PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Tubeaxial fans.

B. Destratification fans.

C. Jet fans.

1.02 REFERENCE STANDARDS

A. AMCA 99 – Standards Handbook.

B. AMCA 204 – Balance Quality and Vibration Levels for Fans.

C. AMCA 210 – Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating.

D. AMCA 230 – Laboratory Methods of Testing Air Circulation Fans for Rating and Certification.

E. AMCA 300 – Reverberant Room method for Sound Testing of Fans.

F. AMCA 301 – Certified Ratings Program Product Rating manual for Fan Sound Performance.

G. AMCA 311 – Certified Ratings Program Product Rating Manual for Fan Sound Performance.

H. UL 705 – Power Ventilators; Current Edition Including all Revisions.

I. UL 762 – Outline of Investigation for Power Roof Ventilators for Restaurant Exhaust Appliances; Current Edition Including all Revisions.

1.03 SUBMITTALS

A. General: Submit data in accordance with Conditions of Contract and Division 1 Specification Sections.

B. Product Data: Provide data on fans and accessories including fan curves with specified operating point clearly plotted, power, RPM, sound power levels at rated capacity, and electrical characteristics and connection requirements. Include the following:

1. For fans with factory-furnished starters or variable frequency drives, include short circuit current ratings.
2. Materials gages and finishes, including color charts.

3. Dampers, including housings, linkages, and operators.

C. Shop Drawings: Shop drawings from manufacturer detailing equipment assemblies and indicating dimensions, weights, required clearances, components, and location and size of field connections.

D. Wiring Diagrams: Wiring diagrams that detail power, signal, and control wiring. Differentiate between manufacturer-installed wiring and field-installed wiring.

E. Maintenance Data: Include instructions for lubrication, motor and drive replacement and spare parts list.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. Extra Fan Belts: One set for each individual fan.

1.04 QUALITY ASSURANCE

A. AMCA Compliance:

1. Provide propeller, tubeaxial, vaneaxial and mixed flow fan products that meet performance requirements and are licensed to use the AMCA Seal.
2.
3. Testing Requirements: The following factory tests are required for propeller, tubeaxial, mixed flow and vaneaxial fans:

a) 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." Fans shall be licensed to bear the AMCA Certified Sound Ratings Seal.

b) Fan 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.

B. UL Compliance: Fans and components shall be UL listed and labeled.

1. Fans used in grease exhaust applications shall be certified in accordance with UL 762.

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

D. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.

E. Electrical Component Standard: Components and installation shall comply with NFPA 70 "National Electrical Code."

1.05 DELIVERY, STORAGE, AND HANDLING

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

1.06 FIELD CONDITIONS

A. Permanent fans may not be used for ventilation during construction.

PART 2 - PRODUCTS AND MATERIALS

2.01 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: 1.5.

D. Belts: Oil-resistant, non-sparking, and non-static.

E. Motors: Refer to Section “Common Motor Requirements for HVAC Equipment” for requirements.

F. Motor 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.

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

G. Hazardous Duty: Provide fans with spark resistant construction and explosion proof motor where specified in the schedule.

2.02 TUBEAXIAL FANS

A. Manufacturers:

1. Bayley Fan Group.

2. Cook (Loren) Co.
3. Chicago Blower Corp.
4. Greenheck Fan Corp.
5. Hartzell Fan, Inc.
6. PennBarry.
7. Trane Co.
8. Twin City Fan Company.

B. Description: Belt-driven or direct-drive as indicated, tubeaxial fans consisting of fan wheel and housing, inlet/outlet cone section as indicated, factory-mounted motor, and accessories.

C. Casing:

1. Steel casing, 12-gage minimum.
2. Continuously weld, with flanged inlet and outlet connections, and motor or shaft supports.
3. Guide Vane Section: Integral guide vanes downstream of the fan wheel designed to straighten the airflow for fans specified for static pressures greater than 1 in-wc..

D. Propeller: Fixed pitch, one piece cast aluminum, axial-flow type, with airfoil-shaped blades keyed and secured to shaft with a split taper bushing and retaining plate.

E. Bearings and Drives:

1. Direct Drive: Encase motor in housing outside of airstream.
2. Fan Shaft: Turned, ground, and polished steel designed to operate at no more than 70 percent of first critical speed at top of fan's speed range.
3. Lubrication: Extend lubrication lines to outside of casing and terminate with grease fittings.

F. Accessories:

1. Inlet Bell: Bell mouth inlet of same material as casing.
2. Outlet Cone: Transition of same material as casing with outlet area to inlet area ration of 1.5 to 1.0, with center pod as recommended by manufacturer.
3. Inlet Screens: Provide wire mesh screen of same material as casing where inlet is not connected to ductwork.
4. Outlet Screen: Wire-mesh screen of same material as casing, where outlet is not connected to ductwork.
5. Access Door: Bolted door of same material as casing to allow limited access to internal parts of fan including the bearing cover.
6. Swing-out Construction: Assembly allowing entire fan section to swing out from duct for cleaning and servicing, of same material as casing.
7. Mounting Feet: Feet bolted to the inlet and outlet flanges to facilitate mounting to the floor, ceiling, or wall that can be used with vibration isolators.

8. Mounting Brackets: Brackets welded in place to facilitate suspension of unit in either the vertical or horizontal configuration designed for use with vibration isolators.
9. Motor Cover: Cover of same material as casing, with side vents to dissipate motor heat.
10. Exterior Up-blast Discharge Assembly: Curb cap, motor cover, panel and butterfly dampers used in conjunction with a roof curb to utilize unit as a roof up-blast unit.

G. Factory Finishes:

1. Sheet Metal Parts: Prime coat before final assembly.
2. Exterior Surfaces: Baked-enamel finish coat after assembly.
3. Coatings: Color-match enamel

a) Apply to finished casings.
b) Apply to fan wheels.

2.03 DESTRATIFICATION FANS

A. Manufacturers:

1. Air Pear
2. Air Row Fans
3. Canarm HVAC
4. Continental Fans
5. Zoo Fans

B. General Description: Small diameter housed propeller type destratification fans as indicated consisting of housing, fan blades, hub, mounting system, motor, and fan controller.

C. Housing: Fan housing shall be constructed from one of the following materials:

1. PC/ABS resin, UL 94 5VA flame resistance rating.
2. Steel with polymeric or corrosion-resistant coating.
3. Painted aluminum.

D. Housing Configuration:

1. Round shaped.

E. Fan Blades: PC/ABS resin or aluminum material with airfoil or axial design.

F. Motor and Frame: Electrically commutated, 92% efficient motor with 0-10 VDC control for tie-in to BAS. Provide thermally protected motor. Operating temperature range shall be -13˚ F (-25˚ C) to 140˚ F (60˚ C). Motor shall have sealed bearings with no lubrication required.

G. Mounting System and Location:

1. Overhead Structure: Designed for secure mounting of fan from overhead support structure. Mount shall be constructed of minimum 3/16" powder-coated steel. Provide minimum 1/4" 7x19 steel safety cable to secure fan assembly to structure.
2. Suspended Ceiling: Support fan from above structure with cable or wire capable of supporting 5 times the fan weight.

H. Fan Controller:

1. Industrial Control Panel constructed per UL 60950 and NEC.
2. Provide fan on/off/auto switch, speed control potentiometer, safety disconnect and properly sized fuse block.
3. Provide NEMA Type 1 controls enclosure for indoor installations and NEMA Type 3R controls enclosure for outdoor installations.
4. Fan controller shall be capable of full integration into the building automation system via Bacnet interface. Refer to the drawings for control sequences.

2.04 JET FANS

A. Manufacturers:

1. Greenheck Fan Corp.
2. Zoo Fans

B. General Description: High velocity, jet induction fan with aerodynamic housing and integral discharge vanes.

C. Housing: Fan housing and support structure shall be constructed of galvanized steel with polymeric or corrosion-resistant coating.

D. Housing Configuration:

1. Low flat profile.

E. Fan Impeller: Composite plastic or aluminum material for blades and wheel hub. Blades shall be axial or centrifugal configuration.

F. Motor and Frame: Squirrel cage induction motor with variable frequency drive or electrically commutated, 92% efficient motor with 0-10 VDC control for tie-in to BAS. Provide thermally protected motor. Operating temperature range shall be -13˚ F (-25˚ C) to 140˚ F (60˚ C).

1. Motors shall have sealed bearings with no lubrication required.
2. Motors with variable frequency drives shall have shaft grounding system.

G. Accessories: Provide the following accessories as scheduled or noted on the drawings:

1. Factory mounted disconnect switch.
2. Inlet and outlet guards.

PART 3 - EXECUTION

3.01 SEQUENCING AND SCHEDULING

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

3.02 INSTALLATION

A. Install fans level and plumb, in accordance with manufacturer's written instructions.

B. Support units using the vibration control devices indicated and specified in Division 23 Section "Vibration Isolation for HVAC Piping and Equipment."

C. Arrange installation to provide access space around fans for service and maintenance.

D. Provide safety screen where inlet or outlet is exposed.

3.03 ADJUSTING, CLEANING, AND PROTECTING

A. Adjust damper linkages for proper damper operation.

B. Clean the entire unit including cabinet interiors just prior to substantial completion to remove foreign material and construction dirt and dust. Vacuum clean fan wheel and cabinet.

3.04 STARTUP

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

1. Remove shipping blocking and bracing.
2. Verify fan assembly is secure on mountings and supporting devices and that connections for 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 and 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 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.
    a) Replace fan and motor pulleys as required to achieve design conditions.
    b) Measure and record motor electrical values for voltage and amperage.
    c) Shut unit down and reconnect automatic temperature control operators.
    d) Refer to Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for procedures for air-handling-system testing, adjusting, and balancing.

3.05 DEMONSTRATION

A. Demonstration Services: 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 "Closeout Procedures" and Division 23 Section "General Mechanical Requirements."

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

END OF SECTION