

Copyright 2009 by The American Institute of Architects (AIA)

Exclusively published and distributed by Architectural Computer Services, Inc. (ARCOM) for the AIA

Modified by MSU Physical Plant / Engineering and Architectural Services

SECTION 233423 - HVAC POWER VENTILATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Utility set fans.
 - 2. Centrifugal roof ventilators.
 - 3. Axial roof ventilators.
 - 4. Upblast propeller roof exhaust fans.
 - 5. Centrifugal wall ventilators.
 - 6. In-line centrifugal fans.
 - 7. Propeller fans.

1.3 PERFORMANCE REQUIREMENTS

- A. Operating Limits: Classify according to AMCA 99.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Also include the following:
 - 1. Certified fan performance curves with system operating conditions indicated.
 - 2. Certified fan sound-power ratings.
 - 3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
 - 4. Material thickness and finishes, including color charts.
 - 5. Dampers, including housings, linkages, and operators.
 - 6. Fan speed controllers.
- B. Shop Drawings:

1. Include plans, elevations, sections, details, and attachments to other work.
2. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Wiring Diagrams: Power, signal, and control wiring.
4. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, and base weights.

1.5 INFORMATIONAL SUBMITTALS

- A. Field quality-control test reports.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For power ventilators to include in emergency, operation, and maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Belts: One set for each belt-driven unit.

1.8 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. AMCA Compliance: Fans shall have AMCA-Certified performance ratings and shall bear the AMCA-Certified Ratings Seal.
- C. UL Standard: Power ventilators shall comply with UL 705. Power ventilators for use for restaurant kitchen exhaust shall also comply with UL 762.

1.9 COORDINATION

- A. Coordinate size and location of structural-steel support members.
- B. Coordinate size and location of concrete bases with actual equipment provided.
- C. Coordinate installation of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

PART 2 - PRODUCTS

2.1 UTILITY SET FANS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Aerovent; a Twin City Fan Company.
 2. Greenheck.
 3. Loren Cook Company.
 4. Trane.
- B. Description: Belt-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, and accessories.
- C. Housing: Fabricated of steel with side sheets fastened with a deep lock seam or welded to scroll sheets.
1. Housing Discharge Arrangement: Adjustable to eight standard positions.
- D. Fan Wheels: Single-width, single inlet; welded to cast-iron or cast-steel hub and spun-steel inlet cone, with hub keyed to shaft.

Select wheel material and blade style in first two subparagraphs below. Some materials and styles are not available in all sizes.

1. Blade Materials: Steel or aluminum.
2. Blade Type: Backward inclined or airfoil.

Retain subparagraph below for spark-resistant construction and coordinate with "Blade Materials" Subparagraph above. Select construction type.

3. Spark-Resistant Construction: AMCA 99, Type A, B or C.

- E. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
- F. Shaft Bearings: Prelubricated and sealed, self-aligning, pillow-block-type ball bearings with ABMA 9, L₁₀ of 200,000 hours. Utilize bearings featuring eccentric collar type shaft lock.
1. Extend grease fittings to accessible location outside of unit. Pre-charge tubing with lubricant.

Retain "Belt Drives" Paragraph below if belt-driven fans are required; delete if only direct-drive fans are required.

- G. Belt Drives: Factory mounted, with final alignment and belt adjustment made after installation.
1. Service Factor Based on Fan Motor Size: 1.5.
 2. Motor Pulleys: Adjustable pitch for use with motors through 5 hp; fixed pitch for use with larger motors. Select pulley so pitch adjustment is at the middle of adjustment range at fan design conditions.
 3. Belts: Oil resistant, nonsparking, and nonstatic; matched sets for multiple belt drives.

4. Belt Guards: Fabricate of steel for motors mounted on outside of fan cabinet. Utilize bearings featuring eccentric collar type shaft lock.

H. Accessories:

Retain accessories in subparagraphs below as necessary.

1. Inlet and Outlet: Flanged.
2. Companion Flanges: Rolled flanges for duct connections of same material as housing.
3. Access Door: Gasketed door in scroll with latch-type handles.
4. Drain Connections: NPS 3/4 (DN 20) threaded coupling drain connection installed at lowest point of housing.
5. Weather Hoods: Weather resistant with stamped vents over motor and drive compartment.
6. Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
7. Vibration Isolators: Spring isolators.

2.2 CENTRIFUGAL ROOF VENTILATORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Aerovent; a Twin City Fan Company
2. Carnes Company HVAC.
3. Greenheck.
4. Loren Cook Company.

- B. Description: Direct-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, curb base, and accessories.

- C. Housing: Removable, spun-aluminum, dome top and outlet baffle; square, one-piece, aluminum base with venturi inlet cone.

Retain "grease collector" in subparagraphs below as necessary for kitchen hood exhaust.

1. Upblast Units: Provide spun-aluminum discharge baffle to direct discharge air upward, with rain and snow drains and grease collector.
2. Hinged Subbase: Galvanized-steel hinged arrangement permitting service and maintenance.

- D. Fan Wheels: Aluminum hub and wheel with backward-inclined blades.

Retain "Belt Drives" Paragraph below if belt-driven fans are required; delete if only direct-drive fans are required.

E. Belt Drives:

1. Resiliently mounted to housing.
2. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
3. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.
4. Pulleys: Cast-iron, adjustable-pitch motor pulley.

5. Fan and motor isolated from exhaust airstream.

F. Accessories:

Retain accessories in subparagraphs below as necessary.

1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
2. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted outside fan housing, factory wired through an internal aluminum conduit.
3. Bird Screens: Removable, 1/2-inch (13-mm) mesh, aluminum or brass wire.
4. Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in curb base; factory set to close when fan stops.
5. Motorized Dampers: Parallel-blade dampers mounted in curb base with electric actuator; wired to close when fan stops.

2.3 AXIAL ROOF VENTILATORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Aerovent; a Twin City Fan Company.
2. Carnes Company HVAC.
3. Greenheck.
4. Loren Cook Company.
5. New York Blower Company (The).

- B. Description: Direct-driven axial fans consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, curb base, and accessories.

- C. Housing: Heavy-gage, removable, spun-aluminum, dome top and outlet baffle; square, one-piece, hinged, aluminum base.

1. Hinged Subbase: Galvanized-steel hinged arrangement permitting service and maintenance.

Select wheel material in first paragraph below.

- D. Fan Wheel: Aluminum or Steel hub and blades.

Retain "Belt Drives" Paragraph below if belt-driven fans are required; delete if only direct-drive fans are required.

E. Belt Drives:

1. Resiliently mounted to housing.
2. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
3. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.
4. Pulleys: Cast-iron, adjustable-pitch motor pulley.

F. Accessories:

Retain accessories in subparagraphs below as necessary.

1. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted outside fan housing, factory wired through an internal aluminum conduit.
2. Bird Screens: Removable, 1/2-inch (13-mm) mesh, aluminum or brass wire.
3. Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in curb base; factory set to close when fan stops.
4. Motorized Dampers: Parallel-blade dampers mounted in curb base with electric actuator; wired to close when fan stops.

2.4 UPBLAST PROPELLER ROOF EXHAUST FANS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Aerovent; a Twin City Fan Company.
 2. Carnes Company HVAC.
 3. Greenheck.
 4. Loren Cook Company.
 5. New York Blower Company (The).
- B. Description: Direct-driven propeller fans consisting of housing, wheel, butterfly-type discharge damper, fan shaft, bearings, motor and disconnect switch, drive assembly, curb base, and accessories.
- C. Wind Band, Fan Housing, and Base: Reinforced and braced aluminum, containing aluminum butterfly dampers and rain trough, motor and drive assembly, and fan wheel.
1. Damper Rods: Steel with bronze bearings.
 2. Hinged Subbase: Galvanized-steel hinged arrangement permitting service and maintenance.
- D. Fan Wheel: Replaceable, cast-aluminum, airfoil blades fastened to cast-aluminum hub; factory set pitch angle of blades.

Retain "Belt Drives" Paragraph below if belt-driven fans are required; delete if only direct-drive fans are required. Add temperature ratings and other features to drive assembly if these fans are used for smoke exhaust.

- E. Belt Drives:
1. Resiliently mounted to housing.
 2. Weatherproof housing of same material as fan housing.
 3. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
 4. Shaft Bearings: Prelubricated and sealed, self-aligning, pillow-block-type ball bearings.
 5. Pulleys: Cast-iron, adjustable-pitch motor pulley.
 6. Motor Mount: On outside of fan cabinet, adjustable base for belt tensioning.

Specify roof curbs, if they are site fabricated, in Division 07 Section "Roof Accessories." Retain paragraph and subparagraphs below to require roof curbs to be provided by fan manufacturer.

- F. Roof Curbs: Pre-fabricated aluminum. Size as required to suit roof opening and fan base.

2.5 CENTRIFUGAL WALL VENTILATORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Aerovent; a Twin City Fan Company.
 2. Carnes Company HVAC.
 3. Greenheck.
 4. Loren Cook Company.
- B. Description: Direct- or belt-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, and accessories.
- C. Housing: Heavy-gage, removable, spun-aluminum, dome top and outlet baffle; venturi inlet cone.
- D. Fan Wheel: Aluminum hub and wheel with backward-inclined blades.

Retain "Belt Drives" Paragraph below if belt-driven fans are required; delete if only direct-drive fans are required.

- E. Belt Drives:
1. Resiliently mounted to housing.
 2. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
 3. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.
 4. Pulleys: Cast-iron, adjustable-pitch motor pulley.
 5. Fan and motor isolated from exhaust airstream.

- F. Accessories:

Accessories listed in subparagraphs below are optional features.

1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
2. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted inside fan housing, factory wired through internal aluminum conduit.
3. Bird Screens: Removable, 1/2-inch (13-mm) mesh, aluminum or brass wire.
4. Wall Grille: Ring type for flush mounting.
5. Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in wall sleeve; factory set to close when fan stops.
6. Motorized Dampers: Parallel-blade dampers mounted in curb base with electric actuator; wired to close when fan stops.

2.6 IN-LINE CENTRIFUGAL FANS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Carnes Company HVAC.
 - 2. Greenheck.
 - 3. Loren Cook Company.
- B. Description: In-line, belt-driven centrifugal fans consisting of housing, wheel, outlet guide vanes, fan shaft, bearings, motor and disconnect switch, drive assembly, mounting brackets, and accessories.
- C. Housing: Split, spun aluminum with aluminum straightening vanes, inlet and outlet flanges, and support bracket adaptable to floor, side wall, or ceiling mounting.
- D. Direct-Drive Units: Motor mounted in airstream, factory wired to disconnect switch located on outside of fan housing; with wheel, inlet cone, and motor on swing-out service door.
- E. Belt-Driven Units: Motor mounted on adjustable base, with adjustable sheaves, enclosure around belts within fan housing, and lubricating tubes from fan bearings extended to outside of fan housing.
- F. Fan Wheels: Aluminum, airfoil blades welded to aluminum hub.
- G. Access Panels: Provide easy access to all internal fan components.
- H. Accessories:

Accessories listed in subparagraphs below are optional features.

- 1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
- 2. Volume-Control Damper: Manually operated with quadrant lock, located in fan outlet.
- 3. Companion Flanges: For inlet and outlet duct connections.
- 4. Fan Guards: 1/2- by 1-inch (13- by 25-mm) mesh of galvanized steel in removable frame. Provide guard for inlet or outlet for units not connected to ductwork.
- 5. Motor and Drive Cover (Belt Guard): Epoxy-coated steel.
- 6. Vibration Isolators:
 - a. Type: Elastomeric hangers.
 - b. Static Deflection: 1 inch (25 mm).

2.7 PROPELLER FANS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Aerovent; a Twin City Fan Company.
 - 2. Buffalo.

3. Greenheck.
 4. Loren Cook Company.
- B. Description: Direct- or belt-driven propeller fans consisting of fan blades, hub, housing, orifice ring, motor, drive assembly, and accessories.
- C. Housing: Galvanized-steel sheet with flanged edges and integral orifice ring with baked-enamel finish coat applied after assembly.

Retain one of first two paragraphs below. Aluminum blades are normally used in large sizes and in high-static-pressure applications.

- D. Steel Fan Wheels: Formed-steel blades riveted to heavy-gage steel spider bolted to cast-iron hub.
- E. Fan Wheel: Replaceable, cast-aluminum, airfoil blades fastened to cast-aluminum hub; factory set pitch angle of blades.
- F. Fan Drive:
1. Resiliently mounted to housing.
 2. Statically and dynamically balanced.
 3. Selected for continuous operation at maximum rated fan speed and motor horsepower, with final alignment and belt adjustment made after installation.
 4. Extend grease fittings to accessible location outside of unit. Pre-charge tubing with lubricant.
 5. Service Factor Based on Fan Motor Size: 1.4.
 6. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
 7. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.
 - a. Ball-Bearing Rating Life: ABMA 9, L_{10} of 100,000 hours.
 8. Pulleys: Cast iron with split, tapered bushing; dynamically balanced at factory.
 9. Motor Pulleys: Adjustable pitch for use with motors through 5 hp; fixed pitch for use with larger motors. Select pulley so pitch adjustment is at the middle of adjustment range at fan design conditions.
 10. Belts: Oil resistant, nonsparking, and nonstatic; matched sets for multiple belt drives.
 11. Belt Guards: Fabricate of steel for motors mounted on outside of fan cabinet.
- G. Accessories:

Accessories listed in subparagraphs below are optional features.

1. Gravity Shutters: Aluminum blades in aluminum frame; interlocked blades with nylon bearings.
2. Motor-Side Back Guard: Galvanized steel, complying with OSHA specifications, removable for maintenance.
3. Wall Sleeve: Galvanized steel to match fan and accessory size.
4. Weathershield Hood: Galvanized steel to match fan and accessory size.
5. Weathershield Front Guard: Galvanized steel with expanded metal screen.

6. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
7. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted inside fan housing, factory wired through an internal aluminum conduit.
8. Vibration Isolators:
 - a. Type: Elastomeric hangers.
 - b. Static Deflection: 1 inch (25 mm).

2.8 MOTORS

- A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."
 1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 26 Sections.
- B. Enclosure Type: Totally enclosed, fan cooled.

2.9 SOURCE QUALITY CONTROL

- A. Certify sound-power level ratings according to AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.
- B. Certify fan performance ratings, including flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests according to AMCA 210, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating." Label fans with the AMCA-Certified Ratings Seal.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install power ventilators level and plumb.

Retain and revise first two paragraphs below for floor-mounted units; delete if vibration controls are specified in "Capacities and Characteristics" paragraphs or are indicated on Drawings. If not scheduled, identify required vibration- and seismic-control device by using the titles of devices described in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment" and identify required static deflection.

- B. Support units using spring isolators having a static deflection of 1 inch (25 mm). Vibration- and seismic-control devices are specified in Division 23 Section "Vibration Controls for HVAC Piping and Equipment."
- C. Install floor-mounting units on concrete bases. Concrete, reinforcement, and formwork requirements are specified in Division 03 Section "Cast-in-Place Concrete."
- D. Secure roof-mounting fans to roof curbs with cadmium-plated hardware.
- E. Ceiling Units: Suspend units from structure; use steel wire or metal straps.

Retain and revise first paragraph below for suspended units; delete if vibration controls are specified in "Capacities and Characteristics" paragraphs or are indicated on Drawings. If not scheduled, verify required vibration-control device by using the titles of devices described in Division 23 Section "Vibration Controls for HVAC Piping and Equipment" and verify required static deflection.

- F. Support suspended units from structure using threaded steel rods and spring hangers having a static deflection of 1 inch (25 mm). Vibration-control devices are specified in Division 23 Section "Vibration Controls for HVAC Piping and Equipment."
- G. Install units with clearances for service and maintenance.
- H. Label units according to requirements specified in Division 23 Section "Identification for HVAC Piping and Equipment."

3.2 CONNECTIONS

- A. Duct installation and connection requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Division 23 Section "Air Duct Accessories."
- B. Install ducts adjacent to power ventilators to allow service and maintenance.
- C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- D. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
 - 1. Verify that shipping, blocking, and bracing are removed.
 - 2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
 - 3. Verify that cleaning and adjusting are complete.

4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
 5. Adjust belt tension.
 6. Adjust damper linkages for proper damper operation.
 7. Verify lubrication for bearings and other moving parts.
 8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
 9. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
 10. Shut unit down and reconnect automatic temperature-control operators.
 11. Remove and replace malfunctioning units and retest as specified above.
- B. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.4 ADJUSTING

- A. Adjust damper linkages for proper damper operation.
- B. Adjust belt tension.
- C. Refer to Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.
- D. Replace fan and motor pulleys as required to achieve design airflow.
- E. Lubricate bearings.

END OF SECTION 233423