

SECTION 15856

MODULAR AIR HANDLING UNITS

PART 1 DESIGN DIRECTIVES

1.1 QUALITY ASSURANCE

- A. NFPA Compliance: Modular air handling units and components shall be designed, fabricated, and installed in compliance with NFPA Standard 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems."
- B. UL Compliance: Modular air handling unit, shall be listed and labeled by Underwriters' Laboratories.
- C. ARI Certification: Modular air handling units and their components shall be factory tested in accordance with the applicable portions of ARI 430 - Standard for Central-Station Air-Handling Units, and shall be listed and bear the label of the Air Conditioning and Refrigeration Institute.

1.2 DELIVERY, STORAGE, AND HANDLING

- A. Lift and support units with the manufacturer's designated lifting or supporting points.
- B. Disassemble and reassemble units as required for movement into the final location following manufacturer's written instructions.
- C. Deliver modular air handling units as a factory-assembled unit to the extent allowable by shipping limitations, with protective crating and covering.

1.3 SEQUENCING AND SCHEDULING

- A. Coordinate the size and location of structural steel support members and housekeeping pads.

1.4 EXTRA MATERIALS

- A. Furnish one additional complete set of filters for each modular air handling unit (AHU).
- B. Furnish one additional complete set of belts for each modular AHU.

1.5 DESIGN CRITERIA

- A. Designer shall evaluate fan performance at both clean and dirty filter conditions. The AHU schedule shall indicate filter pressure drop change out.
- B. Designer shall coordinate the locations of AHU's with consideration to objectionable noise and access. Units located on other than slab on grade, shall be supported on materials that provide a sound deadening mass. Maximum structural deflection shall not exceed 1/4".
- C. The space below roof top units shall be solid. Only duct, pipe, and conduit openings are allowed under the unit. Seal all openings with resilient type seal.
- D. When face and bypass dampers are needed, utilize integral type face and bypass type coils.

- E. When variable airflows are required, use variable frequency drives, not inlet vanes. AHU manufacturers may offer starters and/or VFD's as an option to the unit. These products may be specified providing they comply with the requirements stated within this section and coordination between the mechanical and electrical designers takes place.
- F. Specify air blenders wherever the risk of air stratification can occur.
- G. Insure that the steam coil location will allow a minimum vertical drop of 12" from the discharge of the steam coil to the trap inlet. The discharge from the steam trap shall then be pitched away from the trap so it can drain by gravity. Vertical lifts are not allowed.
- H. Coordinate with the plumbing designer so that there is a floor drain in the immediate proximity of the AHU cooling coil. Arrange piping so that it does not create a trip hazard.
- I. This specification section describes the requirements for modular air handlers as well as smaller, sometimes non-modular air handlers. Generally, modular air handlers may be used from 1500 cfm and 1" external static pressure to over 50,000 cfm and 8" external static pressure. There are instances, due to spatial or design requirements, that smaller air handlers may be used. The decision to use smaller air handlers must be made in conjunction with the FO&M project representative; however they should not be used when air flows exceed 3,500 cfm and/or 2" of external static pressure. Smaller air handlers generally do not have the same features available, and are usually constructed to a lower standard than the larger modular units. Where applicable, this document will list variances permitted for small air handlers, and will be referred to as small AHU's.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers (indoor units):
 - 1. McQuay Air Conditioning - Central Station (Vision)
 - 2. Trane - 'M' series Climate Changer
 - 3. York International Corp. – Solution XTI
- B. Manufacturers (exterior units):
 - 1. McQuay Air Conditioning
 - 2. Trane - 'T' series Climate Changer
 - 3. York International Corp. – Solution XTO
- C. Manufacturers (small AHU's):
 - 1. –Same as above
- D. The design has been based on the manufacturer listed in the schedule. Variations in dimensions and connection sizes must be fully coordinated by the contractor with all trades and at no additional cost to the owner.

2.2 GENERAL

- A. AHU's shall be entirely of double wall galvanized steel construction. Galvanizing shall be hot dipped conforming to ASTM A525 and shall provide a minimum of .90 oz. of zinc per square foot (G90).
- B. The contractor and the AHU manufacturer shall be responsible for insuring that the unit will not exceed the allocated space and weight as shown on the drawings, including required clearances for

service and future overhaul or removal of unit components. All alterations of units which are dimensionally different than the scheduled units shall be the responsibility of the contractor and be performed at no additional cost to the owner.

- C. AHUs shall be fully assembled by the manufacturer in the factory in accordance with the arrangement shown on the drawings. The unit shall be assembled into the largest sections possible subject to shipping and rigging restrictions. The correct fit of all components and casing sections shall be verified in the factory for all units prior to shipment. On units not shipped fully assembled, the manufacturer shall tag each section and include airflow direction to facilitate assembly at the jobsite. Lifting lugs or shipping skids shall be provided for each section to allow for field rigging and final placement of unit.
- D. Provide the necessary gasketing, caulking, and all screws, nuts, and bolts required for assembly.
- E. All door and panel gaskets shall be high quality, bulb type, which seal air tight and retain their structural integrity and sealing capability after repeated assembly and disassembly of bolted panels and opening and closing of hinged components. Bolted sections may use a more permanent gasketing method provided they are not disassembled.
- F. Structural Rigidity: Provide structural reinforcement when required by span or loading so that the deflection of the assembled structure shall not exceed $L/200$ of the span when the unit is operating at a differential static pressure of 8" water gauge minimum. In addition to all mechanical dead loads, exterior units shall be designed to a minimum of a simultaneous 50 psf roof live load and 20 psf wind load, or as required by code, whether or not the unit is operating. At the above stated design parameters, the unit air leakage rate shall be <1% of scheduled air flow @ 8" w.g. pressure.
- G. All piping connections for the unit shall be run to outside the casing from the factory. Grommets and other air seals shall be installed by the factory.
- H. All wiring shall conform the current enforced edition of the National Electric code. In addition, all wiring shall be in metallic raceway.

2.3 UNIT CASING

- A. Formed and reinforced galvanized 18 gauge outer steel panels and floor, fabricated to allow removal for access to internal parts and components, with joints between sections sealed. Panels shall be removable without affecting the structure of the unit.
- B. Comply with NFPA Standard 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems," for insulation. AHU's shall be insulated with rigid mineral wool insulation board, 2" thick and having a minimum density of 1.5 pcf for indoor units, or 2" thick spray injected foam, throughout entire unit. Manufacturer shall provide a written warranty stating the AHU casing shall not condense water on the exterior of the unit at design conditions.
- C. 20 gauge solid galvanized steel liner in all sections, except fan and discharge sections shall be perforated. Floor liner is below unit to hold and protect insulation.
- D. Access panels and doors shall have the same materials, thickness, construction, and finishes as the cabinet and be complete with hinges, latches, handles, and gaskets. All doors shall have a 9"x9" double pane view window. Door latch motion shall not exceed 180° and shall pull the panel snug to the frame. Access panels that are removed via sheet metal screws or similar fasteners are not allowed.
- E. Fan section shall have inspection and access panels and doors sized and located to allow periodic maintenance and inspections.

- F. Double wall drain pans shall be formed sections of 316 stainless steel. The drain pan shall be sloped in two directions with the lowest single point at the drain connection(s). The cooling coil shall have a full width, sloped drain pan that extends downstream of the coil to provide sufficient amount of space to collect moisture carryover. The drain pan shall be double wall construction with a 316 stainless steel liner and have a minimum of 2" insulation. The pan shall have a minimum depth of 4 inches.
- G. Coils with finned height greater than 48" shall have an intermediate 316 stainless steel drain pan extending the entire length of the coil.
- H. Casing construction and finish for outdoor units shall be suitable for exterior, rooftop installation with no leakage or other weather penetration. Roof shall have canting to allow proper draining. Provide structural reinforcement when required by span or loading so that the deflection of the assembled structure shall not exceed L/200 of the span when the unit is operating at a differential static pressure of 1.5 times the design static pressure. In addition to all mechanical dead loads, exterior units shall be designed to a minimum of a simultaneous 50 psf roof live load and 20 psf wind load, or as required by code, whether or not the unit is operating. At the above stated design parameters, the unit air leakage rate shall be <1% of scheduled air flow @ 8" w.g. pressure. Units shall be finished with an exterior grade paint, color selection from manufacturer's standard offering by the architect.
- I. When tested in accordance with ASTM B-117, the unit shall withstand 125 hour salt spray solution (5%) without any sign of rust.
- J. Unit shall be designed such that when the modules are connected together, the gasket seal shall be made tighter.

2.4 UNIT BASE

- A. The entire unit shall be provided with a full length, continuous, base rail channel. Base rail channels shall be formed of a minimum 12 gage galvanized steel. All components shall be supported from the base; integral lifting lugs shall be provided.
- B. Outdoor units will be mounted onto the roof curb supported by a field fabricated structural steel frame. AHU supplier must review details on architectural and structural drawings and coordinate units base rail configuration.

2.5 PIPE CHASE ENCLOSURE

- A. Piping to roof top units must be protected with a weather proof, insulated, piping enclosure furnished with the units and extending down to the base of the unit.

2.6 FAN SECTION

- A. The following factory tests are required:
 - 1. Sound power level ratings shall comply with AMCA Standard 301 "Method for Calculating Fan Sound Ratings From Laboratory Test Data," and shall be the result of tests made in accordance with AMCA Standard 300, "Test Code for Sound Rating". Fans shall be licensed to bear the AMCA Certified Sound Ratings Seal.
 - 2. Unit's fans performance ratings for flow rate, pressure, power, air density, speed of rotation, and efficiency shall be factory tested and ratings established in accordance with AMCA Standard 210/ASHRAE Standard 51 - Laboratory Methods of Testing Fans for Rating.

- B. Fan section shall be equipped with a formed steel channel base for integral mounting of fan, motor, and casing panels. Fan and motor shall be mounted on an independent frame with the frame mounted on spring vibration isolators to isolate fan and motor vibration from the unit frame with seismic restraints.
- C. Design fans and shafts for continuous operation at the maximum rated fan speed and motor horsepower. After the pre-balanced fan is installed in the fan section, the entire section shall be balanced. Fans shall be balanced for inverter duty operation. Fan wheel shall be double-width, double-inlet type with backward curved airfoil section blades as indicated. Airfoil wheels shall be painted steel with zinc chromate primer and an enamel finish coat. Fan shaft shall be solid steel, turned, ground, and polished. Fan wheels shall be keyed to the shaft.
- D. Grease-lubricated ball bearings selected for L(50) 200,000-hour average life, with grease fittings extended to an accessible location outside the fan section.
- E. Design fan drive for a 1.3 service factor and factory mounted with final alignment and belt adjustment made after installation.
- F. Motors and fan wheel pulleys shall be adjustable pitch.

2.7 MOTORS

- A. Refer to Specification Section 15, "ELECTRICAL REQUIREMENTS FOR MECHANICAL EQUIPMENT" for motor requirements in air handling units.
- B. Starters, Electrical Devices, and Wiring: Electrical devices and connections are specified in DC Standards Section 16.

2.8 COILS

- A. Cooling and heating coils, shall be factory tested for rating in accordance with ARI 410 -Standard for Forced-Circulation Air-Cooling and Air-Heating Coils.
- B. Provide common or individual insulated, 16 ga galvanized steel casings for heating and cooling coils. Coil casing shall be 16 ga 304 stainless steel for 100% outside air units. Coil section shall be designed and constructed to facilitate removal of coil for maintenance and replacement and to assure full air flow through coils. All coils shall be drainable, rigidly supported across the full face of the coil, and pitched to allow drainage.
- C. Aluminum fins (0.075" thick) shall be bonded to seamless copper, 0.035" wall tubes by mechanically expanding copper tubes.
- D. Steam coils shall be steam-distributing type. Support distributing tube concentrically inside condensing tube with corrosion-resistant clips. Headers for steam coils shall be steel or cast iron, with connections for drain valve and air vent and threaded piping connections.
- E. Direct-Expansion Refrigerant Coils: Designed and fabricated in compliance with ASHRAE Standard 15, "Safety Code for Mechanical Refrigeration". Provide seamless copper suction headers and distributor tubes. Venturi -type refrigerant distributor, designed for low pressure drop, arranged for down feed with solder connections, and having a maximum of 12 circuits for each distributor. Coils with more than 12 circuits shall have two distributors. Split circuit coils shall have two distributors.
- F. Coils shall be easily removable by removal of a wall panel.

2.9 DAMPERS

- A. All dampers shall be opposed blade, ultra-low leakage, double skin, air-foil, galvanized steel blades with stainless steel jamb seals. Dampers shall include neoprene blade seals to limit leakage to 5 cfm per square foot at 1" static pressure.
- B. Provide mixing box section arranged to allow connections as indicated on the drawings.
- C. Damper actuators shall be sized for 1-1/2 times the actual damper required static pressure differential. Actuators subject to freezing temperatures shall be electric type.

2.10 FILTER SECTION

- A. Filter section shall have cabinet material and finish to match the air-handling unit cabinet, with extruded aluminum filter media holding frames. Section shall have access doors on both sides of the unit. Filter frames shall be built as part of the unit and be provided with neoprene gasketing on the leaving airside of the filter for pressure sealing.
- B. Manufacturer shall supply magnehelic gauge to read pressure drop across the filter bank for scheduling filter replacement. Gauge shall be recessed into the cabinet to minimize chances for damage during shipment and installation.
- C. Pre-filters shall be 30% efficient based on ASHRAE 52-76 test procedure.
- D. Final filters to have an average efficiency rating of 90% as measured by ASHRAE Standard 52-68. Initial resistance not greater than 0.65" of W.G. at 500 feet per minute face velocity.
- E. Manufacturers: Subject to compliance with requirements, provide filters of one of the following
 1. American Air Filter Co.
 2. Environmental Filter
 3. Farr Co.

2.11 BLENDERS

- A. Blenders shall be integrated into the overall unit design to maximize the performance of the downstream components. The blenders shall be fixed devices with no moving parts.

2.12 HUMIDIFIERS

- A. Provide factory fabricated humidifier section of the same construction and finish as the AHU casing including humidifier supports, and hinged double wall access doors.
- B. Furnish humidifiers pre-installed in section for final piping connections by contractor.
- C. Distribution Manifold: Provide stainless steel manifold with provision to return condensate to steam trap. Construct with steam nozzles designed to provide even steam distribution over entire length, from 0 to 100% capacity. Provide stainless steel mounting plate for duct attachment and mounting flange for separator attachment.
- D. Manufacturer: Subject to compliance with requirements, provide jacketed dry steam humidifiers of one of the following:
 1. DRI-STEEM Humidifier Co.
 2. Nortec Industries, Inc.

2.13 ELECTRICAL AND LIGHTING: (For unit Sections and Service Vestibule).

- A. Vapor-proof lights using cast aluminum base style with glass globe and cast aluminum guard and 60 watt light bulb, shall be installed in each section where there is access for maintenance, including service vestibules. A switch outside the unit shall control the lights in each compartment with a pilot light mounted outside the respective compartment access door. All wiring shall run in neatly installed electrical conduits and terminate in a junction box for a single point, 115 volt field connection to the building system. Wiring and equipment specifications shall conform to DC Standards 16, Electrical.
- B. Provide a factory wired convenience GFI duplex outlet next to the light switch. Outlets shall be located no greater than 20 feet on center.
- C. Provide penetrations to allow field installation of power to motors. Coordinate with Electrical Specifications and with installation of starters.
- D. Each roof top unit shall be equipped with a single point motor starter panel serving the fan motors. Panel shall include fused disconnects and all required electrical appurtenances.
- E. The panel and all associated components shall be UL listed. All wiring shall conform to the applicable sections of the National Electric Code and the requirements of DC Standards Section Division 16.
- F. The single point motor starter panel shall be housed in a NEMA 4 enclosure. The enclosure shall be located in the service vestibule on the exterior of the unit near the entry door. Refer to specification section 15030, "ELECTRICAL REQUIREMENTS FOR MECHANICAL EQUIPMENT".

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions for compliance with the design.

3.2 INSTALLATION, GENERAL

- A. Arrange installation of units to provide access space around air handling units for service and maintenance and adequate space and piping arrangement to allow a coil replacement. The isolation valves shall be arranged in such a way that they can be closed and piping between the valve and coil can be removed and the coil pulled out and replaced.
- B. Install seismic bracing as required in DC Standards "SEISMIC RESTRAINTS FOR MECHANICAL SYSTEMS AND EQUIPMENT".
- C. Arrange piping installations adjacent to units to allow unit servicing and maintenance.
- D. Refer to DC Standards, "BASIC MECHANICAL MATERIALS AND METHODS" for filter installation requirements.
- E. *Install air handling units level and plumb, on structural steel equipment bases or concrete housekeeping pad. Steel sub base or concrete pad shall be level in all directions to within 1/16" and as measured with laser instrumentation. Adjust concrete base via non-shrink grout. Structural steel shall be shimmed at the steel connection points, not AHU connection points, to provide a continuously level platform.*

3.3 ADJUSTING, CLEANING, AND PROTECTING

- A. Adjust damper linkages for proper damper operation.
- B. Clean unit cabinet interiors to remove foreign material and construction dirt and dust. Vacuum clean fan wheel, fan cabinet, and coils entering air face. Comb all coil fins so they are straight and parallel.

3.4 MANUFACTURER'S FIELD SERVICE

- A. The contractor shall arrange and pay for a factory-authorized service representative to perform the requirements of this section.
- B. Inspect the field assembly of components and installation of modular air handling units including piping, ductwork, and electrical connections.
- C. Prepare a written report on findings and recommended corrective actions. Copy of the report shall be left on the site for the contractor to share with the owner.
- D. Demonstrate procedures and schedules related to start-up and shutdown, troubleshooting, servicing, preventative maintenance, and how to obtain replacement parts.
- E. Schedule training with at least 7 days advance notice.

END OF SECTION 15856