

University Contact: Sustainability, Energy & Engineering Group

SECTION 23 34 00_HVAC FANS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Centrifugal fans.
2. Axial fans.
3. Propeller fans.
4. Downblast centrifugal roof fans.
5. Upblast centrifugal roof fans.
6. Centrifugal wall fans.
7. Ceiling fans.
8. Centrifugal square inline fans.
9. Roof ventilators.

- B. The intent of these standards is to provide input to the design team on the University's preference of manufacturers, design, equipment options and quality assurance to maintain the longevity of its assets.

1.2 REFERENCES

- A. Common Work for HVAC Systems 23 05 00
- B. Common Requirements for HVAC Systems 23 05 01
- C. Identification of HVAC Equipment and Piping 23 05 53
- D. Testing and Balancing of HVAC Systems 23 05 93
- E. Air Distribution Systems 23 30 00

1.3 ENGINEERING AND DESIGN REQUIREMENTS

- A. Consultant shall design each fan application for high energy-efficiency performance selecting the most effective fan type and wheel to best suit the needs of the application. The fan selection shall focus on life cycle cost and operation. Additional design requirements are as follows:

1. The total allowable fan power limitation for each system shall be 10% less than the limits set by ASHRAE 90.1 or the current International Energy Conservation Code (whichever is more stringent).
 2. Fans shall be selected for quiet operation.
 3. Fan selections at the actual operating point(s) shall be within 10% of the peak total efficiency.
- B. Fan inlet and discharge duct shall be designed without abrupt transitions and have the required distance between inlet/outlet and any elbows or tees. Reference AMCA Publication 201 recommendations for "Effective Duct Length".
- C. All fan motors shall be TEFC type and have NEMA explosive ratings based on the surrounding atmosphere and/or air stream through fan
- D. All fan assemblies must have an UL or OSHA approved equivalent label. All mechanical, electrical, and electronic devices that are used in the fan assemblies must have an UL or OSHA approved equivalent label.

1.4 SUBMITTALS

- A. Shop Drawings: Indicate size and configuration of fan assembly, mountings, weights, duct, and accessory connections.
- B. Product Data: Submit data on each type of fan and include accessories, fan curves with specified operating point plotted, power, RPM, sound power levels for both fan inlet and outlet at rated capacity, electrical characteristics, and connection requirements.
- C. Manufacturer's Installation Instructions: Submit fan manufacturers' instructions.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: Submit instructions for calibrating instruments, installation instructions, assembly views, servicing requirements, lubrication instruction, and replacement parts list.
- B. Fan start up report
- C. As Built operating characteristics that are revised to include all changes to air system made during construction.

1.6 QUALITY ASSURANCE

1.7 DELIVERY, STORAGE, AND HANDLING

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

1.8 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.9 EXTRA MATERIALS

- A. Furnish two sets of belts for each fan.
- B. Furnish two sets of filters for all equipment containing filters.

PART 2 PRODUCTS

2.1 CENTRIFUGAL FANS

A. Manufacturers:

- 1. Harrington Environmental
- 2. Howden Buffalo Fan Company
- 3. New York Blower Company
- 4. Twin City Fan Company
- 5. Greenheck

B. Performance:

- 1. Performance Base: Sea level conditions.
- 2. Temperature Limit: Maximum 600 degrees F.
- 3. Static and Dynamic Balance: Eliminate vibration or noise transmission to occupied areas.
- 4. Performance Ratings: Conform to AMCA 210 and bear the AMCA Certified Rating Seal.
- 5. Sound Ratings: AMCA 301, tested to AMCA 300, and bear AMCA Certified Sound Rating Seal.
- 6. Fabrication: Conform to AMCA 99 and 210.

C. Wheel and Inlet

- 1. University of Delaware prefers Airfoil Wheels but will accept Backward Incline or Forward Curve if these fans produce better and more stable fan performances.
 - a. Backward Inclined: Steel construction with smooth curved inlet flange, heavy back plate, backward curved blades welded to flange and back plate; cast iron or cast steel hub riveted to back plate and keyed to shaft with set screws.
 - b. Forward Curved: Black enamel or Galvanized, per design, steel construction with inlet flange, back plate, shallow blades with inlet and tip curved forward in direction of airflow, mechanically secured to flange and back plate; steel hub swaged to back plate and keyed to shaft with set screw.

- c. Airfoil Wheel: Steel construction with smooth curved inlet flange, heavy back plate die formed hollow airfoil shaped blades continuously welded at tip flange, and back plate; cast iron or cast steel hub riveted to back plate and keyed to shaft with set screws.

D. Housing:

- 1. Factory finish before assembly to manufacturer's standard. Provide two additional coats of paint and fabricate of galvanized steel where fans are handling air downstream of humidifiers.
- 2. Bolted construction with horizontal flanged split housing.
- 3. Steel, spot welded for AMCA 99 Class I and II fans, and continuously welded for Class III, braced, designed to minimize turbulence with spun inlet bell and shaped cut-off.

E. Bearings and Sleeves:

- 1. Bearings: Pillow block type, self-aligning, grease-lubricated ball bearings, with ABMA 9, L-50 life at 100,000 hours.
- 2. Shafts: Hot rolled steel, ground and polished, with keyway, protectively coated with lubricating oil, and shaft guard.
- 3. Drive: Direct Drive for use with variable frequency drive, and not integral to the fan.

F. Motor: Totally enclosed fan cooled: motor shall be inverter duty and should have NEMA hazard rating based on working conditions.

G. Electrical Characteristics & Components.

- 1. Disconnect Switch: Factory mount in control panel or on equipment.

H. Accessories:

- 1. Inlet/Outlet Screens: Galvanized steel welded grid.
- 2. Access Doors: Shaped to conform to scroll, with quick opening latches and gaskets.
- 3. Scroll Drain: ½" steel pipe coupling welded to low point of fan scroll.
- 4. All motors shall be supplied with a Fluke model 3561 FC Vibration Sensor and Fluke model 3502 FC Wireless Gateway.
- 5. All motors shall be supplied with a Fluke model 80BK-A Integrated DMM Temperature Probe

2.2 AXIAL FANS

A. Manufacturers:

- 1. Harrington Environmental

2. Howden Buffalo Fan Company
 3. New York Blower Company
 4. Twin City Fan Company
 5. Greenheck
- B. Hub and Impeller:
1. Airfoil Impeller Blades: Adjustable
 2. Hub: hub bored and keyed to shaft; to facilitate indexing of blade angle with automatic adjustment stops.
 3. Controllable Pitch Assemblies: Incorporate ball bearing counterbalanced blade and variable pitch assembly into hub with mechanical link to casing exterior mounted actuator.
 4. Cast Components: X-ray components after fabrication and statically and dynamically balance assembly before attachment to motor or shaft.
- C. Casing:
1. Casing with inlet and outlet flange connections, and motor or shaft supports. Incorporate flow straightening guide vanes for fans specified for static pressures greater than 2 inches wg.
 2. Finish with one coat enamel applied to interior and exterior.
- D. Bearings and Drives:
1. Bearings: Pillow block type, self-aligning, grease-lubricated ball bearings, with ABMA 9 L-50 life at 100,000 hours.
 2. Shafts: Hot rolled steel, ground and polished, with keyway, protectively coated with lubricating oil.
 3. Drive: Direct Drive for use with variable frequency drive.
- E. Motor: Totally enclosed fan cooled; motor shall be inverter duty and should have NEMA hazard rating based on working conditions.
- F. Electrical Characteristics & Components.
1. Disconnect Switch: Factory mount in control panel or on equipment.
- G. Accessories:
1. Inlet Bell: Bell mouth inlet fabricated with flange.
 2. Outlet Cones: outlet area/inlet area ratio of 1.5, with center pod as recommended by manufacturer.
 3. Inlet Screens: Galvanized steel welded grid to fit inlet bell.
 4. Access Doors: Shaped to conform to casing with quick opening latches and gaskets.

5. Blade Pitch Actuator: Factory mounted and calibrated, electric actuator requiring single phase power and accepting electric input.
6. All motors shall be supplied with a Fluke model 3561 FC Vibration Sensor and Fluke model 3502 FC Wireless Gateway.
7. All motors shall be supplied with a Fluke model 80BK-A Integrated DMM Temperature Probe.

2.3 PROPELLER FANS

A. Manufacturers:

1. Greenheck Fan Corp.
2. Howden Buffalo Fan Company
3. New York Blower Company
4. Twin City Fan Company

B. Construction:

1. Impeller: Shaped steel or steel reinforced aluminum blade with hubs, statically and dynamically balanced, keyed, and locked to shaft, furnished with V-belt drive.
2. Frame: One-piece, square steel with die formed venturi orifice, mounting flanges and supports, with baked enamel finish.

C. Motor: Totally enclosed fan cooled; motor should have NEMA hazard rating based on working conditions.

D. Electrical Characteristics & Components.

1. Disconnect Switch: Factory mount in control panel or on equipment.

E. Accessories:

1. Back-draft Damper: Multiple blade with offset hinge pin, blades linked.
2. Safety Screens: Expanded galvanized metal over inlet, motor, and drive and outlet; to comply with OSHA regulations.
3. Hood: Weather shield, to exclude rain and snow.

2.4 CEILING MOUNTED BATHROOM EXHAUST FANS

A. Manufacturers:

1. Greenheck Fan Corp.
2. PennBarry Company
3. Twin City Fan Company

- B. Centrifugal Fan Unit: Direct driven with galvanized steel lined with 1/2-inch acoustic insulation, resilient mounted motor, gravity backdraft damper in discharge opening, integral outlet duct collar. Discharge position convertible by moving interchangeable panels.
- C. Grille: Aluminum with baked white enamel finish.
- D. Wheel: DWDI or Centrifugal forward curved type constructed of injection molded or polypropylene resin.
- E. Motor: Open drip proof type with permanently lubricated sealed bearings and thermal overload protection.
- F. Electrical Characteristics & Components.
 - 1. Disconnect Switch shall be fan mounted toggle switch for thermal overload protected motor.: Cord & plug in housing for thermal overload protected motor and wall mounted switch multiple speed switch solid state speed controller.
- G. Accessories:
 - 1. Wall cap with damper
 - 2. Roof cap with roof curb.
 - 3. Brick vent constructed of extruded aluminum with bird screen.
 - 4. Rubber-in-shear vibration isolator.

2.5 CENTRIFUGAL SQUARE INLINE FANS

- A. Manufacturers:
 - 1. Greenheck Corp
 - 2. Howden Buffalo Fan Company
 - 3. New York Blower Company
 - 4. Twin City Fan Company
- B. Product Description: V-belt drive with galvanized steel housing lined with 1/2 inch acoustic glass, integral inlet cone, removable access doors on 3 sides, inlet and outlet duct collar, horizontal hanging brackets.
- C. Fan Wheel: Backward inclined centrifugal type.
- D. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheaves selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.
- E. Motor and Drive Mounting: Out of air stream, direct drive for use with variable frequency drive.

- F. Motor: Totally enclosed fan cooled; motor shall be inverter duty and should have NEMA hazard rating based on working conditions.
- G. Bearings: ABMA 9 life at 200,000 hours.
- H. Accessories:
 - 1. Motor cover.
 - 2. Flexible duct connector.
 - 3. Flanged inlet and outlet.
- I. Electrical Characteristics & Components.
 - 1. Disconnect Switch: Factory mount in control panel or on equipment.

2.6 GRAVITY ROOF VENTILATORS

- A. Manufacturers:
 - 1. Greenheck Corp
 - 2. PennBarry Company
- B. Product Description: Aluminum steel housing; aluminum wire bird screen; square base to suit roof curb with continuous curb gaskets.
- C. Roof Curb: 14-inch-high self-flashing of galvanized steel construction with continuously welded seams, 1 inch insulation and curb bottom, and factory installed nailer strip.
- D. Backdraft Damper: Gravity actuated, aluminum multiple blade construction, felt edged with offset hinge pin, nylon bearings, blades linked [and line voltage motor drive, power open, spring return.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify roof curbs are installed and dimensions are as shown on shop drawings or as instructed by manufacture.
- B. Do not put fans into normal use for any purpose until ductwork is clean, filters are in place, bearings lubricated, and fan has been test ran under observation.

3.2 INSTALLATION

- A. Secure roof and wall fans and gravity ventilators with cadmium plated steel lag screws to roof curb or structure.

- B. Suspended Fans: Install flexible connections specified in Section 23 05 29 between fan and ductwork. Ensure metal bands of connectors are parallel with minimum one inch flex between ductwork and fan while running.
- C. Install backdraft dampers on inlet to roof and wall exhaust fans and gravity ventilators used in relief air applications.
- D. Install safety screen where inlet or outlet is exposed.
- E. Pipe scroll drains to nearest floor drain.
- F. Install backdraft dampers on discharge of exhaust fans.
- G. Provide sheaves required for final air balance.
- H. Pipe housing drain to nearest drain.

3.3 CLEANING

- A. Vacuum clean coils and inside of fan cabinet.

3.4 DEMONSTRATION

- A. Demonstrate fan operation and maintenance procedures.

3.5 PROTECTION OF FINISHED WORK

- A. Do not operate fans until ductwork is clean, filters in place, bearings lubricated, and fan has been test ran under observation. Provide documentation indicating manufacturer maintenance has been performed at proper intervals as required during construction.

END OF SECTION