SECTION 23 74 33

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

SPECIFICATIONS

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 SEISMIC DESIGN

A. Should the project be located within a seismic zone requiring special provisions for support and restraint of equipment, components, and piping. Refer to state or local codes for Seismic, Wind, Flood Load Design for additional requirements.

1.4 WIND LOAD DESIGN

A. Refer to state or local codes for Seismic, Wind, Flood Load Design for additional requirements.

B. Miami Dade rated up to ±150psf per TAS 201, 202 & 203 paired with 20” curb or shorter.

1.5 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 2.6-2016.

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

1.6 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. Alternate layouts or dimensional changes will not be accepted.

2.2 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 Down (vertical) discharge through the unit's base or Side (horizontal) discharge through the cabinet.

B. Return: Unit shall also be configurable for No Return, Down (vertical) Return through the unit’s base, or Side (horizontal) Return through the cabinet.

C. Intake Airflow: Unit configuration shall be through use of a fresh/outdoor and return 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 (belt-drive not acceptable) 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. (Submit fan curves).

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
   - 6%-100% on 50 Ton units
   - 7%-100% on 40 and 60 Ton units
   - 15%-100% on 5, 6, 7.5, 8, 10, & 12.5 Ton units/Size 3 30 Ton units
   - 17%-100% on 4 Ton units
   - 20%-100% on 3 Ton units
   - 25%-100% on 15, 20, 22, 25, and 30 Ton units.

2. Refrigerant: Unit shall be factory charged with R454B 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. On optional heat pump units, use of a single 3-way reheat valve to prevent obstructions due to valve failure.

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

6. 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.

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

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

9. Suction line temperature sensor failure detection.

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

11. A2L refrigerant leak detectors are paired with custom logic to mitigate the risk of fire in the event of a detected leak.

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.

F. Each electric heater shall have:

1. SCR electric inserts for side or down discharge supply.

2. Electric coils are controlled using SCR controls. SCR is a time proportioning type controller that modulates the heater and supplies the exact amount of power to match the heat demand with a 10:1 turndown per stage with full modulation between minimum turndown and max output.

2.7 HYDRONIC COILS

A. Chilled Water Option

1. Cold water option piping through curb. Compatible with DX Cooling options. Modulating valves, zone valves, mixing valves, EWT/LWT thermostats, and freeze protection by others.

2. Cold water option piping through side. Modulating valves, zone valves, mixing valves, EWT/LWT thermostats, and freeze protection by others.

3. Chilled Water Activation and 0-10V Output to Third Party Controls.

B. Hot Water Option

1. Hot water option piping through curb. Compatible with DX Cooling options. Modulating valves, zone valves, mixing valves, EWT/LWT thermostats, and freeze protection by others.

2. Hot water option piping through side. Not compatible with DX Cooling options. Modulating valves, zone valves, mixing valves, EWT/LWT thermostats, and freeze protection by others.

3. Hot Water Activation and 0-10V Output to Third Party Controls.

2.8 POWERED EXHAUST (Optional)

A. Powered Exhaust

1. Powered Exhaust for 0-10V Control. 4000 CFM Max at 0”.

2. Powered Exhaust for Building Static Pressure Control. 4000 CFM Max at 0”.

3. Powered Exhaust for Manual Control. 4000 CFM Max at 0”.

B. Powered Exhaust Module

1. Powered Exhaust Module for 208/230V 0-10V Control. Module ships loose.

2. Powered Exhaust Module for 208/230V Building Static Control. Module ships loose.

3. Powered Exhaust Module for 208/230V Manual Control. Module ships loose.

4. Powered Exhaust Module for 460/480V 0-10V Control. Module ships loose.

5. Powered Exhaust Module for 460/480V Building Static Control. Module ships loose.

6. Powered Exhaust Module for 460/480V Manual Control. Module ships loose.

7. Powered Exhaust Module High Capacity 208/230V 0-10V Control. Module ships loose.

8. Powered Exhaust Module High Capacity 208/230V Building Static Control. Module ships loose.

9. Powered Exhaust Module High Capacity 208/230V Manual Control. Module ships loose.

10. Powered Exhaust Module High Capacity 460/480V 0-10V Control. Module ships loose.

11. Powered Exhaust Module High Capacity 460/480V Building Static Control. Module ships loose.

12. Powered Exhaust Module High Capacity 460/480V Manual Control. Module ships loose.

C. Powered Exhaust Terminals

1. Powered Exhaust Terminals for External Exhaust Control from RTU – Building Static Pressure Controls.

2. Powered Exhaust Terminals for External Exhaust Control from RTU – Manual Control.

2.9 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. Up to 3 layers of outdoor air filtration installed. Unit shall ship with a 2” washable metal mesh outdoor air filter. Mixed air shall have optional 2” MERV-8. Mixed air shall have optional MERV-13 filters. Mixed air shall have optional 4” MERV-15. Mixed air shall have optional 4” HEPA filter banks factory installed.

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

2.10 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. Field mounted and wired discharge air sensors will not be accepted.

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 on space or discharge conditions.

2.11 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. Optional Blower Control - CO2 Min/Max Override Setpoint or CO2 Threshold Setpoint.

G. Optional Damper Control - CO2 Min/Max Override Setpoint or CO2 Threshold Setpoint.

H. 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.

    b. Extreme low-ambient operation: Unit(s) with a DX system may operate to extreme low-ambient conditions, down to -25°F outdoor temperatures, are factory fitted with a bypass solenoid.

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 Paragon unit(s).

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 Paragon unit(s).

4. **Discharge Temp Control (Heat Pump)**
   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 heating PID controls designed specifically for the Paragon unit(s). Minimum and maximum discharge set points can be set to limit the temperature entering the space. When ambient temperatures drop below a user configurable minimum outdoor air temperature set point, or the unit is not able to maintain a user configurable minimum discharge temp for 5 minutes time, the heat pump will initiate its backup heat source. Initiation of backup heater operation shall ensure discharge temps are maintained prior to disabling heat pump to make sure discharge temps are never impacted during changeover. 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.

5. **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 Paragon unit(s).

6. **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 Paragon unit(s). 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 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 Paragon unit(s). 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.

8. **Space Temp Control (Heat Pump)**
   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 heating PID controls designed specifically for the Paragon unit(s). Minimum and maximum discharge set points can be set to limit the temperature entering the space. When ambient temperatures drop below a user configurable minimum outdoor air temperature set point, or the unit is not able to maintain a user configurable minimum discharge temp for 5 minutes time, the heat pump will initiate its backup heat source. Initiation of backup heater operation shall ensure discharge temps are maintained prior to disabling heat pump to make sure discharge temps are never impacted during changeover. 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.

9. **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 Paragon unit(s).

10. **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.

I. 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.

2.12 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.

C. Curb shall be factory outfitted with duct support hangers.

2.13 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.

2.14 FIELD COMMISSIONING SERVICES (FCx)

A. Refer to Section 23 08 00 Field Commissioning Services.

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