

## SECTION 237413 - PACKAGED OUTDOOR ROOFTOP HVAC UNITS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes the packaged, outdoor, rooftop unit with the following components and accessories:
1. Direct-expansion cooling.
  2. Roof curb.

#### 1.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design RTU supports to comply with wind and seismic performance requirements, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria relative to building site, use and configuration.

#### 1.3 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.

Delegated-Design Submittal: For RTU supports indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
2. Detail mounting, securing, and flashing of roof curb to roof structure. Indicate coordinating requirements with roof membrane system.
3. Detail fabrication and attachment of wind and seismic restraints and snubbers. Show anchorage details and indicate quantity, diameter, and depth of penetration of anchors.

Manufacturer Wind Qualification Certification: Submit certification that RTUs, accessories, and components will withstand wind forces on site.

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.

Exception – Greenheck doesn't supply vibration isolation curbs. Vibration curbs will need to be ordered through a custom curb manufacturer.

Exception – Aeon does not carry NOA or high wind certification on their units. High wind curbs can be ordered through a custom curb manufacturer.

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. Field quality-control test reports.
- G. Operation and Maintenance Data: For RTUs to include in emergency, operation, and maintenance manuals.
- H. Warranty: Special warranty specified in this Section.

Comply

1.4

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."

Comply – Unit is ETL certified per U.L. 1995 and will bear an ETL sticker.

Exception – Greenheck's sound data is compliant with AMCA 320-07 – Laboratory Methods of sound testing of fans using sound intensity.

Comply – Unit is ETL certified per U.L. 1995 and will bear an ETL sticker.

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

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

Comply – Unit is ETL certified per U.L. 1995 and will bear an ETL sticker.

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.

Comply – Unit is ETL certified per U.L. 1995 and will bear an ETL sticker.

1.5

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 10 years from date of Substantial Completion.

Comply – Select unit with 5 year extended compressor warranty and 10 year extended heat exchanger warranty

Exception – Select unit with 2 year extended warranty to be closer to compliance.

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.

## 1.6 EXTRA MATERIALS

Exceed – Greenheck only has direct drive fans. No spare fan belts required.

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. Fan Belts: One set for each belt-driven fan.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

Need addendum issued for GFC equal.

Subject to compliance with requirements, provide products by one of the following manufacturers:

1. Aaon
2. DesChamps
3. Gouvernaire

B. The basis of the design is all Aaon equipment. Use of the alternate manufacturers noted above is subject to the review and approval of the Architect. Not only must the performance and construction features of the alternate manufacturers be equivalent to the specified units but the physical features (footprint, height, weight and duct connections location) must be similar and not disruptive to the overall project design intent. Any and all time and material design changes required to accommodate the alternate manufacturers listed above (including structural engineering redesign, ductwork redesign, redesign of roof screens, electrical redesign etc.) shall be paid by the Contractor to the Architect and the Contractor will be responsible for all other costs which may arise from use of these alternate manufacturers.

### 2.2 SPECIFICATION CRITERIA

Comply

A. Rooftop units shall be accordance with the following specifications and capacities as shown on the Drawings.

B. Unit cooling capacities shall be in accordance with and tested to ARI standard 210/240-89 or 360-85.

Exceed – All coils are AHRI certified per standard 410-2001.

C. Units up to 20 tons shall carry the ARI compliance label.

D. Unit's minimum cooling efficiency, including the standard supply air blower motor shall be as shown on the Drawings.

E. Units shall be safety certified in accordance with UL Standard UL465, and ANSI Standard Z21.47.

Comply – Unit is ETL certified per U.L. 1995 and will bear an ETL sticker.

F. Units shall be safety certified by an accredited testing laboratory.

Comply

Comply

Comply

Comply

- G. Unit nameplates shall carry the label of the certification agency.
- H. Units shall be shipped completely assembled by the manufacturer including all standard items and optional items.
- I. Units shall be 100% run tested by the manufacturer with a copy of the run test report shipped with the unit.

Exception – If unit is ordered with a powered exhaust fan, the exhaust weather hood is shipped loose and requires field installation.

J. Unit Construction:

- 1. Units shall be completely factory assembled, piped, wired and shipped in one piece.
- 2. Units shall be specifically designed for outdoor rooftop application with a fully weatherproof cabinet.
- 3. Unit design shall be dedicated bottom supply / return air style system for mounting on a roof curb.

Comply

Comply

Comply

Cabinet shall be constructed entirely of G90 wt. galvanized metal with the exterior constructed of 18 gauge or heavier material.

Comply

5. The unit roof shall be cross broken and / or sloped to assure drainage.

Exception – All doors are hinged access with quarter turn handles except blower access doors, compressor access doors, and furnace access doors.

6. Access to compressor(s), controls, filters, blower, heating section, and other items needing periodic checking or maintenance shall be through hinged access doors with a quarter turn latch (door fastening screws are not acceptable).

7. Air side service access doors shall be fully gasketed with rain break overhangs.

8. Air side access doors will have an internal metal liner to protect the door insulation.

Comply

Comply

9. Unit exterior shall be painted with two-part polyurethane paint over a wash primer and a paint grip type galvanized steel.

Comply

10. Wiring shall be color coded and marked with a three digit identification on each end.

Comply

11. The interior air side of the cabinet shall be entirely insulated on all exterior panels with 1" thick, one pound density, neoprene coated, fiberglass insulation.

Exceed – Unit construction is standard 2" fiberglass or foam double wall.

12. To guarantee no leakage of conditioned air from the cabinet all of the cabinet under positive pressure, downstream from the supply air blower, shall have a separate internal cabinet contained within, and separate from, the exterior cabinet by an air gap. The internal cabinet shall be guaranteed to hold a static pressure of up to 12 inches water column.

Comply

Comply

13. All openings through the base pan of the unit shall have upturned flanges of at least 1/2" in height around the opening through the base pan.

Comply

14. Unit shall have decals and tags to indicate unit lifting - rigging, service areas and caution areas.

Comply

15. Wiring diagrams shall be in color and marked to match the color and markings of the wires and shall be both "point-to-point" and "ladder" diagrams.

Exception – Diagrams are permanently fixed to the control compartment door but are not laminated.

Comply  
Comply  
Comply

- 16. Diagrams shall also be laminated in plastic and permanently fixed to the control compartment door.
- 17. Installation and maintenance manuals shall be supplied with each unit, located in a metal pocket in the control access compartment.
- 18. Unit exterior shall be "Grey" in color.
- 19. Double wall interior insulation liners shall be provided in all units.

K. Blowers:

Exception – Blowers are not located on a slide deck for service.

- 1. Blower(s) shall be entirely self-contained on a slide deck for service and removal from the cabinet.
- 2. All belt drive blower(s) shall have backward inclined airfoil blades.
- 3. All direct drive blower(s) shall have forward curved blades.
- 4. Adjustable V-belt drive shall be provided with a minimum rating of 140% of the motor nameplate brake horsepower when the adjustable pulley is at the minimum RPM.

Exceed – All blowers are direct drive backward curved fans.

Comply

Blowers, drives and motors shall be dynamically balanced.

L. Outside Air:

Shall be a two position damper assembly. Provide a motor operated outdoor air damper and return air damper constructed of extruded aluminum, hollow core, air foil blades with rubber edge seals and aluminum end seals. Damper blades shall be gear driven and designed to have no more than 25 CFM of leakage per square foot of damper area when subjected to 2" WG air pressure differential across the damper. Damper motor shall be spring return to ensure closing of outdoor air damper during periods of unit shut down or power failure.

Exceed – All dampers have no more than 8 CFM of leakage per square foot of damper area when subjected to 4" WG air pressure differential across the damper.

M. Condensing Section:

The condensing section shall be equipped with direct drive, vertical discharge condenser fan(s). The condenser coil shall be sloped at least 30 degrees from horizontal to protect the coil from damage. The condenser fans shall be VFD controlled when so noted in the schedule.

N. Evaporator Coil:

Comply

- 1. Evaporator coil(s) shall be copper tube with aluminum fins mechanically bonded to the tubes.
- 2. Evaporator coils to have galvanized steel end casings.
- 3. Evaporator coils to have equalizing type vertical tube distributors with a top suction connection.
- 4. Evaporator coils for multi-compressor units shall be circuited with one circuit and expansion valve per compressor.

Comply: RV/E models are equipped with low sound condensing fans that have an optional lead EC condensing fan for modulating head pressure.

O. Condenser Coil:

Comply

Condenser coil(s) shall be copper tube with aluminum fins mechanically bonded to the tubes.

Comply

2. Condenser coil(s) to be sized for a minimum of 10 degrees sub-cooling.

P. Refrigeration System:

Compressor(s) shall be of the hermetic scroll type with internal thermal overload protection and mounted on the compressor manufacturer's recommended rubber vibration isolators.

2. Stages of capacity control shall be as described on the drawings using various combinations of digital scroll compressors and staged on-off compressors.

3. Compressor(s) shall be mounted in an isolated compartment to permit operation of the unit without affecting air flow when the compressor compartment is open.

4. Compressor(s) shall be isolated from the base pan and supply air to avoid any transmission of noise from the compressor into the building area.

System shall be equipped with thermostatic expansion valve(s) type refrigerant flow control.

6. System shall be equipped with automatic re-set low pressure and manual reset high pressure refrigerant controls.

7. Units shall be equipped with Schrader type service fittings on both the high side and low pressure sides of the system.

8. Units shall be equipped with refrigerant liquid line driers.

9. Units shall be fully factory charged with refrigerant R-410A.

10. Lead circuit(s) shall be provided with hot gas bypass.

11. Units shall be equipped with 20 second between stage delay timer for each compressor.

Q. Filters: All units shall be furnished with 2", 30% efficient, MERV 8, prefilters. Final filters shall be located in the filter curb.

Comply: Units with standard scroll compressors will have hot gas bypass on lead circuit. Digital scroll compressors do not have hot gas bypass.

Comply: Stage delay is adjustable through the controller if required.

Exception: Units are not equipped with a final filter option in the standard curb. If a curb final filter is required, a custom must be ordered.

Comply

R. Power Options: All units shall be provided with phase and brown-out protection for 10% out of balance on voltage, or the voltage is more than 10% under design voltage.

Comply - Standard

S. All units shall be provided with VFDs on supply fans.

Comply

T. Designated units shall be provided with modulating hot gas reheat for subcooling humidity control.

Exception - Spring isolation curbs must be ordered from a custom curb manufacturer.

U. Roof Curbs: Roof curbs shall be fully insulated final filter type with spring mount (2" deflection) vibration isolation - see drawing schedule for mfg/model number.

V. Controls: BMS by others factory mounted and wired by manufacturer.

W. Startup: Shall be furnished by Authorized Manufacturer.

X. Warranty: (1) year parts only; (5) year for compressor part. Labor shall be included.

Comply: Independent Greenheck trained service technician can perform start up.

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Comply: Select 5 year compressor warranty.

## 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 roofs 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 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 seismic attachments.
- B. Install wind restraints according to manufacturer's written instructions.

### 3.3 CONNECTIONS

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

### 3.4 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. 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.
- C. Remove and replace malfunctioning units and retest as specified above.

### 3.5 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
- B. Complete installation and startup checks according to manufacturer's written instructions and do the following:
1. Inspect for visible damage to unit casing.
  2. Inspect for visible damage to furnace combustion chamber.
  3. Inspect for visible damage to compressor, coils, and fans.
  4. Inspect internal insulation.
  5. Verify that labels are clearly visible.
  6. Verify that clearances have been provided for servicing.
  7. Verify that controls are connected and operable.
  8. Verify that filters are installed.
  9. Clean condenser coil and inspect for construction debris.
  10. Clean furnace flue and inspect for construction debris.
  11. Connect and purge gas line.
  12. Remove packing from vibration isolators.
  13. Inspect operation of barometric relief dampers.
  14. Verify lubrication on fan and motor bearings.
  15. Inspect fan-wheel rotation for movement in correct direction without vibration and binding.
  16. Adjust fan belts to proper alignment and tension.
  17. Start unit according to manufacturer's written instructions.
    - a. Start refrigeration system.
    - b. Do not operate below recommended low-ambient temperature.
    - c. Complete startup sheets and attach copy with Contractor's startup report.
  18. Inspect and record performance of interlocks and protective devices; verify sequences.
  19. Operate unit for an initial period as recommended or required by manufacturer.
  20. Calibrate thermostats.
  21. Adjust and inspect high-temperature limits.
  22. Inspect outdoor-air dampers for proper stroke and interlock with return-air dampers.
  23. Start refrigeration system and measure and record the following when ambient is a minimum of 15 deg F above return-air temperature:
    - a. Coil leaving-air, dry- and wet-bulb temperatures.
    - b. Coil entering-air, dry- and wet-bulb temperatures.
    - c. Outdoor-air, dry-bulb temperature.
    - d. Outdoor-air-coil, discharge-air, dry-bulb temperature.
  24. Inspect controls for correct sequencing of heating, mixing dampers, refrigeration, and normal and emergency shutdown.



25. Measure and record the following minimum and maximum airflows. Plot fan volumes on fan curve.
  - a. Supply-air volume.
  - b. Return-air volume.
  - c. Relief-air volume.
  - d. Outdoor-air intake volume.
  
26. Simulate maximum cooling demand and inspect the following:
  - a. Compressor refrigerant suction and hot-gas pressures.
  - b. Short circuiting of air through condenser coil or from condenser fans to outdoor-air intake.
  
27. Verify operation of remote panel including pilot-light operation and failure modes. Inspect the following:
  - a. High-temperature limit on gas-fired heat exchanger.
  - b. Low-temperature safety operation.
  - c. Filter high-pressure differential alarm.
  - d. Economizer to minimum outdoor-air changeover.
  - e. Relief-air fan operation.
  - f. Smoke and firestat alarms.
  
28. After startup and performance testing and prior to final test and balance, replace existing filters with new filters.

### 3.6 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.

### 3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain RTUs.

END OF SECTION 237413