SECTION 233413 - AXIAL HVAC FANS

1. PART 1 – GENERAL

1.1. RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2. SUMMARY

A. This Section includes the following:

1. Roof Mounted Axial Fan
2. Wall Mounted Axial Fan
3. Inline Axial Fan

1.3. PERFORMANCE REQUIREMENTS

A. Project Altitude: Base fan performance ratings on sea level.

B. Operating Limits: Classify according to AMCA 99.

1.4. SUBMITTALS

A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated and include the following:

1. Certified fan performance curves with system operating conditions indicated
2. Certified fan sound-power ratings.
3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
4. Material thickness and finishes, including color charts.
5. Dampers, including housings, linkages, and operators.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Wiring Diagrams: Power, signal, and control wiring.
2. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
3. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, and base weights.

C. Coordination Drawings: Show fan room layout and relationships between components and adjacent structural and mechanical elements. Show support locations, type of support, and weight on each support. Indicate and certify field measurements.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For axial fans to include in emergency, operation, and maintenance manuals.

1.5. QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. AMCA Compliance: Products shall comply with performance requirements and shall be licensed to use the AMCA-Certified Ratings Seal.

C. NEMA Compliance: Motors and electrical accessories shall comply with NEMA 1.

1.6. DELIVERY, STORAGE, AND HANDLING

A. Deliver fans as factory-assembled units, to the extent allowable by shipping limitations, with protective crating and covering.

B. Disassemble and reassemble units, as required for moving to the final location, according to manufacturer's written instructions.

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

1.7. COORDINATION

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

B. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

C. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

1.8. EXTRA MATERIALS

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

1. Belts: One set for each belt-driven unit.

2. PART 2 - PRODUCTS

2.1. ROOF MOUNTED AXIAL FANS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

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

C. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

1. York Fans as Basis of Design

2. Approved Equal, Approved by Engineer

D. Description: Factory-fabricated, -assembled, -tested, and -finished, belt-driven axial fans consisting of housing, wheel, fan shaft, bearings, motor, drive assembly, and support structure.

E. Housings: The fan housing shall be fabricated of heavy gauge sheet steel spun to form a smooth air inlet and welded to a structural plate motor mount.

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

2. For a weatherproof installation the housing shall have overlapping joints and a curb cap extended down over the roof curb a minimum of 3".

F. Propeller: Airfoil propeller available in cast aluminum or heavy gauge carbon steel

G. Shafts: The fan shaft shall be steel, ground for precision fit to bearings and keyed for driving the impeller and drive sheave.

1. Turned, ground, and polished hot-rolled steel with keyway. Ship with protective coating of lubricating oil.

H. Prelubricated and Sealed Shaft Bearings: Self-aligning, pillow-block-type ball bearings. ABMA L10 bearing life shall be 35,000 hours

I. Grease-Lubricated Shaft Bearings: Self-aligning, pillow-block-type, tapered roller bearings with double-locking collars and two-piece, cast-iron housing. ABMA L10 bearing life shall be 35,000 hours

J. Grease-Lubricated Shaft Bearings: Self-aligning, pillow-block-type, ball or roller bearings with adapter mount and two-piece, cast-iron housing. ABMA L10 bearing life shall be 35,000 hours

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

1. Service Factor Based on Fan Motor Size: 1.5.

2. Fan Pulleys: Cast iron or cast steel with split, tapered bushing; dynamically balanced at factory.

3. 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.

4. Belts: Oil resistant, nonsparking, and nonstatic; matched sets for multiple belt drives.

5. 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.

6. Motor Mount: Adjustable for belt tensioning.

L. Accessories:

1. Swing Out Design: Shall be accomplished by hinging the casing and allowing the fan integrals to “swingout" with the hinged section while the casing remains attached to the ductwork.

2. Cleanout Door: Quick-opening, latch-type gasketed door allowing access to fan scroll, of same material as housing.

3. Magnetic Damper Pads: Shall maintain positive building pressures or high lateral winds could cause damper lift. They assure positive closing.

4. Construction Material: Shall have the option of either 304SS or 316SS construction.

5. Discharge Dampers: Assembly with opposed blades constructed of two plates formed around and to shaft, channel frame, and sealed ball bearings; with blades linked outside of airstream to single control lever of same material as housing.

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

7. Spark-Resistant Construction: AMCA 99. Weather Cover: Enameled-steel sheet with ventilation slots, bolted to housing.

M. Motors: Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."

1. Enclosure Type: Totally enclosed, fan cooled.

N. Capacities and Characteristics: See mechanical equipment schedule on Drawings.

2.2. WALL MOUNTED AXIAL FANS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

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

C. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

1. York Fans as Basis of Design

2. Approved Equal, Approved by Engineer

D. Description: Factory-fabricated, -assembled, -tested, and -finished, belt-driven axial fans consisting of housing, wheel, fan shaft, bearings, motor, drive assembly, and support structure.

E. Housings: Fan panel assembly shall be of all welded construction, and shall be constructed completely of carbon steel, aluminum or stainless steel as indicated on the fan schedule

1. The fan panel shall have an integrally die formed, deep shroud for smooth air entry into the propeller.

2. The fan mounting panel assembly shall be coated with enamel as standard or optional other available coating as made available by coating suppliers and as indicated on the fan schedule. The propeller is uncoated.

F. Propeller: The propeller shall be constructed of cast aluminum blades fastened directly to a cast aluminum hub assembly. The hub is designed to incorporate a taper lock bushing and keyed directly to the motor shaft.

G. Shafts: Statically and dynamically balanced and selected for continuous operation at maximum rated fan speed and motor horsepower, with final alignment and belt adjustment made after installation.

1. Turned, ground, and polished hot-rolled steel with keyway. Ship with protective coating of lubricating oil.

H. Prelubricated and Sealed Shaft Bearings: Self-aligning, pillow-block-type ball bearings. ABMA L10 bearing life shall be 35,000 hours

I. Grease-Lubricated Shaft Bearings: Self-aligning, pillow-block-type, tapered roller bearings with double-locking collars and two-piece, cast-iron housing. ABMA L10 bearing life shall be 35,000 hours

J. Grease-Lubricated Shaft Bearings: Self-aligning, pillow-block-type, ball or roller bearings with adapter mount and two-piece, cast-iron housing. ABMA L10 bearing life shall be 35,000 hours.

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

1. Service Factor Based on Fan Motor Size: 1.5.

2. Fan Pulleys: Cast iron or cast steel with split, tapered bushing; dynamically balanced at factory.

3. 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.

4. Belts: Oil resistant, nonsparking, and nonstatic; matched sets for multiple belt drives.

5. 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.

6. Motor Mount: Adjustable for belt tensioning.

L. Accessories:

1. Guards:

1. Front Guard Type #2: 1/2" spiral wire guard mounted on fan discharge
2. Front Guard Type #1: 1/2" spiral wire guard mounted between motor and propeller
3. Rear Guard Type #4: 1/2" expanded metal cage with angle iron frame for mounting over motor end of fan. The Type #4 Guard has a removable rear cover for access to motor and drive.

2. Reversible Flow Unit: Shall allow for the same airflow in both supply and exhaust modes. A double bell venturi is also added to maintain performance in both directions
3. Wall Box Housing: Shall have a sheet metal full sleeve for mounting fan, damper and rear guard to create a package panel fan
4. Shutter: Shall be standard duty suitable for up to 2200 fpm outlet velocity. Heavy duty suitable for up to 3000 fpm outlet velocity. EXHAUST APPLICATIONS ONLY. Damper has a flange on the intake (rear) side. Sizes 60 and larger are shipped in multiple sections
5. Rainhood with Bird Screen: shall use a 45° or 60° galvanized steel rain hood for use on the inlet or as a discharge hood.

M. Motors: Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."

1. Enclosure Type: Totally enclosed, fan cooled.

N. Capacities and Characteristics: See mechanical equipment schedule on Drawings.

2.3. INLINE AXIAL FANS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

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

C. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

1. York Fans as Basis of Design
2. Approved Equal, Approved by Engineer

D. Description: Factory-fabricated, -assembled, -tested, and -finished, belt-driven axial fans consisting of housing, wheel, fan shaft, bearings, motor, drive assembly, and support structure.

E. Housings: Solid welded construction and leakproof housing featuring rolled flanges at inlet and outlet.

F. Propeller: Shall be constructed of cast aluminum material with the cast blades welded to the cast hub per AWS welding standards. The hub is designed to incorporate a taper lock bushing and keyed to the fan shaft.

G. Shafts: Statically and dynamically balanced and selected for continuous operation at maximum rated fan speed and motor horsepower, with final alignment and belt adjustment made after installation.

1. Turned, ground, and polished hot-rolled steel with keyway. Ship with protective coating of lubricating oil.
2. First critical shaft speed on Class I and II fans is at least 125% of the fan’s maximum operating speed. For all Class III and IV fans the first critical speed is at least 142% of the originally specified operating speed.

H. Prelubricated and Sealed Shaft Bearings: Self-aligning, pillow-block-type ball bearings. ABMA L10 bearing life shall be 35,000 hours.

I. Grease-Lubricated Shaft Bearings: Self-aligning, pillow-block-type, tapered roller bearings with double-locking collars and two-piece, cast-iron housing. ABMA L10 bearing life shall be 35,000 hours

J. Grease-Lubricated Shaft Bearings: Self-aligning, pillow-block-type, ball or roller bearings with adapter mount and two-piece, cast-iron housing. ABMA L10 bearing life shall be 35,000 hours

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

1. Service Factor Based on Fan Motor Size: 1.5.

2. Fan Pulleys: Cast iron or cast steel with split, tapered bushing; dynamically balanced at factory.

3. 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.

4. Belts: Oil resistant, nonsparking, and nonstatic; matched sets for multiple belt drives.

5. 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.

6. Motor Mount: Adjustable for belt tensioning.

L. Accessories:

1. Swing Out Design: Shall be accomplished by hinging the casing and allowing the fan integrals to “swingout" with the hinged section while the casing remains attached to the ductwork.

2. Spark-Resistant Construction: AMCA 99.

3. Shaft Seals: Airtight seals installed around shaft on drive side of single-width fans.

4. Full Access Design: Shall allow access to the fan interior through a hinged outer section that opens up 180 degrees. All internal parts can be accessed via a removable access panel, enabling wheel shaft and bearings removal as a complete unit

M. Motors: Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."

1. Enclosure Type: Totally enclosed, fan cooled.

N. Capacities and Characteristics: See mechanical equipment schedule on Drawings.

2.4. SOURCE QUALITY CONTROL

A. 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.

B. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings according to AMCA 210, "Laboratory Methods of Testing Fans for Rating."

3. PART 3 - EXECUTION

3.1. INSTALLATION

A. Install axial fans level and plumb.

B. Support floor-mounting units using spring isolators having a static deflection of 1 inch. Vibration- and seismic-control devices are specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."

1. Secure vibration and seismic controls to concrete bases using anchor bolts cast in concrete base.

C. Install floor-mounting units on concrete bases. Concrete, reinforcement, and formwork requirements are specified in Division 03 Section "Cast-in-Place Concrete."

D. Install floor-mounting units on concrete bases designed to withstand, without damage to equipment, the seismic force required by authorities having jurisdiction. Concrete, reinforcement, and formwork requirements are specified in Division 03 Section "Cast-in-Place Concrete."

E. Support suspended units from structure using threaded steel rods and elastomeric hangers, spring hangers having a static deflection of 1 inch. Vibration-control devices are specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."

F. Install units with clearances for service and maintenance.

G. Label fans according to requirements specified in Division 23 Section "Identification for HVAC Piping and Equipment."

H. Starters to be installed by electrical sub contractor.

3.2. CONNECTIONS

A. Duct installation and connection requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Division 23 Section "Air Duct Accessories."

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

C. Install line-sized piping from scroll drain connection, with trap with seal equal to 1.5 times specified static pressure, to nearest floor drain.

D. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

E. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.3. FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

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. Refer to Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.

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

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

3.4. DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain axial fans. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 233413