

SECTION 23 34 00 HVAC Fans

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes
 - 1. The ceiling-mounted high volume, low speed circulation fan is the model scheduled with the capacities indicated. The fan shall be furnished with standard mounting hardware, direct-drive motor, and digital variable speed wall controller to provide cooling and destratification.
- B. Summary of Work
 - 1. Installation of the fan, miscellaneous or structural metal work (if required), field electrical wiring, cable, conduit, fuses, and disconnect switches, other than those addressed in the installation scope of work, shall be provided by others. Factory installation services are available through Big Ass Fans. Consult the appropriate installation scope of work for information on the available factory installation options, overview of customer and installer responsibilities, and details on installation site requirements.

1.2 RELATED SECTIONS

- A. 21 00 00 Fire Suppression
- B. 23 00 00 Heating, Ventilating, and Air Conditioning (HVAC)
- C. 23 09 13 Instrumentation and Control Devices for HVAC
- D. 25 00 00 Integrated Automation
- E. 26 00 00 Electrical

1.3 REFERENCES

- A. National Fire Protection Association (NFPA)
- B. Underwriters Laboratories (UL)
- C. Canadian Standards Association (CSA)
- D. International Organization for Standardization (ISO)
- E. National Electrical Manufacturers Association (NEMA)
- F. National Electrical Code (NEC)
- G. Occupational Safety and Health Administration (OSHA)
- H. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)
- I. Air Movement and Control Association (AMCA)

1.4 SUBMITTALS

- A. Shop Drawings: Drawings detailing product dimensions, weight, and attachment methods.
- B. Product Data: Specification sheets on the ceiling-mounted fan, specifying electrical and installation requirements, features and benefits, and controller information.
- C. Revit Files: Files provided for architectural design.
- D. Installation Guide: The manufacturer shall furnish a copy of all installation, operation, and maintenance instructions for the fan. All data is subject to change without notice.
- E. Schedule
- F. Ceiling fan sizing, placement, and performance shall be verified using computational fluid dynamics (CFD) analysis. At a minimum, the input data for the CFD analysis shall include the ceiling fan(s), significant obstructions to airflow at the floor level, and the actual space dimensions. As verification of performance, the submittal shall include results of the CFD analysis including, at a minimum, the following performance metrics determined in accordance with ANSI/ASHRAE Standard 55-2017: average air speed, minimum, maximum, and average cooling effect from elevated air speed, Predicted Mean Vote, and Predicted Percentage Dissatisfied for seated and standing occupants in each occupied zone.

1.5 QUALITY ASSURANCE

- A. Certifications
 - 1. The fan assembly, as a system, shall be Intertek/ETL-certified and built pursuant to the guidelines set forth by UL standard 507 and CSA standard 22.2 No. 113.
 - 2. The fan shall be compliant with NFPA 13—Standard for the Installation of Sprinkler Systems, NFPA 72—National Fire Alarm and Signaling Code, and NFPA 70—National Electrical Code (NEC).
 - 3. Controllers shall comply with National Electrical Code (NEC) and Underwriters Laboratory (UL) standards and shall be labeled where required by code.
- B. Manufacturer Qualifications
 - 1. The fan and any accessories shall be supplied by Big Ass Fans, which has a minimum of fifteen (15) years of product experience.
 - 2. ISO 9001-certified
 - 3. The manufacturer shall not be listed on the Air Movement and Control Association International Inc. (AMCA) Certified Ratings Program (CRP) Non-Licensed Products report in the previous 36 months.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver product in original, undamaged packaging with identification labels intact. The fan shall be new, free from defects, and factory tested.
- B. The fan and its components must be stored in a safe, dry location until installation.

1.7 WARRANTY

- A. The manufacturer shall replace any products or components defective in material or workmanship for the customer free of charge⁺⁺⁺⁺ (including transportation charges within the USA, FOB Lexington, KY), pursuant to the complete terms and conditions of the Big Ass Fans Warranty in accordance to the following schedule:

Mechanical [†]	10 years
Electrical ^{††}	5 years (no factory install); 10 years (factory install)
Labor	1 year

 - + "Mechanical" is defined as mechanical components of the fan, including, the fan hub, motor frame, mounting, airfoils, and winglets.
 - +† "Electrical" is defined as electrical and electronic components of the fan, including the motor, motor drive, variable frequency drive, and any standard controller or accessories.
 - +†† The No Factory Install Warranty Period defined above for "Electrical" applies to proper installations by any other state-qualified or licensed electrical contractor.
 - +††† The Factory Install Warranty Period defined above for "Electrical" requires installation to be purchased from Big Ass Fans and performed by a factory-approved, Big Ass Fans Certified Installer.
 - +†††† All reasonable costs of repair or replacement will be paid or reimbursed provided customer obtains pre-approval.
 - +††††† See the complete warranty for more details.
- B. The warranty shall not require the submission of a post-installation form or photographs of the installed fan(s) to the manufacturer for the warranty to be in effect.
- C. The warranty shall not require the periodic submission of maintenance records for the warranty to remain in effect.

PART 2 PRODUCT

2.1 MANUFACTURER

- A. Delta T LLC, dba Big Ass Fans, PO Box 11307, Lexington, Kentucky 40575.
Phone (877) 244-3267. Fax (859) 233-0139. Website: www.bigassfans.com
- B. Substitutions not permitted.

2.2 HIGH VOLUME, LOW SPEED FANS – BIG ASS FANS POWERFOIL® D

- A. Complete Unit
 - 1. Regulatory Requirements:
 - a. The entire fan assembly shall be Intertek/ETL-certified and built pursuant to the construction guidelines set forth by UL standard 507 and CSA standard 22.2 No. 113.

- b. The digital wall controller shall be compliant with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) The device may not cause harmful interference, and (2) The device must accept any interference received, including interference that may cause undesirable operation.
 2. Sustainability Characteristics:
 - a. The fan shall be designed to move an effective amount of air for cooling and destratification in a variety of applications (including industrial, commercial, and agricultural) over an extended life. The fan components shall be designed specifically for high volume, low speed fans to ensure lower operational noise.
 - b. The digital wall controller shall be designed to control Big Ass Fans from a secure, centralized location, and shall be designed specifically for high volume, low speed Big Ass Fans to ensure maximum control.
 3. Good workmanship shall be evident in all aspects of construction. Field balancing of the airfoils shall not be necessary.
- B. Variable Frequency Drive (VFD)**
1. The onboard VFD shall be pre-wired to the motor and factory-programmed to minimize starting and braking torques for smooth and efficient operation.
 2. The VFD shall be pre-wired to the motor using a short run of flexible conduit with a dedicated ground conductor to minimize electromagnetic interference (EMI) and radio frequency interference (RFI).
 3. The VFD shall include a quick disconnect feature to allow for easy replacement of the drive.
 4. A 15-ft (4.6-m) incoming power cord shall be pre-wired to the VFD.
 5. The VFD shall be housed in a sealed, IP66-rated aluminum enclosure for protection in harsh environments.
 6. The VFD shall have an operating temperature of up to 131°F (55°C) ambient conditions.
 7. The VFD and digital wall controller shall communicate over a wired connection using Modbus communication protocol.
 8. The VFD shall be capable of integration with building automation systems.
 9. The VFD shall be equipped with the most current firmware version, and the VFD firmware shall be subject to updates without notice.
 10. The VFD shall include an embedded accelerometer with precise rotor control sensing to instantly detect impacts and obstructions and automatically shut down the fan.
- C. Fire Control Panel Integration**
1. Includes a 10–30 VDC pilot relay for seamless fire control panel integration. The pilot relay can be wired Normally Open or Normally Closed in the field.
- D. Motor**
1. The fan motor shall be a permanent magnet brushless motor rated for continuous operation at maximum speed with the capability of modulating the fan speed from 0–100% without the use of a gearbox or other mechanical means of control. No other motor shall be accepted.
 2. The motor shall be totally enclosed and rated IP66.
 3. The motor frame shall be designed for ease of service.
 4. The motor shall be manufactured with a double baked Class F insulation and shall be capable of continuous operation in -4°F to 131°F (-20°C to 55°C) ambient conditions.
 5. The motor shall operate from any voltage ranging from 200–277 VAC, single or three-phase, 50/60 Hz or 380–480 VAC, three-phase, 50/60 Hz without requiring adapters or customer selection.
- E. Airfoil System**
1. The fan shall be equipped with six (6) Powerfoil airfoils of precision extruded aluminum alloy. The airfoils shall be connected by means of two (2) high strength locking bolts per airfoil. The airfoils shall be connected to the hub and interlocked with zinc plated steel retainers. All airfoil hardware shall be SAE Grade 8 or equivalent.
 2. The fan shall be equipped with six (6) Powerfoil winglets on the ends of the airfoils. The winglets shall be molded of a polypropylene blend. The standard color of the winglets shall be “Safety Yellow.”
 3. Airfoil Restraint System
 - a. All 20- to 24-ft (6- to 7.3-m) diameter fans shall be equipped with a patented airfoil restraint system to provide redundant safety between the ends of the airfoils and the fan hub. The airfoil restraint system shall be available as an option on smaller diameter fans.

- b. The airfoil restraint system shall be comprised of durable, lightweight nylon safety straps that shall extend from winglets through the airfoils and secure to the fan hub with 12-gauge stamped steel safety clips.
 - c. The straps shall be made of 1 in. (24 mm) wide heavy-duty nylon webbing rated for 825 lb (374 kg). The loops at the ends of the straps shall be secured in a double-stitch pattern for reinforced durability.
 - d. The straps shall be precisely matched to each fan's diameter, eliminating the need for a tensioning mechanism and reducing the opportunity for noise.
 - e. The straps shall run along the inside of the airfoils for an uninterrupted look.
 - f. Safety clips shall be pre-attached to each winglet at the factory to comprise the outer anchor points and provide tension, while clips on the opposite end shall secure to threaded inserts incorporated in the fan hub.
- F. Mounting Post
1. The fan shall be equipped with a mounting post that provides a structural connection between the fan assembly and extension tube. The mounting post shall be formed from A36 steel, contain no critical welds, and be powder coated for corrosion resistance and appearance.
- G. Mounting System
1. The fan mounting system shall be designed for quick and secure installation on a variety of structural supports. The design of the upper mount shall provide two axes of rotation to allow for adjustments to be made after installation on the mounting structure to ensure the fan will hang plumb.
 2. The upper mount shall be of ASTM A-36 steel, welded construction, at least 3/16" thick, and powder coated for appearance and corrosion resistance. No mounting hardware or parts substitutions, including cast aluminum, are acceptable.
 3. All mounting bolts shall be SAE Grade 8 or equivalent.
- H. Hub
1. The fan hub shall be 19 inches (48 cm) in diameter and shall be made of precision cut aluminum for high strength and light weight. The hub shall consist of two (2) aluminum plates, six (6) aluminum spars, and one (1) aluminum spacer. The overall design shall provide a flexible assembly such that force loads experienced by the hub assembly shall be distributed over a large area to reduce the fatigue experienced at the attachment point for the fan blade.
 2. The hub shall be secured to the output shaft of the motor by means of one (1) aerospace grade lug nut. The hub shall incorporate three (3) safety retaining clips made of 1/4" (0.6 cm) thick steel that shall restrain the hub/airfoil assembly.
- I. Safety Cables
1. The fan shall be equipped with an upper safety cable that provides an additional means for securing the fan assembly to the building structure. The upper safety cable shall have a diameter of 3/8" (1 cm).
 2. The fan shall be equipped with two lower safety cables pre-attached to the motor that shall provide an additional means of securing the fan to the extension tube. The lower safety cables shall have a diameter of 3/8" (1 cm).
 3. The safety cables shall be fabricated out of 7 x 19 galvanized steel cable. The end loops shall be secured with swaged Nicopress® sleeves, pre-loaded and tested to 3,200 lbf (13,345 N).
 4. Field construction of safety cables is not permitted.
- J. Digital Variable Speed Wall Controller
1. The fan shall be equipped with a digital variable speed wall controller. The controller user interface shall be a wall-mounted, touch interface.
 2. The controller shall be mounted to a standard rectangular or square outlet box.
 3. A 150-ft (45.7-m) CAT5 cable shall be provided for connecting the controller to the fan's VFD and to provide power to the controller.
 4. The controller mounting location shall meet the requirements of OSHA standard 29 CFR 1910.303(g) for accessibility minimum clearances.
 5. The controller shall have an IP65 rating.
 6. The controller shall provide fan start/stop, speed, and direction control functions.
 7. The controller shall provide diagnostic and fault history information for the connected fan, as well as the ability to configure fan parameters with the assistance of Big Ass Fans Customer Service.

8. The controller interface shall be able to be secured with a passcode to prevent unauthorized access to fan controls and settings.
 9. The controller shall operate out of the box without setup and upon connection to CAT5 cable.
- K. BAFCon Controller (Optional)
1. The fan shall have the option of operating with the BAFCon controller.
 2. The digital controller user interface shall be a wall-mounted touchscreen with a 5-inch (127-mm) display and an 800 (RGB) x 480 pixel resolution.
 3. The digital controller shall be mounted to a standard rectangular or square outlet box.
 4. A 150-ft (45.7-m) CAT5 cable shall be provided for connecting the digital controller to the fan's VFD, allowing for seamless communication between BAFCon and the VFD. The cable shall provide power to the digital controller.
 5. The digital controller shall not require a 120 V power supply at the controller mounting location.
 6. The digital controller mounting location shall meet the requirements of OSHA standard 29 CFR 1910.303(g) for accessibility minimum clearances.
 7. The digital controller shall support up to eight Powerfoil D fans controlled as a group or individually.
 8. The digital controller shall provide fan start/stop, speed, and direction control functions.
 9. The digital controller shall provide diagnostic and fault history information for each connected fan as well as the ability to configure fan parameters with the assistance of Big Ass Fans Customer Service.
 10. The digital controller shall include optional SmartSense functionality to maximize energy savings. SmartSense shall provide the capability to automatically control the speed of Big Ass Fans using information from user-determined settings and built-in temperature and humidity sensors.
 11. The digital controller interface shall be able to be secured with user and admin passcodes to prevent unauthorized access to fan controls and settings.
 12. The digital controller shall include Bluetooth® functionality for receiving firmware updates from a mobile app. The app shall be supported by iOS® and Android™ mobile devices. The digital controller's Bluetooth functionality can be disabled if not needed or permitted.
 13. BAFCon Multi-Fan Accessory Kit (Optional)
 - a. If multiple fans will be installed, the BAFCon Multi-Fan Accessory Kit shall be included.
 - b. The kit shall include a two-screw RJ45 terminal block, a ¼ Watt, 120 Ohm termination resistor, RJ45 pass through splitters, and split-gland cord grips for connecting multiple fans to the controller.
- L. Guy Wires
1. Included for installations with extension tubes 4 ft (1.2 m) or longer to limit the potential for lateral movement.

PART 3 EXECUTION

3.1 PREPARATION

- A. Fan location shall have a typical bar joist or existing I-beam structure from which to mount the fan. Additional mounting options may be available.
- B. Mounting structure shall be able to support weight and operational torque of fan. Consult structural engineer if necessary.
- C. Fan location shall be free from obstacles such as lights, cables, or other building components.
- D. Check fan location for proper electrical requirements. Consult installation guide for appropriate circuit requirements.
- E. Each fan requires dedicated branch circuit protection.
- F. The fan system and the fan controller shall be installed according to the instructions in the fan installation guide.
- G. Install a rectangular or square outlet box at the wall controller mounting location.
- H. For multi-fan installations with the BAFCon controller, ensure the appropriate accessory kit is included as described above. The kit shall be installed by a factory-certified installer according to the instructions included with the kit.

3.2 INSTALLATION

- A. The fan and wall controller shall be installed by a factory-certified installer according to the manufacturer's installation guide, which includes acceptable structural dimensions and proper sizing and placement of angle

irons for bar joist applications. Big Ass Fans recommends consulting a structural engineer for installation methods outside the manufacturer's recommendation and a certification, in the form of a stamped print or letter, submitted prior to installation.

- B. Minimum Distances
 - 1. Airfoils shall be at least 10 ft (3 m) above the floor.
 - 2. Installation area shall be free of obstructions such as lights, cables, sprinklers, or other building structures with the airfoils at least 2 ft (0.61 m) clear of all obstructions.
- C. The fan shall not be located where it will be continuously subjected to wind gusts or in close proximity to the outputs of HVAC systems or radiant heaters. Additional details are in the fan installation guide.
- D. In buildings equipped with sprinklers, including ESFR sprinklers, fan installation shall comply with all of the following:
 - 1. The maximum fan diameter shall be 24 ft (7.3 m).
 - 2. The HVLS fan shall be centered approximately between four adjacent sprinklers.
 - 3. The vertical clearance from the HVLS fan to the sprinkler deflector shall be a minimum of 3 ft (0.9 m).
 - 4. All HVLS fans shall be interlocked to shut down immediately upon receiving a waterflow signal from the alarm system in accordance with the requirements of NFPA 72—National Fire Alarm and Signaling Code.
- E. Mount the wall controller to a flat, readily accessible surface that is free from vibration and away from foreign objects and moving equipment. The controller mounting location must meet the requirements of OSHA standard 29 CFR 1910.303(g) for accessibility minimum clearances.
- F. If the SmartSense feature will be used, the BAFCon controller must not be mounted adjacent to or above a radiant heat source, near HVAC ventilation intakes/exhausts, on a poorly insulated exterior wall, or in a different temperature/humidity environment than the fan(s) it will control. Additional mounting guidelines can be found in the controller installation guide.

END OF SECTION