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PACKAGED, OUTDOOR, CENTRAL-STATION AIR-HANDLING UNITS

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes packaged, rooftop units with the following components and accessories:
   1. Direct-expansion cooling.
   2. Electric-heating coils.
   3. Gas furnace.
   4. Economizer outdoor- and return-air damper section.
   5. Integral, space temperature controls.
   6. Roof curbs.

1.02 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 RTUs. "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.

F. VVT: Variable-air volume and temperature.

1.03 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. Field quality-control test reports.

E. Operation and maintenance data.

F. Warranty.

1.04 QUALITY ASSURANCE

A. ARI Compliance:
1. Comply with ARI 210/240 and ARI 340/360 for testing and rating energy efficiencies for RTUs.

B. ASHRAE/IESNA 90.1-2004 Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004, Section 6 - "Heating, Ventilating, and Air-Conditioning."

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.

1.05 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. Warranty Period for Compressors: Manufacturer's standard, but not less than **five** years from date of Substantial Completion.
2. Warranty Period for Gas Furnace Heat Exchangers: Manufacturer's standard, but not less than **five** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Carrier Corporation.
2. Lennox Industries Inc.
3. McQuay International.

4. Trane; American Standard Companies, Inc.
5. YORK International Corporation.

2.02 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. Exterior Casing Thickness: 0.052 inch thick.

C. Inner Casing Fabrication Requirements:
1. Inside Casing: Galvanized steel, **0.034 inch**thick.

D. Casing Insulation and Adhesive: Comply with NFPA 90A or NFPA 90B.
1. Materials: ASTM C 1071, Type I.
2. Thickness: **1 inch**.
3. Liner materials shall have air-stream surface coated with an erosion- and temperature-resistant coating or faced with a plain or coated fibrous mat or fabric.
4. Liner Adhesive: Comply with ASTM C 916, Type I.

E. Condensate Drain Pans: Formed sections of **stainless**-steel sheet, a minimum of 2 inches deep**, and complying with ASHRAE 62.1-2004**.
1. Drain Connections: Threaded nipple.
2. Pan-Top Surface Coating: Corrosion-resistant compound.

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

2.03 FANS

A. Direct-Driven Supply-Air Fans: Double width, **forward curved**, centrifugal; with permanently lubricated, **ECM** motor resiliently mounted in the fan inlet. Aluminum or painted-steel wheels, and galvanized- or painted-steel fan scrolls.

B. Belt-Driven Supply-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.

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

D. Seismic Fabrication Requirements: Fabricate fan section, internal mounting frame and attachment to fans, fan housings, motors, casings, accessories, and other fan section components with reinforcement strong enough to withstand seismic forces.

2.04 COILS

A. Supply-Air Refrigerant Coil:

1. **Aluminum**-plate fin and seamless copper tube in steel casing with equalizing-type vertical distributor.

B. Outdoor-Air Refrigerant Coil:
1. **Aluminum**-plate fin and seamless copper tube in steel casing with equalizing-type vertical distributor.

C. Electric-Resistance Heating:
1. Open Heating Elements: Resistance wire of 80 percent nickel and 20 percent chromium, 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.
2. Overtemperature Protection: Disk-type, 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. **Magnetic** contactors.
   b. Step Controller: Pilot lights and override toggle switch for each step.
   c. SCR Controller: Pilot lights operate on load ratio, a minimum of five steps.
   d. Time-delay relay.
   e. Airflow proving switch.

2.05 REFRIGERANT CIRCUIT COMPONENTS

A. Number of Refrigerant Circuits: Refer to Schedule.

B. Compressor: **Hermetic, reciprocating, Semihermetic, reciprocating or Hermetic, scroll**, mounted on vibration isolators; with internal overcurrent and high-temperature protection, internal pressure relief.

C. Refrigeration Specialties:
1. Refrigerant: **R-22, R-407C, R-410A**.
2. Refrigerant: R-407C or R-410A.
3. Expansion valve with replaceable thermostatic element.
4. Refrigerant filter/dryer.
5. Manual-reset high-pressure safety switch.
6. Automatic-reset low-pressure safety switch.
7. Minimum off-time relay.
8. Automatic-reset compressor motor thermal overload.
9. Brass service valves installed in compressor suction and liquid lines.

2.06 AIR FILTRATION

A. Minimum arrestance according to ASHRAE 52.1, and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.
1. Pleated: Minimum **90** percent arrestance, and MERV [**7**].

2.07 GAS FURNACE

A. Description: Factory assembled, piped, and wired; complying with ANSI Z21.47 and NFPA 54.
   1. CSA Approval: Designed and certified by and bearing label of CSA.

B. Burners: Stainless steel.
   1. Fuel: **Natural or Propane** gas. Refer to schedule.
   2. Ignition: Electronically controlled electric spark or hot-surface igniter with flame sensor.

C. Heat-Exchanger and Drain Pan: Stainless steel.

D. Venting: Gravity vented **or power vent (Refer to schedule)**.

E. Power Vent: Integral, motorized centrifugal fan interlocked with gas valve **with vertical extension**.

F. Safety Controls:
   1. Gas Control Valve: **Single stage**, **Two stage** or **Modulating**.
   2. Gas Train: Single-body, regulated, redundant, 24-V ac gas valve assembly containing pilot solenoid valve, pilot filter, pressure regulator, pilot shutoff, and manual shutoff.

2.08 DAMPERS

A. Outdoor-Air Damper: Linked damper blades, for 0 to 25 percent outdoor air, with **motorized** damper filter.

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. Connect operating rods with common linkage and interconnect linkages so dampers operate simultaneously.
   1. Damper Motor: Modulating with adjustable minimum position.
   2. Relief-Air Damper: Gravity actuated or motorized, as required by ASHRAE/IESNA 90.1-2004, with bird screen and hood.

2.09 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.

2.10 CONTROLS

A. Control equipment and sequence of operation are specified in Division 23 Section "Instrumentation and Control for HVAC."

B. **Electronic** Controller:
      a. Smoke Detectors: Stop fan and close outdoor-air damper if smoke is detected. Provide additional contacts for alarm interface to fire alarm control panel.

b. Firestats: Stop fan and close outdoor-air damper if air greater than **130 deg F** enters unit. Provide additional contacts for alarm interface to fire alarm control panel.

2. Scheduled Operation: Occupied and unoccupied periods on **seven**-day clock with a minimum of **two** programmable periods per day.
3. Unoccupied Period:
   a. Heating Setback: **62 deg F**.
   b. Cooling Setback: System off.
   c. Override Operation: **Two** hours.
4. Supply Fan Operation:
   a. Occupied Periods: Run fan continuously.
   b. Unoccupied Periods: Cycle fan to maintain setback temperature.
5. Refrigerant Circuit Operation:
   a. Occupied Periods: Cycle or stage compressors to match compressor output to cooling load to maintain **room** temperature. Cycle condenser fans to maintain maximum hot-gas pressure.
   b. Unoccupied Periods: Compressors off.
6. Gas Furnace Operation:
   a. Occupied Periods: **Stage** or **Modulate** burner to maintain **room** temperature.
   b. Unoccupied Periods: Cycle burner to maintain setback temperature.
7. Electric-Heating-Coil Operation:
   a. Occupied Periods: **Stage** coil to maintain **room** temperature.
   b. Unoccupied Periods: Energize coil to maintain setback temperature.
8. Fixed Minimum Outdoor-Air Damper Operation:
   a. Occupied Periods: Balance to within 5% of outdoor air capacity shown on schedule.
   b. Unoccupied Periods: Close the outdoor-air damper.
9. Economizer Outdoor-Air Damper Operation:
   a. Occupied Periods: Open to capacity shown on schedule percent fixed minimum intake, and maximum 100 percent of the fan capacity to comply with ASHRAE Cycle II. Controller shall permit air-side economizer operation when outdoor air is less than **60 deg F**. Use **outdoor-air enthalpy** to adjust mixing dampers. During economizer cycle operation, lock out cooling.
   b. Unoccupied Periods: Close outdoor-air damper and open return-air damper.
10. VVT Relays:
   a. Provide heating- and cooling-mode changeover relays compatible with VVT terminal control system.

2.11 ACCESSORIES

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

2.12 ROOF CURBS

A. 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: **1-1/2 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.

B. Curb Height: **14 inches**.

C. Wind and Seismic 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.

PART 3 - EXECUTION

3.01 INSTALLATION
1. Minimum Deflection: [**1/4 inch**] [**1 inch**].

B. Roof Curb: Install on roof structure or 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 roof penetrations and flashing with roof construction specified in Division 07 Section "Roof Accessories." Secure RTUs to upper curb rail, and secure curb base to roof framing or concrete base with anchor bolts.

C. Unit Support: Install unit level on structural **curbs**. Coordinate wall penetrations and flashing with wall construction. Secure RTUs to structural support with anchor bolts.

D. Install wind and seismic restraints according to manufacturer's written instructions.

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

F. Install piping adjacent to RTUs to allow service and maintenance.
1. Gas Piping: Comply with applicable requirements in Division 23 Section. Connect gas piping to burner, full size of gas train inlet, and connect with union and shutoff valve with sufficient clearance for burner removal and service.

G. 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 top of roof curb.
2. Remove roof decking only as required for passage of ducts. Do not cut out decking under entire roof curb.
3. Connect supply ducts to RTUs with flexible duct connectors specified in Division 23 Section "Air Duct Accessories."

4. Install return-air duct continuously through roof structure.

3.02 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.

B. Perform tests and inspections and prepare test reports.
   1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing. Report results in writing.

C. Tests and Inspections:
   1. After installing RTUs 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.

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

3.03 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.

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