils, coils near floors & coils near roofs. Each coil shall be provided with capped vent & drain connections extended to the exterior of the cabinet. All coils shall be fully drainable with no trapped tubes. Coils shall be counter flow design with connections either left or right hand as specified.

2. Coil casings shall be minimum 304 stainless steel, with formed 3/4” flanges on all sides of the coil with the tube sheets having pressed or extruded tube holes. The coil casing shall be reinforced so that the maximum unsupported length is 60”. The reinforcements shall be of the same material as the casing. Both ends of the coil to be sealed off from the main air stream by full height blankoffs on both the entering air and leaving air sides. Blankoffs to be the same material as the coil casing. Headers and return bends to be further insulated with a closed cell neoprene gasket the full height & width of the coil casing to reduce condensation.

3. All coils are tested and rated in accordance with the ARI Standard 410 and certified in accordance with the ARI certification program. All tubes shall be tested at a minimum 1500 PSIG and all assemblies tested under water at 350 PSIG and rated for 250 PSIG working pressures. Individual tube and core tests before installation of header are not considered satisfactory. Hydrostatic tests alone will not be acceptable.

4. Stacked coils: Stacked coils shall be mounted in stainless steel racks to allow individual coil removal without interference to other coils. All coils to be removable from either side of the unit by easily removable end panels. Individual end panels to be supplied for each coil on the supply & return side of the cabinet to allow single coil piping breakdown for coil removal.

5. Coil supply & return piping connections extending through the cabinet wall shall be sealed by rubber grommets with caulking on the exterior of the casing. The escutcheon plate shall have a rolled collar around the pipe opening to protect the pipe and be equipped with an “O” ring rubber gasket between the collar and the pipe to prevent chaffing and provide an air tight seal around the opening

I. HUMIDIFIERS

1. Humidifiers: Certify capacities and selection in accordance with ARI 610. *“Note to A/E: Coordinate humidifier and dispersion grid type with FPC Engineering before specifying”*

2. Steam Grid Humidifier: DriSteam Ultrasorb – No Equivalent. Stainless steel distribution tube with evenly spaced orifices extended full width of unit, factory mounted in location indicated on the plans and schedules. Provide blank-off panels as recommended by humidifier manufacturer.

3. Provide PVDF coating on dispersion tubes, coating to be have a 0/0 flame/smoke spread rating and rated for 300 Deg. F operation. Coating to be DriSteam PVDF coating or equivalent.

J. FILTERS

1. Filters shall be arranged for face, rear or side loading as indicated on the detail drawings. Face loading is preferred where space allows. Face or rear loading to be in gasketed universal holding frames. The filter rack assemblies to blanked off to the sides, roof and floor and properly sealed to minimize filter bypass.

2. All filters to be UL approved.

3. Pre-filters and final-filters shall be provided upstream of first coil within air handling unit. The pre-filter frame and final filter frame shall be separated by at least 6” to allow for differential pressure measurement across each filter bank. Provide Type 8 filter holding frame for all filters. Clipless systems may not be used.

4. The prefilter section shall be factory fabricated as an integral part of the air handling unit. Filters to be arranged for face (rear) loading into a gasketed universal holding frame. Prefilters shall have a minimum filtration level of MERV 8. Pre-filters shall be not less than 7 square feet to 1 square foot of face area for the 4” thick pleated filter. Final dust holding capacity shall be a minimum of 200 grams at 1.0” w.g. Pre-filters shall be Camfil Farr 30/30 – or owner approved equivalent.

5. The final filter section shall be factory fabricated as an integral part of the air-handling unit. Filters to be arranged for loading into a gasketed positive sealing universal holding frame. Final filters shall have a minimum filtration level of MERV 13. Final filters shall be 12” deep Camfil Farr Durafil ES mini-pleat, V-Bank – or owner approved equivalent.

6. Provide walk-in filter access sections upstream / downstream of each filter rack with adequate space for filter service.

7. Filter banks to be sized so maximum filter face velocity does not exceed 450 fpm or velocity shown on equipment schedule, whichever is lower.

O. LIGHTS/CONTROL WIRING

1. Provide vapor proof marine type 150-watt incandescent equivalent light fixtures in each accessible section complete with a protective metal cage and sealed glass enclosure. Lights to be wired to a common switch mounted in a weatherproof box adjacent to the fan access door complete with a convenience outlet. Outlet shall have an indicator light. Power shall be 120v/1/60. Cabinet lighting shall be LED.

2. All wiring to lights shall be in conduit and internal to the unit. No external conduit runs for the lights are allowed.

3. Air handler manufacturer shall allow a minimum 1.5” clearance above the entire width of each interior bulk headers (coils, filters, fan blank off, etc.). This will be to allow wiring of any 110v or 24v runs internally to the unit as required by the controls contractor and reduce the number penetrations of the exterior panels.

4. If the unit requires splitting, junction boxes shall be furnished at each section to allow the electrical contractor to make final connections in the field. Wiring to be clearly labeled at junction points to facilitate reconnection.

P. UV COIL IRRADIANCE

1. Install UV-C fixtures downstream of all coils which will provide latent cooling. UV-C fixtures shall be designed for high moisture, HVAC conditions and for application flexibility to provide the specified irradiance on both the cooling coils and drain pans.

2. UV-C lamps shall be Hot Cathode, T5 diameter type designed for HVAC use and installed in sufficient quantity and in such a manner so as to provide an average of 500 microwatts per square centimeter and not less than 70 microwatts per square centimeter at the farthest point. All calculations are to be at 55degF and 500fpm air velocity.

3. Lamps shall be rated for 9000 hours of useful life with no greater than a 20% drop in UV-C output at end of 9000 hours of lamp use.

4. Lamps shall be sleeved or encapsulated with a UVC transparent material that shall securely contain both glass and mercury in case of accidental breakage. This material shall not inhibit or interfere with UV-C energy production.

5. A disconnect switch shall be installed on the exterior of the UV-C plenum, next to its access door, in plain sight and language, to de-energize all UV-C lamp circuits prior to entering the lamp plenum.

6. Interlock switching shall be supplied on all accesses to the UV-C plenum to de-energize the UV-C lamps when any are opened.

7. Power supplies shall be of the high efficiency, electronic types that auto-match to the lamps supplied, to maximize photon production, irradiance, and reliability, and to ensure a minimum of 9000 hours of lamp life.

Q. CONTROL DAMPERS

1. When dampers are scheduled to be provided with the air handling unit, dampers shall be TAMCO 1500 (return air) or 9000 with “SC” option (outside and relief air) no equivalent.

**3. EXECUTION**

3.1 INSTALLATION

A. Examine rough-in for hydronic, condensate drainage piping and electrical to verify actual locations of connections prior to installation.

B. Install central-station air-handling units level and plumb, in accordance with manufacturer's written instructions, on minimum 6” high base rail.

C. Support floor-mounted units on concrete equipment bases. Secure units to anchor bolts installed in concrete equipment base.

D. Arrange installation of units to provide maximum access space around air-handling units for service and maintenance.

E. Install a continuous neoprene vibration isolation pad below each base when required to meet acoustic requirements. See schedule for thickness and deflection requirements.

F. The air handling units, energy recovery wheel, exhaust fans, and other HVAC airside equipment shall not be used for temporary building conditioning without the written permission from the owner’s Project Manager. If unit is approved for operation prior to substantial completion, contractor is fully responsible for all preventative maintenance. Preventative maintenance to be completed per all manufacturer recommendations. In addition, contractor is fully responsible for all cleaning of the systems to the satisfaction of owner’s project inspector.

G. Air handlers shall not be operated without filters. Temporary filters of specified type shall be installed prior to unit start-up. These shall be changed as required by static pressure drop readings during construction and once again (regardless of static pressure drop readings), before acceptance by owner.

H. Pipe drain pans to floor drain. Provide trap and water seal having a depth of 1.5x the operating static pressure of the system at the drain pan location. Alternately, if a condensate collection system is to be installed, pipe the drain pans per the project documents.

3.2 EQUIPMENT BASES

A. See Section 23 05 00.

3.3 COMMISSIONING

A. Perform the following operations and checks before start-up:

1. Adjust damper linkages for proper damper operation.

2. Clean unit cabinet interiors to remove foreign material and construction dirt and dust. Vacuum clean fan wheel, fan cabinet, and coils entering air face.

3. Lubricate moving parts with factory-recommended lubricants.

4. Comb coil fins for parallel orientation.

5. Install clean filters. Install clean filters again at time of substantial completion.

6. Measure and record motor electrical values for voltage and amperage.

B. Refer to Division 23 Section "Testing, Adjusting, and Balancing" for procedures for air-handling-system testing, adjusting, and balancing.

END OF SECTION 23 73 13