

PART 1: GENERAL

1.01 Purpose:

- A. This standard is intended to provide useful information to the Professional Service Provider (PSP) to establish a basis of design. The responsibility of the engineer is to apply the principles of this section such that the University may achieve a level of quality and consistency in the design and construction of their facilities. Deviations from these guidelines must be justified through LCC analysis and submitted to the University for approval.

1.02 References:

A. Codes and Standards that are Standard at the University:

1. AMCA 210 and 300: Fans must be licensed to bear the AMCA Certified Ratings Seal for both air and sound. Sound rate centrifugal fans in accordance with the latest version of AMCA 300 "Test Code for Sound Rating Air Moving Devices".
2. AMCA 204: Balance Quality and Vibration Levels for Fans
3. ASHRAE Compliance: Test and rate centrifugal fans in accordance with the latest version ASHRAE 51 (AMCA 210) "Laboratory Methods of Testing Fans for Rating".
4. UL Compliance: Provide centrifugal fan electrical components which have been listed and labeled by UL.

1.03 Requirements:

- A. Fans shall be selected with minimum 75% fan efficiency at design operating point. In all cases, the PSP shall evaluate system conditions and select the optimum fan type and configuration based on efficiency, system curve, and fan characteristics at all anticipated design conditions.
- B. Fans shall be dynamically balanced and factory-tested in accordance with AMCA 204-96 at the design operating RPM to Fan Application Category BV-3, Balance Quality Grade G6.3.
- C. Design resonant speed of fan system (not critical speed) shall be minimum 25% greater than its maximum operating speed.
- D. Provide epoxy coating finish as a minimum with additional protective coatings on fans as required by project conditions.
- E. Provide AMCA spark resistant construction option: A, B, or C as required by project conditions.
- F. Refer to 5.23.05 for fan vibration control requirements.
- G. Provide heavy-duty, grease-lubricated, precision anti-friction ball or roller, self-aligning, bearings selected for minimum average life (AFBMA L10) of 200,000 hours.
- H. Direct Drive Fans Only. NO EXCEPTIONS.

- I. Provide TEFC NEMA Premium Efficiency rated motor rated for compatibility with variable frequency drives where applicable. Select non-overloading motors at all points on the RPM operating curve.
- J. Shafts shall be constructed of AISI grade 1040 or 1045 solid hot-rolled steel, turned, ground, and polished. The shaft's first critical speed shall be at least 125% of the fan's maximum operating speed.
- K. Provide accessories per the following requirements where specified:
 - a. Access Doors: Provide access door in scroll housing, with latch-type handles, flush mounted for un-insulated housings, and raised-mounted for insulated housings.
 - b. Backdraft Dampers: Provide gravity-actuated dampers on fan discharge, counterweighted, with interlocking aluminum blades with felt edges in steel frame with inspection port.
 - c. Drain Connections: Provide minimum 3/4 inches threaded coupling drain connection at lowest point of housing.
 - d. Extended Grease Lines: Extend grease lines from bearings to outside of inlet duct flange, terminate with grease fitting.
 - e. Heat Slings: Provide metal disc between bearings and fan wheel, to dissipate heat from shaft.
 - f. Split Housings: Provide flanged, horizontally split housings as required by project conditions.
 - g. Weather Hoods: Provide protective weather hood with stamped vents over motor and drive compartment.
 - h. Screens: Provide heavy mesh removable screens on fan inlet and outlet.
 - i. Fan Guards: Specify guards on inlets and outlets not connected to ductwork, constructed of expanded metal in removable frame
- L. Not Used

PART 2: PRODUCTS

2.01 Centrifugal Fans, Steel (General Application):

- A. Provide centrifugal fans built to Class II construction (minimum).
- B. Provide factory-assembled and tested fan units consisting of housing, wheel, fan shaft, bearings, and side support structure.

- C. Housings: Provide curved scroll housings; lockseam construction for sizes 24 inches to 40 inches, spot welded construction for sizes 44 inches to 60 inches, and continuous weld construction for sizes 66 inches and larger. Provide horizontally split housings, bolted together for sizes 66 inches and larger. Provide spun inlet cones and duct connections.
- D. Wheels: Provide backwardly inclined plate-type blades for sizes 22 inches and smaller, non-power-overloading backwardly inclined airfoil blades for sizes 24 inches and larger. Weld blades to wheel rim and hub plate. The wheels shall be backward inclined. Key wheels to shafts.

2.02 Centrifugal Fans, Fiberglass Reinforced Plastic (Corrosive Applications):

- A. Fan Units: Provide factory-assembled and tested fan units consisting of housing, wheel, fan shaft, bearings, and fan support stand. The exterior of the fan housing shall be coated with an industrial grade gel coat, free from surface imperfections, a pigment to achieve the desired color and an inhibitor to prevent ultra-violet degradation.
- B. Housings: Construct sections with flange joints utilizing stainless steel bolts and appropriate gasketing. The resins used to fabricate the fan housing shall be premium grade, fire retardant and selected for chemical environment. The fiberglass reinforcement shall be an industrial commercial grade of glass mat or woven roving, such as manufactured by Owens-Corning and shall have a suitable coupling agent to provide a bond between the glass reinforcement and the resin.
- C. Wheels: Provide with a cast iron back plate or imbedded hub in the wheel and keyed to a polished steel shaft.

2.03 Utility Fans:

- A. Fan Units: Provide factory-assembled and tested fan units consisting of housing, wheel, fan shaft, bearings, and fan drive.
- B. Housings: Construct of heavy-gage steel with side sheets fastened to scroll sheets by means of deep lock seam. Provide round inlet collar, slip joint discharge duct connection. Construct housings to be convertible to 8 standard discharges. Provide adjustable motor supports.
- C. Wheels: Provide forward curved or backward inclined wheels as scheduled. Provide swaged hubs.

2.04 Not Used

2.05 Inline Centrifugal Fans:

- A. Housing: Aluminum split housing, constructed of spun aluminum, with aluminum straightening vanes, inlet and outlet flanges, and support bracket adaptable to floor, side wall, or ceiling mounting.
- B. Direct-Drive Units: Specify ball bearing motor encased in housing so as to be out of air stream. Provide factory wiring to disconnect located on outside of fan housing.
- C. Not Used

D. Wheel: Aluminum airfoil blades on aluminum hub.

2.06 Vane Axial Fans:

- A. Fan Units: Provide factory-assembled and tested fan units consisting of housing, propeller and hub, fan shaft, bearings, and fan drive
- B. Housing: Shall be constructed of steel with welded construction or corrosion resistant fasteners
- C. Propeller: Shall be adjustable pitch with cast aluminum blades

2.07 Plug Fans:

- A. Fan Units: Provide a centrifugal plug fan built to Class II construction (minimum). Provide factory assembled and tested fan units consisting of frame, wheel, shaft, bearings, and support structure.
- B. Housing: Panels and framework shall be constructed of heavy gauge steel, pre-punched for ease of installation, with die formed flanges and welded corners. Rigid steel gussets are welded to the frame and motor supports to assure precise drive alignment, and to provide a rigid structure to support the shaft and bearings, and reduce low frequency vibration.
- C. Wheels: The fan wheel shall be of the non-overloading backward inclined centrifugal type. Wheels shall be statically and dynamically balanced to balance grade G6.3 per ANSI S2.19. Fan wheel shall be manufactured with continuously welded steel blades. The wheel and fan inlet shall be carefully matched and shall have precise running tolerances for maximum performance and operating efficiency.

END OF STANDARD