

**SECTION 23 34 00**  
**HVAC FANS**

SPEC WRITER NOTES:

1. Delete between // // if not applicable to project. Also delete any other item or paragraph not applicable in the Section and renumber the paragraphs.
2. Provide the year of latest edition to each publication given in paragraph APPLICABLE PUBLICATIONS.

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. A complete listing of common acronyms and abbreviations are included in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.
- B. Fans for heating, ventilating and air conditioning.
- C. Product Definitions: AMCA 99.

**1.2 RELATED WORK**

- A. Section 01 00 00, GENERAL REQUIREMENTS.
- B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.
- C. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.
- D. //Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS.//
- E. //Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.//
- F. Section 23 05 11, COMMON WORK RESULTS FOR HVAC.
- G. //Section 23 05 12, GENERAL MOTOR REQUIREMENTS FOR HVAC and STEAM GENERATION EQUIPMENT.//
- H. Section 23 05 41, NOISE and VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT.
- I. Section 23 05 93, TESTING, ADJUSTING, and BALANCING FOR HVAC.
- J. //Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.//
- K. //Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.//
- L. Section 23 73 00, INDOOR CENTRAL-STATION AIR-HANDLING UNITS.
- M. //Section 23 82 16, AIR COILS.//
- N. Section 26 29 11, MOTOR CONTROLLERS.

**1.3 APPLICABLE PUBLICATIONS**

SPEC WRITER NOTES:

1. Make material requirements agree with requirements specified in the referenced Applicable Publications. Verify and update the publication list to that which applies to the project

unless the reference applies to all HVAC systems. Publications that apply to all HVAC systems may not be specifically referenced in the body of the specification but shall form a part of this specification.

2. Insert the year of approved latest edition of the publications between the brackets // // and delete the brackets if applicable to this project.
- 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. Where conflicts occur these specifications and the VHA standards will govern.
- B. Air Movement and Control Association International, Inc. (AMCA):
- 99-//2016//.....Standards Handbook
  - 210-//2016//.....Laboratory Methods of Testing Fans for  
Aerodynamic Performance Rating
  - 300-//2014//.....Reverberant Room Method for Sound Testing of  
Fans
- C. American Society for Testing and Materials (ASTM):
- B117-//2019//.....Standard Practice for Operating Salt Spray  
(Fog) Apparatus
  - D1735-//2014//.....Standard Practice for Testing Water Resistance  
of Coatings Using Water Fog Apparatus
  - D3359-//2017//.....Standard Test Methods for Rating Adhesion by  
Tape Test
  - G152-//2013 (R2021)//....Standard Practice for Operating Open Flame  
Carbon Arc Light Apparatus for Exposure of  
NonMetallic Materials
  - G153-//2013 (R2021)//....Standard Practice for Operating Enclosed Carbon  
Arc Light Apparatus for Exposure of NonMetallic  
Materials
- D. National Fire Protection Association (NFPA):
- NFPA 96-//2021//.....Standard for Ventilation Control and Fire  
Protection of Commercial Cooking Operations
- E. National Sanitation Foundation (NSF):
- 37-//2020 //.....Air Curtains for Entranceways in Food and Food  
Service Establishments
- F. Underwriters Laboratories, Inc. (UL):

181-//2013//.....Standard for Factory-Made Air Ducts and Air  
Connectors

**1.4 SUBMITTALS**

- A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Information and material submitted under this section shall be marked "SUBMITTED UNDER SECTION 23 XX XX, SECTION TITLE", with applicable paragraph identification.
- C. Manufacturers Literature and Data Including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.
  - 1. Plenum fan, motors, and drives.
  - 2. Centrifugal fans, motors, drives, accessories, and coatings.
    - a. Inline centrifugal fans.
    - b. Tubular Centrifugal Fans.
    - c. Up-blast kitchen hood exhaust fans.
    - d. Industrial fans.
    - e. Utility fans and vent sets.
  - 3. Power roof and wall ventilators.
  - 4. Centrifugal ceiling fans.
  - 5. Propeller fans.
  - 6. Packaged hood make-up air units.
  - 7. Vane axial fans.
  - 8. Tube-axial fans.
  - 9. Air curtain units.
  - 10. Belt guards.
- D. Certified sound power levels for each fan.
- E. Motor ratings, types, electrical characteristics, and accessories.
- F. Certified fan performance curves for each fan showing cubic feet per minute (CFM) versus static pressure, efficiency, and horsepower for design point of operation.

SPEC WRITER NOTE: Coordinate O&M Manual and commissioning requirements with Section 01 00 00, GENERAL REQUIREMENTS and Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS. O&M Manuals shall be submitted for content review as part of closeout documents.

- G. Complete operating and maintenance manuals including wiring diagrams, technical data sheets, information for ordering replaceable parts, and troubleshooting guide:
  - 1. Include complete list indicating all components of the systems.
  - 2. Include complete diagrams of the internal wiring for each item of equipment.
  - 3. Diagrams shall have their terminals identified to facilitate installation, operation, and maintenance.
- H. //Completed System Readiness Checklist provided by the CxA 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.//
- I. //Submit training plans and instructor qualifications in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.//

#### **1.5 QUALITY ASSURANCE**

- A. Fans and power ventilators shall bear the AMCA performance seal.
- B. Operating Limits for Centrifugal Fans: AMCA 99 (Class I, II, and III).
- C. Fans and power ventilators shall comply with the following standards:
  - 1. Testing and Rating: AMCA 210.
  - 2. Sound Rating: AMCA 300.
- D. Vibration Tolerance for Fans and Power Ventilators: Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT.
- E. Performance Criteria:
  - 1. The fan schedule shall show the design air volume and static pressure. Select the fan motor hp by increasing the fan bhp by 10 percent to account for the drive losses and field conditions.
  - 2. Select the fan operating point as follows:
    - a. Forward Curve and Axial Flow Fans: Right hand side of peak pressure point.
    - b. Air Foil, Backward Inclined, or Tubular: At or near the peak static efficiency.
- F. Safety Criteria: Provide manufacturer's standard screen on fan inlet and discharge where exposed to operating and maintenance personnel.
- G. Corrosion Protection:
  - 1. Except for fans in fume hood exhaust service, all steel shall be mill-galvanized, or phosphatized and coated with minimum two coats,

corrosion resistant enamel paint. Manufacturer's paint and paint system shall meet the minimum requirements of ASTM D1735 water fog, ASTM B117 salt spray, ASTM D3359 adhesion, and ASTM G152 and ASTM G153 for carbon arc light apparatus for exposure of non-metallic material.

2. Fans for general purpose fume hoods, or chemical hoods, and radioisotope hoods shall be constructed of materials compatible with the chemicals being transported in the air through the fan.
- H. Spark resistant construction: If flammable gas, vapor or combustible dust is present in concentrations above 20 percent of the Lower Explosive Limit (LEL), the fan construction shall be as recommended by AMCA's Classification for Spark Resistant Construction. Drive set shall be comprised of non-static belts for use in an explosive.
- I. Bio-Based Materials: For products designated by the USDA's Bio-Preferred Program, provide products that meet or exceed USDA recommendations for bio-based content, so long as products meet all performance requirements in this specifications section. For more information regarding the product categories covered by the Bio-Preferred Program, visit <http://www.biopreferred.gov>.
- J. Refer to Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS for additional sustainable design requirements.

#### **1.6 AS-BUILT DOCUMENTATION**

- A. Comply with requirements in paragraph AS-BUILT DOCUMENTATION of Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

#### **1.7 EXTRA MATERIALS**

- A. Provide one additional set of belts for all belt-driven fans.

### **PART 2 - PRODUCTS**

#### **2.1 PLENUM FAN**

SPEC WRITER NOTE: Number of plenum fans in each array shall not exceed four (4). Number of fans in an array shall be based on the percentage redundancy included in the design and other factors, such as, acoustics, overall space requirements, and power input.

- A. Plenum Fans - Single and/or Multiple Fans in an Array:
  1. General: Fans shall be Class II (minimum) construction with single inlet, aluminum wheel and stamped air-foil aluminum bladed. The fan wheel shall be mounted on the directly-driven motor shaft in AMCA Arrangement 4. 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 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. Following fan assembly, 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 variable speed drives with at least one back-up drive as shown in the design documents. Use of a drive with bypass is not permitted.
4. Multiple fans shall be installed in a pre-engineered structural frame to facilitate fan stacking. All fans shall modulate in unison, above or below the synchronous speed within the limits specified by the manufacturer, by a common control sequence. Staging of the fans is not permitted. Redundancy requirement shall be met by all operating fans in an array and without the provision of an idle standby fan.
5. Fan Accessories
  - a. Fan Isolation: Provide //an actuator-controlled damper// //a manual blank off plate// //an automatic back draft damper// to isolate the fan not in operation due to failure.
  - b. 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.

**2.2 CENTRIFUGAL FANS**

- A. Record factory vibration test results on the fan or furnish to the Contractor.

SPEC WRITER NOTE: Coordinate fan arrangement with the equipment schedule in the contract documents.

- B. Fan arrangement, unless noted or approved otherwise:
1. DWD1 fans: Arrangement 3.
  2. SWS1 fans: Arrangement 1, 3, 9 or 10//, except for fume hood (H7 or H13) exhaust fans Arrangement 3 shall not be acceptable//.
- C. Construction: Wheel diameters and outlet areas shall be in accordance with AMCA standards.
1. Housing: Low carbon steel, arc welded throughout, braced and supported by structural channel or angle iron to prevent vibration or pulsation, flanged outlet, inlet fully streamlined. Provide lifting clips, and casing drain. Provide manufacturer's standard access door. Provide 13 mm (1/2 inches) wire mesh screens for fan inlets without duct connections.
  2. Wheel: Steel plate with die formed blades welded or riveted in place, factory balanced statically and dynamically.
  3. Shaft: Designed to operate at no more than 70 percent of the first critical speed at the top of the speed range of the fans class.
  4. Bearings: Heavy duty ball or roller type sized to produce a B10 life of not less than 50,000 hours, and an average fatigue life of 200,000 hours. Extend filled lubrication tubes for interior bearings or ducted units to outside of housing.
  5. Belts: Oil resistant, non-sparking and non-static.
  6. Belt Drives: Factory installed with final alignment belt adjustment made after installation.
  7. Motors and Fan Wheel Pulleys: Adjustable pitch for use with motors through 15 hp, fixed pitch for use with motors greater than 15 hp. Select pulleys so that pitch adjustment is at the middle of the adjustment range at fan design conditions.
  8. Motor, adjustable motor base, drive and guard: Furnish from factory with fan. Provide protective sheet metal enclosure for fans located outdoors. Refer to Section 23 05 11, COMMON WORK RESULTS FOR HVAC for specifications.

9. Furnish variable speed fan motor controllers where shown in the contract documents. Refer to Section 26 29 11, MOTOR CONTROLLERS. Refer to Section 23 05 11, COMMON WORK RESULTS FOR HVAC for controller/motor combination requirements.
- D. Inline Centrifugal Fans: Provide minimum 18 Gauge galvanized steel housing with inlet and outlet flanges, backward inclined aluminum centrifugal fan wheel, bolted access door and supports as required. Motors shall be factory pre-wired to an external junction box.  
//Provide factory wired disconnect switch.//
- E. Tubular Centrifugal Fans: Provide hot rolled steel, one-piece design housing incorporating integral guide vanes, motor mounts, bolted access hatch and end flanges. Provide spun inlet bell and screen for unducted inlet and screen for unducted outlet. Provide welded steel, flanged inlet and outlet cones for ducted connection. Provide mounting legs or suspension brackets as required for support. Guide vanes shall straighten the discharge air pattern to provide linear flow.
- F. Industrial Fans: Use where scheduled or in lieu of centrifugal fans for low volume high static service. Provide material handling flat blade type fan wheel.
- G. Utility Fans, Vent Sets and Small Capacity Fans: Class 1 design, arc welded housing, spun intake cone. Requirement for AMCA seal is waived for wheel diameters less than 300 mm (12 inches) and housings may be cast-iron.

SPEC WRITER NOTES:

1. Designate the fans that are required to be explosion proof in the Fan Schedule.
  2. Select AMCA A, B or C spark resistant construction as required for application.
- H. Spark Resistant/Explosion Proof Fans: If flammable gas, vapor, or combustible dust is present in concentrations above 20 percent of the Lower Explosive Limit (LEL), provide AMCA construction option: A, B or C as indicated. Drive set shall be comprised of non-static belts for use in an explosive atmosphere. Motor shall be explosion proof type if located in air stream.

**2.3 POWER ROOF VENTILATOR**

SPEC WRITER NOTE: Coordinate with height of roof curb shown in the contract documents.

- A. Type: Centrifugal fan, backward inclined blades. Provide down-blast or up-blast type as indicated.
- B. Construction: Steel or aluminum, completely weatherproof, for curb mounting, exhaust cowl or entire drive assembly readily removable for servicing, aluminum bird screen on discharge, UL approved safety disconnect switch, conduit for wiring, vibration isolators for wheel, motor and drive assembly. Provide self-acting back draft damper.  
//Provide electric motor operated damper where indicated.//
- C. Motor and Drive: Refer to Section 23 05 11, COMMON WORK RESULTS FOR HVAC. Bearings shall be pillow block ball type with a minimum L-50 life of 200,000 hours. Motor shall be located out of air stream.
- D. Up-blast Type: Top discharge exhauster, motor out of air stream. For kitchen hood exhaust applications, provide grease trough on base and threaded drain. The mounting height of the kitchen up-blast exhaust fan shall be in compliance with NFPA 96. (Provide vented curb extension if required to maintain required clearances.)

#### **2.4 POWER WALL VENTILATOR**

- A. Type: Centrifugal fan, backward inclined blades.
- B. Construction: Steel or aluminum, completely weatherproof, for wall mounting, exhaust cowl or entire drive assembly readily removable for servicing, aluminum bird screen on discharge, UL approved safety disconnect switch, conduit for wiring, vibration isolators for wheel, motor and drive assembly. Provide self-acting back draft damper.
- C. Motor and Drive: Refer to Section 23 05 11, COMMON WORK RESULTS FOR HVAC. Bearings shall be pillow block ball type with a minimum L-50 life of 200,000 hours. Motor shall be located out of air stream.

#### **2.5 PACKAGED HOOD MAKE-UP AIR UNITS**

- A. Curb mounted air supply unit complete with centrifugal blower and filters.
  - 1. Housing: Galvanized steel with baffled air intake for weather protection and with duct adapter.
  - 2. Blower: Ball bearing utility type with vibration mounts to isolate blower, motor and drive.
  - 4. Filters: Provide four 2 inch MERV 8 disposable filters.
- B. Provide easy access to motor and drive.

SPEC WRITER NOTE: Provide heating coil where tempered make-up air is required.

- C. Provide //hot water// //steam// //electric// heating coil where scheduled. Refer to specification Section 23 82 16, AIR COILS.

#### **2.6 CENTRIFUGAL CEILING FANS**

- A. Steel housing, baked enamel finish, direct connected fan assembly, attached grille. Provide gravity back draft assembly, aluminum wall cap and bird or insect screen. //Provide electric motor operated damper where indicated.//
- B. Acoustical Lining: 13 mm (1/2 inch) thick mineral fiber, dark finish. Comply with UL 181 for erosion.
- C. Motor: Shaded pole or permanent split capacitor, sleeve bearings, supported by steel brackets in combination with rubber isolators.
- D. Ceiling Grille, (Where indicated): White plastic egg crate design, 80 percent free area.
- E. Control: Provide solid state speed control (located at unit) for final air balancing.

#### **2.7 PROPELLER FANS**

- A. Belt-driven or direct-driven fans as indicated in the contract documents.
- B. Square steel panel, deep drawn venturi, arc welded to support arms and fan/motor support brackets, baked enamel finish. Provide wall collar for thru-wall installations.
- C. Motor, Motor Base and Drive: Refer to Section 23 05 11, COMMON WORK RESULTS FOR HVAC. Motor shall be totally enclosed type.
- D. //Wall Shutter: Fan manufacturer's standard, steel frame, aluminum blades, heavy duty stall type electric damper motor, spring closed.//
- E. Wire Safety Guards: Provide on exposed inlet and outlet.

#### **2.8 VANE AXIAL FANS**

SPEC WRITER NOTE: The designer shall analyze fan noise generated by such fans and make provision for noise reduction to comply with VA noise criteria and local ordinance.

- A. The requirements for AMCA listing and seal are waived.
- B. Fan Housings: Hot rolled steel, one-piece design, incorporating integral guide vanes, motor mounts, bolted access hatch and end flanges. Provide spun inlet bell and screen for unducted inlet and screen for unducted outlet. Provide welded steel, flanged inlet and outlet cones for ducted connection. Provide mounting legs or suspension

brackets as required for support. Guide vanes shall straighten the discharge air pattern to provide linear flow.

- C. Impeller: Heat treated cast aluminum alloy incorporating airfoil blades. Impellers shall be balanced statically and dynamically prior to installation on the shaft and as an integral unit prior to shipment.
- D. Variable Pitch Type: Pitch of all blades shall be continuously and simultaneously adjustable throughout the complete pitch range while the impeller is operating at full speed. Blade pitch adjustment shall be accomplished by a factory furnished, mounted, adjusted and tested pneumatic operator with positive positioner relay. Signal pressure shall be 103 kPa (15 psig) and operating pressure shall be 450 kPa to 550 kPa (65 to 80 psig).

SPEC WRITER NOTE: Variable pitch type is direct drive.

- E. Fan Drive: Direct drive or belt drive as scheduled, arrangement 4, with motor located inside fan housing on discharge side of impeller, NEMA C motor mounting, bearings B10 with average operating life of 200,000 hours, motor wiring leads and bearing lubrication lines extended to outside of housing. Refer to Section 23 05 11, COMMON WORK RESULTS FOR HVAC for motor specifications.

SPEC WRITER NOTE: Non-heating air curtains are required for outside doors to Subsistence Storage Room and Kitchens.

## 2.9 AIR CURTAIN UNITS

- A. Manufacturer's standard, high velocity, non-recirculating type with demonstrated performance in effectively preventing entry of dust and insects and effectively stopping inflow of air due to winds of 24 km/h (15 mph) velocity. AMCA seal is waived. Units for kitchens or food storage shall comply with NSF 37.
- B. Casing: Sheet metal or polycarbonate plastic. Provide internal or external vibration isolation to effectively prevent transmission of vibration and noise from units to building structure. Units shall completely house all parts and have manufacturer's standard finish coating.
- C. Fans: Ruggedly constructed, statically and dynamically balanced. Noise level shall not exceed 77 dBA measured at 1.5 m (5 feet) distance.
- D. Air Discharge Outlet Nozzle: Cover full width of door opening. Fan discharge ducts, plenum, flow control vanes and nozzles shall provide a

uniform distribution of air over entire length of door. Provide adjustable volume and directional control.

- E. Heating Coil: Provide //electric// //steam// //hot water// heating coil. Maximum discharge air temperature shall be 49 degrees C (120 degrees F).
- F. Controls: Provide on-off door operated switch. The "on-off" switch circuit shall close to start fan motors when door starts to open and open when the door reaches closed position. A local disconnect switch for each fan motor shall be provided and shall be mounted to be accessible without use of ladder.
- G. Motors: Fan motors shall be of type suitable for service conditions, sealed ball bearings, resilient mounting and automatic thermal overload switch.

### **PART 3 - EXECUTION**

SPEC WRITER NOTES: If any metering work is required, coordinate with Section 25 10 10, ADVANCED UTILITY METERING SYSTEM.

#### **3.1 INSTALLATION**

- A. If an installation is unsatisfactory to the COR, the contractor shall correct the installation at no additional cost or time to the Government.
- B. Install fan, motor and drive in accordance with manufacturer's instructions.
- C. Align fan and motor sheaves to allow belts to run true and straight.
- D. Bolt equipment to curbs with galvanized lag bolts.
- E. Install vibration control devices as shown in the contract documents and specified in Section 23 05 41, NOISE and VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT.

#### **3.2 PRE-OPERATION MAINTENANCE**

- A. Lubricate bearings, pulleys, belts and other moving parts with manufacturer recommended lubricants.
- B. Rotate impeller by hand and check for shifting during shipment and check all bolts, collars, and other parts for tightness.
- C. Clean fan interiors to remove foreign material and construction dirt and dust.

#### **3.3 STARTUP AND TESTING**

- A. Verify operation of motor, drive system and fan wheel according to the contract documents.
- B. Check vibration and correct as necessary for air balance work.

- C. After air balancing is complete and permanent sheaves are in place perform necessary field mechanical balancing to meet vibration tolerance in Section 23 05 41, NOISE and VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT.
- D. Perform tests as recommended by product manufacturer and listed standards and under actual or simulated operating conditions and prove full compliance with design and specified requirements. Tests of the various items of equipment shall be performed simultaneously with the system of which each item is an integral part.
- E. When any defects are detected, correct defects and repeat test at no additional cost or time to the Government.
- F. //The CxA will observe startup and contractor testing of selected equipment. Coordinate the startup and contractor testing schedules with the COR and CxA. Provide a minimum notice of 10 working days prior to startup and testing.//

### **3.3 //COMMISSIONING**

- A. Provide commissioning documentation in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.
- B. Components provided under this section of the specification will be tested as part of a larger system.//

### **3.4 DEMONSTRATION AND TRAINING**

- A. Provide services of manufacturer's technical representative for //4//  
// // hour//s// to instruct each VA personnel responsible in operation and maintenance of the system.
- B. //Submit training plans and instructor qualifications in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.//

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