

SECTION 23 74 17
PACKAGED, MODULAR, CENTRAL-STATION AIR-HANDLING UNITS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Modular air handling units including integral components specified herein.
- B. Definitions: Modular Air Handling Unit (MAHU): A factory fabricated assembly consisting of fan, coils, indirect evaporative coolers, filters, and other necessary equipment to perform one or more of the following functions of supplying air, exhausting air, cleaning, heating and cooling. Design capacities of units shall be as scheduled on the drawings.

1.2 RELATED WORK

- A. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
- B. Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS
- C. Section 07 51 00, BUILT-UP BITUMINOUS ROOFING.
- D. Section 07 60 00, FLASHING AND SHEET METAL.
- E. Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS: Seismic restraints for equipment.
- F. Section 23 05 11, COMMON WORK RESULTS FOR HVAC: General mechanical requirements and items, which are common to more than one section of Division 23.
- G. Section 23 05 12, GENERAL MOTOR REQUIREMENTS FOR HVAC and STEAM GENERATION EQUIPMENT: Types of motors.
- H. Section 23 05 41, NOISE and VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT: Sound and vibration requirements.
- I. Section 23 05 93, TESTING, ADJUSTING, and BALANCING FOR HVAC: Testing, adjusting and balancing of air and water flows.
- J. Section 23 07 11, HVAC and BOILER PLANT INSULATION: Piping and duct insulation.
- K. Section 23 08 00 – COMMISSIONING OF HVAC SYSTEMS: Requirements for commissioning, systems readiness checklists, and training.
- L. Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC: HVAC controls.

- M. Section 23 21 13, HYDRONIC PIPING and Section 23 73 10, INDIRECT EVAPORATIVE COOLERS.
- N. Section 23 34 00, HVAC FANS: Exhaust fans.
- O. Section 23 31 00, HVAC DUCTS and CASINGS: Requirements for flexible duct connectors, sound attenuators and sound absorbing duct lining.
- P. Section 23 40 00, HVAC AIR CLEANING DEVICES: Air filters and filters' efficiency.
- Q. Section 23 73 10, INDIRECT EVAPORATIVE COOLER.
- R. Section 23 82 16, AIR COILS: Heating and cooling coils and pressure requirements.
- S. Section 26 29 11, MOTOR CONTROLLERS: Types of motor starters.

1.3 QUALITY ASSURANCE

- A. Refer to Article, Quality Assurance, in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.
- B. Air Handling Units Certification
 - 1. Air Handling Units with Housed Centrifugal Fans: The air handling units shall be certified in accordance with AHRI 430 and tested/rated in accordance with AHRI 260.
 - 2. Air Handling Units with Plenum Fans:
 - a. Air Handling Units with a single Plenum Fan shall be certified in accordance with AHRI 430 and tested/rated in accordance with AHRI 260.
 - b. Air handling Units with Multiple Fans in an Array shall be tested and rated in accordance with AHRI 430 and AHRI 260.
- C. Heating, Cooling, and Air Handling Capacity and Performance Standards: AHRI 430, AHRI 410, ASHRAE 51, and AMCA 210.
- D. Performance Criteria:
 - 1. The fan BHP shall include all system effects for all fans and v-belt drive losses for housed centrifugal fans.
 - 2. The fan motor shall be selected within the rated nameplate capacity, without relying upon NEMA Standard Service Factor.
 - 3. Operating Limits: AMCA 99 and Manufacturer's Recommendations.

- E. Units shall be factory-fabricated, assembled, and tested by a manufacturer, in business of manufacturing similar air-handling units for at least five (5) year. Unit shall be disassembled for field installation inside mechanical room and remote exhaust fan located on roof.

1.4 SUBMITTALS:

- A. The contractor shall, in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES, furnish a complete submission for all MAHU units covered in the project. The submission shall include all information listed below. Partial and incomplete submissions shall be rejected without reviews.
- B. Manufacturer's Literature and Data:
 - 1. Submittals for MAHUs shall include fans, drives, motors, coils, indirect evaporative cooler, mixing box with outside air dampers, filter housings, and all other related accessories. The contractor shall provide custom drawings showing total air handling unit assembly including dimensions, operating weight, access sections, flexible connections, door swings, controls penetrations, electrical disconnect, lights, duplex receptacles, switches, wiring, utility connection points, unit support system, vibration isolators, drain pan, pressure drops through each component (filter, coil etc) and rigging points.
 - 2. Submittal drawings of section or component only, will not be acceptable. Contractor shall also submit performance data including performance test results, charts, curves or certified computer selection data; data sheets; fabrication and insulation details; if the unit cannot be shipped in one piece, the contractor shall indicate the number of pieces that each unit will have to be broken into to meet shipping and job site rigging requirements. This data shall be submitted in hard copies and in electronic version compatible to AutoCAD version used by the VA at the time of submission.
 - 3. Submit sound power levels in each octave band for fan and at entrance and discharge of MAHUs at scheduled conditions. Include sound attenuator capacities and itemized internal component attenuation. Internal lining of supply air ductwork with sound absorbing material is not permitted. In absence of sound power ratings refer to Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT.
 - 4. Provide fan curves showing Liters/Second (cubic feet per minute), static pressure, efficiency, and horsepower for design point of operation and at maximum design Liters/Second (cubic feet per minute) and 110 percent of design static pressure.
 - 5. Submit total fan static pressure, external static pressure, for MAHU including total, inlet and discharge pressures, and itemized specified internal losses and unspecified internal losses. Refer to air handling unit schedule on drawings.

- C. Maintenance and operating manuals in accordance with Section 01 00 00, GENERAL REQUIREMENTS. Include instructions for lubrication, filter replacement, motor and drive replacement, spare part lists, and wiring diagrams.
- D. Submit written test procedures two weeks prior to factory testing. Submit written results of factory tests for approval prior to shipping.
- E. Completed System Readiness Checklists provided by the Commissioning Agent and completed by the contractor, signed by a qualified technician and dated on the date of completion, in accordance with the requirements of Section 23 08 00 COMMISSIONING OF HVAC SYSTEMS.
- F. Submit shipping information that clearly indicates how the units will be shipped in compliance with the descriptions below.
 - 1. This unit may not be shipped in one (1) piece, provide manufacturer approved shipping splits where required for installation or to meet shipping and/or job site rigging requirements in modular sections. Indicate clearly that the shipping splits shown in the submittals have been verified to accommodate the construction constraints for rigging as required to complete installation and removal of any section for replacement through available access without adversely affecting other sections.
 - 2. If shipping splits are provided, each component shall be individually shrink wrapped to protect the unit and all necessary hardware (e.g. bolts, gaskets etc.) will be included to assemble unit on site (see section 2.1.A4).
 - 3. Lifting lugs will be provided to facilitate rigging on shipping splits and joining of segments. If the unit cannot be shipped in one piece, the contractor shall indicate the number of pieces that each unit will have to be broken into to meet shipping and job site rigging requirements.

1.5 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. Air-Conditioning, Heating, and Refrigeration Institute (AHRI):
 - 260-01 Sound Rating of Ducted Air Moving and Conditioning Equipment
 - 410-01 Standard for Forced-Circulation Air-Heating and Air-Cooling Coils
 - 430-09 Standard for Central Station Air Handling Units
 - AHRI-DCAACP Directory of Certified Applied Air Conditioning Products

- C. Air Moving and Conditioning Association (AMCA):
 - 210-07 Laboratory Methods of Testing Fans for Rating
- D. Anti-Friction Bearing Manufacturer's Association, Inc. (AFBMA):
 - 9-90 (R2008)..... Load Ratings and Fatigue life for Ball Bearings
- E. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE):
 - 51-2007 Laboratory Methods of Testing Fans for Rating
- F. American Society for Testing and Materials (ASTM):
 - A653/653M-02 Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
 - B117-07a Salt Spray (Fog) Testing
 - C1071-05e1 Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material)
 - D1654-08 Standard Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments
 - D1735-08 Water Resistance of Coatings Using Water Fog Apparatus
 - D3359-08 Standard Test Methods for Measuring Adhesion by Tape Test
 - E84-10 Standard Test Method for Surface Burning Characteristics of Building Materials
- G. Anti-Friction Bearing Manufacturer's Association, Inc. (AFBMA):
 - 9-90 Load Ratings and Fatigue life for Ball Bearings
- H. Military Specifications (Mil. Spec.):
 - DOD-P-21035A-2003 Paint, High Zinc Dust Content, Galvanizing Repair
- I. National Fire Protection Association (NFPA):
 - NFPA 90A Standard for Installation of Air Conditioning and Ventilating Systems, 2012
- J. Energy Policy Act of 2005 (P.L.109-58)

PART 2 – PRODUCTS

2.1 MANUFACTURERS

Listed manufacturers subject to compliance with requirements.

- A. Manufacturers:
 - 1. Munters
 - 2. Greenheck Fan Corporation
 - 3. Engineered Air
 - 4. Approved Equal

2.2 MODULAR AIR HANDLING UNITS

- A. General:
 - 1. Modular air handling units (MAHU) shall be fabricated from insulated, solid double-wall galvanized steel without any perforations in draw-through configuration. Casing is specified in paragraph 2.1.C. Galvanizing shall be hot dipped conforming to ASTM A525 and shall provide a minimum of 0.275 kg of zinc per square meter (0.90 oz. of zinc per square foot) (G90). Aluminum constructed units may be provided subject to VA approval and documentation that structural rigidity is equal or greater than the galvanized steel specified.
 - 1. The contractor and the MAHU manufacturer shall be responsible for insuring that the unit will not exceed the allocated space shown on the drawings, including required clearances for service and future overhaul or removal of unit components. All structural, piping, wiring, and ductwork alterations of units, which are dimensionally different than those specified, shall be the responsibility of the contractor at no additional cost to the government.
 - 2. MAHUs 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. All units shall be fully assembled, tested and then split to accommodate shipment and job site rigging. On units not shipped fully assembled, the manufacturer shall tag each section and include air flow direction to facilitate assembly at the job site. Lifting lugs or shipping skids shall be provided for each section to allow for field rigging and final placement of unit.
 - 3. The MAHU manufacturer shall provide the necessary gasketing, caulking, and all screws, nuts, and bolts required for assembly. The manufacturer shall provide a local representative at the job site to supervise the assembly and to assure the units are assembled to meet manufacturer's recommendations and requirements noted on the drawings. Provide

documentation that this representative has provided this service on similar jobs to the Contracting Officer. If a local representative cannot be provided, the manufacturer shall provide a factory representative.

4. Gaskets: All door and casing and panel gaskets and gaskets between air handling unit components, if joined in the field, shall be high quality 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.
5. Structural Rigidity: Provide structural reinforcement when required by span or loading so that the deflection of the assembled structure shall not exceed 1/200 of the span based on a differential static pressure of 1991 Pa (8 inches water gage) or higher.
6. Storage: AHU's sections and components shall be stored in a dry and clean area in accordance with the manufacturers storage instructions.

B. Base:

1. Provide a heavy duty steel base for supporting all major MAHU components. Bases shall be constructed of wide-flange steel I-beams, channels, or minimum 125 mm (5 inch) high 3.5 mm (10 Gauge) steel base rails. Welded or bolted cross members shall be provided as required for lateral stability. Contractor shall provide supplemental steel supports as required to obtain proper operation heights for indirect evaporative cooler drain trap and as shown on drawings.
2. MAHUs shall be completely self supporting for installation on mechanical concrete pad with remote exhaust fan on roof.
3. The MAHU bases not constructed of galvanized material shall be cleaned, primed with a rust inhibiting primer, and finished with rust inhibiting exterior enamel.

C. Casing (including wall, floor and roof):

1. General: MAHU casing shall be entirely double wall insulated panels without any perforations, integral of or attached to a structural frame. Construction shall be such that removal of any panel shall not affect the structural integrity of the unit. Casing finished shall meet 2000 hours salt-spray test in accordance with ASTM B 117. All casing and panel sections shall be tightly bolted and gasketed. No gaps of double wall construction will be allowed where panels bolt to air handling unit structural member. Structural members, not covered by the double wall panels, shall have equivalent insulated double wall construction.
2. Double wall galvanized steel panels, minimum 51 mm (2 inches) thick, constructed of minimum 1.3 mm (18 gauge) outer skin and 1.0 mm (20 gauge) solid inner skin, in dry sections and 0.063" aluminum inner skin in

wet sections to limit wall, roof and floor deflection to not exceed an L/240 ratio when the unit casing is pressurized to (± 1245 Pa (± 5 in. w.g.)). Deflection shall be measured at the midpoint of the panel height. Total housing leakage shall not exceed 1% of rated cfm when the unit casing is pressurized to ± 5 in. w.g. (± 1245 Pa). The outer (skin) and inner panels shall be solid.

3. Blank-Off: Provide blank-offs as required to prevent air bypass between the AHU sections, around coils, and filters.
4. Insulation: Insulation shall be injected CFC free polyurethane foam encased in double-wall casing between exterior and interior panels such that no insulation can erode to the air stream. Insulation shall be 50 mm (2 inch) thick, and 48 kg/m^3 (3.0 lb/ft^3) density with a total thermal resistance (R-value) of approximately $2.3 \text{ m}^2\cdot\text{K/W}$ ($13.0 \text{ hr}\cdot\text{ft}^2\cdot\text{°F/BTU}$). Units with less than 50 mm (2 inch) of insulation in any part of the walls, floor, roof or drain pan shall not be acceptable. The insulation shall comply with NFPA 90-A for the flame and smoke generation requirements. Also, refer to specification Section 23 07 11, HVAC and BOILER PLANT INSULATION.

Table 2.1.C.4

Outer Panel	1.3 mm (18 Gage) Minimum
Inner Panel	1.0 mm (20 Gage) Minimum
Insulation	Foam
Thickness	50 mm (2 inch) Minimum
Density	48 kg/m^3 (3.0 lb/ft^3) Minimum
Total R Value	$2.3 \text{ m}^2\cdot\text{K/W}$ ($13.0 \text{ ft}^2\cdot\text{°F}\cdot\text{hr/Btu}$) Minimum

5. The thickness of insulation, mode of application, and thermal breaks shall be such that there is no visible condensation on the exterior panels of the AHU.
6. Casing panels shall be secured to the support structure with stainless steel or zinc-chromate plated screws and gaskets installed around the panel perimeter. Panels shall be completely removable to allow removal of fan, coils, and other internal components for future maintenance, repair, or modifications. Welded exterior panels are not acceptable.

7. Access Doors: Provide in each access section and where shown on drawings. Show single-sided and double-sided access doors with door swings on the floor plans. Doors shall be a minimum of 50 mm (2 inches) thick with same double wall construction as the unit casing. Doors shall be a minimum of 600 mm (24 inches) wide, unless shown of different size on drawings, and shall be the full casing height up to a maximum of 1850 mm (6 feet). Doors shall be gasketed, hinged, and latched to provide an airtight seal. The access doors for fan section, indirect evaporative cooler and heating coil section shall include a minimum 150 mm x 150 mm (6 inch x 6 inch) double thickness, with air space between glass panes tightly sealed, reinforced glass or Plexiglas window in a gasketed frame. Door frames shall be a minimum 16Ga. 304 stainless steel, welded at the corners.
 - a. Hinges: Manufacturers standard, designed for door size, weight and pressure classifications. Hinges shall hold door completely rigid with minimum 45 kg (100 pound) weight hung on latch side of door.
 - b. Latches: Non-corrosive alloy construction, with operating levers for positive cam action, operable from either inside or outside. Doors that do not open against unit operating pressure shall allow the door to ajar and then require approximately 0.785 radian (45 degrees) further movement of the handle for complete opening. Latch shall be capable of restraining explosive opening of door with a force not less than 1991 Pa (8 inches water gage).
 - c. Gaskets: Neoprene, continuous around door, positioned for direct compression with no sliding action between the door and gasket. Secure with high quality mastic to eliminate possibility of gasket slipping or coming loose.
 8. Provide sealed sleeves, metal or plastic escutcheons or grommets for penetrations through casing for power and temperature control wiring and pneumatic tubing. Coordinate with electrical and temperature control subcontractors for number and location of penetrations. Coordinate lights, switches, and duplex receptacles and disconnect switch location and mounting. All penetrations and equipment mounting may be provided in the factory or in the field. All field penetrations shall be performed neatly by drilling or saw cutting. No cutting by torches will be allowed. Neatly seal all openings airtight.
- D. Unit floor shall be level without offset space or gap and designed to support a minimum of 488 kg/square meter (100 pounds per square foot) distributed load without permanent deformation or crushing of internal insulation. Provide adequate structural base members beneath floor in service access sections to support typical service foot traffic and to prevent damage to unit floor or internal insulation. Unit floors in casing sections, which may contain water or condensate, shall be watertight with drain pan. Floor of unit shall be coated with heresite in wet sections. Floors shall have an upturned flange around the entire perimeter and around all interior chases to contain moisture within the unit.

E. Drain Pan: Drain pan shall be designed to extend entire length of indirect evaporative cooler furnished per Section 23 73 10. Depth of drain pan shall be at least 43 mm (1.7 inches) and shall handle all drains without overflowing. Drain pan shall be double wall construction, minimum 16Ga Type 304 stainless steel and have a minimum of 50 mm (2 inch) insulation, and shall be sloped to drain. Drain pan shall be continuous metal or welded watertight. No mastic sealing of joints exposed to water will be permitted. Drain pan shall be placed on top of casing floor or integrated into casing floor assembly. Drain pan shall be pitched in all directions to drain line.

1. Drain pan shall be piped to the exterior of the unit. Drain pan shall be readily cleanable.
2. Installation, including frame, shall be designed and sealed to prevent blow-by.

F. Plenum Fans – Single Supply Air Fan

1. General: Fans shall be AMCA certified Class II (minimum) construction with single inlet, non-overloading aluminum wheel and stamped air-foil aluminum bladed. The fans shall be EPF (plenum) belt-driven motor shaft in AMCA Arrangement 3, as manufactured by:

- 1) Twin City Fan & Blower
- 2) Greenheck Fan Corporation
- 3) Loren Cook Company
- 4) Approved Equal

Fans shall be dynamically balanced and internally isolated to minimize the vibrations. Provide a steel inlet cone for each wheel to match with the fan inlet. Locate fan in the air stream to assure proper flow. The fan performance shall be rated in accordance with AMCA 210 or ASHRAE 51.

2. Allowable vibration tolerances for fan shall not exceed a self-excited vibration maximum velocity of 0.005 m/s (0.20 inch per second) RMS, filter in, when measured with a vibration meter on bearing caps of machine in vertical, horizontal and axial directions. After field installation, compliance to this requirement shall be demonstrated with field test in accordance with Section 23 05 41, NOISE and VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT and Section 23 05 93, TESTING, ADJUSTING, and BALANCING FOR HVAC. The fan wheel shall meet or exceed guidelines in AMCA 801-92 for dynamic balancing requirements. The complete fan assembly balance shall be tested using an electronic balance analyzer with a tunable filter and stroboscope. Vibration measurements shall be taken on each motor bearing housing in the vertical, horizontal, and axial planes (5 total measurements, 2 each motor bearing and 1 axial).

3. The plenum fans shall be driven by two speed motor controllers, where needed according to the drawings.
4. Fan Airflow Measurement: Provide an airflow measuring device integral to the fan to measure air volume within +/- 5 percent accuracy. The probing device shall not be placed in the airflow path to stay clear of turbulence and avoid loss of performance.
5. Fan Motor, Drive and Mounting Assembly: Fan Motors shall be premium energy efficient type, as mandated by the Energy Policy Act of 2005, with efficiencies as shown in the Specifications Section 23 05 12 GENERAL MOTOR REQUIREMENTS FOR HVAC AND STEAM EQUIPMENT, on drawings and suitable for use in two speed applications where required by the drawings. Refer to Section 23 05 11, COMMON WORK RESULTS FOR HVAC, for additional motor and drive specifications. Refer to Specification Section 26 29 11, MOTOR CONTROLLERS.

G. Exhaust Fan:

1. Roof mounted exhaust fans shall be of the belt driven centrifugal type and shall be BCRU (upblast) as manufactured by:
 - 1) Twin City Fan & Blower
 - 2) Greenheck Fan Corporation
 - 3) Loren Cook Company
 - 4) Approved Equal
- b. Performance: Fans shall be tested in accordance with AMCA 211 and AMCA 311 test codes for air moving devices and shall be guaranteed by the manufacturer to deliver rated published performance levels. Fans shall be licensed to bear the AMCA certified ratings seal for both sound and air. Fans shall be CULUS705 listed.
- c. Construction: Fans shall be constructed of aluminum for durability and appearance. Fan spinings shall have a rolled bead edge for rigidity. Units shall have a deep venture inlet to prevent snow and rain entry into the building. The curb cap shall include prepunched mounting holes for ease of installation. A conduit chase constructed of electrical metallic tubing shall be provided to the motor compartment. The curb base shall provide protection from weather. Lifting lugs shall be provided inside the motor compartment for ease of handling and installation. Fans shall bear a permanently attached nameplate displaying model and serial number of the unit for future identification.
- d. Motor Assembly: Motor assembly shall be mounted on vibration isolators to eliminate vibration and noise transmission into the

ductwork. Motors shall be mounted out of the exhaust airstream and shall have a cooling tube that provides air separate from the exhaust.

- e. Ease of Service: No tools shall be needed to access motor compartment for inspection of motor and drive components.
- f. Wheel: Fan wheels shall be of the centrifugal backward inclined type, constructed of aluminum and containing a marching inlet venture of optimum unit performance. Wheels shall be statically and dynamically balanced.
- g. Shaft
- h. Bearings
- i. Drive
- j. Motor: Motors shall be heavy-duty ball bearing type, closely matched to the fan load. All motors shall be UL and /or CSA recognized. Motors for use with speed control shall provide good speed controllability without any objectionable noise.
- k. Disconnect Switch: A NEMA 3R disconnect switch shall be supplied with wiring leading from the motor to a junction box located outside of the motor compartment.
- l. Finishing and Coating: Fans shall be constructed of aluminum, finished as indicated in Section 09 06 00, SCHEDULE OF FINISHES.
- m. Accessories: When specified accessories such as backdraft damper, roof curb, curb hinge, retaining chain, security hasp, variable speed controller, NEMA-3R disconnect switch, 2-speed switch, firestat, aluminum bird screen, aluminum insect screen, and special coatings shall be provided as indicated on Section 09 06 00, SCHEDULE OF FINISHES to maintain one source responsibility.
- n. Factory Run Test: All fans prior to shipment shall be completely assembled and test run as a unit at operating speed or maximum RPM allowed for the particular construction type. Each wheel shall be statically and dynamically balanced in accordance with ANSI/AMCA 204-96 "Balance Quality and Vibration Levels for Fans" to Fan Application Category BV-3, Balance Quality Grade G6.3. Balance reading shall be taken by electronic type equipment in the axial, vertical, and horizontal directions on each of the bearings. Records shall be maintained and a written copy shall be available upon request.

- K. Discharge Section: Provide aerodynamically designed framed discharge openings or spun bellmouth fittings to minimize pressure loss.
- L. Electrical and Lighting: Wiring and equipment specifications shall conform to Division 26, ELECTRICAL.
 - 1. Vapor-proof lights using cast aluminum base style with glass globe and cast aluminum guard shall be installed in access sections for fan, indirect evaporative cooler and any section over 300mm (12 inch) wide. A switch shall control the lights in each compartment with pilot light mounted outside the respective compartment access door. Wiring between switches and lights shall be factory installed. All wiring shall run in neatly installed electrical conduits and terminate in a junction box for field connection to the building system. Provide single point 115 volt - one phase connection at junction box.
 - 2. Install compatible 100 watt bulb in each light fixture.
 - 3. Provide a convenience duplex weatherproof receptacle next to the light switch.
 - 4. Disconnect switch and power wiring: Provide factory or field mounted disconnect switch. Coordinate with Division 26, ELECTRICAL.
 - 5. The MAHU's shall have single point of power connection with field wiring from the unit up to exhaust fan on roof.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Install modular air handling unit in conformance with ARI 435.
- B. Assemble air handling unit components following manufacturer's instructions for handling, testing and operation. Repair damaged galvanized areas with paint in accordance with Military Spec. DOD-P-21035A. Repair painted units by touch up of all scratches with finish paint material. Vacuum the interior of air-handling units clean prior to operation.
- C. Connect exhaust plenum with roof top UP blast exhaust fan as indicated on the drawing per Section 23 31 00, HVAC DUCTS AND CASINGS.
- D. Install seismic restraints for modular air handling units. Refer to specification Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.
- E. Install roof top exhaust fan on prefabricated curb per Section 23 34 00, HVAC Fans.
- F. Leakage and test requirements for MAHU units shall be the same as specified for ductwork in Specification Section 23 31 00, HVAC DUCTS AND CASINGS

except leakage shall not exceed Leakage Class (C_L) 12 listed in SMACNA HVAC Air Duct Leakage Test Manual when tested at 1.5 times the design static pressure. Repair casing air leaks that can be heard or felt during normal operation and to meet test requirements.

- G. Perform field mechanical (vibration) balancing in accordance with Section 23 05 41, NOISE and VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT.
- H. Seal and/or fill all openings between the casing and MAHU components and utility connections to prevent air leakage or bypass.

3.2 STARTUP SERVICES

- A. The air handling unit shall not be operated for any purpose, temporary or permanent, until ductwork is clean, filters are in place, bearings are lubricated and fan has been test run under observation.
- B. After the air handling unit is installed and tested, provide startup and operating instructions to VA personnel.
- C. An authorized factory representative should start up, test and certify the final installation and application specific calibration of control components. Items to be verified include fan performance over entire operating range, noise and vibration testing, verification of proper alignment, overall inspection of the installation, Owner/Operator training, etc.

3.3 COMMISSIONING

- A. Provide commissioning documentation in accordance with the requirements of Section 23 08 00 – COMMISSIONING OF HVAC SYSTEMS for all inspection, start up, and contractor testing required above and required by the System Readiness Checklist provided by the Commissioning Agent.
- B. Components provided under this section of the specification will be tested as part of a larger system. Refer to Section 23 08 00 – COMMISSIONING OF HVAC SYSTEMS and related sections for contractor responsibilities for system commissioning.

END OF SECTION 23 74 17