University of Kentucky
Procurement Services

REQUEST FOR PROPOSALS

UK-2617.0-8-25
Ag Research Facility 1 – BP-04 Equipment
ADDENDUM # 04
10/01/2024

ATTENTION: This is not an order. Read all instructions, terms, and conditions carefully.

IMPORTANT: RFP AND ADDENDUM MUST BE RECEIVED BY 10/08/2024 @ 3:00 P.M. LEXINGTON, KY TIME

Offeror should acknowledge receipt of this, and any addendum as stated in the Request for Proposal.

ITEM #1: CLARIFICATIONS AND MODIFICATIONS TO THE BIDDING DOCUMENTS

Bidders are instructed to review and incorporate into your offer the attached addendum #4 from Turner Construction Company and BHDP Architects.

OFFICIAL APPROVAL
UNIVERSITY OF KENTUCKY

Corey W. Leslie, Purchasing Officer

SIGNATURE

_____

_____
Typed or Printed Name

University of Kentucky
Procurement Services
322 Peterson Service Building
Lexington, KY 40506-0005

UK AG Research Building
TC-025 Mechanical Equipment RFP
ADDENDUM No. 4
UK-2617.0-8-25
10/01/2024

TCCO Addendum #4 Items

Attachments Included:

- **UK-2617.0-8-25 - BHDP Mechanical Equipment RFP - Addendum #4 dated 9/27/2024**
- **UK-2617.0-8-25 – Question and Response Log**

Date	9/27/2024
Project Title	University of Kentucky Agriculture Research Facility 1
To	All Plan Holders
Purpose	Modify the Bid Documents
Distribution	All Plan Holders University of Kentucky Turner Construction A/E Design Team

TO ALL BIDDERS: This Addendum modifies the Contract Documents and shall be taken into account in preparing bid proposals and shall become a part of the Contract Documents.

Specifications:

Item 1. Section 23 0200 - Equipment and Specialties
- Reissued complete specification. Attached section supersedes all previous versions.

Drawings:

Item 1. Sheet M702.1 – MECHANICAL SCHEDULES
- Revisions to OA-S and OA-N unit schedules.

Item 2. Sheet M703.1 – MECHANICAL SCHEDULES
- Revisions to LEF-N and LEF-s unit schedules.
- Revisions to LEF unit section views.

Respectfully Submitted,

Kelly Gardner

Kelly Gardner
Senior Architect
BHDP Architecture

ATTACHMENTS

1. Section 23 0200 - Equipment and Specialties_RFP ADD-4
2. Sheet M702.1 – MECHANICAL SCHEDULES_RFP ADD-4
3. Sheet M703.1 – MECHANICAL SCHEDULES_RFP ADD-4

END OF MECHANICAL EQUIPMENT RFP - ADDENDUM 4

SECTION 230200 - HVAC EQUIPMENT AND HYDRONIC SPECIALTIES

1. GENERAL

A. The Contractor's attention is directed to the General and Special Conditions, General Conditions-Mechanical and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified herein.

B. The Contractor shall provide in complete working order the following heating, ventilation and air conditioning equipment located as indicated and installed, connected and placed in operation in strict accordance with the manufacturer's recommendations. All equipment shall be factory painted and, where applicable, factory insulated and shall, where such standards exist, bear the label of the Underwriters Laboratory.

C. Each subcontractor shall be responsible for their own completion of System Verification Checklists/Manufacturer’s Checklist.

D. Factory startup is required for all HVAC equipment. In general, as part of the verification process, equipment suppliers shall perform start-up by their factory authorized technicians and shall complete and submit start-up reports/checklists. This shall include air handling units, boilers, chillers, cooling towers, VFDs, etc.

E. All HVAC equipment shall comply with the latest provisions of ASHRAE Standard 90 and/or International Energy Conservation Code 2012, whichever is more stringent.

F. Installation of all heating, ventilating and air conditioning systems shall be performed by a master HVAC contractor licensed in the state the work will be performed.

G. Note to Suppliers and Manufacturers Representative furnishing proposals for equipment for the project:

(1) Review the Controls Section of these Specifications (if applicable) to determine controls to be furnished by the equipment manufacturer, if any. The Contractor shall provide all controls with equipment unless specifically listed otherwise.

(2) Review the section of these specifications entitle: SHOP DRAWINGS, DESCRIPTIVE LITERATURE, MAINTENANCE MANUALS, PARTS LISTS, SPECIAL KEYS, TOOLS, ETC., and provide all documents called for therein.

(3) Ensure that the equipment which you propose to furnish may be installed, connected, placed in operation and easily maintained at the location and in the space allocated for it.

(4) Determine from the Bid Documents the date of completion of this project and ensure that equipment delivery schedules can be met so as to allow this completion date to be met.

(5) Where manufacturers' temperature controls are specified, they shall be in full compliance with International Mechanical Code Section 606 including automatic smoke shut down provisions.

(6) Provide factory start-up on site by a factory representative (not a third-party contractor) for all HVAC equipment, including fan coil units etc. Submit factory start-up reports to the Engineer.

(7) Provide training to the Owner by a factory representative for each type of equipment.

a. Instructor Qualifications

1) A factory-authorized service representative, complying with requirements in Division 01 Section "Quality Requirements," experienced in operation and maintenance procedures and training.

b. Photographer Qualifications

1) A professional photographer who is experienced photographing construction projects.

c. Pre-instruction Conference

1) Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to demonstration and training including, but not limited to, the following:

(a) Inspect and discuss locations and other facilities required for instruction.
(b) Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
(c) Review required content of instruction.
(d) For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

d. Training Coordination

1) Coordinate instruction schedule with the Project Manager. Adjust schedule as required to minimize disrupting Owner's operations.

2) Coordinate instructors, including providing notification of dates, times,

length of instruction time, and course content.

(a) Do not schedule owner training to coincide with the start-up of a piece of equipment or system. The university staff may be invited to watch a start-up, but the formal training shall occur on a date after the equipment or system has been started-up and is operating correctly. All integration to the campus BAS monitoring and control system shall be complete prior to owner training.

3) Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Architect.

e. Instruction Program Requirements

1) Develop an instruction program that includes individual training modules for each system and equipment not part of a system, as required by individual Specification Sections.

(a) Air Handlers
i. Fans
ii. Coils
iii. Filters
iv. Controls

(b) Laboratory Exhaust Fans
i. Fans
ii. ER Coils
iii. Filters

(c) Heat Recovery Chiller
i. Compressors
ii. Controls
iii. Refrigeration System and all components

f. Execution

1) Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

2) Provide instruction at mutually agreed on times. At least two sessions of the same information for each training module for accommodation of the maintenance staff are required. This requirement accounts for staff working off-shifts. The second training will be required during the off-shift. More sessions may be required for specific modules which will be noted in project specifications when warranted by equipment type.

3) Schedule training with Owner with at least 30 days advance notice

4) Collect used and leftover educational materials and remove from project site. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

g. Demonstration and Training Video

1) Engage a qualified commercial photographer to record demonstration and training video. The photographer shall be consistent across all trainings. For this reason, the photographer services shall be acquired and coordinated by the general contractor or construction manager. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.

2) All video shall be high definition video format in mp4 files

3) Mount camera on tripod before starting recording, unless otherwise necessary to show area of demonstration and training. Display continuous running time.

4) Audio of instruction must be clear and understandable – whether filming takes place in a classroom or an operational mechanical room. Instructor is required to wear a lapel mic or similar.

(8) Review the Section on Motor Starters and Electrical Requirements for Mechanical Equipment.

(9) All condensate producing equipment shall be provided with a condensate trap as recommended by the equipment manufacturer and a condensate overflow switch.

(10) Provide a complete air tight enclosure with opening door that seals air tight for all filters on air moving equipment.

(11) All equipment shall be furnished for a single point electrical connection unless specifically excluded as a requirement.

2. EQUIPMENT

A. CUSTOM AIR HANDLING UNITS (AHU-1)

AVAILABLE MANUFACTURERS:

1) The manufacturer shall be a custom air handler manufacturer with a minimum 10 years experience in manufacturing custom air handling units. The basis of design is Airflow Systems. Other acceptable manufacturers are: Climate Craft, Nortek, Ingenia and Air Enterprises.

CABINET CONSTRUCTION

1) Cabinets shall be constructed in a watertight and airtight manner. The manufacturer's cabinet construction shall result in an ASHRAE/ANSI Standard 111 Leakage Class 5 rating, or better, as measured in accordance with AMCA Standard 210. A leakage rate as a percent of airflow shall only be submitted following calculation at specific project conditions. Maximum casing leakage (cfm/100 ft^2 of casing surface area) = CL X $P^{0.65.}$ Published leakage rates at generic conditions shall not be submitted.

2) Casing deflection shall not exceed L/200 (.0005" per inch) at 1.5 times the casing internal operating pressure at design airflow conditions, not to exceed 10" w. g., whichever is less. L is defined as the panel span taken at the panel seam joint.

3) The unit shall be constructed on an 8" welded structural aluminum c-channel base. Equipment using a die-formed sheet metal base is not acceptable. Formed intermediate cross members shall be constructed of structural aluminum tubing.

4) Units shipped in multiple sections shall be engineered for ease of field assembly. Gasket supplied with the unit shall be a high-quality weather resistant closed-cell EPDM sponge rubber. Each section shall include a permanent label to aid in proper field assembly. All gasket and necessary assembly hardware shall ship loose with unit. Floors shall be designed to deflect no more than 1/200 of span under operating conditions.

5) Floors
   a) The floor shall be fabricated of aluminum treadplate. The aluminum tread plate shall be type 3003 (Tread Bright) embossed with four-way tread and finished to high gloss. The thickness shall be 3/16" OD over treads and 0.125" at base.

   b) All floor sheets shall be isolated from the base assembly with an EPDM thermal break gasket.

   c) Floors shall be insulated with a two-part polyurethane water impervious foam insulation. Glass fiber insulation is not acceptable.

   d) Under liner shall also be provided to cover and protect base floor foam insulation. Under liner shall be fabricated of 0.053" aluminum stitch welded plate. Floor shall be cross-broke to provide strength.

6) Wall and roof panels

   a) Panels shall be at minimum 4" thick double wall construction. Panel joints shall be sealed with an industrial EPDM gasket to form a water and airtight seal.

b) Panels shall be individually removable for service without removing the roof or compromising the integrity of the cabinet wall. Panels shall be joined with either screws or 5/16" bolts. All panels shall utilize thermal break construction between the exterior panel and the interior liner and between the panels and the base and roof frames. Screws shall have neoprene gasket and shall not penetrate through casing.

c) For long term durability, exterior panels shall be a minimum 16-gauge G60 galvanized steel

d) Interior liners of the cooling coil section and discharge plenum section shall be a minimum 20-gauge type 304 stainless steel. All other sections shall be a minimum 20-gauge G90 galvanized steel. Panel liners shall be of a single piece construction and attached to the exterior panels with a full thermal break. To allow for cleaning, no fasteners shall be used on the exposed liner surface. Single wall units are not acceptable.

7) Insulation

a) All wall and roof panels shall be insulated with an injected foam insulation with an R value of 6.7/inch. Panels shall be designed to deflect no more than 1/200 of span under operating design conditions when measured at the panel seam. Insulation shall fill the panel without voids. The composite R-value of the 4" unit casing shall be no less than R-26.8.

8) Access doors shall be provided into all sections of the air-handling unit as indicated in the plan documents. Doors shall be sized as shown on plan drawings, shall be a minimum 4" thick with R-19.8 polyurethane foam insulation and shall be double wall construction using the same material type as the corresponding section. Doors shall comply with the requirements of UL 1995 and NFPA 90. The door frame shall be 0.125" extruded 6063-T5 aluminum. Each door shall be mounted with adjustable die cast continuous piano type stainless steel hinges. All doors and mounting frames shall incorporate a thermal break design and the doors shall seal to a replaceable extruded EPDM sponge rubber gasket. Doors shall open against static pressure or shall include a pressure relief feature on the door latch.

a) The door latch assembly shall consist of a roller cam compression arm with a chrome plated steel inner handle and glass fiber/nylon composite outer handle. One tool operated lock shall be provided on each fan section access door. All doors shall have a minimum of two latches.

b) A 10"x12" thermal pane viewing window with one wire mesh safety glass pane and one clear pane shall be provided. The frame shall have a no-through-metal thermal break design. Viewing windows shall be on all doors serving a lighted section.

c) The door height for this project shall be 72". The fan access door shall be 30" wide. All other doors shall be 24" wide.

9) The entire unit, including walls, roof, doors, joints, and seams shall include thermal break construction. This construction shall be supported by tested performance producing no condensation on the exterior surface when the air tunnel temperature is 50°F DB under the following exterior conditions:

   a) (Th – 50) / (Th – Tdp) < 3.4

   b) Th = Ambient dry bulb temperature (°F) external to housing

   c) Tdp = Ambient dew point temperature (°F) external to housing

FAN ASSEMBLIES – GENERAL

1) The fan shall be of the size and type specified in the unit schedule. To assure maximum performance, fans shall be supplied by a manufacturer specializing in fan design and production.

   All fan assemblies shall be designed for heavy-duty industrial applications. Fan framing assemblies shall be fabricated from structural steel electrically welded to form a rigid, integral base. Individual fan assemblies shall be independently isolated.

   All motors shall be NEMA design B with Class F insulation. Electrical characteristics and horsepower shall be as specified on the project schedule. All motors shall have a minimum service factor of 1.15. Motors shall have ball bearings. Motors shall be premium efficiency TEFC type and shall be factory wired to a fan array motor overload panel. The motor shall be located within the unit and mounted on an adjustable heavy steel base. The motor base shall be fastened securely to the structural steel framing of the fan assembly.

   All fans shall meet the minimum efficiency and maximum brake horsepower values as scheduled. All fans shall be selected to operate at a point no higher than 90% of the peak static pressure rating as defined by the fan performance curve at the selected operating speed. Manufacturer must ensure maximum fan RPM is below the first critical speed.

2) Each fan shall be provided with a factory installed airflow measuring device. Airflow device to be mounted out of the direct air stream so as not to affect system static pressure or sound performance. Sensor accuracy shall be +/- 3%. Factory installed assembly shall include flow sensors for field connection to a transducer provided by others.

FAN ASSEMBLIES – DIRECT DRIVE ARRAY OF FANS

1) Approved manufacturers: ClimateCraft, Greenheck, Hunt Air, and Twin City Fan & Blower
   a) Fan Arrays shall be direct-drive, non-overloading SWSI plenum fans designed for industrial duty and suitable for continuous operation.

i) Fans shall be arranged in an array using one or more welded structural steel assemblies and shall be of the size and quantity specified in the unit schedule. Screwed or riveted frames are unacceptable. Fan assemblies shall be attached directly to base structural members.

ii) Fan wheels shall have a minimum of 12 airfoil blades for superior sound characteristics and shall be constructed of aluminum to reduce rotational weight and vibration. Fan blades shall be extruded aluminum for uniformity and improved vibration characteristics.

iii) Each fan and motor assembly shall be independently isolated within the structural assembly using 1-inch deflection spring isolators. Isolators shall be mounted in a three-point arrangement that provides both vertical and horizontal (thrust) isolation and shall not require field adjustment. If hard mounted or rubber in shear is used in place of internal spring isolations, external isolation of the entire air handling unit is required, no exceptions. The isolation system shall be seismic rated to withstand seismic forces in excess of 4G horizontally and vertically to satisfy specified IBC seismic requirements.

iv) A fan inertia base shall be provided, or the fan structure shall exceed an equivalence of 2x mass of the total rotating parts of the fan array. Fan and motor assemblies shall be designed such that no natural frequencies exist within the operating RPM range of the fan, eliminating the need for “lockout” frequency settings in the variable speed drive. The purchasing contractor will be responsible for all costs associated with externally isolating any unit that does not include individual fan isolation.

v) All fan arrays shall meet the minimum motor efficiency, maximum brake horsepower and total motor horsepower values scheduled. All fans shall be selected to operate at a point no higher than 90% of the peak static pressure rating as defined by the fan performance curve at the selected operating speed. Manufacturer must ensure maximum fan RPM is below the first critical speed. Fans shall be Class 2 or 3 construction as required for the application.

vi) All fan and motor assemblies shall be dynamically balanced by the manufacturer to a maximum allowable vibration of 0.040 inches per second at design RPM and a maximum 0.080 inches per second overall vibration limit to bring the fan balance in conformance to a BV-5 Grade G1 per ANSI/AMCA 204. In addition, the manufacturer shall ensure that no critical frequencies exist in the fan operating range by varying motor speed in 1Hz increments from design RPM to 50% of design RPM.

b) Unloading

i) Fan curves shall be submitted with the system curve indicating the minimum system operating static pressure and the point of fan surge.

c) Motors

i) Electrical characteristics and horsepower shall be as specified on the project schedule.

ii) Motors shall be Premium Efficiency per NEMA MG1 Table 12-12 type, shall have NEMA Class F insulation, shall meet NEMA Standard MD-1 Inverter Duty

rating and shall be designed to withstand 1600V peak voltage spikes and rise times ≥0.1 microseconds.

iii) Motors shall have TEFC enclosures.

iv) Motors shall have grease lubricated ball bearings designed to deliver a minimum L10 life of 250,000 hours at full load and the maximum operating RPM of the associated fan. Grease zerks and spring-loaded grease relief valves shall be provided in each motor to allow easy bearing lubrication without damaging the seals due to over lubrication. Permanently lubricated bearings are allowed if a spare motor per fan array is provided.

v) For efficient operation in a direct drive application, motors shall be capable of operating greater than 60HZ to at least the design operating speed of the fan.

vi) Motors shall be factory wired to a motor control center for connection to a VFD. The unit shall have 3 motor control centers for both supply and return fan arrays. Two motors for each motor control center. The motor control center shall include for each motor circuit a control device providing overload protection, short circuit protection and a manual disconnect means, and all circuits shall be wired to a common main panel terminal block. Each control device shall include an auxiliary output capable of providing remote notification of a motor failure. All motors shall operate, at all times, and be controlled in unison, maintaining a consistent and uniform airflow pattern over coils, filters and other devices.

vii) Each motor shall be provided with a shaft grounding device to harmlessly bleed potential induced shaft voltages to ground.

d) Warranty

i) All rotating parts shall be warranted by the unit manufacturer for a full five (5) years from the date of unit start-up. Parts warranties provided by third parties are not acceptable.

e) Options

i) In the fan section, provide an overhead motor removal system to facilitate motor replacement. One of the two options below is to be provided.

(1) The assembly shall include a manually operated winch, capable of being easily moved to any motor location.

(2) A structural steel I beam for mounting a trolley to assist in fan motor removal. The beam system shall be mounted overhead of the fan and motor. The beam system shall be supported and mounted to the unit's base support system.

(3) The assembly shall include a swinging arm structure capable of retracting the motor from inside the AHU.

(4) Fan outlet screens shall be provided.

ii) TAMCO 7600 aluminum gravity backdraft dampers shall be provided on the inlet of each fan to prevent recirculation of air in the event of motor failure.

AIRFLOW AND PRESSURE MEASUREMENT SYSTEM

1) The air handler shall be equipped with a factory controls system for simultaneously measuring each fan array airflow, outside air intake airflow and pressure drop across filters with an accuracy of ±0.25% of full scale. The transmitter shall be housed in a hinged compact NEMA 4X enclosure to provide flexibility in mounting location. Transmitter shall include a color touchscreen display with on-screen keypad. The total (summed) airflow rate for each system shall be available to the Building Automation System (BAS) or local controller via dedicated field selectable 0-10 V or 4-20 mA analog outputs and via field selectable BACnet®-MS/TP network communication. Independent flow and pressure values for each of the sensing points shall also be available to the BAS or local controller via network communication.

   Fan Array: Each fan shall include a piezometer ring airflow station factory installed in each fan inlet. The device shall have a measurement accuracy of ± 5%. Alternate means of air flow measurement systems shall not be used without specific project approval.

FAN SPEED CONTROL AND MOTOR PROTECTION

1) Each pair of supply and return fans shall be provided with an dedicated individual variable frequency drive as specified under another specification section.

2) The manufacturer shall provide, mount, and wire a fan array power distribution panel. The power distribution panel shall have a NEMA 3R enclosure. It shall have a main disconnect switch on the incoming line voltage side, a combination motor overload / disconnect for each fan motor, and all necessary wire termination blocks and terminal strips. It shall have a 65,000-amp short circuit withstand rating.

UNIT SOUND POWER

1) Fan sound power levels (dB) for the unit shall not exceed values as specified on the equipment schedule.

2) Unit manufacturer shall provide certified inlet, supply and casing radiated, sound power levels based on the final unit configuration.

COILS

1) Coils shall be “staggered” within the air tunnel to allow less than full AHU width for coil removal. Provide complete coil section(s) with service access door(s) as shown on the plan drawings. Coil connections shall extend through the section casing for ease of installation. Coil connections must be sealed from both the inside and exterior surfaces of the panel with the sleeve of the inner seal covering the pipe within the depth of the panel, all to minimize leakage and condensation. An integral double wall stainless steel air seal which completely seals around the cooling coil casing and extends to the unit pressure bearing surface shall be provided. An integral single wall galvanized steel air

seal which completely seals around the heating coil casing and extends to the unit pressure bearing surface shall be provided. Air seals/safing materials that are mechanically fastened to the inner liner of the cabinet only shall be constructed of 16-gauge materials to match the material type in the appropriate section and shall be gasketed and have fasteners every 3 inches.

2) Multiple, “stacked” coil arrangements must be constructed to allow independent removal of any coil without the removal of another within the coil bank.

3) All coils shall meet or exceed the capacities specified on the mechanical schedule and all water coil performances shall be certified in accordance with the AHRI Forced Circulation Air Heating and Air Cooling Coil certification program which is based on AHRI Standard 410. Face velocities shall not exceed those specified on the mechanical schedule.

4) All blow-through cooling coils shall have removable stainless-steel mist eliminators as manufactured by Mistop regardless of coil face velocity, no exception.

5) All cooling coil sections shall include a double sloped drain pan constructed from 304L stainless steel. All corners shall be welded watertight. Coils shall rest on stainless steel supports. The pan shall have a minimum pitch of 2" from high point to the bottom of the drain outlet connection, providing at least a 1/8” per foot slope. The drain pan shall be insulated with a 2-part sprayed on polyurethane, water impervious foam. Insulation shall be applied to the entire under side of the drain pan and coil section base assembly. If multiple stacked coils are used, intermediate drain pans are required. Intermediate pans shall be insulated and drained with 3/4” copper down-comers to the main pan. All drain pan openings shall be covered with walk-on aluminum grating for safety. Open drain pan openings are not acceptable.

6) Water coils shall be of a staggered tube design with high efficiency die formed corrugated plate-type fins for maximum performance. All coils shall be tested with 400 psig compressed air under clear water. Coils shall be designed to operate at 300 psig internal pressure and up to 250ºF. Tubes shall be 5/8" diameter, seamless 0.035” wall copper, mechanically expanded into full drawn fin collars for a continuous compression bond over the full finned length for high efficiency performance. Cooling coil casings shall be a minimum of 16-gauge stainless steel. Heating coil casings shall be a minimum of 16-gauge galvanized steel. Coil casing reinforcements shall be required for fin lengths over 42". Coil fins shall be 0.0095” thick aluminum as a minimum. Coils shall be serviceable using 0.25" M.P.T. drain and vent taps on the supply and return headers. Threaded seamless red brass coil connections shall be brazed to copper supply and return headers.

7) **Provide line item cost for “Cooney” freeze projection coil alternative for chilled water coils.**

FILTERS

1) Provide complete filter section(s) with filter racks and service access door(s) as shown on the plan drawings. Holding frames provided for medium efficiency applications will be accessible. Holding frames provided for high efficiency applications will be upstream accessible. Holding frames shall be constructed from heavy gauge galvanized steel and shall be equipped with polyurethane foam gaskets. Frames shall be installed with vertical stiffeners and appropriate frame-to-frame sealant to provide a rigid leak tight assembly. An integral air seal which completely seals around the filter frame assembly and extends to the unit pressure bearing surface shall be provided. Air seals/safing materials that are mechanically fastened to the inner liner of the cabinet only shall be constructed of 16 gage materials to match the material type in the appropriate section and shall be gasketed and have fasteners every 3 inches

   Filter fasteners shall be “P-Clip” type and capable of being installed without the requirement of tools, nuts or bolts. The holding frame shall be designed to accommodate standard size filters with the application of the appropriate type fastener. The filter rack shall be designed to use standard 24”x24” and 12”x24” filters only. Odd sized filters are not allowed. Holding frame assemblies shall be sized to meet or exceed the face area specified by the mechanical schedule.

2) Gauges
   a) A Magnehelic differential pressure gauge shall be provided factory installed for measuring the pressure drop across each filter type. The gauge shall be a diaphragm-actuated dial type, 4¾" O.D., with white dial, black figures and graduations and pointer zero adjustment.

3) Medium efficiency pleated filters shall be 2” thick MERV 8 as rated by ASHRAE Standard 52.1 test methods. Filter media shall be of the non-woven cotton fabric type. Filters shall be UL900 Class 2 listed.

CONTROL DAMPERS

1) Mixing box and economizer outdoor air, return air, and exhaust air openings shall have factory mounted aluminum airfoil low-leak dampers. Damper shall be opposed (exhaust air) and parallel (outdoor air and return air) blade type. Damper frame shall be 0.125” thick aluminum hat channel. Damper shall meet the leakage requirements of ASHRAE Std. 90.1 and of the International Energy Conservation Code by leaking less than 3 CFM/sq. ft. at 1” of static pressure, and shall be tested in accordance with AMCA Standard 500-D.
2) The dampers shall be TAMCO 1000 WP aluminum airfoil or approved equivalent.

ELECTRICAL POWER AND CONTROLS

1) Unit operating voltage shall be 480V, 3-phase, 60Hz. All wiring and electrical equipment supplied by the manufacturer shall conform to and be installed in accordance with the requirements of UL1995.

2) Each section provided with a service access door, or as indicated on the plan drawings, shall be equipped with a vapor proof LED service light. All lights shall be completely installed and wired to a single 60-minute timer switch. All switch boxes shall include a GFCI convenience receptacle. Lights and GFCI outlets shall be wired to a separate 115VAC power connection.

3) Provide copper wires, bus bars, and fittings throughout, except internal wire of the control transformer may be aluminum if copper termination is provided. Identify power supply terminals with permanent markers. The maximum temperature of terminals shall not exceed 167°F (75°C) when the equipment is tested in accordance with its rating.

4) All wiring, 208VAC and 115VAC, shall be run in plated EMT and FMC flexible metal conduit.

5) Mount a permanent nameplate on the unit to display the manufacturer, serial number and model number, date of manufacture, horsepower, current rating, and voltage.

UNIT TESTING AND QUALITY CONTROL

1) The fans shall be factory run tested to insure design integrity and proper RPM. All electrical circuits shall be tested to ensure correct operation before shipment of unit. Units shall pass all quality control checks and be thoroughly cleaned prior to shipment.

2) One (1) unit on the project, chosen by the engineer during the submittal review, shall be factory tested to verify its cabinet leakage rating at design both positive and negative operating static pressure(s). Cabinet leakage shall not exceed a Leakage Class rating of 5 as defined by ANSI/ASHRAE Standard 111. Leak testing shall be performed by measuring the airflow pumped into and out of the air-handling unit at the cabinet design operating static pressure. All unit openings shall be sealed. The air shall then be pumped into and out of the unit until the appropriate operating pressures are achieved. Airflow measurements shall be performed in compliance with AMCA Standard 210. The testing shall be performed at the factory. A detailed report, including all data and test methods, shall be presented to the owner or his representative prior to equipment shipment.

B. CUSTOM OUTSIDE AIR UNITS (OA-N1, OA-N2, OA-N3, OA-S1, OA-S2, OA-S3, OA-S4)

AVAILABLE MANUFACTURERS:

1) The manufacturer shall be a custom air handler manufacturer with a minimum 10 years experience in manufacturing custom air handling units. The basis of design is Airflow Systems. Other acceptable manufacturers are: Climate Craft, Nortek, Ingenia and Air Enterprises.

CABINET CONSTRUCTION

1) Cabinets shall be constructed in a watertight and airtight manner. The manufacturer's cabinet construction shall result in an ASHRAE/ANSI Standard 111 Leakage Class 5 rating, or better, as measured in accordance with AMCA Standard 210. A leakage rate as a percent of airflow shall only be submitted following calculation at specific project conditions. Maximum casing leakage (cfm/100 ft^2 of casing surface area) = CL X $P^{0.65.}$ Published leakage rates at generic conditions shall not be submitted.

2) Casing deflection shall not exceed L/200 (.0005" per inch) at 1.5 times the casing internal operating pressure at design airflow conditions, not to exceed 10" w. g., whichever is less. L is defined as the panel span taken at the panel seam joint.

3) The unit shall be constructed on an 8" welded structural aluminum c-channel base. Equipment using a die-formed sheet metal base is not acceptable. Formed intermediate cross members shall be constructed of structural aluminum tubing.

4) Units shipped in multiple sections shall be engineered for ease of field assembly. Gasket supplied with the unit shall be a high-quality weather resistant closed-cell EPDM sponge rubber. Each section shall include a permanent label to aid in proper field assembly. All gasket and necessary assembly hardware shall ship loose with unit. Floors shall be designed to deflect no more than 1/200 of span under operating conditions.

5) Floors

   a) The floor shall be fabricated of aluminum treadplate. The aluminum tread plate shall be type 3003 (Tread Bright) embossed with four-way tread and finished to high gloss. The thickness shall be 3/16" OD over treads and 0.125" at base.

   b) All floor sheets shall be isolated from the base assembly with an EPDM thermal break gasket.

   c) Floors shall be insulated with a two-part polyurethane water impervious foam insulation. Glass fiber insulation is not acceptable.

   d) Under liner shall also be provided to cover and protect base floor foam insulation. Under liner shall be fabricated of 0.053" aluminum stitch welded plate. Floor shall be cross-broke to provide strength.

6) Wall and roof panels

   a) Panels shall be at minimum 4" thick double wall construction. Panel joints shall be sealed with an industrial EPDM gasket to form a water and airtight seal.

b) Panels shall be individually removable for service without removing the roof or compromising the integrity of the cabinet wall. Panels shall be joined with either screws or 5/16" bolts. All panels shall utilize thermal break construction between the exterior panel and the interior liner and between the panels and the base and roof frames. Screws shall have neoprene gasket and shall not penetrate through casing.

c) For long term durability, exterior panels shall be a minimum 16-gauge G60 galvanized steel

d) Interior liners of the cooling coil section and discharge plenum section shall be a minimum 20-gauge type 304 stainless steel. All other sections shall be a minimum 20-gauge G90 galvanized steel. Panel liners shall be of a single piece construction and attached to the exterior panels with a full thermal break. To allow for cleaning, no fasteners shall be used on the exposed liner surface. Single wall units are not acceptable.

7) Insulation

All wall and roof panels shall be insulated with an injected foam insulation with an R value of 6.7/inch. Panels shall be designed to deflect no more than 1/200 of span under operating design conditions when measured at the panel seam. Insulation shall fill the panel without voids. The composite R-value of the 4" unit casing shall be no less than R-26.8.

8) Access doors shall be provided into all sections of the air-handling unit as indicated in the plan documents. Doors shall be sized as shown on plan drawings, shall be a minimum 4" thick with R-19.8 polyurethane foam insulation and shall be double wall construction using the same material type as the corresponding section. Doors shall comply with the requirements of UL 1995 and NFPA 90. The door frame shall be 0.125" extruded 6063-T5 aluminum. Each door shall be mounted with adjustable die cast continuous piano type stainless steel hinges. All doors and mounting frames shall incorporate a thermal break design and the doors shall seal to a replaceable extruded EPDM sponge rubber gasket. Doors shall open against static pressure or shall include a pressure relief feature on the door latch.

a) The door latch assembly shall consist of a roller cam compression arm with a chrome plated steel inner handle and glass fiber/nylon composite outer handle. One tool operated lock shall be provided on each fan section access door. All doors shall have a minimum of two latches.

b) A 10"x12" thermal pane viewing window with one wire mesh safety glass pane and one clear pane shall be provided. The frame shall have a no-through-metal thermal break design. Viewing windows shall be on all doors serving a lighted section.

c) The door height for this project shall be 72". The fan access door shall be 30" wide. All other doors shall be 24" wide.

9) The entire unit, including walls, roof, doors, joints, and seams shall include thermal break construction. This construction shall be supported by tested performance producing no condensation on the exterior surface when the air tunnel temperature is 50°F DB under the following exterior conditions:

a) $(Th - 50) / (Th - Tdp) < 3.4$

b) Th = Ambient dry bulb temperature (°F) external to housing

c) Tdp = Ambient dew point temperature (°F) external to housing

FAN ASSEMBLIES – GENERAL

1) The fan shall be of the size and type specified in the unit schedule. To assure maximum performance, fans shall be supplied by a manufacturer specializing in fan design and production.

All fan assemblies shall be designed for heavy-duty industrial applications. Fan framing assemblies shall be fabricated from structural steel electrically welded to form a rigid, integral base. Individual fan assemblies shall be independently isolated.

All motors shall be NEMA design B with Class F insulation. Electrical characteristics and horsepower shall be as specified on the project schedule. All motors shall have a minimum service factor of 1.15. Motors shall have ball bearings. Motors shall be premium efficiency TEFC type and shall be factory wired to a fan array motor overload panel. The motor shall be located within the unit and mounted on an adjustable heavy steel base. The motor base shall be fastened securely to the structural steel framing of the fan assembly.

All fans shall meet the minimum efficiency and maximum brake horsepower values as scheduled. All fans shall be selected to operate at a point no higher than 90% of the peak static pressure rating as defined by the fan performance curve at the selected operating speed. Manufacturer must ensure maximum fan RPM is below the first critical speed.

2) Each fan shall be provided with a factory installed airflow measuring device. Airflow device to be mounted out of the direct air stream so as not to affect system static pressure or sound performance. Sensor accuracy shall be +/- 3%. Factory installed assembly shall include flow sensors for field connection to a transducer provided by others.

FAN ASSEMBLIES – DIRECT DRIVE ARRAY OF FANS

1) Approved manufacturers: ClimateCraft, Greenheck, Hunt Air, and Twin City Fan & Blower

a) Fan Arrays shall be direct-drive, non-overloading SWSI plenum fans designed for industrial duty and suitable for continuous operation.
   i) Fans shall be arranged in an array using one or more welded structural steel assemblies and shall be of the size and quantity specified in the unit schedule. Screwed or riveted frames are unacceptable. Fan assemblies shall be attached directly to base structural members.
   ii) Fan wheels shall have a minimum of 12 airfoil blades for superior sound characteristics and shall be constructed of aluminum to reduce rotational weight and vibration. Fan blades shall be extruded aluminum for uniformity and improved vibration characteristics.
   iii) Each fan and motor assembly shall be independently isolated within the structural assembly using 1-inch deflection spring isolators. Isolators shall be mounted in a three-point arrangement that provides both vertical and horizontal (thrust) isolation and shall not require field adjustment. If hard mounted or rubber in shear is used in place of internal spring isolations, external isolation of the entire air handling unit is required, no exceptions. The isolation system shall be seismic rated to withstand seismic forces in excess of 4G horizontally and vertically to satisfy specified IBC seismic requirements.
   iv) A fan inertia base shall be provided, or the fan structure shall exceed an equivalence of 2x mass of the total rotating parts of the fan array. Fan and motor assemblies shall be designed such that no natural frequencies exist within the operating RPM range of the fan, eliminating the need for “lockout” frequency settings in the variable speed drive. The purchasing contractor will be responsible for all costs associated with externally isolating any unit that does not include individual fan isolation.
   v) All fan arrays shall meet the minimum motor efficiency, maximum brake horsepower and total motor horsepower values scheduled. All fans shall be selected to operate at a point no higher than 90% of the peak static pressure rating as defined by the fan performance curve at the selected operating speed. Manufacturer must ensure maximum fan RPM is below the first critical speed. Fans shall be Class 2 or 3 construction as required for the application.
   vi) All fan and motor assemblies shall be dynamically balanced by the manufacturer to a maximum allowable vibration of 0.040 inches per second at design RPM and a maximum 0.080 inches per second overall vibration limit to bring the fan balance in conformance to a BV-5 Grade G1 per ANSI/AMCA 204. In addition, the manufacturer shall ensure that no critical frequencies exist in the fan operating range by varying motor speed in 1Hz increments from design RPM to 50% of design RPM.

b) Unloading
   i) Fan curves shall be submitted with the system curve indicating the minimum system operating static pressure and the point of fan surge.

c) Motors
   i) Electrical characteristics and horsepower shall be as specified on the project schedule.

ii) Motors shall be Premium Efficiency per NEMA MG1 Table 12-12 type, shall have NEMA Class F insulation, shall meet NEMA Standard MD-1 Inverter Duty rating and shall be designed to withstand 1600V peak voltage spikes and rise times ≥0.1 microseconds.

iii) Motors shall have TEFC enclosures.

iv) Motors shall have grease lubricated ball bearings designed to deliver a minimum L10 life of 250,000 hours at full load and the maximum operating RPM of the associated fan. Grease zerks and spring-loaded grease relief valves shall be provided in each motor to allow easy bearing lubrication without damaging the seals due to over lubrication. Permanently lubricated bearings are allowed if a spare motor per fan array is provided.

v) For efficient operation in a direct drive application, motors shall be capable of operating greater than 60HZ to at least the design operating speed of the fan.

vi) Motors shall be factory wired to a motor control center for connection to a VFD. The unit shall have 3 motor control centers for both supply and return fan arrays. Two motors for each motor control center. The motor control center shall include for each motor circuit a control device providing overload protection, short circuit protection and a manual disconnect means, and all circuits shall be wired to a common main panel terminal block. Each control device shall include an auxiliary output capable of providing remote notification of a motor failure. All motors shall operate, at all times, and be controlled in unison, maintaining a consistent and uniform airflow pattern over coils, filters and other devices.

vii) Each motor shall be provided with a shaft grounding device to harmlessly bleed potential induced shaft voltages to ground.

d) Warranty

i) All rotating parts shall be warranted by the unit manufacturer for a full five (5) years from the date of unit start-up. Parts warranties provided by third parties are not acceptable.

e) Options

i) In the fan section, provide an overhead motor removal system to facilitate motor replacement. One of the two options below is to be provided.

(1) The assembly shall include a manually operated winch, capable of being easily moved to any motor location.

(2) A structural steel I beam for mounting a trolley to assist in fan motor removal. The beam system shall be mounted overhead of the fan and motor. The beam system shall be supported and mounted to the unit's base support system.

(3) The assembly shall include a swinging arm structure capable of retracting the motor from inside the AHU.

(4) Fan outlet screens shall be provided.

ii) TAMCO 7600 aluminum gravity backdraft dampers shall be provided on the inlet of each fan to prevent recirculation of air in the event of motor failure.

AIRFLOW AND PRESSURE MEASUREMENT SYSTEM

1) The air handler shall be equipped with a factory controls system for simultaneously measuring each fan array airflow, outside air intake airflow and pressure drop across filters with an accuracy of ±0.25% of full scale. The transmitter shall be housed in a hinged compact NEMA 4X enclosure to provide flexibility in mounting location. Transmitter shall include a color touchscreen display with on-screen keypad. The total (summed) airflow rate for each system shall be available to the Building Automation System (BAS) or local controller via dedicated field selectable 0-10 V or 4-20 mA analog outputs and via field selectable BACnet®-MS/TP network communication. Independent flow and pressure values for each of the sensing points shall also be available to the BAS or local controller via network communication.

   Fan Array: Each fan shall include a piezometer ring airflow station factory installed in each fan inlet. The device shall have a measurement accuracy of ± 5%. Alternate means of air flow measurement systems shall not be used without specific project approval.

FAN SPEED CONTROL AND MOTOR PROTECTION

1) Each pair of supply and return fans shall be provided with an dedicated individual variable frequency drive as specified under another specification section.

2) The manufacturer shall provide, mount, and wire a fan array power distribution panel. The power distribution panel shall have a NEMA 3R enclosure. It shall have a main disconnect switch on the incoming line voltage side, a combination motor overload / disconnect for each fan motor, and all necessary wire termination blocks and terminal strips. It shall have a 65,000-amp short circuit withstand rating.

UNIT SOUND POWER

1) Fan sound power levels (dB) for the unit shall not exceed values as specified on the equipment schedule.

2) Unit manufacturer shall provide certified inlet, supply and casing radiated, sound power levels based on the final unit configuration.

COILS

1) Coils shall be “staggered” within the air tunnel to allow less than full AHU width for coil removal. Provide complete coil section(s) with service access door(s) as shown on the plan drawings. Coil connections shall extend through the section casing for ease of installation. Coil connections must be sealed from both the inside and exterior surfaces

of the panel with the sleeve of the inner seal covering the pipe within the depth of the panel, all to minimize leakage and condensation. An integral double wall stainless steel air seal which completely seals around the cooling coil casing and extends to the unit pressure bearing surface shall be provided. An integral single wall galvanized steel air seal which completely seals around the heating coil casing and extends to the unit pressure bearing surface shall be provided. Air seals/safing materials that are mechanically fastened to the inner liner of the cabinet only shall be constructed of 16-gauge materials to match the material type in the appropriate section and shall be gasketed and have fasteners every 3 inches.

2) Multiple, “stacked” coil arrangements must be constructed to allow independent removal of any coil without the removal of another within the coil bank.

3) All coils shall meet or exceed the capacities specified on the mechanical schedule and all water coil performances shall be certified in accordance with the AHRI Forced Circulation Air Heating and Air Cooling Coil certification program which is based on AHRI Standard 410. Face velocities shall not exceed those specified on the mechanical schedule.

4) All blow-through cooling coils shall have removable stainless-steel mist eliminators as manufactured by Mistop regardless of coil face velocity, no exception.

5) All cooling coil sections shall include a double sloped drain pan constructed from 304L stainless steel. All corners shall be welded watertight. Coils shall rest on stainless steel supports. The pan shall have a minimum pitch of 2" from high point to the bottom of the drain outlet connection, providing at least a 1/8” per foot slope. The drain pan shall be insulated with a 2-part sprayed on polyurethane, water impervious foam. Insulation shall be applied to the entire under side of the drain pan and coil section base assembly. If multiple stacked coils are used, intermediate drain pans are required. Intermediate pans shall be insulated and drained with 3/4” copper down-comers to the main pan. All drain pan openings shall be covered with walk-on aluminum grating for safety. Open drain pan openings are not acceptable.

6) Water coils shall be of a staggered tube design with high efficiency die formed corrugated plate-type fins for maximum performance. All coils shall be tested with 400 psig compressed air under clear water. Coils shall be designed to operate at 300 psig internal pressure and up to 250ºF. Tubes shall be 5/8" diameter, seamless 0.035” wall copper, mechanically expanded into full drawn fin collars for a continuous compression bond over the full finned length for high efficiency performance. Cooling coil casings shall be a minimum of 16-gauge stainless steel. Heating coil casings shall be a minimum of 16-gauge galvanized steel. Coil casing reinforcements shall be required for fin lengths over 42". Coil fins shall be 0.0095” thick aluminum as a minimum. Coils shall be serviceable using 0.25" M.P.T. drain and vent taps on the supply and return headers. Threaded seamless red brass coil connections shall be brazed to copper supply and return headers.

7) **Provide line item cost for "Cooney" freeze projection coil alternative for chilled water coils.**

FILTERS

1) Provide complete filter section(s) with filter racks and service access door(s) as shown on the plan drawings. Holding frames provided for medium efficiency applications will be accessible. Holding frames provided for high efficiency applications will be upstream accessible. Holding frames shall be constructed from heavy gauge galvanized steel and shall be equipped with polyurethane foam gaskets. Frames shall be installed with vertical stiffeners and appropriate frame-to-frame sealant to provide a rigid leak tight assembly. An integral air seal which completely seals around the filter frame assembly and extends to the unit pressure bearing surface shall be provided. Air seals/safing materials that are mechanically fastened to the inner liner of the cabinet only shall be constructed of 16 gage materials to match the material type in the appropriate section and shall be gasketed and have fasteners every 3 inches

   Filter fasteners shall be "P-Clip" type and shall be capable of being installed without the requirement of tools, nuts or bolts. The holding frame shall be designed to accommodate standard size filters with the application of the appropriate type fastener. The filter rack shall be designed to use standard 24"x24" and 12"x24" filters only. Odd sized filters are not allowed. Holding frame assemblies shall be sized to meet or exceed the face area specified by the mechanical schedule.

2) Gauges

   A magnehelic differential pressure gauge shall be provided factory installed for measuring the pressure drop across each filter type. The gauge shall be a diaphragm-actuated dial type, 4¾" O.D., with white dial, black figures and graduations and pointer zero adjustment.

3) Medium efficiency pleated filters shall be 2" thick MERV 8 as rated by ASHRAE Standard 52.1 test methods. Filter media shall be of the non-woven cotton fabric type. Filters shall be UL900 Class 2 listed.

HUMIDIFIER SECTION

1) The AHU shall include a section for a future field mounted dispersion tube system to be installed. Humidification generator, dispersion tube and all related piping, controls and equipment will be in future bid package. Refer to schedule for module size. Mounting features on floor and/or walls shall be included to provide means for future dispersion rack to be installed without creating openings in the air tunnel from field installed fasteners. Gasketed openings shall be provided for future humidifier piping.

CONTROL DAMPERS

1) Mixing box and economizer outdoor air, return air, and exhaust air openings shall have factory mounted aluminum airfoil low-leak dampers. Damper shall be opposed (exhaust air) and parallel (outdoor air and return air) blade type. Damper frame shall be 0.125" thick aluminum hat channel. Damper shall meet the leakage requirements of ASHRAE Std. 90.1 and of the International Energy Conservation Code by leaking less than 3 CFM/sq. ft. at 1" of static pressure, and shall be tested in accordance with AMCA Standard 500-D.
2) The dampers shall be TAMCO 1000 WP aluminum airfoil or approved equivalent.

ELECTRICAL POWER AND CONTROLS

1) Unit operating voltage shall be 480V, 3-phase, 60Hz. All wiring and electrical equipment supplied by the manufacturer shall conform to and be installed in accordance with the requirements of UL1995.

2) Each section provided with a service access door, or as indicated on the plan drawings, shall be equipped with a vapor proof LED service light. All lights shall be completely installed and wired to a single 60-minute timer switch. All switch boxes shall include a GFCI convenience receptacle. Lights and GFCI outlets shall be wired to a separate 115VAC power connection.

3) Provide copper wires, bus bars, and fittings throughout, except internal wire of the control transformer may be aluminum if copper termination is provided. Identify power supply terminals with permanent markers. The maximum temperature of terminals shall not exceed 167°F (75°C) when the equipment is tested in accordance with its rating.
4) All wiring, 208VAC and 115VAC, shall be run in plated EMT and FMC flexible metal conduit.

5) Mount a permanent nameplate on the unit to display the manufacturer, serial number and model number, date of manufacture, horsepower, current rating, and voltage.

UNIT TESTING AND QUALITY CONTROL

1) The fans shall be factory run tested to insure design integrity and proper RPM. All electrical circuits shall be tested to ensure correct operation before shipment of unit. Units shall pass all quality control checks and be thoroughly cleaned prior to shipment.

2) One (1) unit on the project, chosen by the engineer during the submittal review, shall be factory tested to verify its cabinet leakage rating at design both positive and negative operating static pressure(s). Cabinet leakage shall not exceed a Leakage Class rating of 5 as defined by ANSI/ASHRAE Standard 111. Leak testing shall be performed by measuring the airflow pumped into and out of the air-handling unit at the cabinet design

operating static pressure. All unit openings shall be sealed. The air shall then be pumped into and out of the unit until the appropriate operating pressures are achieved. Airflow measurements shall be performed in compliance with AMCA Standard 210. The testing shall be performed at the factory. A detailed report, including all data and test methods, shall be presented to the owner or his representative prior to equipment shipment.

C. HIGH VELOCITY LABORTORY HOOD FUME EXHAUST FAN (LEF-N, LEF-S)

1) OVERVIEW

The fan and energy recovery system shall be a complete turnkey factory fabricated assembly including a base, fans, energy recovery plenum and coils, stack and/or stack extensions, nozzles and all related equipment. Refer to schedule for exact stack heights and footprint sizes. The fan manufacturer shall engage a **Kentucky** licensed structural engineer for a delegated engineered system to provide all structural reinforcements, sub-structures and other structural elements to ensure a fully self-supporting assembly from the factory. The only field installed supports shall be guy wires.

2) MANUFACTURER

Basis-of-Design Manufacturer: Provide fan units manufactured by **Strobic Air Technologies**. Other acceptable manufacturers: **Twin City Fan** and Greenheck

Source Limitations: Obtain inline, centrifugal fans from a single manufacturer.

3) PERFORMANCE REQUIREMENTS

Fan Performance Ratings: Sea level-based.

Compliance: Classified under UL 705.

Fans shall meet the criteria of NFPA-45

Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70.

4) FAN ASSEMBLY

Direct Drive Induced flow Inline Centrifugal Fume Exhaust Fans: Inline Centrifugal fan units, configured for roof mounting, for vertical flow of relatively clean air containing laboratory fumes or hazardous vapors for ventilating applications. Acceptable alternative fan type is direct drive utility type fan configured for roof mounting.

(a) Basis of Design Product: Strobic Air Direct-Drive, Inline induced flow centrifugal axial fans.

(b) Permanently attach nameplate displaying serial number and unit information.

(c) Fan assemblies: Provide unit suitable for maintaining structural integrity and operation in 125 mile per hour (55.9 meter/second) wind.

Fan Wheel Impeller: Centrifugal design with formed aluminum die formed airfoil blades continuously welded to wheel backplate and wheel cone.

(a) Statically and dynamically balance wheel.
(b) Minimum Balance Quality Grade: G6.3, in accordance with AMCA Standard 204.
(c) Include fins on wheel backplate.

Spark Resistant Construction: Mount bearings outside flow airstream, and provide sealed metal belt shield tubes.

(a) AMCA Type B: Provide non-ferrous fan wheel impeller and aluminum rub ring where shaft penetrates fan housing.

Fan Shaft:

(a) AISI C1045 hot-rolled steel.
(b) Turn, grind, and polish shaft.
(c) Size shaft for first critical speed minimum 1.43 times maximum speed for each fan class.
(d) Apply petroleum based rust preventative coating.
(e) Key shaft to wheel hub.

Provide standard shaft seal to reduce leakage and protect the bearings from contaminated airstreams.

Bearings: Manufacturer's standard field-lubricated ball or roller bearings with pillow block mounting, based on fan size, with grease lines extended to outside fan housing.

(a) Minimum L-10 Bearing Life: 200,000 hours at maximum operating speed, in accordance with ABMA 9 for Ball Bearings, or ABMA 11 for Roller Bearings.

Housing: Steel with continuously welded seams and streamlined inlet. Reinforce housing to prevent vibration. Provide punched inlet flange.

(a) Quick Open Latched Access Door.
(b) Provide 3/4 inch NPT drain connection at lowest point of housing.

Weather Cover: Provide hinged steel weather cover to shield motor drive system from weather. Fabricate with rainproof ventilation slots.

Discharge Nozzle and Windband: Provide combination discharge nozzle and windband to increase discharge velocities to velocities that comply with ANSI Z9.5 as scheduled.

(a) The nozzle height shall be as scheduled, even with roof mounted greenhouse ridge.

(b) The nozzle discharge air velocity shall be as minimum as scheduled.

(c) Nozzle shall have ultra quiet silencer.

Provide discharge damper providing 100 percent shutoff preventing rain intrusion while allowing plume to develop when fan is energized.

Straightening Vanes: Fabricate from same material as housing. Aerodynamically designed to recover velocity pressure and convert it to static pressure in downstream ductwork.

Curb Cap: One-piece, weather-tight construction, pre-punched mounting holes for correct attachment to roof curb and fan inlet flange. Fabricate from [painted] [galvanized] steel.

Motors: Totally Enclosed Fan Cooled TEFC that complies with NEMA MG-1 for designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 section "Common Motor Requirements for HVAC Equipment." Provide motors that comply with the Energy Independence and Security Act of 2007 (EISA).

When controlled with a Variable Frequency Drive (VFD), provide premium efficiency motors suitable for inverter duty use.

Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
Provide unfused disconnect switch, NEMA 3R selected in accordance with Division 26 section "Enclosed Switches."

(a) Factory mount and wire disconnect switch.
(b) Ship disconnect switch loose for field mounting and wiring.

Motor Mounting Platform: Heavy-duty motor mounting platform designed to support direct drive motors and accommodates access to motor and drive couplings and components.

Hardware: Provide corrosion resistant stainless steel hardware and fasteners.

Coatings:

Standard Coating: All carbon steel components shall be cleaned and chemically treated by a phosphatizing process. Fan shall then be coated with gray enamel.

Refer to schedule for coating information related to air stream components.

Accessories:

(a) Inlet Safety Screen: Welded wire safety screens fabricated for easy installation and removal.
(b) Stack Section: Tube extension mounted between the outlet of the fan and the nozzle to create an overall fan height as scheduled. All required structure to support overall stack height shall be delegated design by fan manufacturer structural engineer.

(c) Fan Assembly base. Structural steel base to sit on HHS14x6x3/8" flashed roof base. Fan shall be capable of being welded or permanently fastened to roof structure. Finished structural base and associated plenum access doors and fans shall be maximum 24" above finished roof level UNLESS fan assembly is furnished with a self supporting equipment access platform that includes stairs, railing and all support required. Access platform shall not require roof membrane penetration of permanent support from building roof structural elements

(d) Vortex Breaker: Installed in the mixing plenum box at the fan inlet to minimize air turbulence.

(e) Energy Recovery Plenum: Houses coils and filters as scheduled

(a) Energy Recovery Plenum: Plenum matching fan housing material of construction, to include integral duct flange to mate to fan inlet.
(b) Intake: Two side intake energy recovery plenum openings for attachment of lab exhaust duct.
(c) Insulated mixing box with stainless steel liner.

(f) Isolation dampers: Provide isolation dampers to isolate each fan in the system for energy recovery plenum.

(a) Parallel blade design, constructed of epoxy-coated aluminum

a) Provide 24V-powered, two-position, spring return actuator

(g) Bypass Damper: Provide modulating bypass damper to maintain fan discharge velocity as fan delivery changes.

(a) Opposed blade design, constructed of epoxy-coated aluminum

a) Provide 24V-powered, modulating actuator

(h) UL/cUL 705 Compliant Assembly: Provide components required for UL/cUL 705 compliance. Affix UL/cUL 705 labeling and nameplate to finished unit.

(i) Spark Resistant Construction: Mount bearings outside flow airstream, and provide sealed metal belt shield tubes.

(a) AMCA Type C: Provide construction that will not permit shaft or fan wheel impeller to contact or strike ferrous metal parts.

(j) Piezometer Ring: Provide piezometer ring type differential pressure device with connections for field-installed flow measuring instrumentation.

(a) Pressure Transducer without Display: Provide piezometer ring and transducer to convert differential pressure readings to 4 - 20 mA DC signal proportional to flow.

(k) Jib Crane and Mounting Base: Provide manually operated jib crane suitable for unit maintenance and motor removal. **If Jib crane is not available nor practical for this application, manufacturer shall specifically state so and give brief description of process to remove motors given specific to their complete assembly.**

(l) Jib Crane Mounting Base: Provide mounting base for manually operated jib crane.

D. REVERSABLE CHILLER EXTENDED RANGE UNITS

A. Description: Factory assembled and tested, single packaged water-source heat pump consisting of 10-gauge welded steel frame with powder coat paint, sealed refrigerant circuit including two compressors, two refrigerants to water heat exchangers, bi-directional electronic expansion valve, reversing valve, and reverse cycle refrigeration controls. The unit and all refrigeration components shall be rated for use with R-454B refrigerant. Field conversion of refrigerants will not be allowed.

B. Acoustical Enclosure: Provide heavy gauge galvanized steel casing with electro-statically painted finish. Provide access panels for inspection and access to internal components. Insulate panels with a minimum ½ inch thick, 15 lb./cu.ft. density, coated fiberglass insulation. All insulation must meet NFPA 90A.

C. Refrigerant to Water Heat Exchangers: Brazed plate type heat exchangers, dual refrigerant circuits with a single water circuit, with 316 stainless steel plates and cupro-nickel braze material capable of withstanding 650 psig working pressure on the refrigerant side and 450 psig on the water side. The heat exchanger Heat exchangers are to be insulated with ¾" inch thick, 0.27 BTU-in/hr sq.ft. thermal conductivity, expanded closed-cell foam insulation. The insulation shall be manufactured without the use of CFC's or HFC's. Provide access for cleaning.

D. Refrigeration Components: Provide 4-way, electro-magnetically activated solenoid.
refrigerant reversing valve designed for fail-safe operation in the cooling position. The solenoid coil assembly must be detachable from valve body. Provide a bi-directional, electronic expansion valve to deliver proper superheat over the complete range of operating water temperatures. Provide bi-directional flow liquid line filter dryers on each refrigerant circuit. Provide high and low temperature cutouts, and compressor motor overload protection. Provide capability to reset compressor lockout circuit at either remote controls or circuit breaker.

E. Compressor: Provide hermetic, high efficiency, scroll type compressor with internal isolation and mounted on neoprene vibration isolators. A high density sound attenuating blanket shall be factory installed to minimize compressor sound power.

F. Water Piping Connections: The unit shall have one set of entering and leaving water connections. The connection shall be grooved mechanical fitting constructed from cast ductile iron conforming to ASTM A-536, Grade 65-45-12 or malleable iron conforming to ASTM A-47, Grade 32510. Grooved couplings shall be rated for use with carbon steel piping conforming to ASTM F-1476, Grade A-53B/A-106B standards. Gaskets shall be Grade “E” EPDM compound conforming to ASTM D-2000 Designation 2CA615A25B24F17Z.

G. Unit Controls:

1. Provide factory-mounted and factory-wired controls for sequenced operation of compressors and reversing valves. Single-point power connection to non-fused, or fused rotary-type disconnect in control panel. Factory installed; DIN mounted CUBE Fuse with Class J rating wired for protection of each compressor. Low voltage, emergency stop button factory wired and mounted to control panel service door. A 24-volt class 2, minimum 75VA transformer with integral Class CC circuit breaker shall provide power to the low voltage controls. Provide safety lockout control with refrigerant high-pressure switch, refrigerant low-pressure or loss of charge switch, and water freeze protection on both the load and source heat exchangers. The lockout circuit shall be capable of being reset by either resetting the low voltage power supply or the main unit circuit breaker. Unit shall have phase loss/reversal for compressor protection.

2. Microprocessor Control: Provide a factory installed programmable HydroLink2, microprocessor control that sequences all unit functions and modes of operation. The control shall be capable of interface with electro-mechanical temperature controls or a building automation controller using BACnet MSTP communication protocols.

3. Control Display: Provide a factory installed color touch screen HMI. The 10” HMI shall be capable of displaying:
   a. Entering and leaving water temperatures at each brazed plate heat exchanger
   b. Discharge refrigerant pressure and saturated temperature values
   c. Suction refrigerant pressure and saturated temperature values
   d. Superheat and subcooling values
   e. Electrical energy consumption
   f. Modular chiller modes and control status
   g. Modular chiller compressor accumulated runtime.

E. COMBINATION VARIABLE FREQUENCY DRIVE / DISCONNECT (VFD) FOR MOTORS 50 HP AND LESS (FOR REFERENCE ONLY – EQUPMENT WILL BE PROCURED IN CONSTRUCTION BID PACKAGE)

(1) Manufacturers

a. ABB, Allen Bradley or Yaskawa.

(2) General

a. Furnish complete variable frequency VFDs as specified herein for the fans and pumps designated on the drawing schedules to be variable speed. All standard and optional features shall be included within the VFD enclosure, unless otherwise specified. VFD shall be housed in a metal NEMA enclosure of type according to the installation and operating conditions at the job site. The VFD's UL listing shall allow mounting in plenum or other air handling compartments. If a NEMA 12 enclosure is required for the plenum rating, the manufacturer must supply a NEMA 12 rated VFD.

b. The VFD shall have integral disconnecting means to disconnect power to device in accordance with NEC.

c. The VFD shall convert incoming fixed frequency three-phase AC power into a variable frequency and voltage for controlling the speed of three-phase AC motors. The motor current shall closely approximate a sine wave. Motor voltage shall be varied with frequency to maintain desired motor magnetization current suitable for centrifugal pump and fan control and to eliminate the need for motor derating.

d. With the motor's rated voltage applied to the VFD input, the VFD shall allow the motor to produce full rated power at rated amps, RMS fundamental volts, and speed without using the motor's service factor. VFDs utilizing sine weighted/coded modulation (with or without 3rd harmonic injection) must provide data verifying that the motors will not draw more than full load current during full load and full speed operation.

e. The VFD shall include an input full-wave bridge rectifier and maintain a fundamental power factor near unity regardless of speed or load.

f. The VFD and options shall be tested to ANSI/UL Standard 508. The complete VFD, including all specified options, shall be assembled by the manufacturer, which shall be UL-508 certified for the building and assembly of option panels. Assembly of the option panels by a third-party panel shop is not acceptable. The appropriate UL stickers shall be applied to both the VFD and option panel, in the case where these are not contained in one panel. When these VFDs are to be located in Canada, CSA or C-UL certifications shall apply. Both VFD and option panel shall be manufactured in ISO 9001 certified facilities.

g. The VFD shall have a dual 5% DC link reactor on the positive and negative rails of the DC bus to minimize power line harmonics and protect the drive from power line transients. The reactor shall be non-saturating (linear) to provide full harmonic filtering throughout the entire load range. VFDs with saturating (non-linear) DC link reactors shall require an additional3% AC line reactor to provide acceptable harmonic performance at full load, where harmonic performance is most critical.

h. The VFD's full load amp rating shall meet or exceed NEC Table 430-150. The VFD shall be able to provide full rated output current continuously, 110% of rated current for 60 seconds and 160% of rated current for up to 0.5 second while starting.

i. The VFD shall be able to provide full torque at any selected frequency from 29 Hz to base speed to allow driving direct drive fans without derating.

j. An automatic energy optimization selection feature shall be provided standard in the VFD. This feature shall automatically and continually monitor the motor's speed and load and adjust the applied voltage to maximize energy savings and provide up to an additional 3% to 10% energy savings.

k. Input and output power circuit switching shall be able to be accomplished without interlocks or damage to the VFD. Switching rate may be up to 1 time per minute on the input and unlimited on the output.

l. An automatic motor adaptation test algorithm shall measure motor stator resistance and reactance to optimize performance and efficiency. It shall not be necessary to run the motor or de-couple the motor from the load to run the test.

m. Galvanic and/or optical isolation shall be provided between the VFD's power circuitry and control circuitry to ensure operator safety and to protect connected electronic control equipment from damage caused by voltage spikes, current surges, and ground loop currents. VFDs not including either galvanic or optical isolation on both analog I/O and discrete I/O shall include additional isolation modules.

n. VFD shall minimize the audible motor noise through the used of an adjustable carrier frequency. The carrier frequency shall be automatically adjusted to optimize motor and VFD efficiencies while reducing motor noise.

o. VFD supplier shall coordinate with motor supplier to ensure that all motors 20 horsepower and greater are provided with grounding bushings.

(3) Protective Features

a. A minimum of Class 20 I^2t electronic motor overload protection for single motor applications and thermal-mechanical overloads for multiple motor applications shall be provided.

b. Protection against input transients, loss of AC line phase, output short circuit, output ground fault, overvoltage, undervoltage, VFD overtemperature and motor overtemperature. The VFD shall display all faults in plain English. Codes are not acceptable.

c. Protect VFD from sustained power or phase loss. The VFD shall provide full rated output with an input voltage as low as 90% of the nominal. The VFD will continue to operate with reduced output with an input voltage as low as 164 V AC for 208/230-volt units, 313 V AC for 460-volt units, and 394 volts for 600 volts units.

d. The VFD shall incorporate a motor preheat circuit to keep the motor warm and prevent condensation build up in the stator.

e. VFD package shall include semi-conductor rated input fuses to protect power components.

f. To prevent breakdown of the motor winding insulation, the VFD shall be designed to comply with IEC Part 34-17. Otherwise the VFD manufacturer must ensure that inverter rated motors are supplied.

g. VFD shall include a “signal loss detection” circuit to sense the loss of an analog input signal such as 4 to 20 mA or 2 to 10 V DC, and shall be programmable to react as desired in such an instance.

h. VFD shall function normally when the keypad is removed while the VFD is running and continue to follow remote commands. No warnings or alarms shall be issued as a result of removing the keypad.

i. VFD shall catch a rotating motor operating forward or reverse up to full speed.

j. VFD shall be rated for 100,000 amp interrupting capacity (AIC).

k. VFD shall include current sensors on all three output phases to detect and report phase loss to the motor. The VFD will identify which of the output phases is low or lost.

l. VFD shall continue to operate without faulting until input voltage reaches 300 V AC on 208/230-volt units, 539 V AC on 460-volt units, and 690 volts on 600-volt units.

(4) Interface Features

a. Hand/Start, Off/Stop and Auto/Start selector switches shall be provided to start and stop the VFD and determine the speed reference.

b. The VFD shall be able to be programmed to provide a 24 V DC output signal to indicate that the VFD is in Auto/Remote mode.

c. The VFD shall provide digital manual speed control. Potentiometers are not acceptable.

d. Lockable, alphanumeric backlit display keypad can be remotely mounted up to 10 feet away using standard 9-pin cable.

e. The keypads for all sizes of VFDs shall be identical and interchangeable.

f. To set up multiple VFDs, it shall be possible to upload all setup parameters to the VFD’s keypad, place that keypad on all other VFDs in turn and download the setup parameters to each VFD. To facilitate setting up VFDs of various sizes, it shall be possible to download from the keypad only size independent parameters.

g. Display shall be programmable to display in 9 languages including English, Spanish and French.

h. The display shall have four lines, with a minimum of 20 characters on three lines and a minimum of eight large characters on one line.

i. A red FAULT light, a yellow WARNING light and a green POWER-ON light shall be provided. These indications shall be visible both on the keypad and on the VFD when the keypad is removed.

j. A quick setup menu with factory preset typical HVAC parameters shall be provided on the VFD eliminating the need for macros.

k. As a minimum, the following points shall be controlled and/or accessible:

1) VFD Start/Stop
2) Speed reference
3) Fault diagnostics
4) Meter points
   (a) Motor power in HP
   (b) Motor power in kW
   (c) Motor kW-hr
   (d) Motor current
   (e) Motor voltage
   (f) Hours run
   (g) Feedback signal #1
   (h) Feedback signal #2
   (i) DC link voltage
   (j) Thermal load on motor
   (k) Thermal load on VFD
   (l) Heatsink temperature

l. Four additional Form C 230-volt programmable relays shall be available for factory or field installation within the VFD.

m. Two set-point control interface (PID control) shall be standard in the unit. VFD shall be able to look at two feedback signals, compare with two set-points and make various process control decisions.

n. Floating point control interface shall be provided to increase/decrease speed in response to contact closures.

o. Four simultaneous displays shall be available. They shall include frequency or speed, run time, output amps and output power. VFDs unable to show these four displays simultaneously shall provide panel meters.

p. Sleep mode shall be provided to automatically stop the VFD when its speed drops below set “sleep” level for a specified time. The VFD shall automatically restart when the speed command exceeds the set “wake” level.

q. The sleep mode shall be functional in both follower mode and PID mode.

r. Run permissive circuit shall be provided to accept a “system ready” signal to ensure that the VFD does not start until dampers or other auxiliary equipment are in the proper state for VFD operation. The run permissive circuit shall also be capable of sending an output signal as a start command to actuate external equipment before allowing the VFD to start.

s. The following displays shall be accessible from the control panel in actual units: Reference Signal Value in actual units, Output Frequency in Hz or percent, Output Amps, Motor HP, Motor kW, kWhr, Output Voltage, DC Bus Voltage, VFD Temperature in degrees, and Motor Speed in engineering units per application (in GPM, CFM, etc.). VFD will read out the selected engineering unit either in a linear, square or cubed relationship to output frequency as appropriate to the unit chosen.

t. The display shall be programmed to read in inches of water column (in-wg) for an air handler application, pressure per square inch (psi) for a pump application, and temperature (^{0}F) for a cooling tower application.

u. VFD shall be able to be programmed to sense the loss of load and signal a no load/broken belt warning or fault.

v. If the temperature of the VFD’s heat sink rises to 80°C, the VFD shall automatically reduce its carrier frequency to reduce the heat sink temperature. If the temperature of the heat sink continues to rise the VFD shall automatically reduce its output frequency to the motor. As the VFD’s heat sink temperature returns to normal, the VFD shall automatically increase the output frequency to the motor and return the carrier frequency to its normal switching speed.

w. The VFD shall have temperature controlled cooling fans for quiet operation and minimized losses.

x. The VFD shall store in memory the last 10 faults and related operational data.

y. Eight programmable digital inputs shall be provided for interfacing with the systems control and safety interlock circuitry.

z. Two programmable relay outputs, one Form C 240 V AC, one Form A 30 V AC, shall be provided for remote indication of VFD status.

aa. Three programmable analog inputs shall be provided and shall accept a direct-or-reverse acting signal. Analog reference inputs accepted shall include two voltages (0 to 10 V DC, 2 to 10 V DC) and one current (0 to 20 mA, 4 to 20 mA) input.

bb. Two programmable 0 to 20 mA analog outputs shall be provided for indication of VFD status. These outputs shall be programmable for output speed, frequency, current and power. They shall also be programmable to provide a selected 24 V DC status indication.

cc. Under fire mode conditions, the VFD shall be able to be programmed to automatically default to a preset speed.

dd. On motors connected to variable frequency drives, 20hp or greater in size. Provide grounding bushings to prevent arcing.

(5) Interface with Building Automation System/Direct Digital Control System

a. VFD manufacturer shall provide an interface to the BAS/DDC system. Manufacturer shall coordinate as required with the Controls Contractor. Provide Bacnet, Lonworks, FLN, Modbus, or any other interface required for a complete and operational system.

b. Provide mode of operation to BAS/DDC system (hand, off, auto, etc.). BAS/DDC graphic shall highlight or produce pop-up graphic when VFD is in hand or off. Also, provide all points to BAS/DDC identified in section (4).K of this Specification.

(6) Adjustments

a. VFD shall have an adjustable carrier frequency in steps of not less than 0.1 kHz to allow tuning the VFD to the motor.

b. Sixteen preset speeds shall be provided.

c. Four acceleration and four deceleration ramps shall be provided. Accel and decel time shall be adjustable over the range from 0 to 3,600 seconds to base speed. The shape of these curves shall be automatically contoured to ensure no-trip acceleration and deceleration.

d. Four current limit settings shall be provided.

e. If the VFD trips on one of the following conditions, the VFD shall be programmable for automatic or manual reset: under voltage, overvoltage, current limit and inverter overload.

f. The number of restart attempts shall be selectable from 0 through 20 or infinitely and the time between attempts shall be adjustable from 0 through 600 seconds.

g. An automatic “on delay” may be selected from 0 to 120 seconds.

(7) Service Conditions

a. Ambient temperature, -10 to 40°C (14 to 104°F), without derating.

b. 0 to 95% relative humidity, non-condensing.

c. Elevation to 3,300 feet without derating.

d. AC line voltage variation, -10 to +10% of nominal with full output.

e. No side clearance shall be required for cooling of any units. All power and control wiring shall be done from the bottom.

(8) Quality Assurance

a. To ensure quality and minimize infantile failures at the jobsite, the complete VFD shall be tested by the manufacturer. The VFD shall operate a dynamometer at full load and speed and shall be cycled during the test.

b. All optional features shall be functionally tested at the factory for proper operation.

(9) Submittals

a. Submit manufacturer's performance data including dimensional drawings, power circuit diagrams, installation and maintenance manuals, warranty description, VFD's FLA rating, certification agency file numbers and catalog information.

The specification lists the minimum VFD performance requirements for this project. Each supplier shall list any exceptions to the specification. If no departures from the specification are identified, the supplier shall be bound by the specification.

a. Harmonic filtering. The seller shall, with the aid of the buyer's electrical power single line diagram, providing the data required by IEEE-519, perform an analysis to initially demonstrate the supplied equipment will met the IEEE standards after installation. If, as a result of the analysis, it is determined that additional filter equipment is required to meet the IEEE recommendations, then the cost of such equipment shall be included in the bid. A harmonic analysis shall be submitted with the approval drawings to verify compliance with the latest version of IEEE-519 voltage and current distortion limits as shown in table 10.2 and 10.3 at the point of common coupling (PCC). The PCC shall be defined as the consumer–utility interface or primary side of the main distribution transformer.

(10) Start-Up Service

a. The manufacturer shall provide on-site start-up commissioning of the VFD and its optional circuits by a factory certified service technician who is experienced in start-up and repair services. Sales personnel and other agents who are not factory certified shall not be acceptable as commissioning agents. Start-up services shall include checking for verification of proper operation and installation for the VFD, its options and its interface wiring to the building automation system. Provide start-up report to Engineer.

(11) Warranty

a. The VFD shall be warranted by the manufacturer for a period of 36 months from date of shipment. The warranty shall include parts, labor, travel costs and living expenses incurred by the manufacturer to provide factory authorized on-site service. The warranty shall be provided by the VFD manufacturer.

(12) Examination

a. Contractor to verify that job site conditions for installation meet factory recommended and code-required conditions for VFD installation prior to start-up, including clearance spacing, temperature, contamination, dust, and moisture of the environment. Separate conduit installation of the motor wiring, power wiring, and control wiring, and installation per the manufacturer's recommendations shall be verified.

b. The VFD is to be covered and protected from installation dust and contamination until the environment is cleaned and ready for operation. The VFD shall not be operated while the unit is covered.

2. FACTORY START-UP REPORTS

A. Provide factory start-up on site by a factory representative (not a third-party contractor) for all HVAC equipment, including pumps, VFD's, boilers, chillers, cooling towers, heat pumps, rooftop units, etc. Submit factory start-up reports to the Engineer. The Mechanical Contractor and the Controls Contractor shall have a representative on site to correct all deficiencies noted by the factory representative. For each deficiency noted, documentation of corrective action taken shall be submitted to Engineer.

B. At a minimum, the report submitted to the Engineer shall include the following data:

(1) AHU's, OAU's and LEF's

a. Fan bearings lubrication
b. Fan not vibrating
c. Fan motor volts / amps
d. Fan belt tension, if applicable
e. Sheave alignment, if applicable
f. Coils clean
g. Filters clean
h. Fan rotation direction

END OF SECTION

OUTSIDE AIR UNIT SCHEDULE

SYMBOL	SERVICE	MANUFACTURER	MODEL	TYPE	CONFIGURATION	NOMINAL SIZE LxWxH (IN.)	WEIGHT (LBS)	SUPPLY FAN							
								1 AIRFLOW (CFM)	T.S.P / E.S.P (IN WG)	FAN TYPE	FAN QTY	DRIVE TYPE	FAN RPM	MOTOR HP / BHP (PER FAN)	ACOUSTICS DISCHARGE (63/125/250/500/1K/2K/4K/8K)
OA-N1	NORTH WING LABS	AIR FLOW EQUIPMENT INC	CUSTOM	SECTIONAL AIR HANDLER	SEE FLOOR PLANS	546X132X132	29,600	38500	8.70 / 4.00	PLENUM	6	DIRECT	3481	15 / 13.86	91/95/96/98/98/95/91/86
OA-N2	NORTH WING LABS	AIR FLOW EQUIPMENT INC	CUSTOM	SECTIONAL AIR HANDLER	SEE FLOOR PLANS	546X132X132	29,600	38500	8.70 / 4.00	PLENUM	6	DIRECT	3481	15 / 13.86	91/95/96/98/98/95/91/86
OA-N3	NORTH WING LABS	AIR FLOW EQUIPMENT INC	CUSTOM	SECTIONAL AIR HANDLER	SEE FLOOR PLANS	546X132X132	29,600	38500	8.70 / 4.00	PLENUM	6	DIRECT	3481	15 / 13.86	91/95/96/98/98/95/91/86
OA-S1	SOUTH WING LABS	AIR FLOW EQUIPMENT INC	CUSTOM	SECTIONAL AIR HANDLER	SEE FLOOR PLANS	532x134x108	28,250	28500	8.56 / 4.00	PLENUM	6	DIRECT	3560	15 / 10.07	91/95/96/98/98/95/91/86
OA-S2	SOUTH WING LABS	AIR FLOW EQUIPMENT INC	CUSTOM	SECTIONAL AIR HANDLER	SEE FLOOR PLANS	532x134x108	28,250	28500	8.56 / 4.00	PLENUM	6	DIRECT	3560	15 / 10.07	93/93/91/94/93/90/88/85
OA-S3	SOUTH WING LABS	AIR FLOW EQUIPMENT INC	CUSTOM	SECTIONAL AIR HANDLER	SEE FLOOR PLANS	532x134x108	28,250	28500	8.56 / 4.00	PLENUM	6	DIRECT	3560	15 / 10.07	93/93/91/94/93/90/88/85
OA-S4	SOUTH WING LABS	AIR FLOW EQUIPMENT INC	CUSTOM	SECTIONAL AIR HANDLER	SEE FLOOR PLANS	532x134x108	28,250	28500	8.56 / 4.00	PLENUM	6	DIRECT	3560	15 / 10.07	93/93/91/94/93/90/88/85

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OA SCHEDULE - FILTER SECTION

SYMBOL	FILTER SECTION								
	PREFILTER				FINAL FILTER				AIR PRESSURE DROP ("WC)
	TYPE	FILTER EFFICIENCY	NO OF FILTERS	FILTER LENGTH x WIDTH (IN.)	TYPE	FILTER EFFICIENCY	NO OF FILTERS	FILTER LENGTH x WIDTH (IN.)	
OA-N1	2" PLEATED	MERV 8	20 FULL / 5 HALF	FULL 24"x24" / HALF 12"x24"	12" BAG	MERV 13	20 FULL / 5 HALF	FULL 24"x24" / HALF 12"x24"	PREFILTER 0.25 / FINAL FILTER 0.48
OA-N2	2" PLEATED	MERV 8	20 FULL / 5 HALF	FULL 24"x24" / HALF 12"x24"	12" BAG	MERV 13	20 FULL / 5 HALF	FULL 24"x24" / HALF 12"x24"	PREFILTER 0.25 / FINAL FILTER 0.48
OA-N3	2" PLEATED	MERV 8	20 FULL / 5 HALF	FULL 24"x24" / HALF 12"x24"	12" BAG	MERV 13	20 FULL / 5 HALF	FULL 24"x24" / HALF 12"x24"	PREFILTER 0.25 / FINAL FILTER 0.48
OA-S1	2" PLEATED	MERV 8	15 FULL / 5 HALF	FULL 24"x24" / HALF 12"x24"	12" BAG	MERV 13	15 FULL / 5 HALF	FULL 24"x24" / HALF 12"x24"	PREFILTER 0.20 / FINAL FILTER 0.30
OA-S2	2" PLEATED	MERV 8	15 FULL / 5 HALF	FULL 24"x24" / HALF 12"x24"	12" BAG	MERV 13	15 FULL / 5 HALF	FULL 24"x24" / HALF 12"x24"	PREFILTER 0.20 / FINAL FILTER 0.30
OA-S3	2" PLEATED	MERV 8	15 FULL / 5 HALF	FULL 24"x24" / HALF 12"x24"	12" BAG	MERV 13	15 FULL / 5 HALF	FULL 24"x24" / HALF 12"x24"	PREFILTER 0.20 / FINAL FILTER 0.30
OA-S4	2" PLEATED	MERV 8	15 FULL / 5 HALF	FULL 24"x24" / HALF 12"x24"	12" BAG	MERV 13	15 FULL / 5 HALF	FULL 24"x24" / HALF 12"x24"	PREFILTER 0.20 / FINAL FILTER 0.30

ENERGY RECOVERY COIL - 50% GLYCOL 2

SYMBOL	MAX. APD (IN WG)	FLOW RATE (GPM)	MAX WPD (FT.)	MAX COIL ROWS	MAX. FIN SPACING (FINS/IN)	PREHEAT PERFORMANCE					PRECOOL PERFORMANCE				
						CAPACITY (MBH)	EAT (°F)	LAT (°F)	EWT (°F)	LWT (°F)	CAPACITY (MBH)	EAT (DB/WB)	LAT (DB)	EWT (°F)	LWT (°F)
OA-N1	0.73	275	18.35	8	10	951.0	0.0	22.8	37	29	307	92 / 75	84.7	82.4	84.9
OA-N2	0.73	275	18.35	8	10	951.0	0.0	22.8	37	29	307	92 / 75	84.7	82.4	84.9
OA-N3	0.73	275	18.35	8	10	951.0	0.0	22.8	37	29	307	92 / 75	84.7	82.4	84.9
OA-S1	0.67	183	19.65	8	10	698.6	0.0	22.6	36	28	227	92 / 75	84.7	82.3	85.1
OA-S2	0.67	183	19.65	8	10	698.6	0.0	22.6	36	28	227	92 / 75	84.7	82.3	85.1
OA-S3	0.67	183	19.65	8	10	698.6	0.0	22.6	36	28	227	92 / 75	84.7	82.3	85.1
OA-S4	0.67	183	19.65	8	10	698.6	0.0	22.6	36	28	227	92 / 75	84.7	82.3	85.1

2 2 2 3

STEAM PREHEAT COIL

SYMBOL	STEAM PREHEAT COIL							
	EAT (DB)	LAT (DB)	STEAM INLET PRESSURE (PSI)	2 CAPACITY (MBH)	COND (LBS/HR)	COIL FACE VELOCITY (FPM)	MAX. APD (IN WC)	COIL ROWS / FPI
OA-N1	0	55	15	2,283.4	2,412.9	750	0.28	2 / 6
OA-N2	0	55	15	2,283.4	2,412.9	750	0.28	2 / 6
OA-N3	0	55	15	2,283.4	2,412.9	750	0.28	2 / 6
OA-S1	0	55	15	1690.3	1786.2	728	0.3	2 / 6
OA-S2	0	55	15	1690.3	1786.2	728	0.3	2 / 6
OA-S3	0	55	15	1690.3	1786.2	728	0.3	2 / 6
OA-S4	0	55	15	1690.3	1786.2	728	0.3	2 / 6

3

PRECOOL CHILLED WATER COIL

SYMBOL	2 TOTAL CAP. (MBH)	SENSIBLE CAP	EAT DB	EAT WB	LAT DB	LAT WB	MAX. FV	MAX. APD	EWT	LWT	2 FLOW RATE	MAX. WPD	MAX. COIL ROWS	MAX. FIN SPACING
OA-N1	1,810	1,128	92	75	62.8	62.05	453	0.7244	55	65	361.8	8.35	6	12
OA-N2	1,810	1,149	92	75	62.8	62.05	453	0.7244	55	65	361.8	8.35	6	12
OA-N3	1,810	1,149	92	75	62.8	62.05	453	0.7244	55	65	361.8	8.35	6	12
OA-S1	1,369	920.3	92	75	62.8	62.04	470	0.7679	55	65	273.7	8.24	6	12
OA-S2	1,369	920.3	92	75	62.8	62.04	470	0.7679	55	65	273.7	8.24	6	12
OA-S3	1,369	920.3	92	75	62.8	62.04	470	0.7679	55	65	273.7	8.24	6	12
OA-S4	1,369	920.3	92	75	62.8	62.04	470	0.7679	55	65	273.7	8.24	6	12

3 3 3

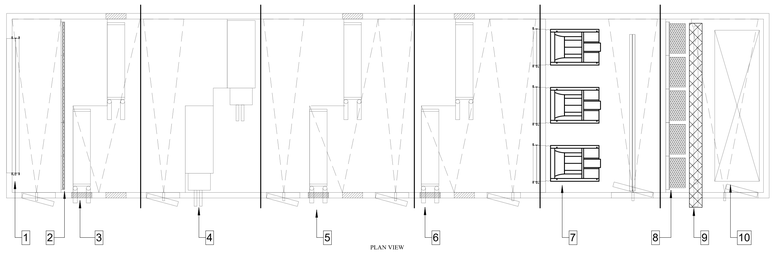
CHILLED WATER COIL

SYMBOL	TOTAL CAP. (MBH)	SENSIBLE CAP (MBH)	TOTAL CFM	EAT DB (°F)	EAT WB (°F)	LAT DB (°F)	LAT WB (°F)	MAX. FV (FPM)	MAX. APD (IN. WG)	EWT (°F)	LWT (°F)	FLOW RATE (GPM)	MAX. WPD (FT)	MAX. COIL ROWS	MAX. FIN SPACING (FINS/IN)
OA-N1	2945.0	1646.0	38500	92.0	75.0	52.5	52.0	453	0.83	44	56	489	9	8	10
OA-N2	2945.0	1646.0	38500	92.0	75.0	52.5	52.0	453	0.83	44	56	489	9	8	10
OA-N3	2945.0	1646.0	38500	92.0	75.0	52.5	52.0	453	0.83	44	56	489	9	8	10
OA-S1	2170.0	1222.0	28500	92.0	75.0	52.8	52.5	470	0.69	44	56	361	9	8	10
OA-S2	2170.0	1222.0	28500	92.0	75.0	52.8	52.5	470	0.69	44	56	361	9	8	10
OA-S3	2170.0	1222.0	28500	92.0	75.0	52.8	52.5	470	0.69	44	56	361	9	8	10
OA-S4	2170.0	1222.0	28500	92.0	75.0	52.8	52.5	470	0.69	44	56	361	9	8	10

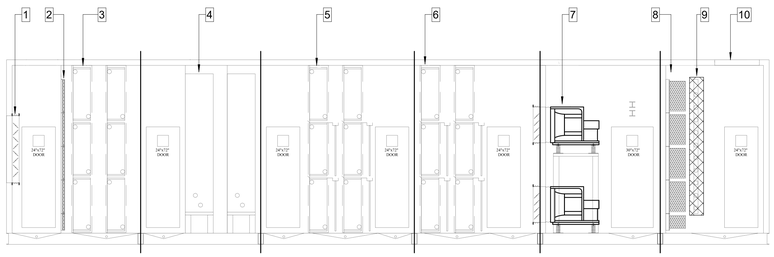
2 3 3 3

REMARKS:
1. ENTIRE UNIT SHALL BE DOUBLE WALL CONSTRUCTION.
2. COORDINATE EXACT DIMENSIONS WITH CONSTRUCTION MANAGER PRIOR TO BID OPENING.
3. SUPPLY STAINLESS STEEL IAQ CONDENSATE DRAIN PAN. ENTIRE PAN SHALL BE PITCHED TO OUTLET.
4. PROVIDE STAINLESS STEEL COIL CASING.
5. PROVIDE WITH PREMIUM EFFICIENCY SUPPLY AIR & RETURN AIR FAN MOTORS, INVERTER RATED WITH CLASS F INSULATION.
6. VFD'S ARE TO BE FIELD INSTALLED AND MOUNTED TO THE WALL WITHIN THE SAME MECHANICAL ROOM. REFER TO VFD SCHEDULE. PROVIDE MOTORS WITH AEGIS SHAFT-GROUNDING RINGS. FACTORY WIRING SHALL INCLUDE 3 POINTS OF POWER FOR EACH FAN ARRAY (2 FANS PER CIRCUIT/VFD). PROVIDE FANS WITH MANUAL MOTOR PROTECTION REQUIRED FOR SINGLE VFD SERVING 2 MOTORS. VFDS ARE TO BE PROVIDE AS PART OF THE FITOUT BID PACKAGE.
7. PROVIDE 6" BASE RAIL UNDER ENTIRE PERIMETER OF UNIT.
8. MANUFACTURER TO ACCOMODATE FUTURE CONDENSATE OVERFLOW SWITCH TO BE PROVIDED BY FUTURE CONTROLS CONTRACTOR.
9. SUPPLY FAN TO BE INTERNALLY ISOLATED WITH VENDOR'S BEST PERFORMING SPRING OR NEOPRENE MOUNT OPTION.
10. PROVIDE UNIT WITH FULL FACE COOLING AND HEATING COIL.
11. PROVIDE HP MOTORS AS LISTED IN SCHEDULE.
12. CHILLED WATER FLOW RATE BASED ON 44 EWT IN THE EVENT THERE IS A LOSS OF CWS TEMPERATURE. REFER TO COIL DETAILS FOR BALANCED FLOW.
13. PROVIDE WITH PIEZO RINGS AT EACH FAN FOR AIRFLOW MEASUREMENT OF SUPPLY.
14. ACCEPTABLE MANUFACTURERS: CLIMATECRAFT, AIRFLOW EQUIPMENT, NORTEK, INGENIA, AIR ENTERPRISES.
15. PROVIDE LINE ITEM COST FOR COONEY FREEZE PROTECTION COILS FOR EACH AHU CW COIL.
16. ENERGY RECOVERY COIL SHALL UTILIZE 50% PROPYLENE GLYCOL.

2



1 - 96"x48" OA DAMPER
2 - 2" PRE FILTER
3 - (4) HEAT RECOVERY COILS
4 - (2) STEAM IFB COIL
5 - (4) PRE COOLING COILS
6 - (4) COOLING COILS
7 - (6) SUPPLY FANS
8 - 12" FINAL FILTERS
9 - HUMIDIFIER MANIFOLD
10 - SUPPLY DISCHARGE



MANIFOLD TO BE PROVIDED BY FUTURE HUMIDIFIER MANUFACTURER, FIELD INSTALLED BY FUTURE CONTRACTOR.

1 OA UNIT SECTION VIEW
NO SCALE

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No.	Issue/Revision/Submission	Date
3	MECHANICAL EQUIPMENT RFP - ADDENDUM 4	09.27.2024
2	CONSTRUCTION AGENCY REVIEW	09.23.2024
1	CORE AND SHELL PACKAGE - BID AND PERMIT	06.28.2024

Flad Architects
MADISON
644 ESOUNCIL DR.
VERONA, WI 53593
PHONE 608.356.2661
WWW.FLADARCH.COM

BHDP
COLUMBUS
211 N. BROADWAY, STE. 2900
COLUMBUS, OHIO 43215
PHONE 614.621.3000

BCAE ENGINEERING: DAYTON, OH
DELMAX CONSTRUCTION: URBANA, OH
TERRACON: LEXINGTON, KY
FLAD: MADISON, WI

CMTA INC: LEXINGTON, KY
THP LIMITED INC: CINCINNATI, OH
NV5: PITTSBURGH, PA
BELL ENGINEERING: HOPKINSVILLE, KY
VIBRASURE: SAN FRANCISCO, CA

UNIVERSITY OF KENTUCKY
AGRICULTURE RESEARCH FACILITY 1
1411 UNIVERSITY DR. LEXINGTON, KENTUCKY 40503

MECHANICAL SCHEDULES

Project Manager: S. JOHNSON
Drawn: K. TEAGUE
Checked: N. ROGERS
Initial Drawing Date: 06.28.2024
Project Number: UKX05.00

M702.1

Autodesk Docs://UKX0500 University of Kentucky - Ag Research Facility 1/XUKA23_MECH_R23.rvt — 10/1/2024 12:42:54 PM

DEDICATED HEAT RECOVERY CHILLER SCHEDULE

SYMBOL	TYPE	MANUFACTURER	MODEL	SERVICE	DIMENSIONS (IN)			WEIGHT (LBS)	FLUID TYPE	REFRIGERANT	ELECTRICAL (PER MODULE)				EER	CAPACITY (TONS)	EVAPORATOR				COP	HEATING CAPACITY (MBH)	CONDENSOR				ACOUSTICS DISCHARGE (63/125/250/500/1K/2K/4K/8K)
					LENGTH	WIDTH	HEIGHT				VOLTAGE	PHASE	MCA	MOCP			EWT (F)	LWT (F)	GPM	FLUID PD (FT WG)			EWT (F)	LWT (F)	GPM	FLUID PD (FT WG)	
HRC-1	HEAT RECOVERY CHILLER	WATERFURNACE	TRUCLIMATE 500	BUILDING CHILLED AND HOT WATER	87	136	75	12896	WATER	R-454B	460 V	3	116 A	150 A	15.6	228	65	55	550	11.5	6.583	774.5	100	130	223	2.5	70/68/65/61/59/52/47/41

REMARKS:
1. PROVIDE WITH FACTORY START-UP UTILIZING MANUFACTURER'S STANDARD FORMS.
2. PROVIDE UNIT WITH FACTORY CONTROLS WITH BACNET / MSTP INTERFACE GATEWAY
3. PROVIDE FOUR-PIPE UNIT. PROVIDE MANUFACTURE HEADER RACK ON MODULES
4. LEAD COMPRESSOR FOR EACH MODULE SHALL BE VARIABLE SPEED.
5. PROVIDE WITH COMPRESSOR SOUND BLANKET
6. APPROVED MANUFACTURERS: WATERFURNACE, ARCTIC CHILL, CLIMACOOL, JETSON.
7. SINGLE POINT POWER CONNECTION 3

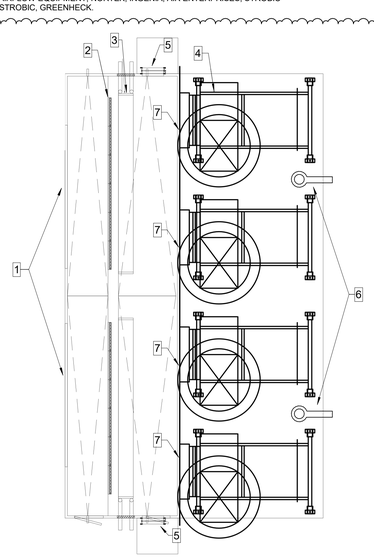
LABORATORY EXHAUST FAN SCHEDULE

SYMBOL	UNIT MANUFACTURER	FAN MANUFACTURER 2	SERVICE	TYPE	MAX WEIGHT (LBS)	MAXIMUM SKID DIMENSIONS (INCLUDING HEAT RECOVERY AND FANS)	EXHAUST FAN										
							MODEL	# OF FANS - CFM (EACH)	PLUME HEIGHT (FT.)	NOZZLE EXIT VELOCITY (FPM)	ESP (IN. W.G.)	DRIVE	OPERATIONAL FAN RPM	ELECTRICAL				TOTAL SOUND POWER AT DISCHARGE(dB) (63 / 125 / 250 / 500 / 1K / 2K / 4K / 8K / AwT)
														FAN HP (EACH)	V	PH	HZ	
LEF-N	STROBIC	STROBIC	NORTH WING LABS	HIGH PLUME FAN SYSTEM WITH ENERGY RECOVERY COIL	42,855	452"x216"	TRI-STACK	4 - 26,000 (1 STANDBY)	52	5501	4.0	DIRECT	1254	60	460 V	3	63	90 / 81 / 72 / 65 / 65 / 64 / 59 / 53 / 72
LEF-S	STROBIC	STROBIC	SOUTH WING LABS	HIGH PLUME FAN SYSTEM WITH ENERGY RECOVERY COIL	44,005	452"x216"	TRI-STACK	4 - 28,500 (1 STANDBY)	53	4643	4.0	DIRECT	1282	60	460 V	3	65	92 / 84 / 75 / 68 / 62 / 67 / 62 / 56 / 74

ENERGY RECOVERY COIL - 30% GLYCOL

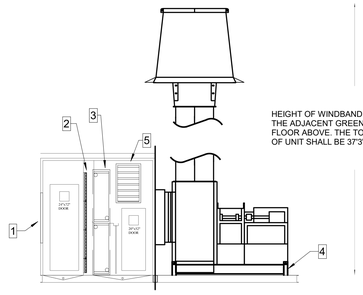
SYMBOL	AIRFLOW	MAX. APD (IN WG)	MAX COIL ROWS	MAX. FIN SPACING (FINS/IN)	PREHEAT PERFORMANCE							PRECOOL PERFORMANCE							PRE FILTER				
					CAPACITY (MBH)	EAT (°F)	LAT (°F)	FLOW RATE (GPM)	MAX WPD (FT.)	EWT (°F)	LWT (°F)	CAPACITY (MBH)	EAT (°F)	LAT (°F)	FLOW RATE (GPM)	MAX WPD (FT.)	EWT (°F)	LWT (°F)	TYPE	MERV RATING	MAX VELOCITY (FPM)	APD (CLEAN / DIRTY)	FILTER SIZE / QUANTITY
LEF-N	77,000	0.69	8	10	1898.0	70.0	47.4	550	17.92	29	37	619	75	82.4	550	10.83	84.9	82.4	2" PLEATED	MERV 8	2905	0.25" / 1.0"	24"x24" / 42 12"x24" / 14
LEF-S	85,500	0.72	8	10	2092.0	70.0	47.5	550	19.4	29	36	684	75	82.4	550	11.92	85.1	82.42	2" PLEATED	MERV 8	2651	0.25" / 1.0"	24"x24" / 42 12"x24" / 14

REMARKS:
1. PROVIDE WITH FACTORY START-UP UTILIZING MANUFACTURER'S STANDARD FORMS AND THE FORMS INCLUDED IN THE SPECIFICATIONS.
2. NEMA 3R DISCONNECT SWITCHES
3. VORTEX BREAKER MOUNTED IN FAN INLET TO IMPROVE EFFICIENCY
4. SHAFT SEALS
5. FAN ACCESS DOORS
6. ENTIRE UNIT SHALL BE MOUNTED ON SKID FROM THE FACTORY. STRUCTURE SUPPORTS REQUIRED FOR EXTENDED EXHAUST STACK SHALL BE PRE-ENGINEERED AND SUPPORTED FROM SKID BELOW.
7. MOUNT FANS ON 3" SPRING ISOLATORS OR PROVIDE UNIT WITH VIBRATION ISOLATION CURB USING 3" SPRING ISOLATORS. 2
8. INTERNAL PANEL CASINGS SHALL BE STAINLESS STEEL. COILS SHALL BE PROVIDED WITH HERESITE COATING. 4
9. FAN SHAFT HAVE CLASS 1 CSM CONSTRUCTION.
10. PROVIDE WITH SOUND ATTENUATION SILENCER IN DISCHARGER RISER TO MEET SOUND REQUIREMENTS LISTED IN SCHEDULE.
11. PROVIDE RETURN PLENUM WITH BYPASS
12. ENTIRE UNIT SHALL BE DOUBLE WALL CONSTRUCTION.
13. COORDINATE EXACT DIMENSIONS WITH CONSTRUCTION MANAGER PRIOR TO BID OPENING.
14. VFD'S ARE TO BE FIELD INSTALLED AND MOUNTED TO THE WALL WITHIN THE ADJACENT MECHANICAL ROOM. REFER TO VFD SCHEDULE. PROVIDE MOTORS WITH AEGIS SHAFT-GROUNDING RINGS. FACTORY WIRING SHALL INCLUDE 3 POINTS OF POWER FOR EACH FAN ARRAY (2 FANS PER CIRCUIT/VFD). PROVIDE FANS WITH MANUAL MOTOR PROTECTION REQUIRED FOR SINGLE VFD SERVING 2 MOTORS. VFDS ARE TO BE PROVIDE AS PART OF THE FITOUT BID PACKAGE.
15. PROVIDE UNIT WITH FULL FACE ENERGY RECOVERY COIL.
16. PROVIDE HP MOTORS AS LISTED IN SCHEDULE.
17. PROVIDE WITH PIEZO RINGS AT EACH FAN FOR AIRFLOW MEASUREMENT OF SUPPLY AND EXHAUST.
18. UNIT PROVIDED WITH 2" MERV 8 FILTERS. FILTER SECTIONS SHALL ACCOMMODATE SIZES NOTED.
19. PROVIDE FANS WITH JIB CRANE FOR MOTOR REMOVAL. MOTORS LOCATED MORE THAN 4' ABOVE THE ROOF SHALL BE PROVIDED WITH PERMANENT ACCESS LADDERS/PLATFORMS SUPPORTED FROM THE UNIT SKID. 2
20. PROVIDE IEEE 841 RATED MOTORS ON EXHAUST FANS.
21. PROVIDE ENERGY RECOVERY UNIT AND FAN WITH PHENOLIC COATING.
22. TSP OF THE FAN SHALL INCLUDED EXTERNAL STATIC, ENERGY COIL UNIT, DISCHARGE SILENCER, WINDBAND, AND INCREASED DUCT STATIC.
23. 4 FANS SHALL NORMALLY OPEARTE AT LESS THAN 60 HZ TO MEET AIRFLOW SETPOINT. 3 FANS SHALL BE CAPABLE OF OVERSPEED TO MEET AIRFLOW FOR N+1 REDUNDANCY.
24. PROVIDE MOTORIZED ISOLATION DAMPERS AT INLET OF EACH FAN.
25. ACCEPTABLE ENERGY RECOVERY MANUFACTURERS: CLIMATECRAFT, AIRFLOW EQUIPMENT, NORTEK, INGENIA, AIR ENTERPRISES, STROBIC
26. ACCEPTABLE LAB EXAHUST FANS MANUFACTURERS: TWIN CITY FANS, STROBIC, GREENHECK.



PLAN VIEW

1. INTAKE OPENINGS
2. 2", MERV 8 PRE FILTERS
3. HEAT RECOVERY COILS
4. EXHAUST FANS W/ VIBRATION ISOLATION BASE
5. BYPASS DAMPERS
6. MOTOR JIB CRANE
7. MOTORIZED FAN ISOLATION DAMPER (PER FAN)

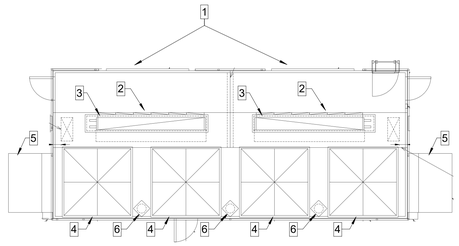


HEIGHT OF WINDBAND SHALL MATCH THE TOP OF THE ADJACENT GREENHOUSE ROOF ON THE FLOOR ABOVE. THE TOTAL APPROXIMATE HEIGHT OF UNIT SHALL BE 37'3" ABOVE THE BASE RAIL.

ELEVATION

1 LEF SECTION VIEW - OPTION B

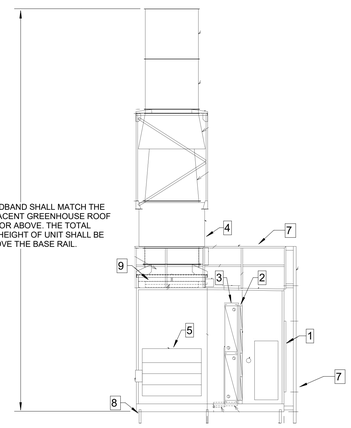
NO SCALE



PLAN VIEW

1. INTAKE OPENINGS
2. 2", MERV 8 PRE FILTERS
3. HEAT RECOVERY COILS
4. EXHAUST FANS
5. BYPASS DAMPERS
6. MOTOR JIB CRANE
7. ACCESS LADDER AND RAILING SHALL BE OSHA COMPLIANT FOR ACCES TO FANS ON UNIT ROOF.
8. PROVIDE VIRBRATION ISOLATION SPRINGS BETWEEN STRUCTURAL STEEL AND UNIT FRAMING
9. MOTORIZED FAN ISOLATION DAMPER (PER FAN)

HEIGHT OF WINDBAND SHALL MATCH THE TOP OF THE ADJACENT GREENHOUSE ROOF ON THE FLOOR ABOVE. THE TOTAL APPROXIMATE HEIGHT OF UNIT SHALL BE 37'3" ABOVE THE BASE RAIL.



ELEVATION

2 LEF SECTION VIEW - OPTION A

NO SCALE

Rev4 Template Version 2021

University of Kentucky

No.	Issue/Revision/Submission	Date
4	MECHANICAL EQUIPMENT RFP - ADDENDUM 4	09.27.2024
3	MECHANICAL EQUIPMENT RFP - ADDENDUM 2	09.20.2024
2	CORE AND SHELL PACKAGE - ADDENDUM 1	08.23.2024
1	CORE AND SHELL PACKAGE - BID AND PERMIT	06.28.2024

Flad Architects
MADISON
644 ESSENCE DR.
MADISON, WI 53711
PHONE 608.358.3681
WWW.FLADARCH.COM

BHDP
COLUMBUS
274 MARCONI BLVD.
2ND FLOOR
COLUMBUS, OHIO 43215
PHONE 614.481.6700
CMTA INC: LEXINGTON, KY
THP LIMITED INC: CINCINNATI, OH
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UNIVERSITY OF KENTUCKY
AGRICULTURE RESEARCH FACILITY 1
1411 UNIVERSITY DR. LEXINGTON, KENTUCKY 40503

MECHANICAL SCHEDULES

STATE OF KENTUCKY
ROBERT S. JOHNSON
27666
LICENSED
PROFESSIONAL ENGINEER

Project Manager: S. JOHNSON
Designed: K. TEAGUE
Checked: N. ROGERS
Initial Drawing Date: 06.28.2024
Project Number: UKX05.00

M703.1

Autodesk Docs://UKX0500 University of Kentucky - Ag Research Facility 1/XUKA23_MECH_R23.rvt — 10/1/2024 12:42:55 PM

UK-2617.0-8-25 Ag Research Facility 1 - BP04 Equipment				
Question and Response Log				
Question Deadline: 09/25/2024				
#	Date	From	Question	Response
1	9/17/2024	Tom Davies, Stoermer-Anderson, Inc.	Per the specification requirements we submit the following RFI for the Dedicated heat Recovery Chiller on sheet M703.1 and spec section 230220-HVAC Equipment & Hydronic Specialties. We seek approval for quoting Jetson as approved Heat and recovery chiller mfr. Jetson is now owned by Modine and used to be OEM chiller manufacturer for the Trane Company. I have attached our preliminary selection data, and our chiller will consist of (4) 45 ton & (1) 55-ton machine to give you overall capacity of 235 tons. Our overall footprint would be 136" long x 60" wide x 76" high. Per the scheduled Water Furnace chiller, I think the length and width dimensions are reversed and I believe the WF chiller is only (4) modular type with overall capacity of 216 tons and not the scheduled 228 tons. Please review our request and if you have any other issues please advise.	Jetson is an acceptable manufacturer
2	9/19/2024	Tom Davies, Stoermer-Anderson, Inc.	It does appear that the VFD's for the units on this bid package are not part of this contract.	that is correct. VFDs in future bid package
3	9/25/2024	Tom Davies, Stoermer-Anderson, Inc.	#1 Please verify on the OA units, if we need to give add/alternate price to provide Cooney coils for only the Pre-Cool Coils, or for both coils. #2 Spec section 2.A.6.C is calling for painted exterior unit. This is not typical for UK Health type projects, and can you please verify if painted exterior is required. #3 Spec section 2.A.E.1 is calling for an airflow totalization transducer with display and BACnet, is it the intent for the fans to have piezometer rings for a transducer provided by others, or will it be the AHU manufacturer responsibility to provide the transducer and CFM display. #4 The Coil section is calling out for a stainless steel drain pan under the Hot Water coils which again is not typical and please verify if this is required. #5 Are there any other additional requirements for the Energy Recovery Plenums other than what is listed in section 2.C.E.A-C? #6 If the Heat Recovery plenums are stainless steel construction with stainless stell inner liners for the ceilings, walls, and floor, can the Heresite lining be eliminated? Coating a unit interior with Heresite is messy and potentially unsafe for those applying the coating. #7 Please verify if the Heat Recovery Coils located in the Heat Recovery plenums need to be Heresite coated?	1. Provide separate line item pricing for both coils 2. see revised specification. 3. manufacturer shall provide BACnet device that displays CFM. 4. refer to specifications. 5. Refer to drawings. 6. Refer to revised drawings. 7. Refer to revised drawings
4	9/25/2024	Tom Davies, Stoermer-Anderson, Inc.	#1 Do the fans need a coating and if so, would Polyurethane Acrylic be acceptable instead of Heresite? #2 Are the power levels shown on the schedule the SPL at the stack discharge, or is this bare fan sound? If we meet the discharge sound without the silencer, can we delete it? #3 Per section 230200-25 C Is an acoustical wind band acceptable as a silencer as long as we meet the Sound power levels? #4 Per section 230200-24 Weather Cover-Only the motor will be exposed to the weather. If tehre are no bearings or shaft on the fan and the motor is suitable for outdoor mounting, can the weather cover be eliminated? #5 Per section 230200-25 Can the outlet damper be installed in the stack and not on the fan outlet/discharge? #6 Since spring isolation is used on the fan and the stack must be supported independently from it, there will be inlet and outlet flex connectors. Will they need sound insulation to avoid the possibility of radiated sound being louder than the sound coming out of the stack?	1. Refer to revised drawings. 2. stack discharge. See revised sound requirements on drawings. Provide attenuator as necessary to meet updated dawings. 3 Yes. 4. Yes. 5. Outlet damper is intended to isolate the fan. As long as that occurrs, it can be mounted in an alternative location. . 6. Provide sound insulation or provide noise power level at flexible connection and demostrate less than/equal nozzle power level.