

SECTION 23 74 13 - PACKAGED, OUTDOOR, CENTRAL STATION AIR HANDLING UNITS

PART 1 - GENERAL

1.1 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. Electric-heating coils.
 - 3. Gas furnace.
 - 4. Economizer outdoor- and return-air damper section.
 - 5. Roof curbs.

1.2 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.

1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design vibration isolation and seismic restraint details, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

- B. Seismic Performance: RTUs shall withstand the effects of earthquake motions determined according to SEI/ASCE 7. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

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. Seismic Qualification Certificates: For air handling units, accessories, and components, from manufacturer.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity 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.
- D. Field quality control test reports.
- E. Operation and maintenance data.
- F. 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 RTUs.
 - 2. Comply with ARI 270 for testing and rating sound performance for RTUs.
- 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.
- C. Local Energy Code Compliance: Comply with Seattle Energy Code for minimum efficiency of heating and cooling.
- D. NFPA Compliance: Comply with NFPA 90A and NFPA 90B.

- E. UL Compliance: Comply with UL 1995.
- F. 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. 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.
 - 3. Warranty Period for Solid-State Ignition Modules: Manufacturer's standard, but not less than three years from date of Substantial Completion.
 - 4. Warranty Period for Control Boards: Manufacturer's standard, but not less than three years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:
 - 1. AAON, Inc.
 - 2. Addison Products Company.
 - 3. Carrier Corporation.
 - 4. Engineered Air.
 - 5. Lennox Industries Inc.
 - 6. McQuay International.
 - 7. Trane; American Standard Companies, Inc.
 - 8. YORK International Corporation.

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. Exterior Casing Thickness: 16 gage.
- C. Inner Casing Fabrication Requirements:
 - 1. Inside Casing: Galvanized steel, 22 gage, perforated except downstream of cooling coils and in outside air intakes.
- D. Casing Insulation and Adhesive: Comply with NFPA 90A or NFPA 90B.
 - 1. Materials: ASTM C 1071, Type I.
 - 2. Thickness: 4 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 galvanized-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 both sides of drain pan.
 - 3. Pan-Top Surface Coating: Corrosion-resistant compound.

2.3 FANS

- A. Direct Driven Supply Air Fans: Double width, **[forward curved]** **[backward inclined]**, centrifugal; with permanently lubricated, 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. Relief Air Fan: **[Propeller]** **[Forward curved]** **[Backward inclined]**, shaft mounted on permanently lubricated motor.
- E. 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 defined in Division 23 Section "Vibration and Seismic Controls for Mechanical Piping and Equipment" when fan mounted frame and RTU mounted frame are anchored to building structure.
- F. Fan Motor: Comply with requirements in Division 23 Section "Electrical Motors for Mechanical Equipment."

2.4 COILS

A. Supply Air Refrigerant Coil:

1. Aluminum-plate fin and seamless[**internally grooved**] copper tube in steel casing with equalizing-type vertical distributor.
2. Coil Split: Interlaced.
3. Condensate Drain Pan: Galvanized 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[**internally grooved**] 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.

2.5 REFRIGERANT CIRCUIT COMPONENTS

A. Number of Refrigerant Circuits: [**One**] [**Two**].

B. Compressor: [**Hermetic, reciprocating**] [**Semihermetic, reciprocating**] [**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-407C**] [**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. Comply with requirements in Division 23 Section "Filters Used in HVAC Systems."

2.7 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 with a minimum thermal efficiency of 80 percent.
 1. Fuel: Natural gas.
 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[**with vertical extension**].
- 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**] [**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.

2.8 DAMPERS

- A. Comply with requirements in Division 23 Section "Air Duct Accessories." Outdoor Air Damper: Linked damper blades, for 0 to 25 percent outdoor air, with motorized damper filter.

2.9 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 "Direct Digital Control (DDC) System."
- B. Basic Unit Controls: Control voltage transformer.
- C. Interface Requirements for (DDC) System:
 - 1. Interface relay for scheduled operation.
 - 2. Interface relay to provide indication of fault at the central workstation and diagnostic code storage.
 - 3. Provide **[BACnet]** **[or]** **[LonWorks]** compatible interface for central HVAC control workstation for the following:
 - a. Adjusting set points.
 - b. Monitoring supply fan start, stop, and operation.
 - c. Inquiring data to include[**outdoor air damper position,**] supply and room air temperature[**and humidity**].
 - d. Monitoring occupied and unoccupied operations.

2.11 ACCESSORIES

- A. Electric heater with integral thermostat maintains minimum 50 deg F temperature in gas burner compartment.
- B. 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.**]
- C. Filter differential pressure switch with sensor tubing on either side of filter. Set for final filter pressure loss.

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 inch.
 - 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] [24 inches]**.

C. 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

3.1 INSTALLATION

A. Equipment Mounting: Install RTUs on concrete base using **[elastomeric mounts] [restrained spring isolators]**. Secure units to anchor bolts installed in concrete bases. Concrete base is specified in Division 23 Section "Common Work Results for Mechanical" and concrete materials and installation requirements are specified in Division 03 Section "Cast-in-Place Concrete." Comply with requirements for vibration isolation devices specified in Division 23 Section "Vibration and Seismic Controls for Mechanical Piping and Equipment."

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

B. 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." 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 with anchor bolts.

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

D. Install piping adjacent to RTUs to allow service and maintenance.

1. Gas Piping: Comply with applicable requirements in Division 23 Section "Facility Natural Gas Piping." 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.

E. 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.

3.2 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.

3.3 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