

SECTION 23 40 00 - HVAC FANS

PART 1 - GENERAL

1.1 DESIGN REQUIREMENTS

A. Exhaust Systems:

1. Exhaust systems that may transport offensive odors, noxious gases, etc., are to be separate systems. Provide identifying labels on exterior stacks per the instructions of the Project Manager.
2. Locate fans so that negative pressure exists in all exhaust ducts within buildings.
3. Conditioned make-up air shall be provided to compensate for exhaust.
4. Recirculation systems are not allowed in laboratory spaces.
5. Refer to Section 23 00 00 for Special HVAC Systems including lab exhaust systems.
6. Lab exhaust systems to utilize utility set fans, with exhaust stacks. Design of exhaust stack to be justified per AHRAE design requirements, or via a wind/wake analysis. Use of high-plume dispersion type fans are at the approval of the university project manager.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Fans:
 - a. Acme
 - b. New York Blower
 - c. Greenheck
 - d. MK Plastics – Reference 1.1
 - e. Cook
 - f. Twin Cities

2.2 MATERIALS, GENERAL

A. Centrifugal Fans:

1. Unit Casing: Galvanized steel panels, formed and reinforced, seams continuously welded. All interior and exterior surface steel shall be coated with a minimum of 2-4 mils of Polyester Urethane, electrostatically applied and baked. No uncoated metal fan parts will be allowed. Provide access doors or panels to allow access to internal parts and components.
2. Fan Wheel: Non-overloading single width airfoil centrifugal type. Wheels shall be statically and dynamically balanced to balance grade G6.3 per ANSI S2.19. Fan wheel shall be manufactured with continuously welded steel airfoils and coated with a minimum of 2-4 mils of Polyester Urethane, electrostatically applied and baked
3. Shaft: Turned, ground, polished, and rust protected steel. Designed to operate at no more than 70 percent of the first critical speed at the top of the fan's speed range.
4. Shaft Bearings: Air handling quality self-aligning, heavy duty, pillow block type, roller or ball type bearings with L10 rated bearing life of 80,000 operating hours. Provide extended lube lines.
5. Belt Drives: V-belt drives rated at not less than 200% of motor nameplate rating. Belt speeds shall not exceed 4500 feet per minute. Center distances between driver and driven sheaves must meet the manufacturer's minimum and maximum. Belts shall be notched AX, BX or CX series.
6. Sheaves: All sheaves shall be fixed pitch type. Variable pitch sheaves are not permitted. Fixed pitched sheaves supplied with units shall be replaceable by fixed pitched sheaves for balancing purposes. No sheave shall be less than 3.9 inch PD
7. All accessible inlet or exhaust openings in fans shall have 1/2 inch square wire mesh guards covering those openings as well as belt and pulley guards.
8. Motor nameplate to include stamped bearing size.

9. All large motors will have double pull, adjustable motor mounts.
10. Size fans to provide design airflow at 15% below maximum rpm as suggested by the manufacturer.
11. Motors: Reference 23 05 13 Motors for more information.
12. Belt Guard: Fabricated to OSHA and SMACNA requirements.
13. Accessories:
 - a. Scroll access doors shaped to conform to scroll with quick-opening latches and gaskets.
 - b. Galvanized steel companion flanges for duct connections.
 - c. 2-inch drain connections.
 - d. Removable inlet and outlet safety screens for access to fan for maintenance.

B. Propeller Fans

1. Panel: Painted steel fan panel with welded corners, pre-punched mounting holes, deeply spun venturi, integral stiffening flanges, and motor support.
2. Motor: Permanently lubricated, continuous duty type. Reference 23 05 13 Motors for more information.
3. Fan Shaft: Ground, polished, and coated steel.
4. Drive Type:
 - a. Belt drive:
 - 1) Motor Pulleys: Fixed pitch, cast iron, sized for 150 percent of maximum cataloged speed.
 - 2) Bearings: Heavy duty ball bearings with L10 rated bearing life exceeding 200,000 operating hours.
5. Fan Blades: Statically and dynamically balanced steel or aluminum blades.
6. Accessories:
 - a. Rear Fan Guard: Removable or with removable access section for fan maintenance, conforming to OSHA requirements.
 - b. Wall Shutter:
 - 1) Gravity shutter with heavy aluminum frame, blades interconnected with tie-rods, and nylon bearings.
 - 2) Motorized shutter with heavy aluminum frame, blades interconnected with tie-rods, nylon bearings, and actuator motor to power open and spring return.
 - c. Wall Sleeve: Galvanized steel sleeve with moveable angle frame.

C. Roof and Wall Ventilators:

1. Housing: Weatherproof, heavy-gauge spun aluminum with rigid steel internal support structure.
2. Fan Wheel: Aluminum, non-overloading, backward inclined, centrifugal type. Dynamically balanced.
3. Motor: Open drip proof, high-efficiency motor, mounted out of the air stream. Reference 23 05 13 Motors for more information.
4. Shafts: Solid steel, precision ground, polished, and treated for rust resistance.
5. Drive:
 - a. Belt drive:
 - 1) Bearings: Heavy duty, with L-10 rated bearing-life exceeding 80,000 operating hours.

2.3 QUALITY ASSURANCE

A. Codes, Regulations and Standards: Comply with the following:

B. Propeller Fans

1. Panel: Painted steel fan panel with welded corners, pre-punched mounting holes, deeply spun venturi, integral stiffening flanges, and motor support.
2. Motor: Permanently lubricated, continuous duty type.
3. Fan Shaft: Ground, polished, and coated steel.
4. Drive Type:

- a. Belt drive:
 - 1) Motor Pulleys: Fixed pitch, cast iron, sized for 150 percent of maximum cataloged speed.
 - 2) Bearings: Heavy duty ball bearings with L10 rated bearing life exceeding 80,000 operating hours.
 5. Fan Blades: Statically and dynamically balanced steel or aluminum blades.
 6. Accessories:
 - a. Rear Fan Guard: Removable or with removable access section for fan maintenance, conforming to OSHA requirements.
 - b. Wall Shutter:
 - 1) Gravity shutter with heavy aluminum frame, blades interconnected with tie-rods, and nylon bearings.
 - 2) Motorized shutter with heavy aluminum frame, blades interconnected with tie-rods, nylon bearings, and actuator motor to power open and spring return.
 - c. Wall Sleeve: Galvanized steel sleeve with moveable angle frame.
 7. Motors: Reference 23 05 13 Motors for more information.
- C. Roof and Wall Ventilators:
 1. Housing: Weatherproof, heavy-gauge spun aluminum with rigid steel internal support structure.
 2. Fan Wheel: Aluminum, non-overloading, backward inclined, centrifugal type. Dynamically balanced.
 3. Motor: Open drip proof, high-efficiency motor, mounted out of the air stream. Reference 23 05 13 Motors for more information.
 4. Shafts: Solid steel, precision ground, polished, and treated for rust resistance.
 5. Drive:
 - a. Belt drive:
 - 1) Bearings: Heavy duty, with L-10 rated bearing-life exceeding 200,000 operating hours.
 - 2) Pulleys: Cast iron fixed pitch, sized for 150 percent of the driven horsepower.
 6. Vibration Isolators: Multidirectional, rubber-in-shear.
 7. Screen: Aluminum bird screen.
 8. Roof Curb:
 - a. Field-built.
 - b. Prefabricated, galvanized curb with welded seams and fastening flange for "self-flashing". Closed cell neoprene rubber gasketing around the top of the curb and 1-1/2-inch thick, 3-pound density rigid insulation along the sides. Curbs shall be minimum 14" high.
 9. Nameplate: Each fan shall bear a permanently affixed manufacturer's nameplate containing the model number and individual serial number for future identification.
 10. Accessories:
 - a. Hinged Sub-base: Rust-proof hinge arrangement permits access to curb well for access to curb mounted dampers.
 - b. Backdraft damper: Galvanized steel frame, multi-leaf, roll formed aluminum blades with nylon bearings.
- D. Upblast Roof Ventilators:
 1. Housing: Heavy-gauge spun aluminum housing with rigid steel internal support structure, spun aluminum windband, and aluminum base with continuously welded curb cap corners.
 2. Fan Wheel: Aluminum, non-overloading, backward inclined, centrifugal type. Dynamically balanced.
 3. Motor: Heavy duty type, permanently lubricated, sealed ball bearing, open drip proof, high-efficiency motor, mounted out of the air stream. Reference 23 05 13 Motors for more information.
 4. Shafts: Solid steel, turned, ground, and polished.
 5. Drive:
 - a. Belt drive, cast iron, keyed and securely attached to wheel and motor shafts:
 - 1) Bearings: Heavy duty, greasable ball type mounted in cast iron housing, L10 rated 100,000 operating hours.

- 2) Pulleys: Fixed pitch, sized for 150 percent of the driven horsepower.
6. Vibration Isolators: Multidirectional, rubber-in-shear.
7. Screen: Aluminum bird screen.
8. Roof Curb:
 - a. Field-built.
 - b. Prefabricated, galvanized curb with welded seams and fastening flange for “self-flashing”. Closed cell neoprene rubber gasketing around the top of the curb and 1-1/2-inch thick, 3 pound-density rigid insulation along the sides.
9. Accessories:
 - a. Hinged Sub-base: Rust-proof hinge arrangement permits access to curb well for access to curb mounted dampers.
 - b. Backdraft damper: Galvanized steel frame, multi-leaf, roll formed aluminum blades with nylon bearings. Motorized Actuator.
 - c. Provide fans with UL-762 listing for all grease applications.
- E. Ceiling Fan:
 1. Housing: Acoustically insulated, galvanized steel housing with chatter proof damper.
 2. Fan Wheel: Centrifugal type, dynamically balanced.
 3. Motor: Permanently lubricated, direct drive motor with built-in overload protection and plug in disconnects. Motor mounted on rubber mountings. Reference 23 05 13 Motors for more information.
- F. Utility Set Fans:
 1. General: Fan constructed such that all surfaces are heavy coated high performance epoxy powder coating Green Kote TM plus or equal, rated at 250°F, 3-4 mils thick. All nuts, bolts and fasteners shall be type 316 SST and powder coated. No un-coated surfaces will be acceptable.
 2. Performance: Fan ratings shall be based on tests made in accordance with AMCA Standard 210 and licensed to bear the AMCA Certified Ratings Seal for Air Performance. Fans shall have a sharply rising pressure characteristic extending throughout the operating range to assure quiet and stable operation. Fan brake horsepower shall be equal to or less than the BHP specified in the schedule at the listed static pressure and CFM.
 3. Sound: Fan manufacturers shall provide sound power level ratings for fans tested and rated in accordance with AMCA Standards 300 and 301.
 4. Bearings: Bearings are to be grease lubricated, precision anti-friction ball, self-aligning, pillow block design. Bearings shall be designed for a minimum L-10 life of 200,000 hours when rated at the fan’s maximum cataloged operating speed. Fan bearings shall be visible and accessible for inspection, maintenance, and replacement. Bearings enclosed within the fan housing where they can be exposed to the corrosive gas steam are not acceptable.
 5. Construction: Fan constructed in accordance with the ASTM D-4167 standard for fiber-reinforced plastic fans and blowers to ensure structural integrity. Fans shall be suitable for outdoor use.
 6. Housing: Constructed with fire retardant vinyl ester resin with an ASTM E84. Housing laminate construction shall conform to ASTM Standard C-582. Shaft hole openings fitted with a teflon closure having a maximum clearance of 1/32 inch to minimize leakage. Inlet assembly bolted to permit wheel removal. Housing shall have weep holes to allow moisture to drain.
 7. Wheel: Backward inclined, non-overloading design for increased efficiency. Wheel coated with a fire-retardant vinyl ester resin with an ASTM E84 flame spread of 25 or less. Wheel hub permanently bonded to the shaft and completely encapsulated in FRP to insure corrosion resistant integrity.
 8. Shaft: Solid, ASTM A-108 steel, grade 1040/1045 with an FRP sleeve fixed securely and bonded to the wheel backplate. The sleeve shall extend out through the housing shaft hole for corrosion protection. Shaft shall be countersunk for tachometer readings.
 9. Fan shaft and bearings to be eccentric lock or taper lock to prevent fretting. Set screws for bearing locks are not allowed.
 10. Balance and Run test: The wheel and shaft shall be dynamically balanced, as an assembly, in accordance with ASTM D-4167 and ANSI S2.19-1975, Grade 6.3. Prior to shipment, completed fans shall receive a final test-balance at the specified operating speed.

11. Accessories:
 - a. Weather Cover/Belt Guard.
 - b. V-Belt Drive, Adjustable. Provide multi-belt type drive.
12. Provide spring-operated automatic lubricator. Provide LubeSite 560 with 6 oz reservoir. Each lubricator shall be suitable for outdoor use, corrosion resistant, suitable for operation from –20 to 120° F, with Viton piston seal ring, and fully compatible with fans and lithium-based lubricant. Other acceptable manufacturers: Alemite, or SKF.

END OF SECTION 23 40 00