

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Roof ventilators.
- B. Upblast roof exhausters.
- C. Inline centrifugal fans.
- D. Kitchen hood exhausters.

1.02 REFERENCE STANDARDS

- A. AMCA 99 – Standards Handbook.
- B. AMCA 204 – Balance Quality and Vibration Levels for Fans.
- C. AMCA 210 – Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating.
- D. AMCA 300 – Reverberant Room method for Sound Testing of Fans.
- E. AMCA 301 – Certified Ratings Program Product Rating manual for Fan Sound Performance.
- F. AMCA 311 – Certified Ratings Program Product Rating Manual for Fan Sound Performance.
- G. NFPA 96 – Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.
- H. UL 705 – Power Ventilators; Current Edition Including all Revisions.
- I. UL 762 – Outline of Investigation for Power Roof Ventilators for Restaurant Exhaust Appliances; Current Edition Including all Revisions.

1.03 SUBMITTALS

- A. General: Submit data in accordance with Conditions of Contract and Division 1 Specification Sections.
- B. Product Data: Provide data on fans and accessories including fan curves with specified operating point clearly plotted, power, RPM, sound power levels at rated capacity, and electrical characteristics and connection requirements. Include the following:
 - 1. For fans with factory-furnished starters or variable frequency drives, include short circuit current ratings.
 - 2. Materials gages and finishes, including color charts.
 - 3. Dampers, including housings, linkages, and operators.
- C. Shop Drawings: Shop drawings from manufacturer detailing equipment assemblies and indicating dimensions, weights, required clearances, components, and location and size of field connections.
- D. Wiring Diagrams: Wiring diagrams that detail power, signal, and control wiring. Differentiate between manufacturer-installed wiring and field-installed wiring.
- E. Maintenance Data: Include instructions for lubrication, motor and drive replacement and spare parts list.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. Extra Fan Belts: One set for each individual fan.

1.04 QUALITY ASSURANCE

- A. AMCA Compliance: Provide products that meet AMCA certified performance and sound ratings and are licensed to use the AMCA Seal.
- B. UL Compliance: Fans and fan motors shall be designed, manufactured, and tested in accordance with UL 705 "Power Ventilators."
- C. Kitchen Hood Exhaust Fans: Kitchen hood exhaust fans and components shall comply with requirements of UL 762 and NFPA 96.

- D. Nationally Recognized Testing Laboratory and NEMA Compliance (NRTL): Fans and components shall be NRTL listed and labeled. The term "NRTL" shall be as defined in OSHA Regulation 1910.7.
- E. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.
- F. Electrical Component Standard: Components and installation shall comply with NFPA 70 "National Electrical Code."

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Protect motors, shafts, and bearings from weather and construction dust.

1.06 FIELD CONDITIONS

- A. Permanent fans may not be used for ventilation during construction.

PART 2 - PRODUCTS AND MATERIALS

2.01 POWER VENTILATORS - GENERAL

- A. General: Provide fans that are factory fabricated and assembled, factory tested, and factory finished; with indicated capacities and characteristics.
- B. Statically and Dynamically Balanced: Fans and shafts shall be statically and dynamically balanced and designed for continuous operation at the maximum rated fan speed and motor horsepower.
 - 1. Fan Shaft: Turned, ground, and polished steel designed to operate at no more than 70 percent of the first critical speed at the top of the speed range of the fan's class.
- C. Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings in accordance with AMCA Standard 210.
- D. Sound Ratings: Comply with AMCA 301. Test fans in accordance with AMCA Standard 300.

- E. Fabrication: Comply with AMCA 99.
- F. Belt Drives: Factory mounted, with final alignment and belt adjustment made after installation.
 - 1. Service Factor: 1.4.
- G. Belts: Oil-resistant, non-sparking, and non-static.
- H. Motors: Refer to Section “Common Motor Requirements for HVAC Equipment” for requirements.
- I. Motor and Fan Wheel Pulleys: Adjustable pitch for use with motors through 15 HP; fixed pitch for use with motors larger than 15 HP. Select pulley so that pitch adjustment is at the middle of the adjustment range at fan design conditions.
 - 1. Belt Guards: Provide steel belt guards for motors mounted on the outside of the fan cabinet.
- J. Factory Finish: The following finishes are required:
 - 1. Sheet Metal Parts: Prime coating prior to final assembly.
 - 2. Exterior Surfaces: Baked-enamel finish coat after assembly.

2.02 ROOF VENTILATORS

- A. Manufacturers:
 - 1. Accurex.
 - 2. Acme Engrg. & Mfg. Corp.
 - 3. CaptiveAire
 - 4. Carnes Company, Inc.
 - 5. Cook (Loren) Co.
 - 6. Greenheck Fan Corp.
 - 7. Hartzell Fan, Inc.
 - 8. PennBarry.
 - 9. Twin City Fan Company.
- B. Fan Unit: Belt-driven or direct-drive as indicated, centrifugal or axial fan, 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, aluminum base with venturi inlet cone.

- D. Roof Curbs: Refer to Section “Hangers and Supports for HVAC” for pre-engineered roof equipment supports .
- E. Fan Wheel: Aluminum hub and wheel.
- F. Belt-Driven Drive Assembly: Resiliently mounted to the housing, with the following features:
 - 1. Pulleys: Cast-iron, adjustable-pitch.
 - 2. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.
 - 3. Fan Shaft: Turned, ground, and polished steel drive shaft keyed to wheel hub.
 - 4. For centrifugal fans, fan and motor shall be isolated from exhaust air stream.
- G. Accessories: Provide the following items as indicated:
 - 1. Disconnect Switch: Nonfusible type, with thermal overload protection mounted inside fan housing, factory-wired through an internal aluminum conduit.
 - 2. Bird Screens: Maximum 1/2-inch mesh, 16-gage, aluminum or brass wire.
 - 3. Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in curb base, factory set to close when fan stops.
 - 4. Dampers: Motor-operated, parallel-blade, volume control dampers mounted in curb base.
 - a) Blades: Die-formed sheet aluminum.
 - b) Frame: Extruded aluminum, with waterproof, felt blade seals.
 - c) Linkage: Nonferrous metals, connecting blades to counter weight or operator.
 - d) Operators: Manufacturer's standard electric actuator.
 - e) Operators: Manufacturer's standard pneumatic actuator.

2.03 UPBLAST ROOF EXHAUSTERS

- A. Manufacturers:
 - 1. Accurex.
 - 2. Acme Engrg. & Mfg. Corp.
 - 3. CaptiveAire
 - 4. Carnes Company, Inc.
 - 5. Cook (Loren) Co.
 - 6. Greenheck Fan Corp.
 - 7. Hartzell Fan, Inc.
 - 8. PennBarry.

9. Twin City Fan Company
 - B. General Description: Belt-driven or direct-drive as indicated, consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, curb base, and accessories.
 - C. Fan Wheel:
 1. Type: Non-overloading centrifugal, propeller or axial blades as scheduled
 2. Material: Aluminum ,
 - D. Housing:
 1. Construct of heavy-gage aluminum including curb cap, windband and motor compartment..
 2. Rigid internal support structure.
 3. One-piece fabricated or fully welded curb-cap to windband for leak proof construction.
 4. Wind Band and Base: Reinforced and braced aluminum, containing aluminum butterfly dampers and rain trough, motor and drive assembly, and fan wheel.
 - a) Dampers Rods: Steel with bronze or nylon bearings.
 5. Provide breather tube for fresh air motor cooling and wiring.
 - E. Shafts and Bearings:
 1. Fan Shaft:
 - a) Ground and polished steel with anti-corrosive coating.
 - b) First critical speed at least 25 percent over maximum cataloged operating speed.
 2. Bearings
 - a) Permanently sealed or pillow block type.
 - b) Minimum L10 life in excess of 50,000 hours.
 - F. Drive Assembly: Resiliently mounted to the housing, with the following features:
 1. Belts, pulleys, and keys oversized for a minimum of 150 percent of driven horsepower.
 2. Belts: Static free and oil resistant.
 3. Pulleys: Cast-iron, adjustable-pitch, keyed and securely attached to the wheel and motor shafts..

- G. Roof Curbs: Refer to Section “Hangers and Supports for HVAC” for pre-engineered roof equipment supports.
- H. Drain Trough: Provides single point drainage for water or other residue.
- I. Accessories: Provide the following items as indicated:
 - 1. Disconnect Switch: Nonfusible type, with thermal overload protection mounted inside fan housing, factory-wired through an internal aluminum conduit.
 - 2. Bird Screens: Maximum 1/2-inch mesh, 16-gage aluminum or brass wire.
 - 3. Dampers: Counter-balanced, parallel-blade, backdraft dampers mounted in curb base; factory set to close when fan stops.
 - 4. Dampers: Motor-operated, parallel-blade, volume control dampers mounted in curb base.
 - a) Blades: Die-formed sheet aluminum.
 - b) Frame: Extruded aluminum, with waterproof, felt blade bumpers.
 - c) Linkage: Nonferrous metals.
 - d) Operators: Manufacturer's standard electric actuator.
 - e) Operators: Manufacturer's standard pneumatic actuator.
 - 5. Hinge Kits:
 - a) Aluminum hinges.
 - b) Hinges and restraint cables mounted to the base.
 - c) Allows fan to tilt away for access to wheel for inspection and cleaning.

2.04 INLINE CENTRIFUGAL FANS

- A. Manufacturers:
 - 1. Acme Engrg. & Mfg. Corp.
 - 2. CaptiveAire
 - 3. Carnes Company, Inc.
 - 4. Cook (Loren) Co.
 - 5. Greenheck Fan Corp.
 - 6. PennBarry.
 - 7. Twin City Fan Company
- B. Fan Unit: Inline, belt or direct driven, centrifugal fans consisting of housing, wheel, outlet guide vanes, fan shaft, bearings, drive assembly, motor and disconnect switch, mounting brackets, and accessories.

- C. Housing: Galvanized steel or split, spun-aluminum housing, with straightening vanes, inlet and outlet flanges, and support bracket adaptable to floor, side wall, or ceiling mounting.
- D. Wheel: Aluminum, forward curved, backward inclined or airfoil blades welded to aluminum hub.
- E. Direct-Drive Units: Motor encased in housing out of air stream, factory-wired to disconnect located on outside of fan housing.
- F. Belt-Drive 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. Provide self-aligning pre-lubricated ball bearings.
- G. Accessories: Provide the following accessories as indicated:
 - 1. Volume Control Damper: Manual operated with quadrant lock, located in fan outlet.
 - 2. Companion Flanges: For inlet and outlet duct connections.
 - 3. Fan Guards: Expanded metal in removable frame.
 - 4. Speed Control: Variable speed switch with on-off control and speed control for 100 to 50 percent of fan air delivery.

2.05 KITCHEN HOOD UPBLAST EXHAUSTERS

- A. Manufacturers:
 - 1. Accurex.
 - 2. CaptiveAire
 - 3. Carnes Company, Inc.
 - 4. Cook (Loren) Co.
 - 5. Greenheck Fan Corp.
 - 6. PennBarry.
 - 7. Twin City Fan Company
- B. Fan Unit: Belt-driven or direct-drive as indicated, centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, curb base, and accessories.
- C. Housing:
 - 1. Construct of heavy-gage, removable, spun-aluminum including curb cap, windband and motor compartment.

2. Rigid internal support structure.
 3. One-piece fabricated or fully welded curb-cap base to windband for leak proof construction.
 4. Construct drive frame assembly of heavy gauge steel, mounted on vibration isolators.
 5. Provide breather tube for fresh air motor cooling and wiring.
- D. Fan Wheel: Aluminum hub and blades.
- E. Shafts and Bearings:
1. Fan Shaft:
 - a) Ground and polished steel with anti-corrosive coating.
 - b) First critical speed at least 25 percent over maximum cataloged operating speed.
 2. Bearings
 - a) Permanently sealed or pillow block type.
 - b) Minimum L10 life in excess of 50,000 hours.
- F. Drive Assembly: Resiliently mounted to the housing, with the following features:
1. Pulleys, and keys oversized for a minimum of 150 percent of driven horsepower.
 2. Pulleys: Cast-iron, adjustable-pitch, keyed and securely attached to the wheel and motor shafts..
- G. Grease Exhaust: Exhaust fans serving Type I kitchen exhaust hoods shall discharge a minimum of 40" above the roof surface, shall have hinged access, shall have access opening on curvature of outer housing for blade inspection and cleaning, and shall be installed in accordance with NFPA 96 and local codes.
- H. Roof Curbs: Refer to Section "Hangers and Supports for HVAC" for pre-engineered roof equipment supports
- I. Drain Trough: Grease drain trough shall be filled with replaceable, absorbent material or replaceable cup with absorbent material and cap which absorbs grease and rejects water.
- J. Accessories: Provide the following items as indicated:

1. Disconnect Switch: Nonfusible type, with thermal overload protection mounted inside fan housing, factory-wired through an internal aluminum conduit.
2. Clean Out Port: Removable grease repellent compression rubber plug allows access for cleaning wheel through windband.
3. Roof Curb Extension: Vented curb extension where required for compliance with minimum clearances required by NFPA 96.
4. Hinge Kit:
 - a) Aluminum hinges.
 - b) Hinges and restraint cables mounted to base (sleeve).
 - c) Allows fan to tilt away for access to wheel and ductwork for inspection and cleaning.
5. Heat Baffle: Prevents heat from radiating into motor compartment.

PART 3 - EXECUTION

3.01 SEQUENCING AND SCHEDULING

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

3.02 INSTALLATION

- A. Install fans level and plumb, in accordance with manufacturer's written instructions.
- B. Secure roof-mounted fans to pre-engineered roof equipment supports in accordance with the requirements specified in Section "Hangers and Supports for HVAC Piping and Equipment."
- C. Cabinet Units: Suspend units from structural steel support frame using steel wire or metal straps.
- D. Install vibration isolation for equipment as specified in Division 23 Section "Vibration Isolation for HVAC Piping and Equipment."
- E. Arrange installation to provide access space around fans for service and maintenance.

3.03 ADJUSTING, CLEANING, AND PROTECTING

- A. Adjust damper linkages for proper damper operation.
- B. Clean the entire unit including cabinet interiors just prior to substantial completion to remove foreign material and construction dirt and dust. Vacuum clean fan wheel and cabinet.

3.04 STARTUP

- A. Final Checks Before Start-Up: Perform the following operations and checks before start-up:
 - 1. Remove shipping blocking and bracing.
 - 2. Verify fan assembly is secure on mountings and supporting devices and that connections for ductwork, and electrical are complete. Verify proper thermal overload protection is installed in motors, starters, and disconnects.
 - 3. Perform cleaning and adjusting specified in this Section.
 - 4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearings operations. Reconnect fan drive system, align belts, and install belt guards.
 - 5. Lubricate bearings, pulleys, belts, and other moving parts with factory-recommended lubricants.
 - 6. Verify manual and automatic volume control and that fire and smoke dampers in connected ductwork systems are in the full-open position.
 - 7. Disable automatic temperature control operators.
- B. Starting procedures for fans:
 - 1. Energize motor; verify proper operation of motor, drive system, and fan wheel. Adjust fan to indicated RPM.
 - a) Replace fan and motor pulleys as required to achieve design conditions.
 - 2. Measure and record motor electrical values for voltage and amperage.
 - 3. Shut unit down and reconnect automatic temperature control operators.
 - 4. Refer to Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for procedures for air-handling-system testing, adjusting, and balancing.

3.05 DEMONSTRATION

- A. Demonstration Services: Train Owner's maintenance personnel on the following:
 - 1. Procedures and schedules related to start-up and shutdown, troubleshooting, servicing, preventative maintenance, and how to obtain replacement parts.
 - 2. Familiarization with contents of Operating and Maintenance Manuals specified in Division 1 Section "Closeout Procedures" and Division 23 Section "General Mechanical Requirements."

- B. Schedule training with at least 7 days' advance notice.

END OF SECTION