

**SECTION 23 73 00**  
**INDOOR CENTRAL-STATION AIR-HANDLING UNITS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

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

**1.2 RELATED WORK**

- B. General mechanical requirements and items, which are common to more than one section of Division 23: Section 23 05 11, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION.
- C. Sound and vibration requirements: Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT.
- D. Piping and duct insulation: Section 23 07 11, HVAC, PLUMBING, AND BOILER PLANT INSULATION.
- E. Piping and valves: Section 23 21 13 HYDRONIC PIPING
- F. Heating and cooling coils and pressure requirements: Section 23 82 16, AIR COILS.
- G. Requirements for flexible duct connectors, sound attenuators and sound absorbing duct lining, and air leakage: Section 23 31 00, HVAC DUCTS AND CASINGS .
- H. HVAC controls: Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.
- I. Testing, adjusting and balancing of air and water flows: Section 23 05 93, TESTING, ADJUSTING, AND BALANCING FOR HVAC.

**1.3 QUALITY ASSURANCE**

- A. Refer to Article, Quality Assurance, in Section 23 05 11, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION.
- B. Air Handling Units Certification: Certify air-handling units in accordance with ARI 430.

C. Heating, Cooling, and Air Handling Capacity and Performance Standards: ARI 430, ARI 410, ASHRAE 51, and AMCA 210.

D. Performance Criteria:

1. The fan schedule indicates design cubic meter per minute (cubic feet per minute) and design static pressure. Scheduled fan motors, 375 watts (1/2 horsepower) and larger, are sized for the maximum of design cubic meter per minute (cubic feet per minute) at 110 percent design static pressure, but not to exceed 187 Pa (3/4 inch water gage) additional pressure.
2. Fans and motors shall be capable of stable operation at design conditions cubic meters per minute (cubic feet per minute) and 110 percent pressure as stated above.
3. Lower than design pressure drop of approved individual components may allow use of a smaller fan motor and still provide the safety factor. When submitted as a deviation, a smaller motor may be approved in the interest of energy conservation. Such a deviation shall not qualify for any value engineering incentive claim or reward.
4. Select fan operating point to right hand side of peak static pressure point and near the peak of static efficiency.
5. Operating Limits: AMCA 99.

E. Units shall be constructed by a manufacturer who has been manufacturing air handling units for at least five (5) years.

F. Units shall be shipped in one (1) piece where possible and in shrink wrapping to protect the unit from dirt, moisture and /or road salt. Shipping splits can be provided as required for installation. Lifting lugs will be supplied on each side of the split to facilitate rigging and joining of segments.

#### **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 air handling 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 AHUs shall include fans, drives, motors, coils, 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. 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; and 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.
2. Submit sound power levels in each octave band for fan and at entrance and discharge of AHUs 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.
3. Provide fan curves showing cubic meters per minute (cubic feet per minute), static pressure, efficiency, and horsepower for design point of operation and at maximum design cubic meters per minute (cubic feet per minute) and 110 percent of design static pressure.
4. Submit total fan static pressure, external static pressure, for AHU 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.

**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 and Refrigeration Institute (ARI):
  - 260-01 ..... Sound Rating of Ducted Air Moving and Conditioning Equipment
  - 410-01 ..... Standard for Forced-Circulation Air-Heating and Air-Cooling Coils
  - 430-89 ..... Standard for Central Station Air Handling Units
  - ARI-DCAACP..... Directory of Certified Applied Air Conditioning Products
- C. Air Moving and Conditioning Association (AMCA):
  - 210-00 ..... Laboratory Methods of Testing Fans for Rating
- D. Anti-Friction Bearing Manufacturer's Association, Inc. (AFBMA):
  - 9-90 ..... Load Ratings and Fatigue life for Ball Bearings
- E. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE):
  - 51-01 ..... Standard, Laboratory Methods of Testing Fans for Rating
- F. American Society for Testing and Materials (ASTM):
  - A653/653M-02 ..... Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
  - B117-97 ..... Salt Spray (Fog) Testing
  - C1071-00..... Thermal and Acoustical Insulation (Mineral Fiber, Duct Lining Material)

- D1654-00 ..... Standard Method for Evaluation of Painted or Coated  
Specimens Subjected to Corrosive Environments
- D1735-97 ..... Water Resistance of Coatings Using Water Fog Apparatus
- D3359-95 ..... Standard Test Methods for Measuring Adhesion by Tape  
Test
- E84-01..... 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-77 ..... Paint, High Zinc Dust Content, Galvanizing Repair
- I. National Fire Protection Association (NFPA):
  - 90A-99 ..... Installation of Air Conditioning and Ventilating Systems

**PART 2 - PRODUCTS**

**2.1 AIR HANDLING UNITS**

A. General:

1. AHUs shall be entirely of double wall galvanized steel construction. Casing is specified in paragraph 2.1.C. Foil face lining is not an acceptable substitute for double wall construction. 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.
2. The contractor and the AHU 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.

3. 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. 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.
4. The AHU 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.
5. 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.
6. 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.

B. Base:

1. Provide a heavy duty 100-150 mm (4-6 inch) mounting legs for supporting all AHU major 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 cooling coil condensate drain trap and as shown on drawings.
2. AHUs shall be completely self supporting for installation on , steel support pedestals.
  3. The AHU 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: AHU casing shall be entirely double wall insulated panels, 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 ASTM B117 125-hour or better salt-spray test (5 percent solution). All casing and panel sections shall be tightly butted 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 shall be minimum 51 mm (2 inches) thick, constructed of minimum 1.3 mm (18 gauge) outer skin and 1.0 mm (20 gauge) solid or perforated inner skin. Perforated panels (inner skin) are not allowed in cooling coil sections, floors, door panels and where solid sheet is required to avoid air bypass. AHUs serving surgical suites shall have all surfaces, exposed to supply air, made of stainless steel from after-filter discharge to AHU discharge. Slight exposure of galvanized metal at assembly and access points will be acceptable. Casings of these sections must be without perforations and shall be same gauge thickness as specified above.
  3. Blank-Off: Provide where required to insure no air bypass between sections, through perforated panels or around coils or filters. Blank-Off shall be installed at each component of the air handling unit and also at the internal panels to prevent recirculation of the air through perforated panels. Seal any holes where bypass occurs.
  4. Insulation: High density, insulation shall be 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, 24 kg/m<sup>3</sup> and (1.5 lb/ft<sup>3</sup>) with a thermal conductivity R of approximately 13.8 W/m.K (8.0 BTU/hr-ft<sup>2</sup>°F). Air handling 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, PLUMBING, AND BOILER PLANT INSULATION.
5. Condensation through metal connections between inner and outer panels shall be kept to an absolute minimum.
  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.
- E. Condensate Drain Pan: Drain pan shall be designed to extend entire length of cooling coils including headers and return bends. Depth of drain pan shall be at least 43 mm (1.7 inches) and shall handle all condensate without overflowing. Drain pan shall be of double wall construction of 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.
2. Drain pan shall be piped to the exterior of the unit. Drain pan shall be readily cleanable.
  3. Installation, including frame, shall be designed and sealed to prevent blow-by.
- F. Fans Sections:
1. Fans shall be minimum Class II construction, double width, type as indicated on drawings, factory balanced and rated in accordance with AMCA 210 or ASHRAE 51. Provide self-aligning, pillow block, regreasable ball-type bearings selected for a B (10) life of not less than 40,000 hours and an L(50) average fatigue life of 200,000 hours

per AFBMA Standard 9. Extend bearing grease lines to motor and drive side of fan section. Fan shall be located in airstream to assure proper air flow.

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 or measured at equipment mounting feet if bearings are concealed. 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.

G. Fan Motor, Drive and Mounting Assembly:

1. Provide internally vibration isolated fan, motor and drive, mounted on a common integral bolted or welded structural steel base with adjustable motor slide rail with locking device. Provide vibration isolators and flexible duct connections at fan discharge to completely isolate fan assembly. Refer to Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT, for additional requirements.
2. Fan Motor and Drive: Motors shall be energy efficient type with efficiencies as shown on drawings.
3. Fan drive and belts shall be factory mounted with final alignment and belt adjustment to be made by the Contractor after installation. Drive and belts shall be as specified in Section 23 05 11, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION. Provide additional drive(s) if required during balancing, to achieve desired airflow.

H. Filter Section:

1. Filters including one complete set for temporary use at site shall be provided independent of the AHU. The AHU manufacturer shall install filter housings and racks in filter section compatible with filters furnished. The AHU manufacturer shall be

- responsible for furnishing temporary filters (pre-filters and after-filters, as shown on drawings) required for AHU testing.
2. Factory-fabricated filter section shall be of the same construction and finish as the AHU casing including filter racks and hinged double wall access doors. Filter housings shall be constructed in accordance with side service or holding frame housing requirements
  - I. Coils: Coils shall be mounted on hot dipped galvanized steel supports to assure proper anchoring of coil and future maintenance. Coils shall be face or side removable for future replacement thru the access doors or removable panels. Each coil shall be removable without disturbing adjacent coil. Cooling coils shall be designed and installed to insure no condensate carry over. Provide factory installed extended supply, return, drain and vent piping connections. Refer to Drawings and Section 23 82 16, AIR COILS for additional coil requirements.
    1. Water Coils
  - J. Discharge Section: Provide aerodynamically designed framed discharge openings or spun bellmouth fittings to minimize pressure loss.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Install 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-21035. 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. Leakage and test requirements for air handling 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.

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

### **3.2 STARTUP SERVICES**

- A. A factory-trained service representative of the manufacturer shall supervise the unit startup and application specific calibration of control components.
- B. 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.
- C. After the air handling unit is installed and tested, provide startup and operating instructions to VA personnel.

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