

SPECIAL SPECIFICATION

SECTION 15860S

ACID EXHAUST FANS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Direct Drive Acid Exhaust fans.
- B. Fan Accessories

1.02 REFERENCES/PROJECT REQUIREMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Requirements of the following Project Specification Sections apply to this section:
 - 1. Section 13085-S – Seismic Protection
 - 2. Section 15170-S - Motors.
 - 3. Section 15070S – Vibration Limits and Controls.
 - 4. Section 15950-S – Testing Adjusting and Balancing.
 - 5. Section 15994 – Mechanical Systems Demonstration.
 - 6. Section 16269 – Variable Frequency Controllers.
- C. References
 - 1. ANSI/AFBMA Std. 9-1990, American National Standard, AFBMA Standard Load Ratings and Fatigue Life for Ball Bearings.
 - 2. AFBMA 11 - Load Ratings and Fatigue Life for Roller Bearings.
 - 3. AMCA 99 - Standards Handbook.
 - 4. AMCA 210 - Laboratory Methods of Testing Fans for Rating Purposes.

5. AMCA 300 - Test Code for Sound Rating Air Moving Devices.
6. AMCA 301 - Method of Publishing Sound Ratings for Air Moving Devices.
7. NEMA Standards Publication No. MG1, Motors and Generators, 1993.
8. NFPA 70 - National Electrical Code.
9. SMACNA - HVAC Duct Construction Standards - Metal and Flexible.
10. ASTM D4167 - Standard Specifications for Fiber Reinforced Plastic Fans and Blowers.

D. Environment Air Requirements

1. Do not operate fans for any purpose until ductwork is clean, bearings lubricated, and fan has been test run under observation.

1.03 DEFINITIONS

- A. Not used

1.04 SYSTEM DESCRIPTION

- A. Acid exhaust fans shall be direct drive arrangement #8. Capacity, rotation, and discharge configuration shall be as indicated in the schedules and as shown on the drawings.

1.05 SUBMITTALS

- A. Submit under provisions of Sections 01300S.
- B. Shop Drawings: Indicate dimensional assembly of centrifugal fans and accessories including flanged inlet and outlet connections and bolt hole centers compatible with duct connections. Include electrical connection requirements. Include fan weights and center of gravity, and dimensioned fabrication drawings for galvanized steel fan support bases and spring pockets.
- C. Product Data: Provide data on centrifugal fans and accessories including fan curves with specified operating point clearly plotted, sound power levels for both fan inlet and outlet at rated capacity and electrical characteristics and connection requirements.
- D. Manufacturer's Installation Instructions

- E. Submit Operation and Maintenance Data under provisions of Section 01700.
- F. Maintenance Data: Include instructions for lubrication, motor and drive replacement, spare parts list and wiring diagrams.

1.05 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacture, assembly, and field performance of fans with minimum ten years experience.
- B. Fans shall be factory tested and certified prior to shipping.
- C. Alignment: Base mounted fans alignment shall be field checked and corrected by qualified millwright and alignment certified.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Protect Fans from damage due to normal handling during shipment and storage. Protection shall be applied to open ends to prevent dirt and moisture from entering.
- B. Consignee must inspect shipment upon delivery and note any and all damages and discrepancies on bill of lading and notify manufacturer within 24 hours.
- C. Fans shall not be stored in an area where they will have a chance to be damaged from traffic or debris. Where possible, store inside and protect from dirt and debris. When necessary to store outside, store above grade and enclose with waterproof wrapping to protect from dirt and debris.

1.07 WARRANTY

- A. Refer to section 01700 for warranty requirements

1.08 SYSTEM STARTUP

- A. Refer to Division15 for system start-up information and requirements.

1.09 OWNER'S INSTRUCTIONS

- A. Not used.

1.10 COMMISSIONING

- A. Not used.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Harrington

2.02 EQUIPMENT

A. General Requirements

1. Performance Ratings: Conform to AMCA 210 and bear the AMCA Certified Rating Seal.
2. Sound Ratings: AMCA 301, tested to AMCA 300 and bear the AMCA Certified Sound Rating Seal.
3. Fabrication: Conform to AMCA 99.
4. Performance Base: 5300 feet above sea level.
5. Temperature Limit: Maximum 200 degrees F. unless otherwise specified.
6. Static and Dynamic Balance: Eliminate vibration or noise transmission to occupied areas.
7. Performance: As scheduled on drawings.

B. Wheel and Inlet

1. Acid Exhaust Fans: True centrifugal airfoil design with backward inclined blades of a composite construction, using high strength industrial vinyl ester resin such as Ashland Chemical Hetron 922L or equal, with no fillers except as required for viscosity control. Reinforcement material shall be industrial commercial grade of glass mat or woven roving with a coupling agent to provide suitable bond between glass reinforcement and resin. Attach wheel to shaft with spoked sheave and taper-lock bushings. Balancing weights: vinyl ester resin and glass mat applied by experienced fiberglass fabricator.
2. Rotor Balance: Meet or exceed ISO 1940 G **I** specifications.

C. Housing

1. Acid Exhaust Fans

- a. Premium quality industrial grade vinyl ester resin such as Ashland Chemical Hetron 922L or equal; surfaces exposed to the surrounding atmosphere shall require a polyester resin of high quality fire retardant industrial grade selected for environment in which it will operate.
- b. Resin shall not contain any fillers except for viscosity or fire control; but shall in no case exceed five percent by weight of the total resin weight.
- c. Exterior gel coat: industrial grade, free from imperfections, consisting of a polyester resin for corrosion control, color pigment, and a UV inhibitor, such as diatomaceous earth. Fiberglass reinforcement shall be of industrial commercial grade of glass fibers and shall have a coupling agent suitable for bonding of the glass reinforcement and the resin.
- d. Interior surface: Resin rich to comply with resin manufacturer's recommendation, flow coated with same resin as used in manufacture of the fan housing. Interior housing shall contain a resin rich veil interior when required for the service application.
- e. Housing shall be one piece to provide a strong, seamless finished product. Provide access door to view fan wheel.

D. Bearings and Drives

1. Bearings: AFBMA, L-10 life at 50,000 hours heavy duty split pillow block type, self-aligning, grease lubricated ball bearings, or AFBMA L-10 life at 50,000 hours heavy duty split pillow block type, self-aligning, grease lubricated roller bearings.
2. Shafts: Hot rolled steel, ground and polished, with key-way, protectively coated with lubricating oil and shaft guard. The shaft seal shall be suitable for the application.
3. Coupling
 - a. All- metal grid type.
 - b. Use spacer couplings for units larger than 40 hp.
 - c. Coupling type and mounting arrangement to be agreed upon by driver and driven equipment vendors and purchaser. Record required coupling gap.

- d. Couplings suitable for variable frequency drive application.
4. Coupling Guard
- a. All-metal type; meet OSHA requirements.
 - b. Guard shall allow access to bearings for vibration readings without removing guard.
- E. Electrical Characteristics and Components
- 1. Electrical Characteristics: As scheduled on drawings or other applicable Sections.
 - 2. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70.
- F. Accessories
- 1. Access Doors: Shaped to conform to scroll, with quick opening latches and gaskets.
 - 2. Scroll Drain
 - a. Corrosive service: Provide 1 inch threaded drain at the lowest point of the housing.
 - 3. Flanges
 - a. Inlet and outlet flanges, coordinate with duct connections.
- G. Miscellaneous
- 1. Nameplates and other dataplates: Stainless steel, secured to fan.
 - 2. Nameplate to contain following information as a minimum: Fan manufacturer, fan serial number, capacity in cubic feet per minute, total static pressure in inches of water, vendor's size and model number, wheel diameter in inches, and speed in revolutions per minute.
 - 3. Mark rotation arrows on fan.

2.03 ACCESSORIES

- A. Not used

2.04 SOURCE QUALITY CONTROL

- A. Owner/Engineer has right to inspect the manufacturing facility at anytime to determine quality and schedule conformance.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install fans as indicated, with flexible electrical leads.
- C. The fan, motor and drive assembly shall be mounted on an inertia base with 4-inch minimum deflection spring isolation. The spring shall have 50 percent overload capacity. Isolators shall be individually selected from each load bearing location to maintain equal deflection*
- D.* Install flexible connections specified in Section 15890-S between fan inlet and discharge ductwork. Ensure flanges are parallel while fans are running.
- E.* Install fan restraining snubbers as required. Adjust snubbers to prevent tension in flexible connectors when fan is operating.
- F.* Provide safety screen where inlet or outlet is exposed.
- G.* Lubricate fans before startup.
- H.* Coordinate electrical power requirements with Electrical Contractor.
- I.* Preliminary Installation for Direct Drive Units:
 - 1. Support ductwork independently and anchor to avoid imposing stresses on fan. Design inlet ductwork to minimize friction losses and to present uniform velocity profile at inlet.
 - 2. Make final ductwork connections after preliminary alignment.

J. Final Alignment:

1. Prior to final alignment of equipment, clean motor feet and contact areas of burrs, dirt and paint. Check each motor foot individually for soft-foot condition with dial indicator mounted on motor foot. Correct softness in excess of 0.002 inches. Use precut stainless steel shims properly sized for motor feet. Verify shaft runout of both driver and driven units to ensure that less than 0.002 inches of mechanical runout exists for shaft diameters less than or equal to 6 inches. Give consideration to thermal movement from off-line to running condition.
2. Attach piping so that pipe strain does not exist on equipment. Use dial indicators mounted on rim and face of coupling or on equipment feet; permit maximum 0.002 inches of movement when piping is connected or disconnected. Check each flange separately.
3. Perform final alignment and adjusting for thermal growth using dial indicator or laser alignment method. Both angular and parallel misalignment shall not exceed 0.002 inches for equipment rotating at 3600 rpm or less.
4. Make corrections to alignment using precut stainless steel shims sized to fit motor feet. Do not use more than five shims under any one foot. Steel plates ground flat on both sides may be used for shims greater than 0.250 inches. Maintain motor foot to baseplate contact of at least 80 percent through alignment process.

K. Record initial and final alignment readings and submit to Owner.

3.02 FIELD QUALITY CONTROL

A. Final Acceptance Test:

1. Perform final vibration acceptance test on units larger than 20 hp and those in critical applications.
2. Remote vibration sensors may be required where safe access of bearing housings is not practical.
3. Vibration velocity readings taken at bearing locations in axial or radial direction shall not exceed 0.06 inches/sec (peak) under normal operating conditions over frequency range $f_{\min} = (0.4 \times \text{motor synchronous speed})$ to $f_{\max} = 120,000$ cpm.
It is allowable to test with the springs locked out.
4. Submit final vibration readings to Owner.

5. After motor and pump have been operating and have thermally stabilized, check bearing and casing temperatures. Ensure that bearing temperatures do not exceed lubrication manufacturer's specifications; confirm accuracy of preliminary thermal growth calculations.

END OF SECTION