

SECTION 23 74 13

PACKAGED, OUTDOOR, CENTRAL-STATION AIR-HANDLING UNITS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary 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 or RTUs)
- B. Related Sections include the following:
 - 1. Common Work Results for HVAC.
 - 2. HVAC Insulation.

1.3 PERFORMANCE REQUIREMENTS

- A. Wind-Restraint Performance:
 - 1. Basic Wind Speed: Minimum 130 mph. Refer to Structural Drawings
 - 2. Building Classification Category: Refer to Structural Drawings
 - 3. Minimum 10 lb/sq. ft multiplied by the maximum area of the mechanical component projected on a vertical plane that is normal to the wind direction, and 45 degrees either side of normal.

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. LEED Submittals:
 - 1. Product Data for Credit EA 4: Documentation required by Credit EA 4 indicating that equipment and refrigerants comply.
 - 2. Product Data for Prerequisite EQ 1: Documentation indicating that units comply with ASHRAE 62.1-2004, Section 5 - "Systems and Equipment."
- C. 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.

- D. Manufacturer Wind Loading Qualification Certification: Submit certification that specified equipment will withstand wind forces identified in "Performance Requirements" Article and in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculations.
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of wind force and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- E. Coordination Drawings: Plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - 1. Structural members to which RTUs will be attached.
 - 2. Roof openings
 - 3. Roof curbs and flashing.
- F. Operation and Maintenance Data: For RTUs to include in emergency, operation, and maintenance manuals.
- G. Warranty: Special warranty specified in this Section.

1.5 QUALITY ASSURANCE

- A. ARI Compliance:
 - 1. Comply with ARI 210/240 and ARI 340/360 for testing and rating energy efficiencies for RTUs.
 - 2. Comply with ARI 270 for testing and rating sound performance for RTUs.
- B. ASHRAE Compliance:
 - 1. Comply with ASHRAE 15 for refrigeration system safety.
 - 2. Comply with ASHRAE 33 for methods of testing cooling and heating coils.
 - 3. Comply with applicable requirements in ASHRAE 62.1-2004, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."
- C. ASHRAE/IESNA 90.1-2004 Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004, Section 6 - "Heating, Ventilating, and Air-Conditioning."
- D. NFPA Compliance: Comply with NFPA 90A and NFPA 90B.
- 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 RTUs that fail in materials or workmanship within specified warranty period.
 - 1. Provide one (1) year warranty from date of Substantial Completion.
 - 2. Include a parts only warranty on refrigerant compressors for the 2nd through 5th year from date of Substantial Completion.

1.7 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Filters: Two spare sets with unit for a total of 3 sets (one at start-up, one at substantial completion and one at final).

1.8 OPERATION AND MAINTENANCE DATA

- A. Submit operation and maintenance data under provisions Division 1.
- B. Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listing.

1.9 DELIVERY, STORAGE AND HANDLING

- A. Deliver products to site under provisions Division 1.
- B. Store and protect products under provisions of Division 1.
- C. Protect units from physical damage by storing off site until roof mounting frames are in place, ready for immediate installation of units.

1.10 CLOSE-OUT DOCUMENTS

- A. Refer to Division 23 Section "Common Work Results for HVAC" for close-out document requirements, including, but not limited to the following:
 - 1. Operation and Maintenance manuals;
 - 2. List of Contractors and Parts and Equipment Suppliers—complete with contact person, proper company name, address, and telephone numbers;
 - 3. All Contractor and Manufacturer warranties;
 - 4. List of attic stock signed for by Owner;

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide TRANE or a comparable product by one of the following:
 - 1. Carrier Corporation.
 - 2. YORK International Corporation.

2.2 MANUFACTURED UNITS

- A. Unit shall be self-contained, packaged, factory assembled and prewired, consisting of cabinet and frame, supply fan, controls, air filters, refrigerant cooling coil and compressor, hot gas bypass, electric heaters, condenser coil and condenser fan. Refer to drawings for components required.
- B. The units shall be dedicated downflow airflow. The operating range shall be between 115 F and 0 F in cooling as standard from the factory for all units. Cooling performance shall be rated in accordance with ARI testing procedures. All units shall be factory assembled, internally wired, fully charged and 100% run tested to check cooling operation, fan and blower rotation and control sequence before leaving the factory. Wiring internal to the unit shall be colored and numbered for simplified identification. Units shall be UL listed and labeled, classified in accordance to UL 1995/CAN/CSA No. 236-M90 for Central Cooling Air Conditioners.

2.3 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. Unit casing shall be constructed of zinc coated, heavy gauge, galvanized steel. Exterior surfaces shall be cleaned, phosphatized, and finished with a weather-resistant baked enamel finish. Unit's surface shall be tested for 500 hours (above 10 tons) or 1000 hours (10 tons and below) in a salt spray test in compliance with ASTM B117. Manufacturer shall provide written documentation supporting this quality of corrosion protection. Cabinet construction shall allow for all maintenance on one side of the unit. Service panels shall have lifting handles and shall be removed and reinstalled by removing not more than three screws while providing a water and air tight seal. All exposed vertical panels and top covers in the indoor air section of units 10 tons and below shall be insulated with a ½", 1 pound density foil-faced, fire-retardent permanent, odorless glass fiber material. Units above 10 tons shall have matt-faced insulation in lieu of foil-faced. The base of the downflow unit shall be insulated with ½", 1 pound density foil-faced, closed cell material. The downflow unit's base pan shall have no penetrations within the perimeter of the curb other than the raised 1 1/8" high supply/return openings to provide an added water integrity precaution should the condensate drain back up. The base of the unit shall have provisions for forklift and crane lifting.
- C. Condensate Drain Pans: Formed sections of stainless-steel
 - 1. Double-Wall Construction: Fill space between walls with foam insulation and seal moisture tight.

2. Drain Connections: Threaded nipple

- D. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.

2.4 FANS

- A. Direct-Driven Supply-Air Fans: Direct-drive, statically and dynamically balanced, draw through in the vertical discharge position. The fan motor(s) shall be permanently lubricated and have built-in thermal overload protection.
- B. Fan Motor: Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."

2.5 COILS

A. Evaporator and Condenser Coils:

1. Internally finned 3/8" copper tubes mechanically bonded to configured aluminum plate fin shall be standard. Coils shall be leak tested at the factory to ensure the pressure integrity. The evaporator coil and condenser coil shall be leak tested to 200 psig and pressure tested to 450 psig. On all dual compressor models, the evaporator coil shall have an intermingled configuration.
2. Condensate Drain Pan: Stainless steel formed with pitch and drain connections complying with ASHRAE 62.1-2004.

B. Hot-Gas Reheat Refrigerant Coil: (Refer to Drawings where required)

1. Internally finned 3/8" copper tubes mechanically bonded to configured aluminum plate fin shall be standard. Coil shall be leak tested at the factory to ensure the pressure integrity. The hot-gas reheat coil shall be leak tested to 200 psig and pressure tested to 450 psig.
2. Polymer strip shall prevent all copper coil from condensate pan.

C. Electric-Resistance Heating: (Refer to Drawings where required)

1. Open Heating Elements: Resistance wire of 80 percent nickel and 20 percent chromium, internally delta connected for 240 volt (wye connected for 480 volt), supported and insulated by floating ceramic bushings recessed into casing openings, fastened to supporting brackets, and mounted in galvanized-steel frame. Terminate elements in stainless-steel machine-staked terminals secured with stainless-steel hardware. Electric heat modules shall be UL listed.
2. Overtemperature Protection: Heating element contactors, automatically reset, thermal-cutout, safety device; serviceable through terminal box.
3. Overcurrent Protection: Manual-reset thermal cutouts, factory wired in each heater stage.
4. Control Panel: Unit mounted with disconnecting means and overcurrent protection. Include the following controls:

- a. Step Controller: Pilot lights and override toggle switch for each step (magnetic contactors).
- b. SCR Controller: Pilot lights operate on load ratio, a minimum of five steps (mercury contactors).
- c. Time-delay relay.
- d. Airflow proving switch.

2.6 REFRIGERANT CIRCUIT COMPONENTS

- A. Compressor: Units shall be direct-drive hermetic, reciprocating or scroll type compressors with centrifugal oil pump providing positive lubrication to moving parts. Motor shall be suction gas-cooled and shall have a voltage utilization range of plus or minus 10 percent of unit nameplate voltage. Crankcase heater, internal temperature and current-sensitive motor overloads shall be included for maximum protection. Compressors shall have internal spring isolation and sound muffling to minimize vibration transmission and noise. High and low pressure protection shall be provided.
- B. Refrigeration Specialties:
 1. Refrigerant: Refer to Drawings.
 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.
 9. Low-ambient kit high-pressure sensor.
 10. Hot-gas reheat solenoid valve with a replaceable magnetic coil. (Refer to Drawings where required)
 11. Hot-gas bypass solenoid valve with a replaceable magnetic coil. (Refer to Drawings where required)
 12. Four-way reversing valve with a replaceable magnetic coil, thermostatic expansion valves with bypass check valves, and a suction line accumulator.

2.7 ENERGY RECOVERY

- A. The rooftop unit shall have a factory mounted and tested energy recovery wheel, where shown on the plans. The energy recovery wheel shall be mounted in a rigid frame containing the wheel drive motor, drive belt, wheel seals and bearings.

- B. The energy recovery component shall incorporate a rotary wheel in an insulated cassette frame complete with seals, drive motor and drive belt.
- C. The total energy recovery wheel shall be coated with silica gel desiccant permanently bonded by a process without the use of binders or adhesives, which may degrade desiccant performance. The substrate shall be lightweight polymer and shall not degrade nor require additional coatings for application in marine or coastal environments. Coated segments shall be washable with detergent or alkaline coil cleaner and water. Desiccant shall not dissolve nor deliquesce in the presence of water or high humidity.
- D. Sensible energy recovery wheels shall be constructed of lightweight polymer and shall be provided without desiccant coating. Sensible-only wheels shall be constructed in the same fashion as the total energy recovery wheel.
- E. The wheel shall be wound continuously with one flat and one structured layer in an ideal parallel plate geometry providing laminar flow and minimum pressure drop-to-efficiency ratios. The layers shall be effectively captured in stainless steel wheel frames or aluminum and stainless steel segment frames that provide a rigid and self-supporting matrix.
- F. Wheels greater than 25" in diameter shall be provided with removable energy transfer matrix. Wheel frame construction shall be a welded hub, spoke and rim assembly of stainless, plated and/or coated steel and shall be self-supporting without matrix segments in place. Segments shall be removable without the use of tools to facilitate maintenance and cleaning. Wheel bearings shall be selected to provide an L-10 life in excess of 400,000 hours. Rim shall be continuous rolled stainless steel and the wheel shall be connected to the shaft by means of taper locks.
- G. Wheels 25" in diameter shall be provided with a monolithic removable energy transfer matrix. Wheel frame construction shall be a welded hub and rim assembly of stainless, plated and/or coated steel. Monolithic wheel shall be removable and replaceable from the cassette frame when the cassette frame is taken out of the unit. Wheel bearings shall be selected to provide an L-10 life in excess of 400,000 hours. Rim shall be continuous rolled stainless steel and the wheel shall be connected to the shaft by means of taper locks.
- H. All diameter and perimeter seals shall be provided as part of the cassette assembly and shall be factory set. Drive belts of stretch urethane shall be provided for wheel rim drive without the need for external tensioners or adjustment.
- I. The energy recovery cassette shall be an Underwriters Laboratories Recognized Component for electrical and fire safety. The wheel drive motor shall be an Underwriters Laboratory Recognized Component and shall be mounted in the cassette frame and supplied with a service connector or junction box. Thermal performance shall be certified by the manufacturer in accordance with ASHRAE Standard 84, Method of Testing Air-to-Air Heat Exchangers and ARI Standard 1060, Rating Air-to-Air Energy Recovery Ventilation Equipment. Cassettes shall be listed in the ARI Certified Products
- J. The exhaust fan(s) shall be airfoil type. Fan(s) and motor(s) shall be dynamically balanced. A back draft damper shall be included with the exhaust fan. Outside air filters shall be 4" thick fiberglass pleated with an ASHRAE efficiency of 30%.
- K. Exhaust fan motors shall be standard (premium) efficiency. Motors for use with a VFD shall be premium efficiency inverter rated only. Motors shall have ball bearings rated for 200,000 hours service and external lubrication connections.

2.8 CORROSION RESISTANT COATING

- A. Condenser coils and exposed cabinetry shall be provided with a factory applied corrosion resistant coating. Coils shall have coating applied in a dipping process. Spray coatings are not acceptable on the condenser coils.
- B. Corrosion resistant coating shall result in less than a 1% loss of rated heat transfer capacity.
- C. Corrosion resistant coating shall be resistant to materials with a PH range from 3 to 11.
- D. Corrosion resistant coating shall have a salt spray test rating of at least 2000 hours.
- E. Corrosion resistant coating shall be non-flammable.
- F. As an acceptable alternate, the condenser coil assembly and exposed cabinetry may have a Bronz-Glow corrosion coating compliant with the above parameters applied at the Bronz-Glow factory.

2.9 AIR FILTRATION

- A. Minimum arrestance according to ASHRAE 52.1, and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.
 - 1. 2" Pleated: MERV 13.

2.10 DAMPERS

- A. Outdoor-Air Damper: Linked damper blades. Outdoor air dampers shall open to set position when indoor fan starts. The damper shall close to the full closed position when indoor fan shuts down.

2.11 CONTROLS

- A. Unit shall be completely factory wired with necessary controls and contactor pressure lugs or terminal block for power wiring. Units shall provide an external location for mounting fused disconnect device. Micro-processor controls shall be provided for all 24 volt control functions. The resident control algorithms shall make all heating, cooling and/or ventilating decisions in response to electronic signals from sensors measuring indoor and outdoor temperatures. The control algorithm maintains accurate temperature control, minimizes drift from set point and provides better building comfort. a centralized Micro-processor shall provide anti-short cycle timing and time delay between compressors to provide a higher level of machine protection.
- B. Manufacturer shall provide for field installation by Mechanical Contractor a circuit board which shall provide an interface from the unit's microprocessor based controller to field installed electromechanical controls or automation systems.

2.12 ROOF CURBS

- A. Materials: Galvanized steel with corrosion-protection coating, watertight gaskets, and factory-installed wood nailer; complying with NRCA standards. The roof curb shall be designed to mate with the downflow unit and provide support and a water tight installation when installed properly. The roof curb design shall allow field-fabricated rectangular

supply/return ductwork to be connected directly to the side of the curb. The curb shall have an enclosed bottom intended for ground mounting. Curb shall ship knocked down for field assembly and include wood nailer strips. Curbs shall be properly insulated in the field by the installing Mechanical Contractor.

- B. Curb Height: 24 inches minimum.
- C. Wind Restraints: Metal brackets compatible with the curb and casing, painted to match RTU, used to anchor unit to the curb, and designed for loads at Project site. Comply with requirements in Division 23 Section "Vibration and Wind Restraint Controls for HVAC Piping and Equipment" for wind-load requirements.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of RTUs.
- B. Examine roughing-in for RTUs to verify actual locations of piping and duct connections before equipment installation.
- C. Examine area for suitable conditions where RTUs will be installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Roof Curb: Install on concrete base, 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.". Install RTUs on curbs and coordinate building penetrations and flashing with building construction specified in Division 01. Secure RTUs to upper curb rail, and secure curb base to concrete base with anchor bolts.
- B. Install wind and seismic restraints according to manufacturer's written instructions. Wind and seismically restrained vibration isolation roof-curb rails are specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."

3.3 CONNECTIONS

- A. Install condensate drain, minimum connection size, with trap terminate above grade at a permeable area near unit. Refer to plans for additional information..
- B. Install piping adjacent to RTUs to allow service and maintenance.
- C. Duct installation requirements are specified in other Division 23 Sections. Drawings indicate the general arrangement of ducts. The following are specific connection requirements:
 - 1. Install ducts to termination at side of roof curb.

2. Connect ducts to RTUs with flexible duct connectors specified in Division 23 Section "Air Duct Accessories."

3.4 MANUFACTURER'S FIELD SERVICES

- A. **Manufacturer's Field Service:** Manufacturers shall furnish a factory-trained service engineer without additional charge to prepare the machine for operation, start the unit and certify initial field startup. The Manufacturer shall provide a written certification to the Owner that the unit has been prepared and ready for operation. Contractor provided services are not acceptable.

*** END OF SECTION 23 74 13 ***