SECTION 23 74 13 – VAV PACKAGED ROOFTOP UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes packaged, outdoor, central-station air-handling units (rooftop units) with the following components and accessories:

1. Direct-expansion cooling.
2. Economizer outdoor and return-air damper section.
3. Integral, space temperature controls.
4. Roof curbs.

1.3 DEFINITIONS

A. Outdoor-Air Refrigerant Coil: Refrigerant coil in the outdoor-air stream to reject heat during cooling operations and to absorb heat during heating operations. "Outdoor air" is defined as the air outside the building or taken from outdoors and not previously circulated through the system.

B. Outdoor-Air Refrigerant-Coil Fan: The outdoor-air refrigerant-coil fan in RTU's. "Outdoor air" is defined as the air outside the building or taken from outdoors and not previously circulated through the system.

C. RTU: Rooftop unit. As used in this Section, this abbreviation means packaged, outdoor, central-station air-handling units. This abbreviation is used regardless of whether the unit is mounted on the roof or on a concrete base on ground.

D. Supply-Air Fan: The fan providing supply-air to conditioned space. "Supply air" is defined as the air entering a space from air-conditioning, heating, or ventilating apparatus.

E. Supply-Air Refrigerant Coil: Refrigerant coil in the supply-air stream to absorb heat (provide cooling) during cooling operations and to reject heat (provide heating) during heating operations. "Supply air" is defined as the air entering a space from air-conditioning, heating, or ventilating apparatus.

1.4 SUBMITTALS

A. Product Data: Include manufacturer's technical data for each RTU, including rated capacities, dimensions, required clearances, characteristics, furnished specialties and accessories.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components and location and size of each field connection.

1. Wiring Diagrams: Power, signal and control wiring.

C. Field quality-control test reports.

D. Operation and maintenance data.

E. Warranty.

1.5 QUALITY ASSURANCE

A. ARI Compliance:

1. Comply with ARI 210/240 and ARI 340/360 for testing and rating energy efficiencies for RTU's.
2. Comply with ARI 270 for testing and rating sound performance for RTU's.

B. ASHRAE Compliance:

1. Comply with ASHRAE 15 for refrigerant system safety.
2. Comply with ASHRAE 33 for methods of testing cooling and heating coils.
3. Comply with ASHRAE/IESNA 90.1 for minimum efficiency of heating and cooling.

C. NFPA Compliance: Comply with NFPA 90A and NFPA 90B.

D. UL Compliance: Comply with UL 1995.

E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to replace components of RTU's that fail in materials or workmanship within specified warranty period. The manufacturer's warranty shall include complete five year parts, labor and refrigerant warranty for all components on the RTU.

1. Warranty Period for Compressors: Manufacturer's standard, but not less than five years from date of Substantial Completion.
2. Warranty Period for Control Boards: Manufacturer's standard, but not less than three years from date of Substantial Completion.
3. Warranty coverage extended to include use prior to date of substantial completion.

1.7 DELIVERY, STORAGE, AND HANDLING:

A. Deliver rooftop units as factory-assembled units with protective crating and covering as recommended by the manufacturer.

B. Coordinate delivery of units in sufficient time to allow movement into building.

C. Handle rooftop units to comply with manufacturer's written rigging and installation instructions for unloading and moving to final location.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

1. Carrier Corporation.
2. JCI/York International Corporation.
3. The Trane Co.

4. Aaon.
5. Daikin McQuay

2.2 CASING

A. General Fabrication Requirements for Casings: Formed and reinforced double-wall insulated panels, fabricated to allow removal for access to internal parts and components, with joints between sections sealed.

B. Exterior Casing Material: Galvanized steel with factory-painted finish, with pitched roof panels and knockouts with grommet seals for electrical and piping connections and lifting lugs.

1. Zinc coated heavy gauge galvanized steel.

C. Inner Casing Fabrication Requirements:

1. Inside Casing: Galvanized steel.

D. Casing Insulation and Adhesive: Comply with NFPA 90A or NFPA 90B.

1. Materials: ASTM C 1071, Type I. 1.5 pound density matt faced fiberglass insulation.
2. Minimum Thickness: 1/2inch.
3. Liner materials shall have air-stream surface coated with an erosion and temperature-resistant coating or faced with a plain or coated fibrous matt or fabric.
4. Liner Adhesive: Comply with ASTM C 916, Type I.

E. Condensate Drain Pans: Double sloped, Formed sections of stainless-steel sheet, a minimum of 2 inches deep, and complying with ASHRAE 62.

1. Double-Wall Construction: Fill space between walls with foam insulation and seal moisture tight.
2. Drain Connections: Threaded nipple.

2.3 FANS

A. Belt-Driven Supply-Air and Return-Air Fans: Double width, forward curved, centrifugal; with permanently lubricated, single-speed motor installed on an adjustable fan base resiliently mounted in the casing. Aluminum or painted-steel wheels, and galvanized or painted-steel fan scrolls.

1. Supply Fans shall have factory mounted and wired VFD with bypass wired for duct static pressure control through the BAS
2. Return Fans shall have factory mounted and wired VFD with bypass wired to track with the supply fan; controlled through the BAS.

B. Condenser-Coil Fan: Propeller, mounted on shaft of permanently lubricated motor.

2.4 COILS

A. Supply-Air Refrigerant Coil:

1. Aluminum-plate fin and seamless copper tube in steel casing with equalizing-type vertical distributor.
2. Coil Split: Interlaced.
3. Condensate Drain Pan: Double-sloped, stainless steel with corrosion-resistant coating formed with pitch and drain connections complying with ASHRAE 62.

B. Outdoor-Air Refrigerant Coil:

1. Aluminum-plate fin and seamless copper tube in steel casing with equalizing-type vertical distributor.
   a. Copper tube/aluminum fin condenser coils are preferred if available.
   b. Condenser coils shall have all Aluminum Microchannel coils. All coils shall be leak tested at the factory to ensure pressure integrity. The condenser coil is pressure tested to 650 psig.
   c. Provide subcooling circuit(s) integral with condenser coils to maximize efficiency and prevent premature flashing of liquid refrigerant, to a gaseous state, ahead of the expansion valve.
   d. Provide vertical discharge, direct drive fans with steel blades, and three phase motors. Fans shall be statically and dynamically balanced. Motors shall be permanently lubricated, with built-in current and thermal overload protection and weathertight slinger over motor bearings.
   e. Provide factory-installed louvered steel coil guards around perimeter of condensing section to protect the condenser coils, refrigerant piping and control components. Louvered panels shall be fabricated from heavy gauge galvanized steel and be rigid enough to provide permanent protection for shipping and pre-/post- installation. Course wire mesh is not an acceptable material for coil guards.

2.5 REFRIGERANT CIRCUIT COMPONENTS

A. Number of Refrigerant Circuits: As indicated on the drawings.

B. Compressor: Hermetic, scroll, mounted on vibration isolators; with internal overcurrent and high-temperature protection, internal pressure relief, and crankcase heater.

C. Refrigeration Specialties:

1. Refrigerant Charge: R-410A.
2. Expansion valve with replaceable thermostatic element.
3. Refrigerant filter/dryer.
4. Manual-reset high-pressure safety switch.
5. Automatic-reset low-pressure safety switch.
6. Minimum off-time relay.
7. Automatic-reset compressor motor thermal overload.
8. Brass service valves installed in compressor suction and liquid lines.

2.6 AIR FILTRATION

A. Minimum arrestance according to ASHRAE 52.1, and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.

B. Filters:
1. Merv (ASHRAE 52.2): 8
2. Media: Replaceable media on permanent filter frame.
3. Holding Frame: Galvanized steel,

2.7 DAMPERS

A. Outdoor-Air Damper: Linked damper blades, for 0 to 100 percent outdoor air, with motorized damper actuator.

B. Outdoor and Return-Air Mixing Dampers: Parallel or opposed-blade galvanized-steel dampers mechanically fastened to cadmium plated for galvanized-steel operating rod in reinforced cabinet.

1. Damper Motor: Modulating with adjustable minimum position is described in the sequence of operations in specification section 230993.
2. Relief-Air Damper: Shall be controlled through the BAS as described in the sequence of operations in specification section 230993.
3. Economizer and affiliated dampers shall be controlled and monitored through the BAS. Refer to the sequence of operations in specification section 230993
4. Provide spring-return motor for outside air damper closure during unit shutdown or power interruption.

2.8 ELECTRICAL POWER CONNECTION

A. Provide for single connection of power to unit with unit-mounted disconnect switch accessible from outside unit and control-circuit transformer with built-in overcurrent protection.

2.9 Controls

A. Rooftop Units (RTUs) shall be controlled and monitored through the BAS. The staging of RTU compressors and gas heat when applicable and RTU internal compressor and gas heater safeties shall be by the RTU controls..

B. The Human Interface Panel shall be readily accessible for service diagnosis and programming without having to open the main control panel on the rooftop unit. Alphanumeric coded displays shall not be acceptable.

1. Human Interface (HI) Panel - shall be a 16 key touch-sensitive membrane key switch panel, password protected to prevent use by unauthorized personnel. The Human Interface Panel display shall consist of a 2 line by 40 characters per line clear English display. The display shall be Supertwist Liquid Crystal Display (LCD) with blue characters, 5 X 7 dot matrix with cursor, on a gray-green background for high visibility and reading ease.

C. Remote Human Interface (RHI) - shall provide the same diagnostic monitoring and control capabilities as the unit mounted Human Interface Panel (except, for service technician safety, the "service test mode") including clear English display. The Remote Human Interface shall be capable of controlling up to four rooftops simultaneously. The Remote Human Interface device shall function in conjunction with the unit mounted Human Interface Panel. Removal of the unit mounted Human Interface, for remote mounting, while leaving no interface at the rooftop unit, shall not be permitted. Night setback and morning warmup functions shall also be established through the RHI, as well as the HI, as desired by the user.

D. Ventilation Override Module (VOM) - shall be provided which will allow the user to field reconfigure and establish up to five different purge, exhaust and building pressurization sequences. These sequences, factory prioritized, shall be reconfigurable through the Human Interface Panel at the rooftop unit, the Remote Human Interface or the TRACER building automation system.

E. Anti-recycle Protection - shall be provided to prevent excessive cycling, and premature wear, of the compressors, contactors and related components.

F. Tie the units into the building management system. Controls shall be BACnet. See Section 230993 Sequence of Operation for required points of control.

2.10 ACCESSORIES

A. Duplex, 115-V, ground-fault-interrupter outlet with 15-A overcurrent protection. Include transformer if required. Outlet shall be energized even if the unit main disconnect is open.

B. Coil guards of painted, galvanized-steel wire.

2.11 ROOF CURBS

A. The roof curbs shall be fabricated to match the roof slope so that the rooftop units sit level. Roof curb height shall be as indicated on the drawings.

B. The roof curbs for the RTU's shall be 14" high.

C. Materials: Galvanized steel with corrosion-protection coating, watertight gaskets and factory-installed wood nailer complying with NRCA standards.

1. Curb Insulation and Adhesive: Comply with NFPA 90A or NFPA 90B.

a. Materials: ASTM C 1071, Type I or II.
b. Thickness: 2 inches.

2. Application: Factory applied with adhesive and mechanical fasteners to the internal surface of curb.

a. Liner Adhesive: Comply with ASTM C 916, Type I.
b. Mechanical Fasteners: Galvanized steel, suitable for adhesive attachment, mechanical attachment, or welding attachment to duct without damaging liner when applied as recommended by manufacturer and without causing leakage in cabinet.
c. Liner materials applied in this location shall have air-stream surface coated with a temperature-resistant coating or faced with a plain or coated fibrous mat or fabric depending on service air velocity.
d. Liner Adhesive: Comply with ASTM C 916, Type I.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Roof Curb: Install on roof structure, level and secure, according to NRCA's "Low-Slope Membrane Roofing Construction Details Manual," Illustration "Raised Curb Detail for Rooftop Air Handling Units and Ducts" or ARI Guideline B. Install RTU's on curbs and coordinate roof penetrations and flashing with roof construction specified in Division 07 Section "Roof Accessories." Secure RTU's to upper curb rail, and secure curb base to roof framing with anchor bolts.

B. Install condensate drain, minimum connection size, with trap and indirect connection to nearest roof drain or area drain.

C. Roof curb shall be sealed airtight to unit.

3.2 FIELD QUALITY CONTROL

A. Provide factory startup for these units.

B. Tests and Inspections:

1. After installing RTU's and after electrical circuitry has been energized, test units for compliance with requirements.
2. Inspect for and remove shipping bolts, blocks, and tie-down straps.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Remove and replace malfunctioning units and retest as specified above.

D. Designer Note: Coordinate the below training requirement with CMS. Final training time allotment will be dependent on the size of the project.

E. Provide owner training for these units. Training shall be onsite and shall be a minimum of 8 hours for an initial training session with 8 hours of follow-up training. These time allotments for training are not per unit but cover all units described in this section provided on a project.

3.3 CLEANING AND ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to site during other-than-normal occupancy hours for this purpose.

B. After completing system installation and testing, adjusting, and balancing RTU and air-distribution systems, clean filter housings and install new filters.

END OF SECTION 23 74 13