SECTION 233400 – HVAC FANS

PART 1 - GENERAL

1.1. SUMMARY

A. Section includes centrifugal rooftop fans, cabinet fans, inline centrifugal fans, propellor fans, and terminal equipment centrifugal fans.

1.2. PERFORMANCE REQUIREMENTS

A. Operating Limits: Classify according to AMCA 99.

1.3. SUBMITTALS

A. Product Submittals: For each type of product indicated include rated capacities, operating characteristics, and furnished specialties and accessories. The product data shall also include the following: certified fan performance curves with system operating conditions indicated; certified fan sound-power ratings; motor ratings and electrical characteristics, plus motor and electrical accessories; material thickness and finishes; dampers, including housings, linkages, and operators; roof curbs; and fan speed controllers.

B. Close-Out Submittals:

1. Operation and Maintenance Data: For power ventilators to include in emergency, operation, and maintenance manuals.

1.4. QUALITY ASSURANCE

A. Electrical Components, Devices and Accessories: UL listed and labeled as defined by NFPA 70, the National Electric Code, or equivalent by a qualified testing agency marked for the intended location and application and accepted by the Authority Having Jurisdiction and Engineer.

B. Mechanical Equipment and Materials: UL listed and labeled as defined by State Building Codes or equivalent by a qualified testing agency marked for the intended location and application and accepted by the Authority Having Jurisdiction and Engineer.

C. Testing and listing laboratories of mechanical and electrical equipment shall be accredited by the North Carolina Building Code Council (NCBCC).

1.5. EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Belts: Two set(s) for each belt-driven unit.

PART 2 - PRODUCTS

2.1. GENERAL REQUIREMENTS

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

1. Greenheck Fan Corp.
2. Loren Cook Company
3. Twin City Fan and Blower

B. Description: Factory fabricated, assembled, tested, and finished, belt-driven or direct-driven (as scheduled) fans consisting of housing, wheel, fan shaft, bearings, motor, drive assembly and support structure with factory installed and wired service disconnect switch. Deliver fans as factory-assembled units, to the extent allowable by shipping limitations.

C. AMCA Compliance: Comply with AMCA performance requirements and bear the AMCA-Certified Ratings Seal. Classify operating limits according to AMCA 99.

1. Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.
2. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings according to AMCA 210/ASHRAE 51, "Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating."

D. Shafts: Fan shafts shall be statically and dynamically balanced and selected for continuous operation at maximum rated fan speed and motor horsepower, with adjustable alignment and belt tensioning. Shafts shall be turned, ground, and polished hot-rolled steel with keyway and finished with an anti-corrosive coating. They shall be designed to operate at no more than 70 percent of first critical speed at top of fan's speed range.

E. Pre-lubricated and Sealed Shaft Bearings: Self-aligning, pillow-block type bearings rated for L10 at 100,000 hours.

1. Extend grease fitting to accessible location outside of unit.
2. Insulated bearings for all fan motors 100 hp and larger.

F. Belt Drives: Factory mounted, with adjustable alignment and belt tensioning, and with 1.5 service factor based on fan motor.

1. Fan Pulleys: Cast iron or cast steel with split, tapered bushing; dynamically balanced at factory.
2. Motor Pulleys: Adjustable pitch for use with motors through 5 hp; fixed pitch for use with larger motors. Select pulley so pitch adjustment is at the middle of adjustment range at fan design conditions.
3. Belts: Oil resistant, non-sparking, and non-static V-belts; in matched sets for multiple-belt drives.
4. Belt Guards: Fabricate to comply with OSHA and SMACNA requirements of diamond-mesh wire screen welded to steel angle frame or equivalent, prime coated. Secure to fan or fan supports without short circuiting vibration isolation. Include provisions for adjustment of belt tension, lubrication, and use of tachometer with guard in place.
5. Motor Mount: Adjustable for belt tensioning.

G. Direct Drives: Factory-mounted with 1.2 service factor based on fan motor.

H. Motors: Comply with requirements of Section 230513.

I. Speed Controller: Where indicated, provide solid-state, factory-mounted, manual speed controller on 115V or 230V single-phase, direct-drive fans for air flow balancing.

J. Variable Frequency Controllers: Refer to Section 230514.

1. Variable frequency drives shall not be installed outdoors without supplemental cooling.

K. Motor Starters and Disconnects: Refer to Section 230511.

1. Disconnect Switch: Factory wired and mounted non-fusible type with thermal-overload protection mounted to the fan housing, unless otherwise indicated. Wiring shall be enclosed in aluminum conduit.

L. Dampers: Motor-operated, parallel blade aluminum dampers mounted in the curb base shall open when the fan starts and close when it stops. Refer to Section 233300.

1. Where indicated, provide counter-balanced backdraft dampers in lieu of motor-operated type.

M. Roof Curbs: Factory-fabricated welded-seam self-flashing roof curb to match fan and roof-slope, constructed of galvanized sheet metal with 1 1/2-inch pressure-treated wood nailer, water-tight gasket, 1 1/2-inches of rigid fiberglass insulation, damper tray, and finished with primer and powder baked white enamel.

1. Wind and Seismic Restraints: Metal brackets compatible with the curb and casing, painted to match exhaust fan, used to anchor unit to the curb, and designed for loads at project site. Comply with requirements in Section 230548.

2. Curb Height: 16-inches with a minimum of 12-inches above the finished roof surface.

2.2. CENTRIFUGAL ROOFTOP FANS

A. General Description: Rooftop fan with removable spun-aluminum dome top and outlet baffle; square one-piece aluminum base with venture inlet cone; fan wheel with aluminum hub and wheel with backward-inclined blades; and belt or direct-drive as scheduled. Outlet shall have removable 1/2-inch aluminum mesh birdscreen. The drive shall be equipped with an automatic belt tensioner.

B. Rooftop Dome-Type Downblast Centrifugal Fans: Greenheck G/GB Series, Loren Cook ACE Series, or Twin City BCRD/DCRD Series.

1. Application: General building exhaust systems.

C. Rooftop Dome-Type Upblast Centrifugal Fans: Fan housing shall have spun-aluminum discharge baffle to direct discharge air upward with rain drains. Greenheck CUE/CUBE Series, Loren Cook ACR Series, or Twin City BCRU/DCRU Series.

1. Application: General building exhaust systems.

D. Rooftop Grease-Type Upblast Centrifugal Fans: Fan housing shall have spun-aluminum discharge baffle to direct discharge air upward with rain drains. Provide with hinged-base, vented curb extension and grease capture and containment system. Vented curb extension shall extend the mounting height of the fan's discharge to minimum 40-inches above the finished roof surface to comply with NFPA 96, but no higher than 44-inches unless otherwise noted. Greenheck CUE/CUBE Series, Loren Cook VCR Series, or Twin City BCRUR/DCRUR Series.

1. Application: Grease hood exhaust systems.

2.3. CABINET FANS

A. General Description: Cabinet style fan with steel housing lined with acoustical insulation; removable centrifugal fan wheel; and belt or direct-drive as scheduled. Electrical connection shall be hard-wired. Cord and plug wiring is not acceptable unless specifically noted on the equipment schedule.

B. In-Line Cabinet Fan: Greenheck CSP/SP Series, Loren Cook Gemini Series, or Twin City TL/DB Series.

1. Applications: General exhaust air systems.

C. Ceiling Cabinet Fan: Provide fan with white painted aluminum ceiling grille; plastic grilles are not acceptable. When located in fire-rated ceiling assemblies, provide with ceiling radiation damper that complies with Section 233300. Greenheck CSP/SP Series, Loren Cook Gemini Series, or Twin City TL/DB Series.

1. Applications: General exhaust air systems.

2.4. IN-LINE CENTRIFUGAL FANS

A. General Description: In-line centrifugal fan with split spun-aluminum housing with aluminum straightening vanes; inlet and outlet flanges; support bracket for floor, sidewall or ceiling mounting; fan wheel with cast-aluminum hub and aluminum airfoil blades; and belt or direct-drive as scheduled.

B. In-Line Square Centrifugal Fan: Greenheck SQ/BSQ Series, Loren Cook SQ Series, or Twin City BSI/DSI Series.

1. Applications:

C. In-Line Tubular Centrifugal Fan: Greenheck TC Series, Loren Cook TCN Series, or Twin City TSL/TCLB Series.

1. Applications:

2.5. PROPELLER FANS

A. General Description: Galvanized sheet steel and orifice ring housing with replaceable fan wheel with cast-aluminum hub and cast-aluminum airfoil blades at factory-set pitch angles; motor-side back-guard complying with OSHA standards; and belt or direct-drive as scheduled.

B. Propeller Wall Fans: Wall type fan with flanged edges; factory-fabricated galvanized steel wall sleeve; gravity shutters with aluminum frame and interlocked blades and nylon bearings; and galvanized steel weather shield hood with removable 1/2-inch aluminum mesh birdscreen. Greenheck SC/SBC Series, Loren Cook AWB/AWD Series, or Twin City WPB/WPD Series.

1. Applications: Utility room ventilation air systems.

2.6. CENTRIFUGAL FANS

A. Description: Fans included in packaged and terminal units shall meet the requirements of this section.

B. Housings: Horizontally-split, bolted-flange curved-scroll housing with shaped cutoff, flanged spun inlet cone and flanged outlet. Panel Bracing shall be steel angle or channel-iron member supports for mounting and supporting fan scroll, wheel, motor, and accessories.

C. Centrifugal Fan Wheels:

1. Airfoil Wheels: Fan wheels shall be single-width single-inlet (SWSI) and double-width double-inlet (DWDI) construction with curved inlet flange; heavy backplate; hollow die-formed, airfoil-shaped blades continuously welded at tip flange and backplate; and cast-iron or cast-steel hub riveted to backplate and fastened to shaft with set screws.

2. Backward-Inclined Wheels: Fan wheels shall be single-width single-inlet (SWSI) and double-width double-inlet (DWDI) construction with curved inlet flange; backplate; backward-inclined

blades; fastened to shaft with set screws; and cast-iron or cast-steel hub riveted to backplate welded or riveted to flange and backplate.

3. Forward-Curved Wheels: Fan wheels shall be black-enameled or galvanized-steel construction with inlet flange; backplate; shallow blades with inlet and tip curved forward in direction of airflow; cast-steel hub swaged to backplate and fastened to shaft with set screws; and mechanically secured to flange and backplate.

4. Plenum Fan Wheels: Airfoil wheel shall be single-width single-inlet (SWSI) construction with heavy backplate; hollow die-formed, airfoil-shaped blades continuously welded at tip flange and backplate; and cast-iron or cast-steel hub riveted to backplate and fastened to shaft with set screws.

5. Plug Fan Wheels: Airfoil wheel shall be single-width-single-inlet (SWSI) construction with smooth-curved inlet flange; heavy backplate; hollow die-formed, airfoil-shaped blades continuously welded at tip flange and backplate; and cast-iron or cast-steel hub riveted to backplate and fastened to shaft with set screws.

PART 3 - EXECUTION

3.1. GENERAL INSTALLATION

A. Install power ventilators level and plumb.

B. Equipment Mounting:

1. Comply with requirements for vibration isolation and seismic control devices specified in Section 230548.

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

D. Ceiling Units: Suspend units from structure; use steel wire or metal straps.

E. Support suspended units from structure using threaded steel rods and spring hangers with vertical-limit stops having a static deflection of 1 inch. Vibration-control devices are specified in Section 230548.

F. Install units with clearances for service and maintenance.

G. Label units according to requirements specified in Section 230553.

3.2. CONNECTIONS

A. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Section 233300.

B. Install ducts adjacent to fans to allow service and maintenance.

C. Ground equipment according to Division 26.

D. Connect wiring according to Division 26.

3.3. FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Verify that shipping, blocking, and bracing are removed.

2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.

3. Verify that cleaning and adjusting are complete.

4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.

5. Adjust belt tension.

6. Adjust damper linkages for proper damper operation.

7. Verify lubrication for bearings and other moving parts.

8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.

9. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.

10. Shut unit down and reconnect automatic temperature-control operators.

11. Remove and replace malfunctioning units and retest as specified above.

B. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Prepare test and inspection reports.

3.4. ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Adjust belt tension.

C. Comply with requirements in Section 230593 for testing, adjusting, and balancing procedures.

D. Replace fan and motor pulleys as required to achieve design airflow. Coordinate with the TAB Contractor.

E. Lubricate bearings.

END OF SECTION 233400