SPECIFICATIONS

FIBERGLASS CENTRIFUGAL EXHAUST FANS SERIES HPI/HPIA

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FIBERGLASS AXIL–CENTRIFUGAL AND AIRFOIL EXHAUST FAN SPECIFICATION

1.0 SCOPE

This specification covers requirements for HEE Environmental Engineering, LLC. (HEE) fiberglass Centrifugal Airfoil (HPIA series) BI AF Axial Centrifugal exhaust fans intended for use in industrial applications where corrosion control is of prime importance and process service temperatures do not exceed 200 degrees F (250 degrees F for special construction).

3.0 MATERIALS OF CONSTRUCTION

.1 FAN HOUSING AND RELATED PARTS

3.1.1 Resin – A premium quality, industrial grade vinyl ester resin shall be used for all surfaces exposed to the corrosive air such as Ashland Chemical's Hetron 922L, or equal. All surface exposed to the surrounding atmosphere shall require a polyester resin of a high quality, fire retardant industrial grade resin, such as Koppers Dion 6693FR, or equal. The selected resin for the chemical environmental shall be based on comprehensive evaluation of actual field services performance and experience and laboratory testing in accordance with ASTM-C581, or determined by actual testing by the customer utilizing a test coupon supplied by Harrington.

3.1.2 The selected resin shall not contain any filler except as required for viscosity control or fire retardancy, and in no case shall the amount of filler material exceed five percent by weight of the total weight of the resin. Antimony Trioxide may be added, up to the five percent limit, in compliance with the resin manufacturer's recommendations, to create a finished product with a Class I flame spread rating of 25 or less when tested per ASTM-E84 Steiner Tunnel Test.

3.1.3 Exterior Gel Coat – The exterior of the fan housing shall be an industrial grade gel coat, free from surface imperfections, consisting of a polyester resin for corrosion control, a pigment to achieve the desired color, and an inhibitor, such as diatomaceous earth, to prevent ultraviolet light degradation. The material shall be such as that manufactured by American Colors Incorporated or equal.

3.1.4 Fiberglass Reinforcement – The reinforcement material shall be an industrial commercial grade of glass fibers, such as that manufactured by Owens – Corning or Certainteed and shall have a coupling agent to provide a suitable bond between the glass reinforcement and the resin.

3.1.5 Interior Surface – The fan housing shall have a resin rich interior surface to comply with that recommended by the resin manufacturer. The surface shall be flow-coated with the same resin as used in the manufacture of the fan housing, utilizing the proper percentage of wax as recommended by the resin manufacturer to promote proper curing. If an additional barrier is required, because of severe chemical service application, a veil-type material such as "C" Veil, Dynel Veil, or Nexus shall be used on the fan housing interior.

2.2 CENTRIFUGAL AND AIRFOIL WHEEL

2.2.1 Resin – The vinyl ester resin shall be a premium quality, high strength industrial resin such as Ashland Chemical's Hetron 992L, or equal.

2.2.2 The selected resin shall not contain any fillers except as required for viscosity control, and in no case shall the amount of filler material exceed one half of one percent by weight of the total weight of the resin

2.2.3 Fiberglass reinforcement – The reinforcement material shall be an industrial commercial grade of glass mat or woven roving, such as manufactured by Owens-Corning or Certainteed, and shall have a coupling agent to provide a suitable bond between the glass reinforcement and the resin.

2.2.4 Imbedding Hub – A spoked sheave, such as manufactured by Browning, shall be used with taper-lock bushings to attach the wheel to the shaft. The hub shall be cast grey iron, machined to proper tolerances, and the bushing shall be steel.

2.2.5 Balancing Weights – Polyester or vinyl ester resin and glass mat shall be used as balancing materials and applied to the wheel by an experienced fiberglass fabricator.

2.3 SHAFT

2.3.1 Material – The fan drive shaft shall be turned, ground and polished carbon steel, and shall be sized to operate at below eighty percent of the first critical speed. Applications requiring additional corrosion resistance shall utilize 316 stainless steel shaft material.

2.3.2 Machining – One end of the shaft shall be machined with the appropriate key-way to allow keying of the drive sheave, and shall be dimpled in the center to allow for RPM measurements.

2.3.3 Fail Safe – The other end of the shaft shall be machined with an appropriate key-way to allow keying the shaft to the embedding hub of the wheel. This end will also be drilled and tapped for installation of a fail-safe washer, designed to prevent wheel slippage on the shaft due to loosing of the taper-lock bushing on the embedding hub.

2.4 BEARING

2.4.1 Type – Bearings shall be ball bearing or roller bearing pillow block type, depending on the installation requirement and operational requirement of the fan.

2.4.2 Self Aligning – Full self alignment shall be provided by a spherical outer race of the bearing inner unit which fits accurately into a spherical seat in the housing. The outer race shall be locked to resist rotation.

2.4.3 Seals – The pillow block unite shall be effectively sealed to retain lubricant and exclude dust and dirt. The sealed shall consist of a nylon composition designed for wear resistance and flexibility. The seal will have a very low running friction and be blow-out resistant.

2.4.4 Locking Mechanism – The bearing shall have a locking collar, secured with two set screws through the collar at 120 degrees.

2.5 SHAFT SEAL

2.5.1 The standard shaft seal shall be an elastomer material such as Neoprene. In case where severe corrosion may be encountered, viton shaft seal shall be utilized.

2.5.2 For service operating with positive pressure in the fan housing, an optional mechanical shaft seal is recommended consisting of polypropylene seal housing gland and acrylic packing as manufactured by John Crane.

2.6 MOUNTING HARDWARE

2.6.1 All nuts, bolts, and washers used to mount the fan housing to the support stand shall be stainless steel of the type compatible with the surrounding environment. Mounting hardware for the bearing and motor shall be cadmium plated high strength steel hardware.

2.7 V-BELT DRIVES

2.7.1 V – Belt drivers shall be manufactured by Browning Manufacturing and be selected with a minimum safety factor of 1.5 based upon the installed fan motor horsepower. Fixed drives or adjustable drives shall be provided. Adjustable drives shall be selected to operate at the mid range fan RPM allowing a ten percent adjustment in either direction.

3.0 DESIGN

3.1 FAN HOUSING AND RELATED PARTS

3.1.1 Shape – The fan housing shall be designed to collect the air flow from the periphery of the wheel and discharge it in the proper direction.

3.1.2 One Piece – The housing shall be manufactured as one part in a mold, to provide a strong, seamless finished product.

3.1.3 Flange – The inlet or outlet of the housing shall be flanged, with the flange being back faced to provide a smooth, evenly sealing flange surface.

3.1.4 Direction – The fan shall be designed to operate in the counter clockwise direction.

3.1.5 Inlet Cone – The inlet cone shall be designed to reduce incoming air turbulence to a minimum. The inlet cone shall extend into the wheel cone, while maintaining close tolerance between the two parts, to prevent leakage and loss of efficiency.

3.2 CENTRIFUGAL WHEEL – HPI 1225 – 1825

Backward Inclined – The wheel shall be a centrifugal design with backward inclined flat blades using a composite construction consisting of a premium vinyl ester.

3.2A AIRFOIL WHEEL

3.2.1 Backward Inclined Airfoil – The wheel shall be a centrifugal design with backward inclined true airfoil shaped blades using a composite construction consisting of a premium vinyl ester exterior and a high density light weight interior. The unique airfoil wheel design shall provide operation at high speeds without distortion or bond separation, high static efficiencies and offer excellent chemical resistance.

3.2.2 Bedding Hub – The hub shall be bolted and bonded to the fiberglass back plate. The imbedding hub shall be located on the back side of the wheel back plate to allow for a smooth air stream flow passage through the wheel. The hub shall be encapsulated with fiberglass hub cover, and the bolt extending through the back plate shall be completely encapsulated with fiberglass.

3.2.3 Shaft Sleeve – A fiberglass sleeve shall be bonded to the wheel. The sleeve shall extend from the wheel through a shaft seal, to the exterior of the fan housing, to prevent any exposure of the shaft to the air stream in the fan housing.

3.2.4 Balancing – The wheel and shaft assembly shall be balanced per ANSI S2.19-1975 quality grade G-6.3, both statically and dynamically on electronically controlled balancing machines.

3.3 BEARINGS

3.3.1 All bearings shall have a minimum B-10 life of 75,000 hours.

3.4 CLASSIFICATION

3.4.1 Class I - All fans shall be capable of operating at tip speeds of 10,000 FPM or less.

3.4.2 Class II – All fans shall be capable of operating at tip speeds of 14,000 FPM or less.

3.4.3 Class III – All fans shall be capable of operating at tip speeds of 17,000 FPM or less.

3.4.4 Design Safety Factor – The HPIA series centrifugal airfoil fans shall conform to ASTM D4167 “Standard Specifications for Fiber Reinforced Plastic Fans and Blowers”. For applications requiring an additional corrosion barrier, the housing interior shall include a resin rich veil interior. The safe operating speed shall be obtained by testing to destruction to determine failure speeds. The safe operating speed is a maximum of 58% of the failure speed, or a safety factor of 3:1 on stress.

3.4.5 Safe Operating Speed at Elevated Temperature – The safe operating speed shall be derated at higher temperatures and shall be calculated as outlined in ASTM D4167.

4.0 TESTING

4.1 Performance

The rating shall be based on tests and procedures as outlined in AMCA 210-85 “Laboratory Methods of Testing Fans for Rating” and comply with the requirements of AMCA Publication 211-87 “Certified Ratings Program – Air Performance”

4.2 Sound

The sound information shall be data obtained as a result of laboratory testing based on a reverberant room as described in AMCA standard 300-85 “Reverberant Room Method for Sound Testing of Fans” and processed by the procedures shown in AMCA Bulletin 301-90 “Methods for Calculating Fan Sound Rating from Laboratory Test Data”

4.3 Shop Performance

Each fan shall be run at the factory to assure proper operation of all – rotating parts, including wheel, shaft, bearings, sheaves, and belts. Motor shall be tested for amperage draw by dampering the fan from free - flow to no - flow operating.

4.4 Vibration Analysis

Each Completely assembled fan shall be tested at the factory per ASTM D4167 standards, and be re – balanced if necessary. The assembled fan shall be run and the peak - to – peak displacement shall be measured at the pillow block bearings and be in accordance with the following:

- 2.5 mils up to 600 rpm
- 2.0 mils up to 900 rpm
- 1.5 mils up to 1200 rpm
- 1.0 mils up to 1800 rpm
- 0.6 mils up to 3000 rpm

A permanent record of the vibration signature shall be maintained for each assembled fan.

5.0 WARRENTY

Refer to HEE STANDARD PRODUCT WARRENTY for details and information on the warranty.

ACCESSORIES AND OPTIONS AVAILABLE

Access Doors * Disconnect Switch * Extended Lube Lines * Flanged Intel * Flexible Connection * Graphite Impregnation * Gravity Dampers * Intel Boxes * Intel or Outlet Screens * Intel Vane and Outlet Dampers * Mechanical Shaft Seal * Outlet Transition * Silencers * Stacks * Structural Bases * Vibration Switch * Viton Shaft Seal (or Teflon) * Weather Covers * 316 Stainless Steel or Hastelloy Shafts

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