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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. Combination kitchen hood supply and exhaust fans.
 - 10. High Plume Dilution Exhaust Fans
 - 11. Roof ventilators.

- B. The intent of these standards are 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

ENGINEERING AND DESIGN REQUIREMENTS

- A. Poor inlet and discharge conditions often lead to underperformance of fans in relation to design. Fan inlet and discharge duct shall be designed without abrupt transitions and have the required distance between inlet/outlet and any elbows or tees.
- B. High plume dilution fans shall be used to exhaust laboratory, pilot plant and process spaces. The University Energy and Engineering Department must be consulted when using other types of fans to exhaust these areas.
- C. All roof mounted fans shall be mounted on structural steel supports with an access platform for maintenance.
- D. Fan materials of construction shall be selected based on the explosive hazards and corrosiveness of the air stream through the fan.
- E. All fan motors shall be TEFC type and have NEMA explosive ratings based on the surrounding atmosphere and/or air stream through fan.

1.3 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.

1.4 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.

1.5 QUALITY ASSURANCE

1.6 DELIVERY, STORAGE, AND HANDLING

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

1.7 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.8 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 HIGH PLUME DILUTION EXHAUST FANS

- A. Manufacturers:
 - 1. Greenheck Corp (Vortex)
 - 2. Harington Environmental
 - 3. MK Plastics
 - 4. Strobic Air
- B. Fan assembly shall be minimum AMCA type C spark resistant construction unless stated otherwise on the drawings.
- C. Fan Housing:
 - 1. Corrosion Resistance: Fan Housing shall be constructed of corrosion resistant materials such as FRP or polypropylene or steel with a corrosion resistant coating rated for a 4000 hour ASTM B117 Salt Spray Resistance.
 - 2. Fan housing shall be aerodynamically designed to reduce incoming air turbulence.
 - 3. Fan Housing shall allow all drive components including motors to serviced and maintained without contact with the contaminated airstream.
 - 4. Fan housing shall have an integral housing drain
 - 5. Fan housing shall have an access door for impeller inspections.

- D. Induction Discharge Nozzle:
1. Corrosion Resistance: Induction Discharge Nozzle shall be constructed of corrosion resistant materials such as FRP or polypropylene or steel with a corrosion resistant coating rated for a 4000 hour ASTM B117 Salt Spray Resistance.
 2. Induction Discharge Nozzle shall be integral to the body and be designed for outlet velocities of 7000fpm.
 3. Induction Discharge Nozzle shall be integral to the body and be designed for outlet velocities of 7000fpm.
 4. Induction Discharge Nozzle shall induce ambient air up to 2.5 times the fan capacity.
- E. Fan :
1. Fan Unit: Direct Drive, airfoil blower, constructed of corrosion resistant materials such as FRP or polypropylene or steel with a corrosion resistant coating rated for a 4000 hour ASTM B117 Salt Spray Resistance; spring isolated; statically and dynamically balanced .
 2. Sheaves: dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheave selected so required rpm is obtained with sheaves set at mid-position.
 3. Bearings: Ball or roller pillow block type: L-10 life of 200,000 hours; extended lines with Zerk fittings.
 4. Motor: Premium efficiency TEFC, Inverter Duty.
- F. Master Control Panel: Factory wired to disconnect switch for exhaust fan. Furnish with fused magnetic starters, overload protection, wiring terminals and weatherproof housing. Furnish with 120 volt control circuit transformer.
- G. Plenum Curb: Self-flashing of 12 gage galvanized steel construction with continuously welded seams, 1 inch thick sound insulation on inner surface, and factory installed nailer strip.
- H. Disconnect Switch: Factory wired, non-fusible, in fan housing for thermal overload protected motor, NEMA 250 Type 1, lockable enclosure.
- I. Bypass Air Plenum: [\(Constant Volume Units Only\)](#)

1. Corrosion Resistance: Fan Housing shall be constructed of corrosion resistant materials such as FRP or polypropylene or steel with a corrosion resistant coating rated for a 4000 hour ASTM B117 Salt Spray Resistance.
 2. Bypass Air & Fan Isolation Dampers: Opposed blade airfoil design suitable for 15" wg; Corrosion resistant materials; Blades shall have polymer damper edge seals; Stainless steel damper rods, bearings and jamb seals.
 3. Weatherhood: Construction to match bypass air plenum with stainless steel insect screen.
- J. Glycol Based Energy Recovery Coil:
1. Construction: 1/2 inch copper tube mechanically expanded into aluminum plate fins, leak tested under water to 200 psig pressure, factory installed.
- K. Airflow Measuring Station: Calibrated nozzle type mounted on the inlet venturi of the fan.

2.2 CENTRIFUGAL FANS

- A. Manufacturers:
1. Harrington Environmental
 2. Howden Buffalo Fan Company
 3. New York Blower Company
 4. Twin City Fan Company
- 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.
- C. Wheel:
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.
- D. Housing:
1. Factory finish before assembly to manufacturer's standard.
 2. Bolted construction with horizontal flanged split housing.
- 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 key way, protectively coated with lubricating oil, and shaft guard.
- F. Drive: Direct Drive for use with variable frequency drive
- G. Motor: Totally enclosed fan cooled; motor should have NEMA hazard rating based on working conditions.

2.3 AXIAL FANS

- A. Manufacturers:
1. Harrington Environmental
 2. Howden Buffalo Fan Company
 3. New York Blower Company
 4. Twin City Fan Company
- 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.
 4. Lubrication: Extend lubrication fittings to outside of casing.

- E. Motor: Totally enclosed fan cooled; motor should have NEMA hazard rating based on working conditions.
- F. 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. Vibration Detector: Factory installed vibration switch to stop fan with extra set of contacts.

2.4 PROPELLER FANS

- A. Manufacturers:
 - 1. Greenheck 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. 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.

2.5 UPBLAST AND DOWNBLAST CENTRIFUGAL ROOF FANS (For Kitchen and General Exhaust Only, These Fans Should Never Be Used to Exhaust Laboratory, Pilot Plant or Process Areas or Operations)

- A. Manufacturers:
 - 1. Greenheck Corp
 - 2. PennBarry Company
 - 3. Twin City Fan Company
- B. Fan Unit: V-belt drive, with spun aluminum housing; resilient mounted motor; aluminum wire bird screen; square base to suit roof curb with continuous curb gaskets.
- C. Sheaves: steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheave selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.
- D. Motor: Totally enclosed fan cooled
- E. 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.
- F. Disconnect Switch: Factory wired, non-fusible, in fan housing for thermal overload protected motor, NEMA 250 Type 1, lockable enclosure.
- G. Accessories:
 - 1. Backdraft Damper: Gravity actuated, aluminum multiple blade construction, felt edged with offset hinge pin, nylon bearings, blades linked, spring return.
 - 2. Fan speed controller.

2.6 CEILING MOUNTED BATHROOM EXHAUST FANS

- A. Manufacturers:
 - 1. Greenheck 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. Disconnect Switch: Fan mounted toggle switch for thermal overload protected motor.
- D. Grille: Aluminum with baked white enamel finish.

- E. Wheel: DWDI or Centrifugal forward curved type constructed of injection molded or polypropylene resin.
- F. Motor: Open drip proof type with permanently lubricated sealed bearings and thermal overload protection.
- 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.

2.7 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 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.

2.8 COMBINATION KITCHEN HOOD SUPPLY AND EXHAUST FANS

- A. Manufacturers:
 - 1. CaptiveAire
 - 2. Gaylord Industries
 - 3. Grease Master
 - 4. Greenheck Corp
 - 5. Halton
 - 6. Kees Inc.

- B. Exhaust Fan:
 - 1. Fan Unit: Upblast type. V-belt drive, spun aluminum housing with grease tray; resilient mounted motor; aluminum wire bird screen; square base to suit roof curb with continuous curb gaskets.

 - 2. Sheaves: steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheave selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

 - 3. Motor: Open drip proof

 - 4. Accessories:
 - a. Backdraft Damper: Gravity actuated, aluminum multiple blade construction, felt edged with offset hinge pin, nylon bearings, blades linked, spring return.
 - b. Fan speed controller.

- C. Supply Fan:
 - 1. Fan Unit: Belt driven, double width, double inlet centrifugal blower, galvanized steel housing with galvanized finish; resilient mounted motor; square base to suit roof curb.

 - 2. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheave selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

 - 3. Motor: Open drip proof.

- D. Master Control Panel: Factory wired to disconnect switch for supply fan and disconnect switch for exhaust fan. Furnish with fused magnetic starters, overload protection, wiring terminals and weatherproof housing. Furnish with 120 volt control circuit transformer.

- E. Fresh Air Intake Section: Constructed of galvanized steel. Size as indicated on Drawings. Galvanized steel duct support at end of intake duct.

- F. Filters: 2inch thick polyester media, washable and cleanable. Furnish bird screen at filter opening.
- G. 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.
- H. Curb Cap: Galvanized steel, welded construction. Fits over roof curb to accommodate supply fan and exhaust fan. Insulate with 1-1/2 inch, 3 pound per cubic foot density fiberglass insulation. Furnish vented extension for exhaust fan. Comply with NFPA 96 for fan spacing and vertical separation.
- I. Damper: Motor operated, aluminum multiple blade construction, felt edged with offset hinge pin, nylon bearings, blades linked and line voltage motor drive, power closed.
- J. Disconnect Switch: Factory wired, non-fusible, in fan housing for thermal overload protected motor, NEMA 250 Type 1, lockable enclosure.
- K. Hot Water Heating Coil:
 - 1. Construction: Minimum 1/2 inch copper tube mechanically expanded into aluminum plate fins, leak tested under water to 200 psig pressure, factory installed.

2.9 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.

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 run under observation.

END OF SECTION