
SECTION 237413 – PACKAGED ROOFTOP HEATING AND COOLING UNITS

First Edition 5-16-2017

(Engineer shall edit specifications and blue text in header to meet project requirements. This includes but is not limited to updating Equipment and/or Material Model Numbers indicated in the specifications and adding any additional specifications that may be required by the project. Also turn off all “Underlines”.)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this section and all other sections of Division 23.

1.2 SUMMARY

- A. This Section includes the requirements for packaged, outdoor, central station air handling rooftop heating and cooling units with the following components and accessories: **<Edit for particular Project>**
 - 1. Unit casing
 - 2. Fans. .
 - 3. Coils.
 - 4. Refrigerant circuit components.
 - 5. Air filtration.
 - 6. Dampers.
 - 7. Electric power connection.
 - 8. Controls.
 - 9. Accessories.
 - 10. Roof curbs.

1.3 PERFORMANCE REQUIREMENTS

- A. Minimum Efficiency Requirements: ASHRAE 90.1-2010.
- B. Wind Restraint Performance: **<Edit for particular Project>**
 - 1. Basic Wind Speed: **<Insert value>**.
 - 2. Building Classification Category: **[I] [II] [III] [IV]**.
 - 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.
- C. Seismic Performance: RTUs shall withstand the effects of earthquake motions determined according to [SEI/ASCE 7]. **<Edit for particular Project>**

1. 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 ACTION SUBMITTALS

- A. Product Data: For each specified product, include manufacturers cut sheets, dimensional data, performance data, installation instructions, wirings diagrams, power requirements, specified options, and warranty information.
- B. For each type of product indicated.
 1. Include manufacturer's technical data for each RTU, including rated capacities, dimensions, required clearances, characteristics, furnished specialties, and accessories.
- C. LEED Submittals: <Delete if not LEED Project>
 1. Product Data for Credit EA 4: Documentation indicating that equipment and refrigerants comply.
 2. Product Data for Prerequisite IEQ 1: Documentation indicating that units comply with ASHRAE 62.1, Section 5 - "Systems and Equipment."
- D. Shop Drawings:
 1. Submit shop drawings detailing the manufacturer's electrical requirements for power supply wiring for rooftop heating and cooling units. Submit manufacturer's ladder type wiring diagrams for interlock and control wiring. Clearly differentiate between portions of wiring that are factory installed and portions to be field-installed.
 2. Submit shop drawings detailing the mounting, securing, and flashing of the roof curb to the roof structure. Indicate coordinating requirements with roof membrane system.

1.5 INFORMATIONAL SUBMITTALS

- A. 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.
- B. Manufacturer Wind Loading Qualification Certification: Submit certification that specified equipment will withstand wind forces identified in "Performance

Requirements" Article and in Division 23 Specification Section "Vibration and Seismic Controls for HVAC Systems."

- C. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculations.
- D. Dimensioned Outline Drawings of Equipment Unit: Identify center of wind force and locate and describe mounting and anchorage provisions.
- E. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- F. Manufacturer Seismic Qualification Certification: Submit certification that RTUs, accessories, and components will withstand seismic forces defined in "Performance Requirements" Article and in Division 23 Specification Section "Vibration and Seismic Controls for HVAC Systems."
- G. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
- H. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
- I. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- J. Field quality control test reports.
- K. Warranty: Special warranty specified in this Section.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: Include a copy of each approved submittal along with any applicable maintenance data in the project operation and maintenance manual.
- B. Maintenance Material Submittals:
 - 1. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - a. Fan Belts: One (1) set for each belt driven fan.
 - b. Filters: One (1) set of filters for each unit.

1.7 QUALITY ASSURANCE

- A. AHRI Compliance:

1. Comply with AHRI 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, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

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

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.

1.8 WARRANTY/GUARANTEE

A. See Division 23 Specification Section "Basic Mechanical Requirements – HVAC" for warranty and guarantee requirements.

B. Additional Warranty: In addition to the warranty requirements referenced above the following additional warranties shall be included by the manufacturer:

1. Warranty Period for Solid-State Ignition Modules: Manufacturer's standard, but not less than three (3) years from date of Substantial Completion.
2. Warranty Period for Control Boards: Manufacturer's standard, but not less than three (3) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL PRODUCT REQUIREMENTS

A. Equipment Design and Selection: Packaged outdoor central station air handling units shall be designed and selected in accordance with the scheduled capacities on the drawings and the requirements of this specification.

B. Basis of Design: The basis of design for packaged outdoor central station air handling units are units manufactured by Trane as follows: <Edit for project requirements>

1. Precedent Series – 3 to 10 ton range <Delete range and insert model number>

2. Voyager Series – 12 to 25 ton range <Delete range and insert model number>

C. Other Acceptable Manufacturers: Subject to compliance with requirements, provide heating and cooling and/or heating terminal units by one (1) of the following: <Edit required for project>

1. York
2. Acon
3. McQuay

2.2 UNIT 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 (G90) 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: 0.05 inch thick.

C. Inner Casing Fabrication Requirements:

1. Inside Casing: Galvanized steel, 0.028 inch thick.

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

1. Materials: ASTM C 1071, Type I.
2. Thickness: One (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 two (2) inches deep, and complying with ASHRAE 62.1.

1. Double Wall Construction: Fill space between walls with foam insulation and seal moisture tight.
2. Drain Connections: Threaded nipple.
3. Pan Top Surface Coating: Corrosion resistant compound.

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

2.3 FANS <Edit for Project>

- A. Direct Driven Supply Air Fans: Double width, forward curved, centrifugal; with permanently lubricated, [multispeed] [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. Relief Air Fan: Forward curved, shaft mounted on 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 defined in Division 23 Specification Section "Vibration and Seismic Controls for HVAC Systems" when fan-mounted frame and RTU-mounted frame are anchored to building structure.
- E. Fan Motor: Comply with requirements in Division 23 Specification Section "Motor Requirements for HVAC Equipment."

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. Polymer strip shall prevent all copper coil from contacting steel coil frame or condensate pan.
 - 3. Coil Split: Interlaced.
 - 4. Baked phenolic coating.
 - 5. Condensate Drain Pan: Stainless steel formed with pitch and drain connections complying with ASHRAE 62.1.
- B. Outdoor Air Refrigerant Coil:
 - 1. Aluminum plate fin and seamless copper tube in steel casing with equalizing type vertical distributor.
 - 2. Polymer strip shall prevent all copper coil from contacting steel coil frame or condensate pan.
 - 3. Baked phenolic coating.
- C. Hot Gas Reheat Refrigerant Coil: <All units shall have hot gas bypass factory installed on the lead compressor.>

1. Aluminum plate fin and seamless copper tube in steel casing with equalizing type vertical distributor.
2. Polymer strip shall prevent all copper coil from contacting steel coil frame or condensate pan.
3. Baked phenolic coating.

D. Electric-Resistance Heating: <Edit for particular Project.> <Delete if not required>

1. Open Heating Elements: Resistance wire of 80% nickel and 20% 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. Over Temperature Protection: Disk type, automatically reset, thermal cutout, safety device; serviceable through terminal box.
3. Over Current 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 (5) steps.
 - d. Time delay relay.
 - e. Airflow proving switch.

2.5 REFRIGERANT CIRCUIT COMPONENTS

- A. Number of Refrigerant Circuits: <Unit shall have no less than 2 circuits for units above 25 tons.>
- B. Compressor: Scroll, mounted on vibration isolators; with internal over current and high temperature protection, internal pressure relief, and crankcase heater.
- C. Refrigeration Specialties: <Edit for particular Project.>
 1. Refrigerant: <R-407C or 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.
 9. Low ambient kit high-pressure sensor.

10. Hot gas reheat solenoid valve with a replaceable magnetic coil.
11. Hot gas bypass solenoid valve with a replaceable magnetic coil.
12. Four (4) way reversing valve with a replaceable magnetic coil, thermostatic expansion valves with bypass check valves, and a suction line accumulator.

2.6 AIR FILTRATION <Provide filter performance as required for project.>

- A. Minimum arrestance according to ASHRAE 52.1, and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.
 1. Pre Filter: Minimum 80% arrestance, and MERV 5.
 2. Final Filter: Minimum 95% arrestance, and MERV 8.
- B. Spare Filters: Provide two (2) sets of spare filters for each type of filter media. One (1) set of spare of filters shall be installed in the air handling unit for the testing and balancing procedure. The second set of spare filter media shall be turned over to the owner.
- C. Air Handling Unit Operation during Construction: When the air handling units need to be operated during construction the contractor shall provide the filters for the air handling unit. These filters shall be separate from the specified filter media. Install specified filter media prior to final test and balance of air handling systems.

2.7 DAMPERS <Edit for particular Project.>

- A. 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, with bird screen and hood.

2.8 ELECTRICAL POWER CONNECTION <Edit for particular Project.>

- 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 over current protection.

2.9 CONTROLS

- A. Control equipment and sequence of operation are specified in Division 23 Specification Sections for "Building Automation Systems" and on Contract Drawings.
- B. Controls:

1. Unit controls shall be completely factory packaged.
2. VAV units shall operate with a sensor in the supply air stream for cooling operation. Staging decisions shall be based upon the deviation of supply air temperature from set point and the rate of change of the supply air temperature. Morning warm up shall be enabled when the controller enters the occupied time and the return air temperature is lower than the setpoint.
3. Provide supply air temperature sensor, duct static pressure sensor, space economize static pressure sensor. <Space Static Sensor for modulating Economizer exhaust.>
4. Controllers shall have the following safeties:
 - a. High and low pressure cut outs (one (1) for each refrigerant circuit).
 - b. Minimum on time for compressors.
 - c. Delay between compressor stages.
 - d. Anti recycle (minimum off time) for compressors.
 - e. Brown out protection. (lock out compressors in case of a drop in voltage)
 - f. Cooling lockout at 0°F for low ambient operation.
 - g. Minimum heat on/off times.
 - h. Air flow proving switch requiring proper air flow for heat or cool operation.

C. DDC Controller:

1. Controller shall have volatile memory backup.
2. Safety Control Operation:
 - 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°F] <Insert temperature> enters unit. Provide additional contacts for alarm interface to fire alarm control panel.
 - c. Fire Alarm Control Panel Interface: Provide control interface to coordinate with operating sequence described in Division 28 Specifications Section "Digital, Addressable Fire Alarm System" and Section "Zoned (DC Loop) Fire Alarm System."
 - d. Low Discharge Temperature: Stop fan and close outdoor air damper if supply air temperature is less than [40°F] <Insert temperature>.
 - e. Defrost Control for Condenser Coil: Pressure differential switch to initiate defrost sequence.
3. Scheduled Operation: Occupied and unoccupied periods on [seven (7)] [three hundred sixty five (365)] day clock with a minimum of [two (2)] [four (4)] programmable periods per day. <Edit for Project.>
4. Unoccupied Period: <Edit for Project.>

- a. Heating Setback: [10°F] <Insert temperature>.
 - b. Cooling Setback: System off.
 - c. Override Operation: [Two (2)] <Insert number> hours.
5. Supply Fan Operation:
- a. Occupied Periods: Run fan continuously.
 - b. Unoccupied Periods: Cycle fan to maintain setback temperature.
6. Refrigerant Circuit Operation: <Edit for Project.>
- a. Occupied Periods: Cycle or stage compressors [, and operate hot gas bypass] to match compressor output to cooling load to maintain [room] [discharge] temperature[and humidity]. Cycle condenser fans to maintain maximum hot gas pressure. Operate low ambient control kit to maintain minimum hot gas pressure.
 - b. Unoccupied Periods: [Compressors off] [Cycle compressors and condenser fans for heating to maintain setback temperature].
 - c. Switch reversing valve for heating or cooling mode on air to air heat pump.
7. Hot Gas Reheat Coil Operation:
- a. Occupied Periods: Humidistat opens hot gas valve to provide hot gas reheat, and cycles compressor.
 - b. Unoccupied Periods: Reheat not required.
- D. Interface Requirements to the Campus BAS by BacNet IP Protocol:
1. Interface relay for scheduled operation.
 2. Interface relay to provide indication of fault at the central workstation and diagnostic code storage.
 3. Provide compatible interface to the Campus BAS 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.
 - e. Monitoring constant and variable motor loads.
 - f. Monitoring variable frequency drive operation.
 - g. Monitoring cooling load.
 - h. Monitoring economizer cycles.
 - i. Monitoring air distribution static pressure and ventilation air volume.

2.10 ACCESSORIES

- A. Electric heater with integral thermostat maintains minimum 50°F temperature in gas burner compartment.
- B. Duplex, 115 volt, ground fault interrupter outlet with 15 amp overcurrent protection. Include transformer if required.
- C. Low ambient kit.
- D. Filter differential pressure switch with sensor tubing on either side of filter. Set for final filter pressure loss.

2.11 ROOF CURBS

- A. Roof curbs with vibration isolators and wind or seismic restraints are specified in Division 23 Specification Section "Vibration and Seismic Controls for HVAC Systems."
- B. 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.
 - 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.
- C. Curb Height: Fourteen (14) inches.
- D. 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. Comply with requirements in Mechanical Specification Section "Vibration and Seismic Controls for HVAC" 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 pipe, power, controls and duct connections before equipment installation.
- C. Examine roofs for suitable conditions where RTUs will be installed.
- D. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable Installer.

3.2 INSTALLATION

- A. General: Install rooftop units in accordance with manufacturer's installation instructions. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer's recommended clearances.
- B. Roof Curb Assembly: Roof curb assembly shall be provided by the unit manufacturer and installed by [the roofing contractor who maintains the warranty for the existing roof.] [the roofing contractor for the new building.] <Coordinate with Architect and Edit for project requirements> See Architectural Specification Section "Roof Accessories" and/or details for roof type and flashing requirements.
- C. Roof Top Unit: Install and secure rooftop units on curbs following the unit manufacturer's recommendations.

3.3 MECHANICAL CONNECTIONS

- A. Install condensate drain, minimum connection size, with trap and indirect connection to nearest roof drain or area drain.
- 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 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 as specified in Division 23 Specification Section "HVAC Duct Systems and Accessories."

4. Install return air duct continuously through roof structure.

D. Sound Barrier: Install normal weight, three thousand (3,000) psi, compressive strength twenty eight (28) day concrete mix inside roof curb, four (4) inches thick. Concrete, formwork, and reinforcement are specified with concrete.

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. 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.

3.5 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°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 and failure modes. Inspect the following:
 - a. Low temperature safety operation.
 - b. Filter high pressure differential alarm.
 - c. Economizer to minimum outdoor air changeover.
 - d. Relief air fan operation.
 - e. Smoke and firestat alarms.

28. After startup and performance testing and prior to Substantial Completion, replace existing filters with new filters.

3.6 CLEANING AND ADJUSTING

- A. Occupancy Adjustments: When requested within twelve (12) months of date of Substantial Completion, provide onsite assistance in adjusting system to suit actual occupied conditions. Provide up to two (2) visits to site during other than normal occupancy hours for this purpose. <Edit for Project.>

- 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. Refer to Section "Demonstration and Training."

END OF SECTION 237413