

PART 1 GENERAL**1.1 DESCRIPTION**

- A. Provide Heating, Cooling, and Ventilating Equipment as specified herein and shown on the Drawings.
- B. Equipment capacity and size shall be as indicated on the Drawings.
- C. Related Work: The requirements of Section 23 0500, Common HVAC Materials and Methods, also apply to this section.

1.2 QUALITY ASSURANCE

- A. Air Handling Equipment: Rated in accordance with AMCA certified rating procedures and AMCA labeled.
- B. Air Conditioning and Refrigeration Equipment Rating: Rated in accordance with ARI certified rating procedures and ARI labeled.
- C. Field Wiring: Comply with requirements of Section 23 0500

1.3 SUBMITTALS

- A. Submit catalog data, construction details and performance characteristics for each HVAC unit.
- B. Submit operating and maintenance data.

PART 2 PRODUCTS**2.1 ROOFTOP HVAC UNIT**

- A. The following manufacturers will be considered provided they comply with the contract documents.
 - 1. Daikin
 - 2. Trane
 - 3. Carrier
 - 4. York
 - 5. Lennox
- B. General Description
 - 1. Furnish as shown on plans, Packaged Systems, Single-zone Heating and Cooling Unit(s). Unit performance and electrical characteristics shall be per the job schedule.
 - 2. Configuration: Fabricate as detailed on prints and drawings:
 - a. Return plenum / economizer section
 - b. Filter section
 - c. Cooling coil section
 - d. Supply fan section
 - e. Gas heating section
 - f. Condensing unit section
 - 3. The complete unit shall be cULus listed. Gas furnace units shall be UL listed and classified in accordance with ANSI Z 21.47.
 - 4. Unit shall comply with ASHRAE 90.1-2007 standards for efficiency and EER.

5. Each unit shall be specifically designed for outdoor rooftop application and include a weatherproof cabinet. Each unit shall be completely factory assembled and shipped in one piece. MPS packaged units shall be shipped fully charged with Refrigerant 410A and POE oil.
6. The unit shall undergo a complete factory run test prior to shipment. The factory test shall include final balancing of the supply fan assemblies, a refrigeration circuit run test, a unit control system operations checkout, a unit refrigerant leak test and a final unit inspection.
7. All units shall have decals and tags to indicate caution areas and aid unit service. Unit nameplates shall be fixed to the main control panel door. Electrical wiring diagrams shall be attached to the control panels. Installation, operating and maintenance bulletins and start-up forms shall be supplied with each unit.
8. Performance: All scheduled capacities and face areas are minimum accepted values. All scheduled amps, kW, and HP are maximum accepted values that allow scheduled capacity to be met.
9. Warranty: The manufacturer shall provide 12-month parts only warranty. Defective parts will be repaired or replaced during the warranty period at no charge. The warranty period shall commence at startup or six months after shipment, whichever occurs first.
10. The manufacturer shall provide extended 48-month, parts only, warranty on the compressor. Defective parts will be repaired or replaced during the warranty period at no charge. The warranty period shall commence at startup or six months after shipment, whichever occurs first.

C. Cabinet, Casing, and Frame

1. Panel construction shall be 18 GA single wall construction with a baked powder coat finish. Insulation shall be a minimum of 3/4" thick fiberglass with a foil face surface. Insulation shall be glued to the panel as well as mechanically fastened. In lieu of foil face insulation with mechanical fasteners, double wall construction may be substituted. Panel design shall not have any exposed insulation edges.
2. Exterior surfaces shall be constructed of 18 GA, G90 galvanized, with a baked powder coat finish of a neutral beige color. Finished panel surfaces to withstand a minimum 1000-hour salt spray test in accordance with ASTM B117 standard for salt spray resistance.
3. Base frame shall be 14 GA galvanized steel and be a full perimeter design. The base frame shall have integral forklift slots and rigging holes. The unit base shall overhang the roof curb for positive water runoff and shall seat on the roof curb gasket to provide a positive, weather tight seal.
4. The full unit base pan shall be a one-piece stamped design. The base pan shall have a stamped 1 1/8" flange around the supply and return air openings to prevent any water to penetrate into the building. The base pan shall be insulated with foil face insulation with mechanical fasteners on the underside of the pan. The rooftop base pan shall not have insulation on the air stream side of the equipment.
5. Service doors shall be provided on the filter section, supply fan, and the electrical control panel section. All service access doors shall be mounted on multiple hinges and shall be secured by a 1/4 turn latch system. Removable panels secured by multiple mechanical fasteners are not acceptable.

D. Supply Fan

1. Supply fan shall be a double width double inlet (DWDI) forward curved centrifugal fan. The supply fan shall be mounted using solid.
2. The fan assembly shall have adjustable pitched sheaves on the motor. Bushings shall be used on all sheaves to allow for easy removal of the pulleys from the fan and motor shaft. Fixed bore pulleys fastened to the shaft by setscrews will not be allowed. The drives shall be selected with a 1.2 service factor.
3. All fan assemblies shall be statically and dynamically balanced at the factory, including a final trim balance, prior to shipment. All fan assemblies shall employ solid steel fan shafts. Bearings shall be sized to provide a L-50 life of 250,000 hours.

4. Fan motors shall be heavy-duty, 1800 rpm, open drip-proof (ODP). Motors efficiencies shall meet EPA efficiencies. Motors shall be mounted on an adjustable base that provides for proper alignment and belt tension adjustment. Outdoor and Indoor Fan motors shall be permanently lubricated and have internal thermal overload protection.
5. The fan design shall allow for the fan and motor assembly to slide out of the rooftop unit for ease of servicing the equipment.

E. Electrical

1. Unit wiring shall comply with NEC requirements and with all applicable UL standards. All electrical components shall be UL recognized where applicable. All wiring and electrical components provided with the unit shall be number and color-coded and labeled according to the electrical diagram provided for easy identification. The unit shall be provided with a factory wired weatherproof control panel. Unit shall have a single point power connection for main power connection. A terminal board shall be provided for low voltage control wiring. Each compressor and condenser fan motor shall be furnished with contactors and thermal overload protection. Supply fan motors shall have a factory installed and wired control contactor. Knockouts shall be provided in the bottom of the main control panels for field wiring entrance.
2. A single non-fused disconnect switch shall be provided for disconnecting electrical power at the unit. Disconnect switches shall be mounted internally to the control panel and operated by an externally mounted handle

F. Heating and Cooling Sections

1. Direct expansion (DX) cooling coils shall be fabricated of seamless high efficiency copper tubing that is mechanically expanded into high efficiency aluminum plate fins. Coils shall be a multi-row design. All coils shall be factory leak tested with high pressure air under water.
2. A stainless steel or non-corrosive polymer positively sloped drain pan shall be provided with the cooling coil. The drain pan shall extend beyond the leaving side of the coil and underneath the cooling coil connections. The drain pan shall have a minimum slope of 1/8" per foot to provide positive draining. The slope of the drain pan shall be in two directions and comply with ASHRAE Standard 62.1. The drain pan shall be connected to a threaded drain connection extending through the unit base. Unit shall include a condensate overflow switch to shut the unit down in the event that a clogged condensate drain line prevents proper condensate removal from the unit.
3. The rooftop unit shall include a natural gas heating section. The heating module shall be a tubular design with in-shot gas burners. The heat exchanger tubes shall be constructed of stainless steel. The module shall have an induced draft fan that will maintain a negative pressure in the heat exchanger tubes for the removal of the flue gases.
4. The heater shall have an electronic direct spark ignition system with a remote flame sensor. The gas furnace shall have a flame rollout safety protection switches and a high temperature limit switch that will shut the gas valve off upon detection of improper burner manifold operation. The induced draft fan shall have an airflow safety switch that will prevent the gas valve from turning on in the event of no airflow in the flue chamber.
5. Programmable Thermostat with Economizer Logic Controller:
 - a. Provide with electronic, 7-day programmable thermostat and controller system for night-set-back, economizer and heating/cooling control sequences. Honeywell 8220 Series or approved substitute.
 - b. Economizer Logic Controller: Provide solid state economizer logic module to proportion outdoor and return air dampers to control for "free" cooling. Unit to include inputs for discharge temperature, dry bulb temperature input, and mixed or return air input. Include CO₂ sensor for demand control ventilation where indicated on plans. Belimo Zip or approved.

G. Filters

1. Unit shall be provided with a draw-through filter section. The filter rack shall be designed to accept a 2" filter. The unit design shall have a hinged access door for the filter section.
- H. Outdoor / Return Air Section
1. Unit shall be provided with an outdoor air economizer section. The 0 to 100% outside air economizer section shall include outdoor, return, and exhaust air dampers. The outside and return air dampers shall be sized to handle 100% of the supply air volume. Damper blades shall be gasketed with side seals and jamb seals to provide an air leakage rate of 4 cfm / square foot of damper area at 1" differential pressure per ASHRAE 90.1 Energy Standard. Leakage rate to be tested in accordance with AMCA Standard 500.
 2. A barometric exhaust damper shall be provided to exhaust air out of the back of the unit. A bird screen shall be provided to prevent infiltration of rain and foreign materials. Exhaust damper blades shall be lined with vinyl gasketing on contact edges. Control of the dampers shall be by a factory installed direct coupled actuator. Damper actuator shall be of the modulating, spring return type. An adjustable enthalpy control shall be provided to sense the dry-bulb temperature and relative humidity of the outdoor air stream to determine if outdoor air is suitable for "free" cooling. If outdoor air is suitable for "free" cooling, the outdoor air dampers shall modulate in response to the unit's temperature control system.
 3. Provide power exhaust fan as scheduled. Operate fan based on outside air damper position. Provide device to tune fan operation based on exact outside air damper position.
 4. Provide Remote Potentiometer for minimum position setting of the economizer.
- I. Condensing Section
1. Condenser coils shall be multi-row and fabricated from high efficiency rifled copper tubing mechanically bonded to high efficiency aluminum fins. Each condenser coil shall be factory leak tested with high-pressure air under water. Condenser coils shall be protected from incidental contact to coil fins by a coil guard.
 2. Condenser fans shall be direct drive, axial type designed for low tip speed and vertical air discharge. Condenser fan rpm shall be 1140 rpm maximum. Fan blades shall be constructed of steel and riveted to a steel center hub. Condenser fan motors shall be heavy-duty, non-reversing type with permanently lubricated ball bearing and thermal protection. Motor design shall be totally enclosed air over (TEAO) to protect the motors from rain and damage by water.
 3. Refrigeration circuit shall be complete with a thermal expansion valve and liquid line filter drier. F Refrigerant gauge ports shall be external to the cabinet for both low and high pressure for ease of service.
 4. Each unit shall have multiple, heavy-duty scroll compressors. Each compressor shall be complete with gauge ports, anti-slug protection, motor overload protection and a time delay to prevent short cycling and simultaneous starting of compressors following a power failure. Compressors shall be isolated with resilient rubber isolators to decrease noise transmission.
 5. Unit shall have 2 stage scroll type compressors with centrifugal type oil pumps. Motor shall be suction gas cooled and shall have a voltage utilization range of plus or minus 10 percent of unit nameplate.
 6. All units 8 through 12 tons shall have two independent refrigeration circuits. Each circuit shall be dehydrated and factory charged with Refrigerant 410A and oil.

2.2 OPERATING CONTROLS

- A. General: Microprocessor controls shall be provided for all 24 volt control functions. The resident control algorithms shall make all heating, cooling and ventilation decisions in response to electronic signals from sensors measuring indoor and outdoor temperatures. The control algorithm maintains accurate temperature control, minimizes drift from setpoint and provides better building comfort. A centralized microprocessor shall provide anti-short cycle timing and time delay between compressors to provide a higher level of machine protection.
- B. Constant Volume Controls: Provide all necessary controls to operate rooftop from a zone Based temperature sensor, including microprocessor unit control and economizer control.
- C. Clogged filter indication: Provide factory installed differential pressure switch to indicate filter replacement status. Differential pressure switch shall cause a contact closure to display a service indication and unit will continue to operate normally.
- D. Provide Wall or duct mounted CO2 sensor as shown on plans, to monitor space occupancy levels within the building by measuring the parts per million of CO2 (Carbon Dioxide) in the air. As CO2 Levels increase, the economizer fresh air damper shall modulate to meet the co2 space ventilation requirements.

2.3 STAGING CONTROLS

- A. Provide manual changeover control with (heat-off-cool) temperature controls and fan auto/on switch.

2.4 CURB MOUNTED SPRING ISOLATION BASE

- A. Rooftop equipment shall be mounted on an integrated spring and weather seal curb arrangement that fits under the equipment to be isolated and over the curb. Top and bottom members shall be of extruded aluminum and shall be connected by a flexible, water-proof neoprene membrane. The aluminum members shall seal against the equipment and against the curb with continuous closed cell neoprene sponge.
 - 1. Springs shall be cadmium plated and shall have a deflection as required by drawings with 50% additional travel to solid. Spring diameters shall be no less than 0.8 of the spring height at rated load. Wind resistance shall be provided by means of resilient snubbers in the corners with a minimum clearance of 1/4" so as not to interfere with the spring action except in high winds.
 - 2. Curb shall be seismically rated for seismic zone where building is located.
 - 3. Submittals shall include spring deflections, spring diameters, compressed spring height and solid spring height, seal material details and the design configuration of the entire base arrangement.
 - 4. Vibrex, Thycurb, Amber Booth, Mason, Kinetics Noise Control.
- B. Where required, provide perimeter angle and cross members to support two layers of 5/8" sheet rock. Install two layers of 5/8" weatherproof sheet rock with staggered joints on the roof deck. Perimeter angle and cross members provided with the vibration isolator bases. Apply sheet rock around all ductwork above the roof and Caulk all joints and seams. Provide additional acoustical materials as recommended by acoustical engineer. Mason Industries RSCA or approved.

PART 3 EXECUTION**3.1 INSTALLATION**

- A. Provide and Install and arrange equipment as shown on the Drawings and as recommended by the equipment manufacturer.
- B. Piping: Refer to applicable sections for piping, ductwork, insulation, painting, etc.

3.2 AIR HANDLING INSTALLATION

- A. Installation and Arrangement: Air handling equipment shall be installed and arranged as shown on the Drawings. Comply with the manufacturer's recommendations for installation, connection, and start-up.
- B. Lubrication: All moving and rotating parts shall be lubricated in accordance with the manufacturer's recommendations prior to start-up.
- C. Filters: Specified filters or approved temporary construction filters shall be installed in supply units prior to start-up or used for drying and/or temporary heat. See specifications related to ensuring ducts remain clean during construction for more information.

3.3 ROOF MOUNTED EQUIPMENT INSTALLATION

- A. All roof mounted mechanical equipment shall be supported and seismically anchored on leveled, flashed and counterflashed vibration isolated curbs anchored to resist seismic forces and suitable for the roof construction. Minimum curb height shall be 14" above the roof unless indicated otherwise on the Drawings. Flashing into the roof is specified in another Section.
- B. Make all piping, electrical and duct penetrations for each piece of equipment within the curb unless shown otherwise on the Drawings. Piping and electrical conduit routed above and across the roof shall be supported on flashed and counterflashed curbs with pipe guides anchored to the curbs in "pitch pockets." Submit shop drawings on other arrangements for approval.
- C. Acoustical Protection: Install two layers of 5/8" weatherproof sheet rock with staggered joints on the perimeter angle and cross members provided with the vibration isolator bases. Apply sheet rock around all ductwork above the roof and caulk all joints and seams. Provide additional acoustical materials as recommended by acoustical engineer.
- D. Install on vibration isolation curbs where noted on drawings.

3.4 SMOKE DETECTOR INSTALLATION

- A. Provide and install duct mounted smoke detectors at air handling units in accordance with Code requirements.
- B. Automatic Smoke Detector Fan Shutdown: Where smoke detector is required, install detector provided by other division in return air duct. Interlock with fan to disable operation per code.

3.5 CONTROLS

- A. Wiring: All wiring shall be in accordance with the National Electrical Code and local electrical codes.

- B. See drawings. Provide all conduit and conductors between control devices and controller or rooftop unit.
- C. Provide relay to start and operate exhaust fan when furnace goes occupied.

PART 4 SEQUENCE OF OPERATIONS

4.1 PACKAGED ROOFTOP UNITS (RTU)

- A. Microprocessor controller - Each RTU shall be controlled by a stand-alone microprocessor based controller with resident control logic. The controller will interface with the BAS and the inputs and outputs in the points list to accomplish the following temperature control and energy conservation strategies.
 - 1. Occupied Mode - All unit functions will be enabled for normal heating and cooling operation. Unit defaults to default temperature setpoints in the unit microprocessor when communication with BAS is lost.
 - 2. Occupied Space Temperature Control - When in occupied mode as described above, the dedicated unit control shall operate stages of heating and cooling to maintain space temperature setpoint. Setpoints may be set by one of the following methods:
 - a. Locally through the thermostat by the occupant
- B. Economizer - Each RTU when equipped will measure OSA Temp and select lowest total heat air stream to meet cooling demands.

END OF SECTION