SECTION 15851 - AIR HANDLING FANS

PART 1 - GENERAL:

1.1 DESCRIPTION OF WORK:

A. Extent of air handling equipment work required by this section is indicated on drawings and schedules, and by requirements of this section.

B. Refer to other Division 15 sections for vibration control; control system; sequence of operation; testing, adjusting and balancing.

C. Refer to Division 16/1 section for the following work; not work of this section.

1. Power supply wiring from power source to power connections at air handling units.

D. Refer to Section 15040 Paragraph 2.6 for requirements of sheaves and belts for critical areas.

1.2 QUALITY ASSURANCE:

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of air handling equipment of types and sizes required, whose products have been in satisfactory use in similar service for not less than 3 years.

B. Codes and Standards:

1. Fans 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/ASHRAE Standard 51 - Laboratory Methods of Testing Fans for Rating.

2. UL Compliance: Provide air handling equipment which are listed by UL and have UL label affixed.

3. UL Compliance: Provide air handling equipment which are designed, manufactured, and tested in accordance with UL 805 "Power Ventilators".

4. NEMA Compliance: Provide motors and electrical accessories complying with NEMA standards.

5. Sound Power Level Ratings: Comply with AMCA Standard 301 "Method for Calculating Fan Sound Ratings from laboratory Test Data." Test fans in accordance with AMCA Standard 300 "Test Code for Sound Rating."

6. Nationally Recognized Testing Laboratory and NEMA Compliance (NRTL): Fans and components shall be NRTL listed and labeled. The term "NRTL" shall be defined in OSHA Regulation 1910.7.

7. Electrical Component Standards: Components and installation shall comply with NFPA 70 "National Electrical Code."

1.3 SUBMITTALS:

A. Product Data: Submit manufacturer's technical data for air handling equipment including specifications, capacity ratings, dimensions, weights, materials, operating & service/access clearance accessories furnished, and installation instructions.

B. Shop Drawings: Submit assembly-type shop drawings showing unit dimensions, construction details, methods of assembly of components, and field connection details.

C. Wiring Diagrams: Submit manufacturer's electrical requirements for power supply wiring to air-handling units. Submit manufacturer's ladder-type wiring diagrams for interlock and control wiring. Clearly differentiate between portions of wiring that are manufacturer-installed and portions to be field-installed.

D. Record Drawings: At project closeout, submit record drawings of installed systems products; in accordance with requirements of Division 15.

E. Maintenance Data: Submit maintenance data and parts list for each type of power and gravity ventilator, accessory, and control. Include this data, product data, shop drawings, and wiring diagrams in maintenance manuals in accordance with requirements of Division 15.

1.4 DELIVERY, STORAGE, AND HANDLING:

A. Lift and support units with the manufacturer's designated lifting or supporting points.

B. Disassemble and reassemble units as required for movement into the final location following manufacturer's written instructions.

C. Deliver fan units as a factory-assembled unit to the extent allowable by shipping limitations, with protective crating and covering.

1.5 SEQUENCING AND SCHEDULING:

A. Coordinate the size and location of concrete equipment pads. Cast anchor bolt inserts into pad.

B. Coordinate the installation of roof curbs, equipment supports, and roof penetrations.

C. Coordinate the size and location of structural steel support members.

1.6 EXTRA MATERIALS:

A. Furnish one additional complete set of belts for each belt-driven fan.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

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

1. Centrifugal Fans:

a. Aladdin Heating Corp.
b. Buffalo Forge Co.
c. ILG Industries, Inc.
d. Loren Cook Co.
e. New York Blower Co.
f. Trane Co.
g. Twin City Fan and Blower Co.
h. Greenheck
i. York; Division of York International

j. Carnes

2. Utility Sets:

a. Acme Engineering And Mfg. Corp.
b. Aladdin Heating Corp.
c. Buffalo
d. Brundage (The) Co.
e. Loren Cook Co.
f. ILG Industries, Inc.
g. New York Blower Co.
h. Penn Ventilator Co., Inc.
i. Trane Co.
j. Twin City Fan and Blower Co.
k. Greenheck

3. Tubular Centrifugal Fans:

a. Acme Engineering and Manufacturing Corp.
b. Aladdin Heating Corp.
c. Buffalo
d. Loren Cook Co.
e. New York Blower Co.
f. Twin City Fan and Blower Co.
g. Greenheck
h. Carnes

4. Inline Centrifugal Fans:

a. Acme Engineering and Manufacturing Corp.
b. Buffalo
c. Loren Cook Co.
d. Penn Ventilator Co.
e. Jenn Industries Inc.
f. New York Blower Co.
g. Greenheck
h. Carnes

5. Centrifugal Roof Ventilators:

a. Acme Engineering and Manufacturing Corp.
b. Aerovent, Inc.
c. Briedert Co., C.G.
d. Carnes Company, Inc.
e. Loren Cook Co.
f. Jenn Industries, Inc.
g. Penn Ventilator Co., Inc.
h. Greenheck

6. Centrifugal Plug Fans:

a. Peerless Fan Co.
b. Chicago Blower
c. Greenheck
d. Twin City Fan Co.
e. New York Blower

f. Carnes

7. Axial Roof Ventilators:

a. Acme Engineering & Mfg. Corp.
b. Aerovent, Inc.
c. Carnes Company, Inc.
d. Loren Cook Co.
e. Jenn Industries, Inc.
f. Penn Ventilator Co., Inc.
g. Greenheck

8. Upblast Propeller Roof Exhaust Fans:

a. Loren Cook Co.
b. Essick Air Products, Breidert.
c. Greenheck
d. ILG Industries, Inc.
e. Carnes

9. Centrifugal Wall Ventilators:

a. Acme Engineering & Mfg. Corp.
b. Briedert Co., C.G.
c. Carnes Company, Inc.
d. Greenheck
e. ILG Industries, Inc.
f. Jenn Industries, Inc.
g. Penn Ventilator Co., Inc.

10. Ceiling-Mounted Ventilators:

a. Acme Engineering & Mfg. Corp.
b. Bridert Co., C.G.
c. Broan Mfg. Co., Inc.
d. Carnes Company, Inc.
e. Loren Cook Co.
f. Greenheck
g. ILG Industries, Inc.
h. Jenn Industries, Inc.
i. Penn Ventilator Co., Inc.
j. Thermador/Waste King; Div. of Norris Industries.

11. Propeller Fans:

a. Acme Engineering & Mfg. Corp.
b. Aerovent Inc.
c. Briedert Co., C.G.
d. Carnes Company, Inc.
e. Loren Cook Co.
f. ILG Industries, Inc.
g. Jenn Industries, Inc.
h. New York Blower Co.
i. Penn Ventilator Co., Inc.
j. Greenheck
k. Carnes

12. Vaneaxial Fans:

    a. Acme Engineering & Mfg. Corp.
    b. Aerovent, Inc.
    c. ILG Industries
    d. New York Blower Co.
    e. Trane Co.
    f. Twin City Fan and Blower Co.
    g. Flakt
    h. Greenheck
    i. Carnes

13. Variable Pitch Vaneaxial Fans

    a. Joy Mfg. Co.
    b. Trane Co.
    c. Flakt
    d. Greenheck
    e. Carnes

14. Bathroom Exhausters

    a. Broan Mfg. Co., Inc.
    b. NuTone Div; Scovell Mfg. Co.
    c. Thermador/Waste King; Div. of Norris Industries.
    d. Greenheck

15. Gravity Ventilator (Hooded and Round Stationary)

    a. Penn Ventilator Co., Inc.
    b. Briedert Co., C.G.
    c. Bristol Fiberlite Industries
    d. Burt Mfg. Co.
    e. Hirschman-Pohle Co.
    f. Robertson Co., H.H.
    g. Steelite, Inc.
    h. Greenheck

16. Low Silhouette Box-Type Gravity Ventilators

    a. Robertson Co., H.H.
    b. Swartwout Industries, Inc.
    c. Greenheck

17. Prefabricated Roof Curbs

    a. Custon Curb, Inc.
    b. Pate Co.
    c. S & L Manufacturing Co.
    d. ThyCurb Div.; Thybar Corp.

2.2 FANS, GENERAL:

A. General: Provide fans that are factory fabricated and assembled, factory tested, and factory finished, with indicated capacities and characteristics.

B. Fans and Shafts: 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. Belt Drives: Factory mounted, with final alignment and belt adjustment made after installation.

1. Service Factor: 1.4.

D. Belts: Oil-resistant, nonsparking, and nonstatic.

E. Motors 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. Provide energy efficient motor.

1. Belt Guards: Provide steel belt guards for motors mounted on the outside of the fan cabinet.

NOTE: Light duty/8 hours/day operation, 20,000 to 60,000 medium duty/8 to 16 hours/day operation, 60,000 to 100,000 and heavy duty/24 hours/day operation 100,000 to 200,000.

F. Shaft Bearings: Provide type indicated, having a median life "Rating Life" AFBMA L10 of [ ] calculated in accordance with AFBMA Standard 9 for ball bearings and AFBMA Standard 11 for roller bearings.

G. 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.

H. Vibration: Provide vibration isolators as specified in Section 15241 and as indicated.

EDIT NOTE: Provide the following section for CSU projects where Ken Medearis is the vibration consultant. Consider limiting types and/or horsepower of fans.

2.3 FAN VIBRATIONAL PERFORMANCE REQUIREMENTS:

A. The fan manufacturer shall provide all fans over 5000 cfm according to the following specifications and provide submittals as noted.

1. Rotor shafts shall be solid steel. Hollow shafts are not permitted.

2. The design resonant speed of the fan system shall be a minimum of 25 percent above the fan maximum operating speed considering both wheel mass and inertia. The design resonant speed is that speed which corresponds to the natural frequency of the spring-mass system consisting of the rotating components, bearing lubrication and housing and supporting pedestal with the supporting floor, foundation, etc., considered to be infinitely rigid.

3. Design resonant calculations shall be submitted by the Manufacturer to support the design resonant speed value to insure that the bearing support structure has adequate stiffness in all three directions (lateral, axial and vertical). Use of vibration isolation springs is not allowed.

4. Shop drawings shall be submitted for fan assembly details including dimensions and thickness of steel frames and bases, rotor shaft dimensions, wheel weight, bearing types and center-to-center distance. The Manufacturer shall not withhold this information for proprietary or any other reasons.

5. The fan shall be factory balanced so that the inboard and outboard bearing motions do not exceed 1 mil peak-to-peak in any direction when measured in the “filter in” measurement mode at any operating speed. On-site fan balancing will be required if the operational bearing motions (inboard and outboard) exceed 1.2 mils, peak-to-peak in any direction when measured in the “filter out” mode at any operating speed. The vibrating measurement system used, in either case, must have a flat response down to 120 rpm.

6. The Manufacturer shall provide a written vibration balance report of the fan showing the vibrations as described above. The report shall include a description of how the fan was mounted during the test, operating conditions which include rpm, static pressure and duct arrangements and the type of vibration instruments used.

B. The fan and air handler support structures are an integral part of the vibratory system and shop drawings are required. It is essential for those structures to be capable of providing a direct avenue for transfer of forces generated by the fans and motors to the supporting structural floor system.

C. If the Manufacturer cannot provide design resonant calculations, then the Owner will, at their expense of the contractor, employ a Structural Vibration Consultant to perform design resonant calculations based upon the shop drawings. The results of the analysis may require structural changes to the fan support system. The Manufacturer shall make these changes without cost to the owner or choose to assemble the fan and perform a vibration test to demonstrate compliance with the peak-to-peak limits.

D. The Owner will employ, at their expense, a Structural Vibration Consultant to measure the vibrations after start-up should the fan system)s) fail the vibration tests, the contractor will be required to pay for subsequent tests of the vibration after repairs are made.

E. Fan vibrations which exceed the amounts, as described above, during operation in the warranty period shall be reduced by the Contractor. The Contractor can choose to dynamically balance the fan in place using a recognized specialist, replace bearings or make structural modifications to reduce the vibrations.

F. The Owner will provide and install a sticker identifying the fan maximum operating speed. Speed changes which exceed this value are not permitted without permission of Structural Vibration Consultant through the University Representative.

2.4 CENTRIFUGAL FANS:

A. General Description: Belt-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, and support structure.

B. Housings: Fabricated from formed and reinforced galvanized steel panels to form curved scroll housings with continuously welded or deep-locked seams and access doors or panels to allow access to internal parts and components.

1. Inlet Cones: Spun metal.

2. Duct Connections: Flanged.

3. Panel Bracing: Steel angle- or channel-iron member supports for mounting and supporting fan scroll, wheel, motor, and accessories.

C. Fan Wheels: Single-width, single-inlet, welded to cast-iron or cast-steel hub and spun steel inlet cone, with hub keyed to the shaft.

D. Fan Wheels: Double-width, double-inlet, welded to cast-iron or cast-steel hub and spun steel inlet cone, with hub keyed to the shaft.

1. Blade Materials: Steel.

2. Blade Type: Backward-curved, flat-plate type.

3. Blade Type: Backward-curved, airfoil type.

4. Blade Type: Forward-curved, airfoil type.

E. Shaft Bearings: Prelubricated and sealed, self-aligning, pillow- block type ball bearings.

OR

Shaft Bearings: Grease-lubricated, self-aligning, pillow-block type; tapered roller bearings with double-locking collars and two- piece, cast-iron housing.

OR

Shaft Bearings: Grease-lubricated, self-aligning, pillow-block type, with double spherical roller bearings with adapter mount and two-piece cast-iron housing.

F. Accessories: The following accessories are required.

1. Scroll Bypass Dampers: Aluminum, opposed, airfoil blades with extruded vinyl seals on blades, low-friction bearings, and positive control linkage for manual or automatic operation.

2. Scroll Housing Access Doors: Latch-type handles; flush-mounted for uninsulated housings and raised-mounted for insulated housings.

3. Inlet Vanes: Radial vanes with linkage for manual or automatic operation.

4. Double-Width Fans Inlet Vanes: Connected for single operator.

5. Inlet Screens: Heavy wire mesh screens, mounted inside of shaft bearings.

6. Discharge Dampers: Heavy-gauge steel, opposed blade design, with linkage for manual or automatic operation.

7. Drain Connections: Threaded, 3/4-inch NPS, capped nipple installed at lowest point of housing.

8. Shaft Cooler: Metal disc between bearings and fan wheel, designed to dissipate heat from shaft.

9. Spark-Resistant Construction: AMCA construction option A, B, or C as indicated.

10. Shaft Seals: Air-tight seals installed around shaft on drive side of single-width fans.

11. Special Coatings: Provide protective coatings on fans as indicated.

12. Extended Grease Lines: Extend grease lines from bearings to a convenient, visible location and terminate with grease fitting.

2.5 UTILITY SET FANS:

A. General Description: Belt-driven, centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, and accessories.

B. Housings: Fabricated from heavy-gauge steel with side sheets fastened to scroll sheets by means of welding or deep lock seam.

1. Inlet: Round duct collar.

2. Discharge: Slip-joint duct connection.

3. Housings Discharge Arrangement: Adjustable to 8 standard positions.

C. Fan Wheels: Single-width, single-inlet, welded to cast-iron or cast-steel hub and spun steel inlet cone, with hub keyed to the shaft.

1. Blade Materials: Steel.

2. Blade Type: Backward-curved, die-formed.

3. Blade Type: Forward-curved, die-formed.

D. Shaft Bearings: Prelubricated and sealed, self-aligning, pillow- block-type ball bearings.

E. Accessories: The following accessories are required where indicated:

1. Backdraft Dampers: Gravity-actuated with counterweight and interlocking aluminum blades and felt edges in steel frame installed on fan discharge.

2. Access Doors: Gasketed doors with latch-type handles.

3. Scroll Dampers: Single-blade damper installed at fan scroll top with adjustable linkage.

4. Spark-Resistant Construction: AMCA construction option A, B, or C as indicated.

5. Inlet Screens: Removable, heavy wire mesh.

6. Drain Connections: 3/4-inch, threaded coupling drain connection installed at lowest point of housing.

7. Weather Hoods: Weather-resistant with stamped vents over motor and drive compartment.

8. Special Coatings: Provide protective coatings on fans as indicated.

2.6 TUBULAR CENTRIFUGAL FANS:

A. General Description: Tubular, inline, belt-driven, centrifugal fans consisting of housing, wheel, outlet guide vanes, fan shaft, bearings, drive assembly, motor and disconnect switch, mounting brackets, and accessories.

B. Housings: Fabricated from formed and reinforced galvanized steel panels with welded seams.

1. Duct Connections: Spun inlet cones with flange removable for access to internal parts, and an outlet flange.

2. Mounting Brackets: Suitable for horizontal or vertical mounting.

3. Motor Mount: Adjustable for belt tensioning.

4. Fan Wheels: Single-width, single-inlet, welded to cast-iron or cast-steel hub and spun steel inlet cone, with hub keyed to the shaft.

a. Blade Materials: Steel.

b. Blade Type: Backward-curved, flat-plate type.

c. Blade Type: Backward-curved, airfoil type.

C. Shaft Bearings: Prelubricated and sealed, self-aligning, pillow- block-type ball bearings.

OR

D. Shaft Bearings: Grease-lubricated, self-aligning, pillow-block type; tapered roller bearings with double-locking collars and two- piece, cast-iron housing.

OR

E. Shaft Bearings: Grease-lubricated, self-aligning, pillow-block type, with double spherical roller bearings with adapter mount and two-piece cast-iron housing.

F. Accessories: The following accessories are required where indicated:

1. Companion Flanges: For inlet and outlet connections.

2. Weather Cover: Heavy-gauge, galvanized, sheet steel with ventilation slots, bolted to housing.

3. Belt Guard: Manufacturer's standard to meet OSHA requirements.

4. Ceiling Brackets: Structural angles welded and drilled for hanger rod attachment.

5. Inlet Vanes: Radial vanes with linkage suitable for manual or automatic operation.

6. Access Doors: Located over wheel in an accessible position, hinged and having latch-type handles; flush mounted for uninsulated housings, raised-mounted for insulated housings.

7. Spark-Resistant Construction: AMCA construction option A, B, or C as indicated.

8. Inlet and Outlet Screens: Removable, heavy wire mesh.

9. Special Coatings: Provide protective coatings on fans as indicated.

10. Drain Connections: Provide 3/4" threaded coupling drain connection at lowest point of housing.

2.7 INLINE CENTRIFUGAL FANS:

A. General Description: Inline, belt-driven, centrifugal fans consisting of housing, wheel, outlet guide vanes, fan shaft, bearings, drive assembly, motor and disconnect switch, mounting brackets, and accessories.

B. Housing: Split, spun-aluminum housing, with aluminum straightening vanes, inlet and outlet flanges, and support bracket adaptable to floor, side wall, or ceiling mounting.

C. Direct-Drive Units: Motor encased in housing out of air stream, factory-wired to disconnect located on outside of fan housing.

D. 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.

E. Wheel: Aluminum, airfoil blades welded to aluminum hub.

F. Bearings: Grease lubricated ball or roller anti-friction type with extended lubrication lines to outside fan housing.

G. Accessories: The following accessories are required 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.

2.8 CENTRIFUGAL ROOF VENTILATORS:

A. General Description: Belt-driven or direct-drive as indicated, centrifugal consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, curb base, and accessories.

B. Housing: Heavy-gauge, removable, spun-aluminum, dome top and outlet baffle; square, one-piece, hinged, aluminum base with venturi inlet cone.

1. Upblast Units: Provide spun-aluminum discharge baffle to direct discharge air upward, with rain and snow drains.

C. Fan Wheel: Aluminum hub and wheel with backward-inclined blades.

D. 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. Fan and motor isolated from exhaust air stream.

E. Accessories: The following items are required 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: Removable 1/2-inch mesh, 16-gauge, aluminum or brass wire.

3. Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in curb base, factory set to close when fan stops.

OR

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 motor.

OR

Operators: Manufacturer's standard pneumatic motor.

4. Roof Curbs: Prefabricated, heavy-gauge, galvanized steel; mitered and welded corners; 2-inch-thick, rigid, fiberglass insulation adhered to inside walls; built-in cant and mounting flange for flat roof decks; and 2-inch wood nailer. Size as required to suit roof opening and fan base.

a. Overall Height: 12 inches.

*** EDIT NOTE: Select Unhoused or Housed Fan***

2.9 CENTRIFUGAL PLUG FAN:

A. Provide unhoused/housed fan assembly complete with motor, non-overloading centrifugal fan wheel, flanged mounting panel, screw type motor adjustment.

B. Belt guard shall be provided at fan motor and belt to meet OSHA requirements.

C. Construction of fan shall be completely welded.

D. Fan shall be painted with enamel paint.

E. Ceramic felt seal element between fan panel and metal retaining disc.

F. Shaft Bearings: Grease-lubricated, self-aligning pillow-block type; tapered roller bearings with double-locking collars and two piece, cast-iron housing.

G. Fan Wheel: Single width, single-inlet, welded to cast-iron or cast-steel hub and spun steel inlet cone, with hub keyed to the shaft.

H. Accessories: The following accessories are required where indicated.

1. Inlet vanes: Radial vanes with linkage for automatic operation.

2. Shaft Seals: Air tight seals installed around shaft on drive side of single-width fans.

2.10 AXIAL ROOF VENTILATORS:

A. General Description: Belt-driven or direct-drive as indicated, axial fans consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, curb base, and accessories.

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

C. Fan Wheel: Aluminum hub and blades.

D. Fan Wheel: Steel hub and blades.

E. 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.

F. Accessories: The following items are required 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: Removable, 1/2-inch mesh, 16-gauge aluminum or brass wire.

3. Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in curb base, factory set to close when fan stops.

OR

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 motor.

OR

Operators: Manufacturer's standard pneumatic motor.

4. Roof Curbs: Prefabricated, heavy-gauge, galvanized steel; mitered and welded corners; 2-inch-thick, rigid fiberglass insulation adhered to inside walls; built-in cant and mounting flange for flat roof deck; and 2-inch wood nailer. Size as required to suit roof opening and fan base.

a. Overall Height: 12 inches.

2.11 UPBLAST PROPELLER ROOF EXHAUST FANS:

A. General Description: Belt-driven or direct-drive as indicated, propeller fans consisting of housing, wheel, butterfly-type discharge damper, fan shaft, bearings, motor and disconnect switch, drive assembly, curb base, and accessories.

B. Wind Band, Fan Housing, and Base: Reinforced and braced galvanized steel, containing galvanized steel butterfly dampers and rain trough, motor and drive assembly, and fan wheel.

OR

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. Dampers Rods: Steel with bronze bearings.

OR

Dampers Rods: Steel with nylon bearings.

C. Fan Wheel: Dynamically and statically balanced, replaceable, cast- aluminum blades fastened to cast-aluminum hub. Factory-set pitch angle of blades.

OR

Fan Wheel: Replaceable, extruded-aluminum, airfoil blades fastened to cast-aluminum hub. Factory set pitch angle of blades.

D. Shaft Bearings: Prelubricated and sealed, self-aligning, pillow- block-type ball bearings.

E. Motors and Fan Wheel Pulleys: Adjustable pitch. Select pulley so that pitch adjustment is at the middle of the adjustment range at design conditions.

F. Motors Mounts: Outside of the fan cabinet with adjustable base for belt tensioning, drive assembly and belts enclosure, and weatherproof housing of same material as fan housing.

G. Roof Curbs: Prefabricated, heavy-gauge, galvanized steel; mitered and welded corners; 2-inch-thick, rigid fiberglass insulation adhered to inside walls; built-in cant and mounting flange for flat roof deck; and 2-inch wood nailer. Size as required to suit roof opening and fan base.

1. Overall Height: 12 inches.

2.12 CENTRIFUGAL WALL VENTILATORS:

A. General Description: Belt-driven or direct-drive as indicated, centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, and accessories.

B. Housing: Heavy-gauge, removable, spun-aluminum, dome top and outlet baffle; venturi design fan inlet cone.

C. Fan Wheel: Aluminum hub and wheel with backward-inclined blades.

D. 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. Fan and motor isolated from exhaust air stream.

E. Bearings: Permanently lubricated, permanently sealed anti-friction ball bearings.

F. Accessories: The following items are required 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: Removable, 1/2-inch mesh, 16-gauge aluminum or brass wire.

3. Dampers: Counterbalanced, parallel-blade backdraft dampers mounted in curb base, factory set to close when fan stops.

OR

Dampers: Motor-operated, parallel-blade 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 motor.

OR

Operators: Manufacturer's standard pneumatic motor.

2.13 CEILING-MOUNTED VENTILATORS:

A. General Description: Centrifugal fan designed for installation in ceiling, wall, or concealed inline applications.

B. Housing: Galvanized steel lined with acoustical insulation.

C. Fan Wheel: Centrifugal wheels directly mounted on motor shaft Fan shrouds, motor, and fan wheel shall be removable for service.

D. Grille: Stainless steel, louvered grille with flange on intake and thumbscrew attachment to fan housing.

E. Electrical Requirements: Junction box for electrical connection on housing and receptacle for motor plug-in.

F. Remote Fan Speed Control: Solid state, capable of controlling fan speed from full speed to approximately half speed.

G. Accessories: Manufacturer's standard roof jack, wall cap, and transition fittings as indicated.

2.14 PROPELLER FANS:

A. General Description: Belt-driven or direct-drive propeller fans as indicated consisting of fan blades, hub, housing, orifice ring, motor, drive, and accessories.

B. Housings: Galvanized, sheet steel with flanged edges, and integral orifice ring.

C. Wheels: Formed-steel blades riveted to a heavy-gauge steel spider bolted to cast-iron hub.

OR

Fan Wheel: Replaceable, cast-aluminum blades fastened to cast- aluminum hub. Factory set pitch angle of blades.

OR

Fan Wheel: Replaceable, extruded-aluminum, airfoil blades fastened to cast-aluminum hub. Factory set pitch angle of blades.

D. Drive Assembly: Direct-drive or belt-driven as indicated.

E. 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. Motor and Drive Assembly: Resiliently mounted to the housing.

F. Accessories: The following accessories are required as indicated:

1. Belt Guards: Expanded metal with reinforced edges.

2. Gravity Shutters: Gravity-type shutters with aluminum blades in steel frames, mounted on discharge side of fan.

2.15 VANEAXIAL FANS:

A. General Description: Belt-driven or direct-drive as indicated, variable pitch or adjustable pitch as indicated, vaneaxial fans consisting of fan wheel and housing, straightening vane section, factory-mounted motor, an inlet cone section, and accessories.

1. Variable pitch fans include internally mounted, pneumatic actuator, externally mounted positive positioner, and mechanical-blade-pitch indicator for variable volume operation.

B. Housings: Steel housing, 14-gauge minimum, with inlet bell and diffuser sections.

1. Inlet and Outlet Connections: Outer mounting frame and companion flanges; inlet cone shall be welded to the fan raceway.

2. Guide Vane Section: Integral guide vanes downstream of the fan wheel designed to straighten the airflow.

C. Wheels: Cast-aluminum, axial-flow type, with airfoil-shaped blades mounted on cast-iron wheel plate keyed to shaft with solid steel key.

1. Variable-Pitch Fans: Provide a factory-mounted actuator and blade pitch operating mechanism.

D. Fan Hub and Blade Bearing Assemblies: Cast aluminum, machined and fitted with threaded bearing wells to receive blade bearing assemblies.

1. Blades: Replaceable, cast aluminum; factory-mounted and balanced to the hub assembly.

2. Fan Shaft: Turned, ground, and polished steel.

3. Shaft Bearings: Prelubricated and sealed, self-aligning, pillow-block-type ball bearings.

OR

Shaft Bearings: Grease-lubricated, self-aligning, pillow-block type; tapered roller bearings with double-locking collars and two-piece, cast-iron housing.

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: Provide enclosure around belts and sheaves.

G. Motor Mounting: Adjustable base.

1. Sheaves: Adjustable.

2. Belts: Oil-resistant, nonsparking, and nonstatic.

3. Accessories: The following accessories are required as indicated:

H. Companion Flanges: Rolled-steel flanges.

1. Inlet and Outlet Screens: Heavy wire mesh inlet screens on fans not connected to ductwork.

2. Backdraft Dampers: Butterfly-style, for mounting with flexible connection to the discharge of the fan, or direct-mounted to the discharge diffuser section.

3. Stall Alarm Probe: A sensing probe capable of detecting fan operation in stall and sending a signal to control devices. Control devices and sequence of operation are specified in other Division 15 sections.

4. Flow Measurement Port: Pressure measurement taps installed in the inlet of the fan to detect and signal air flow readings to temperature control systems. Control devices and sequence of operation are specified in other Division 15 sections.

5. Inlet Vanes: Adjustable; having peripheral control linkage operated from outside of the air stream, bronze sleeve bearings on each end of vane support, and provision for manual or automatic operation as indicated.

2.16 CABINET FANS:

A. Casing shall be fabricated of heavy gauge galvanized or painted steel and shall be fully insulated. Panels shall be removable for complete access to the unit interior.

B. Fan wheel bearings shall be selected for a minimum average life of 200,000 hours.

C. Fan motor shall be mounted on a universal motor base, with adjustable belt drive and belt guard.

D. Provide vibration isolators.

2.17 AIR INTAKE AND RELIEF HOOD:

Show installed height above roof to bottom of hood on drawings. Roof curb height must meet building code requirements.

A. Roof intake and relief hood housing shall be constructed of heavy gauge aluminum and shall be fully weatherproof.

B. Roof intake and relief hood shall be complete with [louvered sides] [insulated top] [hinged top] [hinged side section] [bird screen,] [gravity backdraft damper,] [exhaust cap], [counterbalanced relief damper] [relief cap], [and roof curb].

The following requires very careful editing for each specific project.

2.18 KITCHEN VENTILATION SYSTEM:

A. Kitchen Exhaust Hood:

1. Hood shall be grease extraction type exhaust hood with integral make-up air system. Hood shall be all-welded 18 gauge stainless steel/painted black steel construction including stainless steel grease extractors, trough, and receptacle, adjustable supply air grilles, vapor-proof incandescent lights, and factory installed/field installed dry chemical fire extinguishing system.

2. Extinguishing system shall include wall mounted manual pull station, control cabinet, and chemical canisters. All dry chemical piping shall be galvanized steel, schedule 40, ASTM A-120. All exposed piping shall be installed within chrome plates sleeves.

3. Mechanical gas safety shut-off valve with manual reset shall be furnished by the hood manufacturer and installed by the plumbing contractor.

4. Hood shall be designed and constructed in complete accordance with bulletin NFPA-96.

B. Kitchen Hood Make-up Air Unit:

1. Make-up air unit shall be packaged roof mounted combination supply and exhaust air unit complete with 16 gauge steel casing with weatherproof baked enamel finish, individual centrifugal supply and exhaust fans and motors, separated supply and exhaust section, adjustable belt drives, 2"thick intake filters, intake and discharge hoods with bird screens, supply fan discharge damper, 18 gauge galvanized steel roof curb.

C. Kitchen exhaust hood and make-up air unit shall be compatible for supply and exhaust directly to and from the installation shall be in complete accordance with the requirements of bulletin NFPA 96.

D. Kitchen exhaust hood manufacturer shall supervise the installation and air balance of the hood and shall guarantee full performance of the exhaust hood under all conditions without smoke blowout or cold air discharge into the occupied space. Hood and installation shall meet all State and local Health Department requirements and shall be fully approved by all agencies having jurisdiction, including the local fire department.

E. Shop drawings shall include extinguisher piping installation drawings showing number of heads and location, pipe sizes, number of canisters, and total charge.

2.19 AUTOMOTIVE EXHAUST SYSTEM:

A. Overhead:

1. System shall be overhead hanging type. System shall be installed in complete accordance with the manufacturer's recommendations.

2. Exhaust hoses shall be no-crush neoprene, sizes as noted on drawings. Hose assembly shall include tailpipe adaptor(s), bumper hood, nylon cord and pulley set with cleats.

3. Overhead ductwork shall be as specified in Section 15890.

B. Underfloor:

1. System shall be underfloor disappearing type. System shall be installed in complete accordance with manufacturer's recommendations.

2. Floor outlets shall be heavy cast aluminum dual/single type with hinged doors. Assembly shall include sweep connection and saddle for connection to transite underfloor duct. Doors shall close automatically and shall be replaceable.

3. Exhaust hoses shall be flexible stainless steel, size as noted on drawings. Hose assembly shall include insertion guide, bumper hook, and tailpiece adaptor.

4. The underfloor duct systems shall be transite/[ ] as specified in Section 15890.

C. Exhaust Fan:

1. Exhaust fan shall be as specified under Utility Fan and shall include corrosion-resistant coating on all parts within the airstream, and non-overloading backward inclined blades. Fan construction shall be AMCA type B non-sparking construction.

| |
|---|
| Specify any special features of construction for the exhaust fans in the Exhaust Fan Schedule on drawing. |

2.20 PREFABRICATED ROOF CURBS:

A. Furnish and install roof curbs as scheduled for duct openings through the roof and for exhaust fan support. The curbs shall be galvanized steel self-flashing type/with integral cant, for flashing in the field. If the curbs are to have sound attenuation qualities, they shall be not less than those catalogued for the equipment specified.

PART 3 - EXECUTION

3.1 EXAMINATION:

A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances, housekeeping pads, and other conditions affecting performance of fans.

B. Do not proceed until unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL:

A. Install fans level and plumb, in accordance with manufacturer's written instructions. Support units using vibration control devices as indicated. Vibration control devices are specified in Division 15 Section "Vibration Controls."

1. Support floor-mounted units on concrete equipment bases using neoprene pads. Secure units to anchor bolts installed in concrete equipment base.

OR

Support floor-mounted units on concrete equipment bases using housed spring isolators. Secure units to anchor bolts installed in concrete equipment base.

2. Secure roof-mounted fans to roof curbs with cadmium-plated hardware.

a. Installation of roof curbs is specified in Division 7.

3. Suspended Units: Suspend units from structural steel support frame using threaded steel rods and vibration isolation springs.

B. Arrange installation of units to provide access space around air-handling units for service and maintenance.

3.3 EQUIPMENT BASES:

A. Construct concrete equipment pads as follows:

1. Coordinate size of equipment bases with actual unit sizes provided. Construct base 4 inches larger in both directions than the overall dimensions of the supported unit.

2. Form concrete pads with steel channels conforming to ASTM A 36, size and location as indicated. Miter and weld corner and provide cross bracing. Anchor or key to floor slab.

3. Form concrete pads with framing lumber with form release compounds. Chamfer top edge and corners of pad.

4. Install reinforcing bars, tied to frame, and place anchor bolts and sleeves to facilitate securing units.

5. Place concrete and allow to cure before installation of units. Use Portland Cement conforming to ASTM C 150, 4,000 psi compressive strength, and normal weight aggregate.

6. Clean exposed steel form in accordance with SSPC Surface Preparation Specifications SP 2 or SP 3 and apply 2 coats of rust-preventive metal primer.

3.4 CONNECTIONS:

A. Duct installations and connections are specified in other Division 15 sections. Make final duct connections on inlet and outlet duct connections with flexible connections.

B. Electrical Wiring: Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's wiring diagram submittal to Electrical Installer.

1. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division -16 sections. Ensure that rotation is in direction indicated and intended for proper performance. Do not proceed with centrifugal fan start-up until wiring installation is acceptable to centrifugal fan Installer.

2. Temperature control wiring and interlock wiring are specified in Division 15.

3. Grounding: Connect unit components to ground in accordance with the National Electrical Code.

3.5 FIELD QUALITY CONTROL:

A. Upon completion of installation of air handling equipment, and after motor has been energized with normal power source, test equipment to demonstrate compliance with requirements. Where possible, field correct malfunctioning equipment, then retest to demonstrate compliance. Replace equipment which cannot be satisfactorily corrected.

B. Manufacturer's Field Inspection: Arrange and pay for a factory- authorized service representative to perform the following:

1. Inspect the field assembly of components and installation of fans including ductwork and electrical connections.

2. Prepare a written report on findings and recommended corrective actions.

3.6 ADJUSTING, CLEANING, AND PROTECTING:

A. Startup, test and adjust air handling equipment in presence of manufacturer's authorized representative.

B. Adjust damper linkages for proper damper operation.

C. Clean unit cabinet interiors to remove foreign material and construction dirt and dust. Vacuum clean fan wheel and cabinet.

3.7 SPARE PARTS:

A. General: Furnish to Owner with receipt one spare set of belts for each belt driven air handling equipment.

3.8 COMMISSIONING:

A. Final Checks Before Start-Up: Perform the following operations and checks before start-up:

1. Remove shipping blocking and bracing.

2. Verify unit is secure on mountings and supporting devices and that connections for piping, 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.

2. Replace fan and motor pulleys as required to achieve design conditions.

3. Measure and record motor electrical values for voltage and amperage.

C. Shut unit down and reconnect automatic temperature control operators.

D. Refer to Division 15 Section "Testing, Adjusting, and Balancing" for procedures for air-handling-system testing, adjusting, and balancing.

3.9 DEMONSTRATION:

A. Demonstration Services: Arrange and pay for a factory-authorized service representative to 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 "Project Closeout" and Division 15 Section "Basic Mechanical Requirements."

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

END OF SECTION 15851