SECTION 15842
CENTRIFUGAL PROCESS EXHAUST FANS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawing and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.

1.2 SUMMARY

A. This Sections includes the following HVAC air system equipments:
   1. Centrifugal fans.

B. Related Sections: The following Sections contain requirements that relate to this Section:
   1. Division 09, Section 09900, “Painting”.
   2. Division 15, Section 15055, “Motors”.
   3. Division 15, Section 15990, “Testing, Adjusting, and Balancing”.
   4. Division 16, Section 16441, “Disconnect Switches”.
   5. Division 16, Section 16476, “Enclosed Circuit Breakers”.
   6. Division 16, Section 16483, “Motor Control”.
   7. Division 16, Section 16484, “Variable Frequency Drives”.
   8. Division 17,Instrumentation and Controls. (All related sections)

1.3 REFERENCES

A. Air Movement and Control Associations, Inc. (AMCA):
   1. AMCA 500 – (1991) Louvers, Dampers and Shutters.
   2. AMCA 210 NEMA MG-1

B. American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc. (ASHRAE):
   1. ASHRAE 3 – (1996) Reducing Emission of Fully Halogenated Chlorofluorocarbon (CFC) Refrigerants in Refrigeration and Air-Conditioning Equipment and Applications.

C. American Society of Mechanical Engineers (ASME):
   1. ASME/ANSI B16.5 – (1996) Pipe Flanges and Flanged Fittings NPS ½ Through NPS 24.
   2. ASME B31.1 – (1996; Addenda 1996 and 1997) Power Piping.
   3. ANSI/ASME B40.1 – (1991; Special Notice 1992) Gauges – Pressure Indicating Dial Type – Elastic Element.
   4. ASME N509 Testing and Balancing

D. American Society for Testing and Materials (ASTM):
   1. ASTM A 126 – (1995) Gray Iron Castings for Valves, Flanges, and Pipe Fittings.

E. National Fire Protection Association (NFPA):
   1. NFPA 70 – (1999) National Electrical Code.
   2. NFPA 90A – (1996) Installation of Air Conditioning and Ventilation Systems.

F. Sheet Metal & Air Conditioning Contractors’ National Association, Inc. (SMACNA):
   1. SMACNA DCS – (1995; Addendum 1997) HVAC Duct Construction Standards – Metal and Flexible.
   2. SMACNA HVACTAB – (1993) HVAC Systems Testing, Adjusting, and Balancing.

G. Underwriters Laboratories Inc. (UL):
   1. UL 506 – (1994; R 1997, Bul. 1997) Specialty Transformers.
   2. UL 555S -- (1996) Leakage Rated Dampers for Use in Smoke Control Systems.
   3. UL 916 – (1994; Bulletin, Rev. 1996) Energy Management Equipment.
   4. UL 1449 – (1996) Transient Voltage Surge Suppressors.

1.4 SUBMITTALS

A. General: Submit each item in this Article according to the conditions of the Contract and General and Supplementary Conditions.

B. Product Data for each air-handling unit specified, including 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 fan accessories.
   4. Material gages and finishes.
   5. Dampers, including housings, linkages, and operators as applicable.
   6. Unitary base and required roof curb suitable for flat equipment installation on a sloping roof as shown in the Architectural drawings.

C. Shop Drawings from manufacturer detailing equipment assemblies and indicating dimensions, weights, loadings, required clearances, method of field assembly, components, and location and size of each field connection, including the applicable information on Unitary Base installation to the roof structure..

D. Installing contractor shall provide wiring diagrams detailing wiring for power and control systems, control interface differentiating between manufacturer-installed and field-installed wiring.

E. Installing contractor shall provide Coordination Drawings, including plans and sections drawn to scale. Submit with Shop Drawings. Show facility 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.

F. Installing contractor shall provide field test reports indicating and interpreting test results relative to compliance with specified requirements.

G. Operation and Maintenance data: For Centrifugal Process Exhaust Fans include the Operation and Maintenance (O&M) manuals as specified in General and Supplementary Conditions and Division 15 requirements.

1.5 QUALITY ASSURANCE

A. NFPA Compliance: Air-handling equipments and components shall be designed, fabricated, and installed in compliance with NFPA 90A, “Installation of Air Conditioning and Ventilating Systems.”

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

C. UL and NEMA Compliance: Provide motors required as part of air-handling units that are listed and labeled by UL and comply with applicable NEMA standards.

D. Comply with NFPA 70 for electrical components devices and accessories installation.

E. Listing and Labeling: Provide electrically operated components specified in this Section that are listed and labeled.
   1. The Terms “Listed” and “Labeled”: As defined in the National Electrical Code (NEC), Article 100.
   2. Listing and Labeling Agency Qualifications: A “Nationally Recognized Testing Laboratory” (NRTL) as defined in OSHA Regulations 1910.7.

F. Coordination: Coordinate layout and installation of fans with piping and ductwork and with other installations.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver fans as a factory-assembled module with protective crating and covering.

B. Store fans in a secure lay down area.

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

1.7 SEQUENCING AND SCHEDULING

A. Coordinate size and location of concrete utility bases. Cast anchor-bolt inserts into base.

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

PART 2 - PRODUCTS

2.1 GENERAL

A. Provide process exhaust fan and components in accordance with specific equipment schedules as indicated on drawings.

B. Process exhaust fans shall be factory assembled and tested.

2.2 MANUFACTURERS

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:
   1. Buffalo Forge Co.
   2. Chicago Blower Corp.
   3. Twin City Blower.
   4. Greenheck
   5. New York Blower.

2.3 PRE-MANUFACTURED EXHAUST FAN ASSEMBLIES

A. Centrifugal Fans: EF-CN-01 and EF-CN-02, EF-CN-04 and EF-CN-05.
   1. General: Factory fabricated direct drive, SWSI centrifugal fans consisting of housing, spark resistance wheel construction (SRC), fan shaft, bearings, motor, switch, drive assembly, and support structure.
   2. Housings
      a. Materials and Fabrication:

1) Exhaust Fans shall be formed and reinforced Carbon Steel panels to make curved scroll housings with shaped cutoff, spun metal inlet bell, and doors or panels to allow access to internal parts and components.

b. Panel Bracing:
1) Exhaust Fans housings shall be braced with Carbon Steel angle, or channel member supports for mounting and supporting fan scroll, wheel, motor, and accessories.

c. Fabrication Class: AMCA 99, Class I

d. Horizontal Flanged Split Housing: Bolted construction.

e. Flanged inlet and outlet connections.

3. Wheels
a. Single Width Air-Foil Fan Wheels:
1) Exhaust Fans wheels shall be of spar resistant alloy construction. Provide a buffer plate around the housing shaft-hole opening. Wheel shall be of air-foil type with curved inlet flange, back plate, backwardly-inclined blades welded to flange and back plate, and fastened to shaft with set screws or keyed collar. Max temperature rating shall be 200 F.

b. Balancing: Wheels shall be statically and dynamically balanced to grade G6.3 per ANSI S2.19, prior to being assembled in the fan, followed by final balance of entire rotating assembly.

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

b. Turned, ground, and polished ANSI Grade 1040 or 1045 hot-rolled steel with keyway. Ship with a protective coating of lubricating oil.

c. Designed to operate at no more than 70 percent of first critical speed at top of fan's speed range.

5. Bearings
a. Prelubricated and Sealed Shaft Bearings: Self-aligning, pillow-block-type ball bearings.
1) Ball-Bearing Rating Life: ABMA 9, L_{10}, of 120,000.
2) Roller-Bearing Rating Life: ABMA 11, L_{10}, of 120,000.

6. Drives
a. Centrifugal fans shall be belt-drive. Arrangement as indicated on drawings. Include a flexible coupling for fan and motor shaft alignment.

b. Provide OSHA shaft and coupling guard fabricated of steel frame with wire mesh screen.

c. Fixed pitch CI pulleys, dynamically balanced at factory.

d. Belts shall be oil resistant, non-sparking, non-static. Provide matched sets for multiple drives.

7. Accessories
a. Scroll Access Doors: Shaped to conform to scroll, with quick-opening latches and gaskets.

b. Companion 304 L Flanges: Stainless steel, for duct connections.

c. Discharge Dampers: Heavy-duty 304 stainless steel assembly with opposed blades constructed of two plates formed around and welded to shaft, channel frame, sealed ball bearings, with blades linked outside of airstream to single control lever.

d. Scroll Drain Connection: 1" NPS stainless steel pipe coupling welded to low point of fan scroll.

e. Shaft Seals: Airtight seals installed around shaft on drive side of SWSI fans.

8. Motors
a. Refer to Division 15, Section 15055, "Motors" for general requirements.

b. Motor construction: NEMA MG 1, general purpose, continuous duty, high efficiency, Design B, mounted on adjustable base.

c. Enclosure type: Totally enclosed fan cooled (TEFC), unless otherwise indicated.

9. Laboratory Exhaust Fans: EF-CN-01 and EF-CN-02.
   a. In addition to Section 1.3A, for Laboratory Exhaust applications, all parts in contact with the exhaust air stream shall be coated. Coating material shall be "PLASITE, Type 7122",(no known equal). Fan manufacturer or their appointed representative shall apply the coating as directed by the coating manufacturer and as approved by the Construction Manager. Fan arrangement shall be as shown on drawings. Fans shall be belt driven. Fans shall be field adjusted after installation.

2.4 SOURCE QUALITY CONTROL

A. Sound-Power Level Ratings: Comply with AMCA 301, "Method 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."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions to receive equipment, for compliance with installation tolerances and other conditions affecting performance of exhaust fans.

B. Examine roughing-in of tie-downs, connecting ductwork orientations, condensate drainage piping where applicable and electrical services to fan motor to verify actual locations of connections before installation.

C. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install process exhaust fans level and plumb, according to manufacturer's written instructions
   1. Support units on concrete bases using neoprene pads. Secure units to anchor bolts installed in concrete housekeeping base.

B. Arrange installation of units to provide access space fans for service and maintenance.

C. Shim level and grout in place.

3.3 HOUSEKEEPING BASES (non-concrete)

A. All fans to be mounted on a Unitary Base/Equipment Roof Curb sized and designed as required for flat fan installation on a sloping roof.

3.4 CONNECTIONS

A. Duct installation and connection requirements as specified on the drawings. Drawings are to indicate the general arrangements of ducts and any duct accessories. Make final duct connections to fans with flexible connections, as specified on drawings.

B. Electrical: Conform to applicable requirements of Division 16 provisions.
   1. Connect fan motors to wiring systems and to ground. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. When manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.5 ADJUSTING

A. Adjust damper linkages for proper damper operation.

3.6 CLEANING AND PAINTING

A. After completing installation, inspect all exposed assembly finish. Remove burrs, dirt, and construction debris, and repair damaged exterior surfaces, scratches, or abrasions.

B. Clean fan interiors to remove foreign material and construction dirt and dust. Vacuum clean and wipe clean fan wheels and housings.

C. Exterior surfaces of the fan and connecting ductwork shall be cleaned prior to painting. Provide a prime coat and a final coat of epoxy to cover all blemishes on exterior surfaces repaired in a professional manner. All cleaned surfaces shall be painted the same day they are cleaned.

D. The installing contractor shall provide an epoxy coat on the exterior surface of the entire fan assembly after erection. Color as specified by CM.

3.7 COMMISSIONING

A. Manufacturer's Field Inspection: Engage a factory-authorized service representative to perform the following:
   1. Inspect field assembly of components and installation of process exhaust fans, ductwork, and electrical connections.
   2. Prepare a written report on findings and recommended corrective actions.

B. Final Checks before Startup: Perform the following before startup:
   1. Verify that shipping, block, and bracing are removed.
   2. Verify that unit is secure on mountings and supporting devices and that connections for ductwork, and electrical are complete. Verify that 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 free fan wheel 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 that manual or automatic volume control and combination "fire and smoke" dampers in connected ductwork systems are in a "fully-open" position.

C. Starting procedures for process exhaust fans include the following:

1. Energize motor; verify proper operation of motor, drive system, and fan wheel. Adjust fan to indicated RPM, using variable frequency drive.
2. Measure and record motor electrical values for voltage and amperage.
3. Manually operate dampers from fully closed to fully open position and record fan performance.

D. Refer to Division 15, Section 15990, “Testing, Adjusting, and Balancing” for air-handling system testing, adjusting, and balancing.

3.8 DEMONSTRATION

A. Engage the services of a factory-authorized service representative to train CM designated operating and maintenance personnel on procedures to adjust, operate, schedule as related to startup and shutdown, troubleshooting, servicing, and for preventative maintenance.
1. Review data in the Operation and Maintenance (O&M) manuals. Refer to closeout requirements in General and Supplementary General Conditions.
2. Schedule training with Construction Manager, with at least 7 days’ advance notice.

END OF SECTION 15842