**BENEDUM AIRPORT AUTHORITY**
**HARRISON COUNTY, WEST VIRGINIA**
**MHI BUILDING RENOVATIONS**

**ADDENDUM #2**

**OCTOBER 13, 2023**

**THRASHER PROJECT #030-10119**

TO WHOM IT MAY CONCERN:

A non-mandatory Pre-Bid Conference was held on Thursday, September 28, 2023, on the above-referenced project. The following are clarifications and responses to questions posed by contractors for the above reference project.

## A. GENERAL

## B. SPECIFICATIONS

1. Specification Section 235533 – Fuel Fired Unit Heaters, paragraph 2.1.A., add 2.1.A.5. Schwank Products
2. Specification Section 237433 – Factory Fabricated Packaged, 100% Outdoor, Heating and Cooling Makeup Air Units, paragraph 2.2, add 2.2.D. Mitsubishi Electric.

## C. DRAWINGS

None on this Addendum

## D. QUESTIONS AND RESPONSES

QUESTION

1. Addendum 1 E. 4 ii. States that the fire alarm system is now an open spec but also states that all system providers must be able to communicate/notify other adjacent MHI buildings. Can this be clarified?

RESPONSE

The fire alarm system should operate similar to a remote station protective signaling system, or proprietary supervising station system. Local systems in other adjacent MHI buildings need to transmit an alarm notification to a remote station in the project building.

QUESTION

2. Are multiple panels networked together or being monitored by a fire alarm command center? If the facility is using a command center type of system by Simplex then other system providers may not be able to communicate with adjacent buildings. What is being used at the adjacent buildings?

RESPONSE

Presently, the facility is not monitoring the other adjacent buildings. Individual detection and notification device monitoring is not required. It is anticipated that the existing Simplex devices and panel will be replaced.

Other adjacent MHI buildings are using Honeywell and Edwards systems. Edwards Systems in the newest hangar buildings were provided by Electronic Specialties Company.

QUESTION

3. New fire alarm panel can have monitoring that requires the monitoring company to call security or someone to notify them of the building being in alarm. Would this qualify as notifying adjacent buildings?

RESPONSE

The system in the project building needs to be able to receive alarm notification from the other buildings. It is not required that the project building notify the other buildings. The building owner is not currently contracted with a monitoring company.

QUESTION

4. Can the old existing panel be left in place and on the existing network that notifies the existing buildings and the new panel have monitors and relays to tie into the old panel? This would allow all new devices and fire alarm to be added. The old panel would need a few relays and monitors only and would be capable of showing alarm status but would not show detail of what device and what room. Would that meet the requirements of addendum 1E4ii?

RESPONSE

The project building does not currently monitor or notify other buildings. The project building would need to serve as the remote station that is notified of fire events in the other buildings. If the existing old panel can be connected through relays to a new panel that receives alarm notification from the other buildings that is acceptable.

QUESTION

5. Does the existing fire alarm have to stay operational during the project? They was a note stating that this would be the case the first time this bid, that note is not on the new drawings.

RESPONSE

See specification section 284600, paragraph 2.3.A.

QUESTION

6. Please confirm that the lightning protection scope has been removed.

RESPONSE

Lightning Protection is **not** in the scope of work.

QUESTION

7. Please confirm that the BAS scope has been removed.

RESPONSE

See specification section 23.923 – Direct Digital Control System for HVAC and HVAC Installation sequence of work on M1.00.

## E. CLARIFICATIONS

If you have any questions or comments, please feel free to contact me at your earliest convenience. As a reminder, bids will be received until **10:00 a.m. on Thursday, October 19, 2023**, at the Benedum Airport Authority, 2000 Aviation Way, Bridgeport, WV. Good luck to everyone and thank you for your interest in the project.

Sincerely,

THE THRASHER GROUP, INC.

Philip M. Freeman, AIA, NCARB
Project Architect

# SECTION 235533 - FUEL-FIRED UNIT HEATERS

## PART 1 GENERAL

### 1.1 SECTION INCLUDES

A. Gas fired unit heaters.

B. Tubular infrared heaters.

C. Room thermostats.

### 1.2 RELATED REQUIREMENTS

A. Section 230713 - Duct Insulation.

B. Section 233100 - HVAC Ducts and Casings.

C. Section 260583 - Wiring Connections: Electrical characteristics and wiring connections.

### 1.3 REFERENCE STANDARDS

A. NFPA 54 - National Fuel Gas Code; 2015.

B. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2015.

### 1.4 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's literature and data indicating rated capacities, weights, accessories, electrical nameplate data, and wiring diagrams.

C. Manufacturer's Instructions: Indicate rigging, assembly, and installation instructions.

D. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts listing.

E. Warranty: Submit manufacturers warranty and ensure forms have been filled out in Benedum Airport Authority's name and registered with manufacturer.

### 1.5 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturers warranty for heat exchangers.

## PART 2 PRODUCTS

### 2.1 TUBULAR INFRARED HEATERS

A. Manufacturers:
1. Calcana USA Ltd: www.calcana.com.
2. Detroit Radiant Products Company: www.reverberay.com.
3. Solaronics, Inc: www.solaronicsusa.com.
4. Space-Ray, Division of Gas Fired Products, Inc: www.spaceray.com.
5. Schwank Products: www.schwankgroup.com.

B. Infrared Heaters: Tubular type; packaged, partially factory assembled, pre-wired unit consisting of cabinet, burner, heat exchanger, radiant tube, reflector, controls; for natural gas.

C. Heat Exchanger: Aluminized tubular steel combustion chamber with aluminized steel tube with aluminum reflector.

D. Gas Burner:
1. Gas Burner: Forced draft type with adjustable combustion air supply.
2. Gas valve provides 100 percent safety gas shut-off; 24 volt combining pressure regulation, safety pilot, manual set (On-Off), pilot filtration, automatic electric valve.
3. Electronic pilot ignition, with electric spark igniter.
4. Non-corrosive burner air blower with permanently lubricated motor.

E. Gas Burner Safety Controls: Thermo-couple sensor prevents opening of solenoid gas valve until pilot flame is proven and stops gas flow on ignition failure.

F. Operating Controls: Low voltage room thermostat cycles burner to maintain room temperature setting.

### 2.2 ROOM THERMOSTATS

A. Manufacturers:
1. Honeywell: www.honeywell.com.
2. Johnson Controls, Inc: www.johnsoncontrols.com.
3. Siemens Building Technologies, Inc: www.buildingtechnologies.siemens.com.

B. Room Thermostat: Electric solid state microcomputer based room thermostat with remote sensor:
1. Thermostat Display:
a. Actual room temperature.
b. Programmed temperature.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that space is ready for installation of units and openings are as indicated on shop drawings.

B. Verify that proper power supply is available.

C. Verify that proper fuel supply is available for connection.

3.2 INSTALLATION

A. Install in accordance with NFPA 90A.

B. Install gas fired units in accordance with NFPA 54 and applicable codes.

C. Provide vent connections in accordance with NFPA 211. Refer to Section 235100. END OF SECTION

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SECTION 237433 - FACTORY FABRICATED PACKAGED, 100% OUTDOOR, HEATING AND COOLING MAKEUP AIR UNITS

SPECIFICATIONS

TAG: DOAS-1

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes packaged heating and cooling units capable of supplying up to 100 percent outdoor air.

1.2 SUBMITTALS

A. The manufacturer assumes no liability for the use or results of use of this document. This specification is to be reviewed by the engineer to confirm requirements of the project and building codes are met.

B. As the manufacturer continues product development, it reserves the right to change design and specifications without notice.

1.3 QUALITY ASSURANCE

A. All models shall be ETL listed and comply to safety standards UL 1995, the Standard for Safety for Heating and Cooling Equipment. The Engineer of Record shall take responsibility for the approval of any modifications or additions to the unit, including aftermarket UV or ionization filtration devices.

B. All models shall be ETL listed and comply to safety standards CSA Std. C22.2, No. 236-11.

C. Units outfitted with indirect fired heaters shall also comply with ANSI Z83.8-2013, and CSA 2.6-2013.

D. This unit has been tested in accordance to the following standards:

- ANSI/AHRI Standard 340/360
- ANSI/ASHRAE Standard 37
- AHRI Standard 270/370

1.4 WARRANTY

A. All units shall be provided with the following standard warranties:

1. 10-Year (non-prorated) parts warranty covering the entire unit when accompanied by a company provided service plan. 5-Year (non-prorated) parts warranty covering the entire unit otherwise.

2. 25-year (non-prorated) parts warranty for SS heat exchanger on indirect fired units.

B. This warranty shall not apply if:

1. The equipment is not installed by a qualified installer per the manufacturer's installation instructions shipped with the product.

2. The equipment is not installed in accordance with Federal, State, and Local codes and regulations.

3. The equipment is misused, neglected, or not maintained per the manufacturer's maintenance instructions.

4. The equipment is not operated within its published capacity.

5. The invoice is not paid within the terms of the sales agreement.

C. The manufacturer shall not be liable for incidental and consequential losses and damages potentially attributable to malfunctioning equipment. Should any part of the equipment prove to be defective in material or workmanship within the 10-year period, upon examination by the manufacturer, such part will be repaired or replaced by manufacturer at no charge. The buyer shall pay all labor costs incurred in connection with such repair or replacement. Equipment shall not be returned without manufacturer's prior authorization and all returned equipment shall be shipped by the buyer, freight prepaid to a destination determined by the manufacturer.

PART 2 - PRODUCTS

2.1 GENERAL

A. Supply single zone one piece packaged units that are complete as per the following specification, deliver all capacities scheduled, and conform to design indicated herein.

2.2 MANUFACTURER

A. Cature Aire (Bais of Design)

B. Carrier

C. Greenheck

D. Mitsubisih Electric

2.3 CABINET

A. Size 1 unit(s) cabinets shall be constructed of minimum 24-gauge. Sizes 2, 3, or 4 cabinets shall be 20-gauge G-90 galvanized steel riveted together via structural pop-rivets. All metal shall be CNC bent for precise assembly.

1. Rigging Provisions: The unit shall have a structural base constructed of minimum 18-gauge in cabinet size 1 and 14-gauge in cabinet sizes 2, 3 & 4 G-90 galvanized steel, and include full sized fork pockets and lifting points on all four sides.

2. Roof Construction: The lids shall be fabricated by forming a double-standing, self-locking seam that requires no additional support. Roof shall be pitched to allow for proper drainage.

3. Exterior Wall Construction: All exterior walls shall consist of a double wall, G-90 galvanized steel construction. Cabinet size 1 shall be insulated with 1-inch thick, R4.3 fiber glass duct board insulation. Cabinet sizes 2, 3 & 4 shall be insulated with 2-inch thick, R13 closed cell foam.

4. Service Access Doors: All door jambs shall be gasketed around their perimeter, and allow for doors to be mounted via removable, spring actuated, stainless steel hinges with stainless steel rivets, and self-compressing latches. Each compartment shall have removable access panels to allow for ease of service and maintainability. Electrical cabinet access doors shall have a door hold installed to prop doors open. All doors shall have stainless steel latches which are pad lockable. Electrical cabinet doors shall be outfitted with schematic/manual pouches formed into the door, along with wiring diagram attached to the indoor of the door from the factory.

B. Entire interior and exterior casing shall be constructed of minimum G90 galvanized steel. Unit shall have undergone a salt spray corrosion test as per ASTM B 117.

C. Entire unit shall be Miami-Dade wind rated up to ±150psf per TAS 201, 202 & 203 on any units utilizing a 20” or shorter factory provided roof curb.

2.3 AIRFLOW CONFIGURATIONS

A. Discharge: Unit shall be configurable for Side (horizontal) discharge through the cabinet.

B. Return: Unit shall also be configurable for No Return.

C. Intake Airflow: Unit configuration shall be through use of a fresh/outdoor air damper.

1. Damper: Shall exceed AMCA Class 1A standard for low leakage. Damper assembly shall be a single assembly, and outfitted with an integral bird screen and louver/gutter system to divert any drainage through the base of the unit – intake air hood not required.

2. Actuator: A single direct drive damper actuator shall be used with spring return to ensure that the outdoor air section closes when not powered.

2.4 SUPPLY AIR BLOWER AND MOTOR

A. All supply fans shall be direct drive variable speed plenum fans.

B. Blower Motor: Motor shall be a premium efficiency motor available as:

1. Open Drip Proof (ODP) or Totally Enclosed Fan Cooled (TEFC) motor driven by a Variable Frequency Drive.

2. Electronically Commutated Motor (ECM) modulated using a Pulse Width Modulating (PWM) signal.

C. Fans to be selected at or near efficiency peak.

D. Blower and motor assembly shall be dynamically balanced. The entire blower and motor assembly shall be mounted on rubber vibration isolators. Wheels balanced as per AMCA 204-96, Balance Quality and Vibration Levels for fans.

E. Unit equipped with total CFM monitoring to measure airflow across supply discharge.

2.5 REFRIGERATION SYSTEM

A. Unit shall utilize a variable speed inverter duty scroll compressor with the following features:

1. Modulation: Compressor shall be capable of compressor speed modulation from 15%-100% on 5, 6, 7.5, 8, 10, & 12.5 Ton units. Compressor shall be capable of compressor speed modulation from 25%-100% on 15, 20, 22, 25, 30, 40, and 50 Ton units.

2. Refrigerant: Unit shall be factory charged with R410A refrigerant.

3. Vibration Isolation: Compressor as well as blower assembly shall each be mounted on rubber vibration isolators to reduce transmission of vibration to the building structure.

4. Internal Overload Protection: Compressor shall include internal thermal overload production to protect against excessive motor temperatures.

5. Crankcase Heater: Compressor shall include a crankcase heater to protect against liquid flood-back and elimination of oil foaming on startup. The crankcase heater must remain powered when the compressor is not in operation.

6. Oil Management: Unit shall utilize both passive and active oil return management using Oil Level Sensor and scheduled oil boosts.

7. Monitored Envelope: Unit shall monitor all critical refrigeration points to ensure compressor does not operate outside of safe operating envelope.

8. Throttling Logic: Unit shall allow for high head pressure monitoring throttle mode for high ambient operation, and low suction pressure throttle mode for low capacity operation or any conditions resulting in low suction pressure.

9. Pump-Down: Active pump-down mode with discharge line check valve to protect against liquid migration into compressor during idle times.

10. Defrost mode in optional Heat Pump: When outdoor coils are deemed at risk of freezing, the unit shall simultaneously turn on auxiliary heat while running the heat pump in “cooling” mode to help defrost outdoor coils as needed while still maintaining desired leaving air temperatures.

B. The unit shall be outfitted with the following:

1. Indoor Coil: Indoor coil shall be a high efficiency 4-10 row coil design with aluminum fins mechanically bonded to copper tubes. Coil is staggered to increase turbulence, reduce the coil bypass factor, and ultimately increase the time the air stays within the coil. Includes two probe sensors to read average coil face temperature.

2. Electronic Expansion Valve: Each refrigeration circuit will be outfitted with an electronic expansion valve metering device which can be throttled from 0-100% open to allow for precise superheat control.

3. Indoor Coil Drain Pan: The indoor coil shall be outfitted with a sloped stainless steel drain pan. This pan shall be insulated along the entire base to prevent condensation, and outfitted with a safety overflow switch which will automatically shut down cooling operation prior to water overflowing the drain pan in the event of a drain clog. The entire drain pan shall be 20 GA Stainless Steel construction and wrap beneath the entire coil with flashing on entering side of coil to ensure capture of all condensate. Drain pan discharge pipe shall also be stainless steel construction. Drain pan shall be pitched to exceed ASHRAE 62.1 standard.

4. Base of the condensing coil cabinet shall be pitched away from the unit as a safety to ensure all draining exits away from the curb.

5. Optional Hot Gas Reheat Coil: The unit shall include an optional copper tube and aluminum fin hot gas reheat coil mounted downstream of the indoor coil. This coil shall be controlled via fully modulating hot gas reheat valve to provide precise reheat temperature control. This coil shall include the addition of an evaporative coil leaving condition sensor to maintain a coil dew point. This also prevents operation of a dehumidification call when intake dew point conditions are found to be below space dew point conditions, preventing wasted energy.

6. Outdoor (Condenser) Coil: Outdoor coil shall be a high efficiency coil design with aluminum fins mechanically bonded to copper tubes. The coil shall be downward sloped to protect coil from hail damage. Optional hail guards may also be outfitted to the outdoor coil for added protection from hail bouncing off the unit's roof up the coil.

7. Outdoor Fans: The outdoor coil shall have a vertical discharge outfitted with quiet, efficient, fully modulating Electronically Commutated Motor (ECM) condensing fans. These fans shall modulate to maintain a temperature differential between outside air and the outdoor coil.

C. To help mitigate any long-term potential for leaks or hardware failures, the unit shall be outfitted with the following protection measures:

1. Suction line accumulator for added protection against liquid entering suction line of compressor.

2. Bi-flow, low pressure drop, filter drier.

3. Electronic Expansion Valve (EEV) for precise superheat control. EEV shall open partially allowing system pressure equalization prior to activation of the compressor.

4. Protective rubber sleeves installed on all distribution lines of indoor coil to prevent wear from rubbing.

5. All refrigeration ports shall be short-stub assembly and any access port with a transducer or switch is mounted vertically to mitigate risk of bent/cracked stub joints.

6. Refrigeration circuit shall be mechanically CNC pre-bent tubing wherever possible with minimal brazed joints to minimize points for potential refrigeration leaks.

7. Factory tested for leaks via high pressure nitrogen decay and helium tracer gas testing.

8. Suction line temperature sensor failure detection.

9. Preventative failure alerts through a manufacturer provided, cloud based, cellular remote monitoring system.

2.6 HEATING SYSTEM

A. The gas burner shall be an indirect-fired, push-through type, using natural gas or liquid propane gas. The inlet-supply pressure to the unit for natural gas must be 7” w.c. minimum. For liquid propane gas, the minimum must be 11" w.c.

B. Burner shall be a tubular in-shot fired design capable of using natural or LP type gas. Each burner ignition shall be of the direct-spark design with remote flame sensing at inlet of the last firing tube of the gas manifold.

C. Direct-sparking sequence shall last through the complete duration of the trial for ignition period for guaranteed light-off. Burner shall always be lit at maximum gas flow and combustion airflow for guaranteed light-off. Each burner ignition module shall have LED indicators for troubleshooting and a set of exposed prongs for testing flame indication signal.

D. All furnaces shall be controlled by an electronic Vernier-type fully modulating control system capable of achieving 81% combustion efficiency over the entire gas firing range of the unit.

E. Each furnace shall have:

1. A minimum turndown ratio of 6:1 for natural gas and 5:1 for LP gas while maintaining a constant 81% efficiency (90% for high efficiency furnace option). No cold air bypass of the heat exchanger.

2. Each furnace heat exchanger shall be a bent-tube style design made entirely of stainless steel.

3. Stainless steel Quick Seal Connection for gas connection.

4. Manifold and Input gas pressure gauges.

5. Factory piped condensate drain to exterior of cabinet.

6. A combustion flue to be installed on adjacent side as combustion intake with integrated high velocity wind cap.

7. A blocked vent safety airflow switch with high temperature silicone tubing operating off of absolute pressure measured inside of the power-vent blower housing.

8. A high temperature auto-recycling limit with a maximum non-adjustable set point.

9. A manual reset high temperature flame roll out switch with a non-adjustable set point.

10. Each furnace compartment shall have a removable post and panel that allows the furnace to be easily removed for service and maintainability.

11. A power-vent assembly for exhausting flue gases with a PSC or ECM type motor that is securely mounted and easily accessible/removable for service.

12. A 0-10" w.c. gas pressure gauge installed on the gas manifold.

2.7 FILTERS

A. Provide filters as part of unit. All filters shall be furnished and installed to meet the performance requirements set forth in the schedule and as specified under another section of this work.

B. All filters shall be installed on tracks for easy removal from the unit.

C. Unit shall have 2" MERV-8 and 2" MERV-13 filters.

D. Unit shall have an optional adjustable pressure differential sensor for the filter bank to alert in the event of a clogged filter.

2.8 ELECTRICAL

A. All controls shall be pre-wired and housed in an insulated electrical cabinet within the unit to protect against risk of condensation.

B. Units shall be provided with single point electrical connection or separate electrical heat connection.

C. Unit shall be provided with a door safety switch that de-energizes the supply fan when the door is opened.

D. Unit shall be provided with a factory mounted averaging supply air temperature sensor to allow for accurate discharge temperature readings within unit when a downstream sensor is not installed.

E. Unit shall be provided with a factory mounted averaging intake air temperature sensor to allow for accurate intake temperature reading regardless of how the OA/RA dampers are positioned.

F. The electrical cabinet shall be outfitted with the following:

1. LED electrical cabinet service light with automatic activation upon door switch.

2. Color wiring schematics, laminated to the interior wall of the cabinet doors.

3. Factory mounted disconnect with unit bottom knockouts.

4. A LED backlit, LCD Human-Machine Interface (HMI) shall be mounted within the unit's control cabinet to allow for all set points configuration and refrigeration system monitoring at the unit.

5. Up to 4 additional space mounted HMIs available. Additional HMIs shall allow for full programming capabilities and are outfitted with integral temperature and humidity sensors.

Additional HMIs shall be capable of being individually averaged for space temperature/humidity readings. All HMIs shall be wired using standard CAT5/6 cables.

6. Optional 120V, 15A unit powered or unpowered convenience outlet.

G. All sensors shall be wired back to the main control board that continuously monitors all critical components and makes decisions based on pre-determined logic to accurately control the following:

1. PID logic to control heater modulation ensuring precise discharge/space temperature control.

2. PID logic to control compressor speed to provide precise control over evaporative coil temperatures, leaving dew point, and discharge/space temperatures.

3. PID logic for Outdoor fan modulation to maintain an optimal outdoor coil temperature.

4. PID logic for Electronic Expansion Valve (EEV) position to maintain a precise superheat temperature

5. PID logic for Modulating Reheat valve to limit supply air temperature and relative humidity based off of space or discharge conditions.

2.9 CONTROLS

A. Unit shall be outfitted with a control board to allow for full control of the entire unit.

B. Provide air flow switch on the supply fan system to sense air flow with available set of contacts for connection to BMS for airflow alerts.

C. All unit controls shall be compatible with BACnet and LonWorks based building management systems.

D. All units shall be outfitted with CASLink cloud based monitoring, which monitors every point of operation. Provides configurable automated fault alert e-mails, and remote control capabilities.

E. Integrated cellular module to provide remote connection to monitoring services to view both real time and historical unit operation. Data shall be stored a minimum of 3 years on the cloud. Data sample rate shall be a maximum of 60 seconds.

F. Temperature Control System

1. Low-Ambient Cooling: Unit is factory outfitted with logic allowing for low-ambient operation of the DX system

a. Standard low-ambient operation: Unit(s) with a DX system may operate down to 0°F outdoor temperatures purely through software utilizing the standard factory modulating components.

2. Discharge Temp Control (Heating)
Unit modulates the burner flame (current supply in the case of electric heating) to accurately maintain the desired discharge temperature set point and compensate for fluctuations in

entering air temperature, air volume and % of OA using heating PID controls designed specifically for the DOAS.

3. Discharge Temp Control (Cooling)
   Unit modulates the compressor frequency to accurately maintain the desired discharge temperature set point and compensate for fluctuations in entering air temperature, air volume and % of OA using proprietary cooling PID controls designed specifically for the DOAS.

4. Discharge Humidity Control (Dehumidification)
   Unit modulates the compressor frequency to accurately maintain a desired evaporative coil dew point measured via a coil mounted temperature sensor between the evaporative and hot gas reheat coils. A fully modulating hot gas reheat valve shall utilize excess waste heat from the condensing section feeding the hot gas reheat coil with the precise amount of heat needed to accurately reheat the airstream in order to maintain a desired discharge temperature compensating for fluctuations in entering air temperature, air volume and % of OA using proprietary dehumidification PID controls designed specifically for DOAS.

5. Space Temp Control (Heating)
   Unit modulates the burner flame (current supply in the case of electric heating) to accurately maintain the desired space temperature set point and compensate for fluctuations in entering air temperature, air volume and % of OA using heating PID controls designed specifically for the DOAS. Minimum and maximum discharge set points can be set to limit the temperature entering the space. An optional additional HMI or room thermostat can be used to determine the space temperature. In the case that no temperature sensor is available in the space, the unit will use an internal return temperature sensor.

6. Space Temp Control (Cooling)
   Unit modulates the compressor frequency to accurately maintain the desired space temperature set point and compensate for fluctuations in entering air temperature, air volume and % of OA using cooling (heating when in heat pump mode) PID controls designed specifically for the DOAS. Minimum and maximum discharge set points can be set to limit the temperature entering the space. An optional additional HMI or room thermostat can be used to determine the space temperature. In the case that no temperature sensor is available in the space, the unit will use an internal return temperature sensor.

7. Space Humidity Control (Dehumidification)
   Unit modulates the compressor frequency to accurately maintain a desired evaporative coil dew point measured via a coil mounted temperature sensor between the evaporative and hot gas reheat coils. A fully modulating hot gas reheat valve shall utilize excess waste heat from the condensing section feed the hot gas reheat coil with the precise amount of heat needed to accurately reheat the airstream in order to maintain a desired space temperature compensating for fluctuations in entering air temperature, air volume and % of OA using proprietary dehumidification PID controls designed specifically for the DOAS.

8. Advanced Total Unit Economizer: The control system is outfitted standard, without need for any additional hardware, with an Advanced Total Unit Economizer which will take maximum advantage of as much energy available in the outdoor air conditions in order to run the compressor the minimum amount required at any given incoming air conditions. If the outdoor enthalpy (temperature and relative humidity) permits, the unit will be capable of completely modulating and shutting off compressor to provide “free” cooling and dehumidification as the outdoor air conditions allow.

G. Activation Controls:

1. Activate Based on Intake (Heating)
   Unit will activate heating when the intake temperature drops below the desired set point.

2. Activate Based on Intake (Cooling)
   Unit will activate cooling when the intake temperature rises above the desired set point.

3. Activate Based on Intake (Dehumidification)
   Unit will activate dehumidification when the intake conditions rise above the desired intake set point, with activation set points configured to a Dew Point, Relative Humidity or a combination of Dew Point/Relative Humidity.

4. Activate Based on Space (Heating)
   Unit will activate heating when the space temperature drops below the desired set point.

5. Activate Based on Space (Cooling)
   Unit will activate cooling when the space temperature rises above the desired set point.

6. Activate Based on Space (Dehumidification)
   Unit will activate dehumidification when the space set point rises above the desired space set point, with activation set points configured to a Dew Point, Relative Humidity or a combination of Dew Point/Relative Humidity.

7. Activate Based on Both (Heating)
   Unit will activate heating when the space AND intake temperature drop below the desired set point.

8. Activate Based on Both (Cooling)
   Unit will activate cooling when the space AND intake temperature rise above the desired set point.

9. Activate Based on Both (Dehumidification)
   Unit will activate dehumidification when the space and intake set point rise above the desired space and intake set point, with activation set points configured to a Dew Point, Relative Humidity or a combination of Dew Point/Relative Humidity.

10. Activate Based on Either (Heating)
    Unit will activate heating when the space OR intake temperature drops below the desired set point.

11. Activate Based on Either (Cooling)
    Unit will activate cooling when the space OR intake temperature rises above the desired set point.

12. Activate Based on Either (Dehumidification)
    Unit will activate dehumidification when the space or intake set point rises above the desired space or intake set point, with activation set points configured to a Dew Point, Relative Humidity or a combination of Dew Point/Relative Humidity.

13. Activate Based on Stat (Heating)
    Unit will activate heating when the space thermostat sends a 24V signal to W and G on the main control board. Unit will modulate to maintain a constant discharge heat set point.

14. Activate Based on Stat (Cooling)
    Unit will activate cooling when the space thermostat sends a 24V signal to Y and G on the main control board. Unit will modulate to maintain a constant discharge cool set point.

2.10 ROOF CURB

A. Unit shall be factory assembled, and constructed of 18GA galvanized steel, with optional 16GA available.

B. Curb shall be fully insulated with 1" acoustical and thermal insulation.

2.11 VARIABLE FREQUENCY DRIVES

A. Provide Variable Frequency Drive for the compressor as part of the AC unit. VFD shall be furnished and installed to meet the performance set forth in the schedule and as specified under another section of this work.

    1. Accessories to be furnished and mounted by the drive manufacturer and contained in a single enclosure. (The use of more than one enclosure is not acceptable).

B. Provide Variable Frequency Drive for speed control on all non-ECM direct drive supply fans.

C. All VFDs shall provide the following inherent protections:

    1. Phase protection.

    2. Brownout protection.

    3. Overload/Overheat protection.

    4. Soft starts to protect bearings/hardware.

    5. Low & High voltage & over-torque protections.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions under which packaged units are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions, drawings, written specifications, manufacturer’s installation manual and all applicable building codes.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate the general arrangement of piping, fittings, and specialties. Install piping to allow service and maintenance.

B. Duct installation requirements are specified in other Division 23 Sections. Drawings indicate the general arrangement of ducts.

C. Electrical: Conform to applicable requirements in Division 26 Sections.

3.4 SYSTEM START-UP

A. System start-up is performed by a factory trained Service Technician.

END OF SECTION 23 74 33