

## 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 05 00, 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. Gas-fired Equipment: Design certified by American Gas Association.
- D. Field Wiring: Comply with requirements of Section 23 05 00.

### 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. Unit Performance
  - 1. Unit cooling capacities shall be in accordance with and tested to ARI standard 210/240-89 or 360-85.
  - 2. Units shall carry the ARI compliance label.
  - 3. Unit MINIMUM cooling efficiency, including the standard supply air blower motor shall be as shown on the plans.
  - 4. Units shall be safety certified in accordance with UL Standard UL1995, and ANSI Standard Z21.47.
  - 5. Unit shall be safety certified by an accredited testing laboratory.
  - 6. Unit nameplate shall carry the label of the certification agency.
  - 7. Unit shall be shipped completely assembled by the manufacturer including all standard items and optional items.
  - 8. Unit shall be 100% run tested by the manufacturer with a copy of the run test report shipped with the unit.
- B. Unit Construction:
  - 1. Unit shall be completely factory assembled, piped, wired and shipped in one piece.
  - 2. Unit 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.
  - 4. Cabinet shall be constructed entirely of G90 galvanized metal with the exterior constructed of 18 gauge or heavier material and interior construction of 22 gauge or heavier solid liner.
  - 5. The unit roof shall be cross-broken and / or sloped to assure drainage.
  - 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). Provide with door hold backs to prevent over extension.
  - 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.
  - 9. Unit exterior shall be painted with polyurethane paint over a primer and a G90 type galvanized steel.
  - 10. Paint finish shall be capable of withstanding at least 2000 hours, with no visible corrosive effects, when tested in a salt spray and fog atmosphere in accordance with ASTM B 117-95 test procedure.
  - 11. All wiring shall be color-coded.
  - 12. The interior airside of the cabinet shall be entirely insulated on all exterior panels with 2" thick, 1.5-pound density, neoprene coated, fiberglass insulation or foam filled panels.
  - 13. 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.

14. 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.
  15. Unit shall have decals and tags to indicate unit lifting - rigging, service areas and caution areas.
  16. 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.
  17. Diagrams shall also be laminated in plastic and permanently fixed to the control compartment door.
  18. Installation and maintenance manuals shall be supplied with each unit, located in a metal pocket in the control access compartment.
  19. VFD equipped units shall have drives installed internally unless noted otherwise. The VFD may be installed in an environmentally controlled cabinet attached to the rooftop unit in a manner approved by the rooftop unit manufacturer. See Section 230500 for VFD specifications.
- C. Blowers:
1. Blower(s) shall be entirely self-contained on a slide deck for service and removal from the cabinet.
  2. Blowers, drives and motors shall be dynamically balanced to comply with 0.10 in/second for supply air fans and 0.15 in/second for return air fans. Provide certification or field test in presence of engineer.
- D. Outside Air: Shall be 0-100% with a motor operated outside air damper constructed of extruded aluminum, hollow core, air foil blade with rubber edge seals and aluminum end seals. Damper blades shall be gear driven and designed to have no more than 4 CFM of leakage per square foot of damper area when subjected to 1" 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. Coordinate with airflow measurement station manufacturer for placement of device.
- E. Exhaust Fan Section:
1. Provide with unit mounted smoke detector. Detector shall include contacts for fan shut-down per code and axillary contacts to allow connection to building fire alarm system with relay module provided by other division.
- F. Gas Heating Section:
1. Unit shall be provided with a gas-heating furnace consisting of stainless steel heat exchanger with multiple concavities, an induced draft blower and an electric pressure switch to lockout the gas valve until the combustion chamber is purged and combustion air flow is established. Heat exchanger tubes with separate internal turbulators are not acceptable.
  2. Unit shall be provided with a gas ignition system consisting of an electronic ignitor to a pilot system, which will be continuous when the heater is operating, but will shut off the pilot when heating is not required.
  3. Unit shall have gas supply piping entrances in the unit base for through the curb gas piping and in the outside cabinet wall for across the roof gas piping.
  4. Unit shall be equipped with a Stainless Steel tubular heat exchanger with a 25-year non pro-rated warranty.
  5. The completely factory mounted gas heating assembly shall be capable of operating at any firing rate between 100% and 30% of rated capacity. The discharge air set point shall be adjusted at the electronic controller within the rooftop unit control compartment. Burner control shall be a Honeywell 7800 series unit with digital read-out module. Heating control shall be capable of operation initiated by a 0 to 10 volt signal from a DDC control system.
- G. Power Option:
1. Unit equipment shall be provided with a single disconnect switch with fusing.
  2. Unit shall be provided with phase and brownout protection to shut down all motors in the unit if the phases are more than 10% out of balance on voltage, or the voltage is more than 10% under design voltage.
  3. Unit shall be provided with single point electrical connection with disconnect.
- H. Filters:
1. Unless otherwise noted, unit to be furnished with 2" pleated throw away supply air filters, see previous specification section.
  2. Provide one complete extra set of filters for replacement once building flush out or construction is complete.
- I. Condensing Coil:
1. Condenser coil(s) shall be copper tube with aluminum fins mechanically bonded to the tubes.

2. Condenser coil(s) to be sized for a minimum of 10 degrees sub-cooling.
- J. Evaporator Coil:
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. Evaporator coil(s) shall be copper tube with aluminum fins mechanically bonded to the tubes.
  5. Coils shall be interlaced where more than one compressor is connected to one coil.
- K. Refrigeration System: (DX Cooling System)
1. 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. Lead compressor in each circuit shall be a digital scroll compressor.
  2. Units shall be factory piped to condensing section.
  3. All units shall be variable capacity.
  4. Compressor(s) shall be mounted in an isolated compartment to permit operation of the unit without affecting airflow when the compressor compartment is open.
  5. 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.
  6. System shall be equipped with thermostatic expansion valve(s) type refrigerant flow control.
  7. System shall be equipped with automatic re-set low pressure and manual reset high-pressure refrigerant controls.
  8. Unit shall be equipped with Schrader type service fittings on both the high side and low-pressure sides of the system.
  9. Unit shall be equipped with refrigerant liquid line driers.
  10. Unit shall be fully factory charged with HFC R-410A.
  11. All circuits shall be equipped with liquid line sight glasses.
  12. Unit shall be equipped with a 5 minute anti-short cycle delay timer for each compressor.
- L. Controls
1. Terminal Strip: Provide factory terminal strip with wiring from unit mounted devices required for operation of all HVAC function from field installed controls. See Section 23 09 23 and 23 09 93 for control devices and operating sequences provided by Control Contractor.
  2. BACnet Controller: Provide factory installed native BACnet controller to operate all HVAC functions of the unit. Controller shall integrate directly with JCI Control System. See Section 23 09 23 for device specifications. See Section 23 09 93 for sequences that shall be available. Coordinate with Control Contractor for integration and operation.
- M. Roof Curbs
1. General Requirements
    - a. Curb mounted rooftop units shall be isolated on a spring isolated noise control curb consisting of galvanized curb sections with integral vertical and laterally restrained isolators formed to fit the contractor supplied rooftop equipment. The spring isolation curb and acoustical treatment package shall provide a space and adjacent space noise criteria of NC 35.
    - b. The silencing elements and the spring isolation elements shall be built complete by the noise control manufacturer as an integral unit roof curb.
    - c. The noise control curb shall bear directly on the roof structure and shall be flashed and waterproofed into the roof's membrane waterproofing system by the installing contractor.
  2. Submittals
    - a. The noise control manufacturer shall provide the following acoustical and pressure drop calculations, as part of the submittal package to demonstrate that the resultant noise levels in the indoor occupied spaces served by the rooftop equipment meet the above noise criteria and maximum allowable pressure drop including system effects:
      - 1) Airborne noise through supply air ducts
      - 2) Airborne noise through return air ducts
      - 3) Breakout noise through all ducts
      - 4) Flanking noise through roof deck
      - 5) Structure-borne vibration noise
      - 6) Supply air pressure drop including system effects

- 7) Return air pressure drop including system effects
  - b. Submittals shall include IBC code compliant overturn calculations for site specific wind and seismic conditions. Calculations shall be sealed by a Professional Engineer registered in the State of Oregon.
  - c. Submittals shall include a written test report by a third party organization showing airside silencing elements have flame-spread index not exceeding 25 and smoke-developed index not exceeding 50 when tested according to ASTM E 84, NFPA 255 or UL 723.
  - d. Calculations shall be clearly typed or printed, not handwritten.
3. Performance
- a. The total noise contribution from other sources other than the AHU's must be at least 5 dB below the specified noise criteria. Sound power levels of actual equipment to be installed on project shall be used for the submitted analysis.
  - b. If the noise level in the occupied spaces exceeds the specified noise criteria level, it will be the financial responsibility of the noise control manufacturer to provide product and labor to achieve the specified criteria. The project schedule is based on the sound power levels of the "basis of design" air handling units. Additional noise control required as a result of the purchase of noisier air handling units will be the financial responsibility of the purchasing Contractor.
4. Noise Control Curb Construction
- a. Silencing elements shall be constructed of ASTM A 653/A 653M G90 galvanized steel, with fiberglass acoustic media fill protected from erosion by a perforated steel liner. Where indicated on the silencer schedule, media shall be encapsulated in glass fiber cloth or film to help prevent shedding, erosion and impregnation of the glass fiber.
  - b. The curb shall be constructed from a minimum of 16 ga G90 galvanized perimeter steel with a factory attached wood nailer. The perimeter steel seams shall be continuously welded. The galvanized perimeter curb steel shall be attached to a structural steel frame that incorporates a minimum of 4 restrained spring isolators that support the rooftop unit.
  - c. The curb shall have factory installed lifting points.
  - d. Curb sides and ends shall be capable of accepting 51 mm (2") external insulation, factory installed.
  - e. The isolation springs shall be of the vertical and laterally restrained type. The springs shall be designed to be laterally stable and properly selected to provide minimum specified deflection with 50% additional travel to solid. Isolation springs shall be powder coated for corrosion resistance and have a minimum static spring deflection of 25 mm (1") or 51 mm (2") or 76 mm (3") or greater as scheduled.
  - f. Overhung condensing unit sections shall be supported by a structural steel pedestal assembly with isolation springs that are vertically and laterally restrained and shall be installed as the main curb section.
  - g. A galvanized and insulated pan shall be provided under condensing sections that are located within the curb perimeter.
  - h. The curb section shall be complete with factory installed duct supports.
  - i. The curb section shall be complete with factory installed supply air and return air neoprene flex connections.
  - j. Curb access doors or sections shall be installed as required for servicing curb components or accessories.
  - k. The curb shall be constructed to match the pitch of the roof.
  - l. The isolation shall allow 6 mm (1/4") movement before resisting wind loads in any lateral direction.
  - j. Where required by the project specification the isolation curb shall be designed to meet all seismic loads and wind loading as defined by the building code having jurisdiction.
  - k. The perimeter of the curb shall have a flexible neoprene air and weather seal joining the upper and lower curb sections. There shall also be a continuous closed cell sponge material between the top of the spring isolation curb and underside of the rooftop unit to provide a waterproof seal.
  - l. The spring isolation curb shall be shipped pre-assembled where possible. Where size prohibits one piece shipping, the isolation curb shall be split into a minimum number of sections and all connecting hardware shall be supplied by the manufacture. Additional acoustic accessories shall be shipped loose for field installation.
  - m. The curb shall include a piping enclosure to match the rooftop unit.

- n. Where required the curb shall be equipped with a 914 mm (36") wide service platform. That includes – handrails, stairs and an open grating walkway.
  - o. All acoustic installation hardware shall be provided by the isolation curb manufacturer.
  - p. Provide with zee clips or other seismically documented means of attaching RTU to curb.
5. Vibro-Acoustics or approved.
- N. Approved manufactures: AAON with Control option #1, AAON, Daikin with Control option #2.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. 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 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 12" 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.

### 3.3 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.

### 3.4 SMOKE DETECTOR INSTALLATION

- A. Provide duct-mounted smoke detector at return side of air handling units. Provide device compatible with Simplex fire alarm system or with addressable module to allow connection to Simplex fire alarm system. Detector to be wired to disable fan operation in accordance with Code requirements.
- B. Automatic Smoke Detector Fan Shutdown: Coordinate with Automatic Temperature Controls specified elsewhere in these specifications.

### 3.5 CONTROLS

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

END OF SECTION