

SECTION 23 34 00

HVAC Fans

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes
 - 1. The ceiling-mounted circulation fan is the model scheduled with the capacities indicated. The fan shall be furnished with standard mounting hardware and variable speed control 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. 25 50 00 Integrated Automation Facility Controls
- F. 26 00 00 Electrical

1.3 REFERENCES

- A. National Fire Protection Association (NFPA)
- B. Underwriters Laboratories (UL)
- C. Restriction of Hazardous Substances (RoHS)
- D. European Community (CE)
- E. European Standards (EN)
- F. Canadian Standards Association (CSA)
- G. National Electrical Manufacturers Association (NEMA)
- H. National Electrical Code (NEC)
- I. Occupational Safety and Health Administration (OSHA)
- J. International Organization for Standardization (ISO)
- K. UK Conformity Assessed (UKCA)
- L. Nationally Recognized Testing Laboratory (NRTL)

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 operating 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 (with or without light kit), shall be Nationally Recognized Testing Laboratory (NRTL)-certified and built pursuant to the guidelines set forth by UL standard 507 and CSA standards 22.2 No. 60335-1 and 22.2 No. 113.
2. The fan assembly, as a system (with or without light kit), shall be CE- and UKCA-compliant.
3. The fan (with or without light kit) 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).
4. Controllers shall comply with National Electrical Code (NEC) and Underwriters Laboratories (UL) standards and shall be labeled where required by code.
5. The optional LED Light Kit shall be IP65-rated, DLC-qualified, and RoHS-compliant.
6. The optional occupancy sensor shall be CE-compliant and UL and cUL listed.

B. Manufacturer Qualifications

1. The fan and any accessories shall be supplied by Big Ass Fans, which has a minimum of twenty (20) years of product experience.
2. ISO 9001 compliant
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 [†]	15 years
Electrical ^{††}	7 years (no factory install ^{†††}); 15 years (factory install ^{††††})
Labor	1 year

[†]"Mechanical" is defined as mechanical components of the fan, including the gearbox, 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.

^{†††††}The Warranty Period for light kits is limited to 1 year (parts).

^{††††††}All reasonable costs of repair or replacement will be paid or reimbursed provided customer obtains pre-approval.

^{†††††††}The Warranty period for any manufacturer defects or flaws to surface finishes is limited to 1 year.

^{††††††††}All products are considered for indoor use only unless specifically specified on the product label.

^{†††††††††}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

2.2 HIGH VOLUME, LOW SPEED FANS – BIG ASS FANS POWERFOIL®X3.0 & POWERFOIL®X3.0 PLUS

- A. Complete Unit
1. Regulatory Requirements:
 - a. The entire fan assembly (with or without light kit) shall be NRTL-certified and built pursuant to the construction guidelines set forth by UL standard 507 and CSA standards 22.2 No. 60335-1 and 22.2 No. 113.
 - b. The 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 and agricultural) over an extended life. The fan components shall be designed specifically for high volume, low speed fans to ensure lower operational noise. Sound levels from the fan operating at maximum speed measured in a laboratory setting shall not exceed 55 dBA. Actual results of sound measurements in the field may vary due to sound reflective surfaces and environmental conditions.
 - b. The optional BAFCon controller shall be designed to control Big Ass Fans and lighting systems from a secure, centralized location. The system shall be designed specifically for high volume, low speed Big Ass Fans to ensure maximum control. The system 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.
 3. Good workmanship shall be evident in all aspects of construction. Field balancing of the airfoils shall not be necessary.
- B. Onboard Fan Control
1. The onboard fan controller shall be constructed using a variable frequency drive (VFD) that is pre-wired to the motor and factory-programmed to minimize the starting and braking torques for smooth and efficient operation. The onboard controller shall be prewired 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). A 15-ft incoming power cord shall be pre-wired to the controller with one of the following plugs: NEMA L6-20P Twist-Lock Plug, NEMA L6-30P Twist-Lock Plug, NEMA L15-20P Twist Lock Plug, NEMA L16-20P Twist-Lock Plug.
 2. As an option, the architect or owner may upgrade to the “harsh environment package,” which includes a seal for the weather-resistant onboard VFD enclosure and a motor with IP55 NEMA classification.
 3. For fans with single-phase input, conversion to three-phase output takes place at the VFD.
- C. Airfoil System
1. The fan shall be equipped with eight (8) 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.
 2. The fan shall be equipped with eight (8) Powerfoil winglets (standard) or eight (8) Powerfoil Plus winglets (optional) on the ends of the airfoils and eight (8) AirFences® positioned on the airfoils at the optimum location for performance. Both the winglets and AirFences shall be molded of a polypropylene blend. The standard color of the winglet and AirFence shall be “BAF 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 opportunity for noise.
 - e. The straps shall run along the inside of the airfoils for an uninterrupted look.
 - f. Safety clips shall secure to each winglet 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.
- D. Motor
1. The fan motor shall be an AC induction type inverter rated at one of the following:
 - a. 3450 RPM, 200–240/400–480 VAC, 50/60 Hz, three-phase, 1 hp
 - b. 1725 RPM, 200–240/400–480 VAC, 50/60 Hz, three-phase, 1.5 hp
 - c. 1725 RPM, 200–240/400–480 VAC, 50/60 Hz, three-phase, 2 hp
 - d. 3450 RPM, 575–600 VAC, 50/60 Hz, three-phase, 1 hp
 - e. 1725 RPM, 575–600 VAC, 50/60 Hz, three-phase, 1.5 hp
 - f. 1725 RPM, 575–600 VAC, 50/60 Hz, three-phase, 2 hp
 2. The motor shall be totally enclosed, fan cooled (TEFC) with an IP44 NEMA classification. A NEMA 56C standard frame shall be provided for ease of service. The motor shall be manufactured with a double baked Class F insulation and be capable of continuous operation in 32°F to 122°F (0°C to 50°C) ambient conditions.
 3. The motor shall have a C-face attachment that shall enable technicians to detach the motor for easy field service. The C-face motor adapter shall be designed to work with the NitroSeal™ gearbox.
 4. As an option, the architect or owner may upgrade to the “harsh environment package,” which includes a motor with an IP55 NEMA classification. As part of the “harsh environment package,” the onboard VFD enclosure is sealed for weather-resistant operation.
- E. Gearbox
1. The fan gearbox shall be a NitroSeal™ Drive designed specifically for the Powerfoil X series. The gearbox shall include a high-efficiency, hermetically sealed, nitrogen-filled, offset helical gear reducer with two-stage gearing, a hollow output shaft, cast iron housing, double lip seals, high quality SKF Explorer Series bearings with crowned cages for optimal lubrication flow, and precision machined gearing to maintain backlash less than 11 arc-minutes over the life of the unit. Lubrication shall be high-grade, low-foaming synthetic oil with extreme pressure additives and a wide temperature range and shall be lubricated for the life of the product (no oil changes required).
 2. The gearbox shall be equipped with a hollow shaft threaded to accept a ¾" NPT fitting in which wiring, piping, etc., can be routed to below the fan. A standard junction box can be affixed to this hollow shaft to allow for installing optional features such as lights or cameras. The inclusion of the hollow shaft shall be specified at the time of order.
- 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. This design shall allow for adjustments to be made after the mount is installed to the mounting structure to ensure the fan will hang level from the structure.
 2. The upper mount shall be of ASTM A-36 steel, 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 hardware shall be SAE Grade 8 or equivalent.
- H. LED Light Kit (Optional)
1. The fan gearbox shall be equipped with a hollow shaft through which electrical wiring can be routed to below the fan and to which an LED light can be attached.
 2. The LED light shall operate independently from the fan at an operating voltage of 100–277 VAC, 50/60 Hz and be suitable in operating temperatures ranging from -40°F to 113°F (-40°C to 45°C).
 3. The LED light shall have an output of up to 48,000 or 39,000 lumens.
 4. The LED light shall have a standard color temperature of 5,000 K or 4,000 K.

5. The LED light shall be equipped with a standard lens angle of 120°.
 6. The LED light shall be constructed of aluminum alloy and shall be available in black or white.
 7. The LED light shall be suitable for wet locations.
- I. Occupancy Sensor (Optional)
1. The occupancy sensor shall be powered by the fan drive (200–240 VAC or 400–480 VAC) and be suitable in operating temperatures ranging from -40° to 158°F (-40° to 70°F).
 2. The occupancy sensor shall provide 360 degrees of coverage up to 50 ft (15 m) when mounted 40 ft (12.2 m) above the floor.
 3. Motion timeout settings shall consist of 30 minutes (default), 1 hour, 2 hours, 4 hours, and 8 hours.
- J. Hub
1. The fan hub shall be 19" (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, eight (8) aluminum spars, and one (1) aluminum spacer fastened with a pin and collar rivet system. 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 gearbox by means of ten (10) high strength bolts. The hub shall incorporate four (4) safety retaining clips made of 1/4" (0.6 cm) thick steel that shall restrain the hub/airfoil assembly.
- K. Safety Cables
1. The fan shall be equipped with an upper safety cable that provides an additional means of securing the fan assembly to the building structure. The upper safety cable shall have a diameter of $\varnothing 3/8$ " (1 cm).
 2. The fan shall be equipped with two lower safety cables pre-attached to the fan hub that shall provide an additional means of securing the fan to the extension tube. The lower safety cables shall have a diameter of 1/4" (0.6 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.
- L. Digital Variable Speed Wall Controller
1. The fan shall be equipped with a digital variable speed wall controller. The user interface shall be an intuitive touchscreen 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 IP55 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.
- M. 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 X3.0 or Powerfoil X3.0 Plus 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 shall include a scheduling feature that shall provide the ability to create up to four fan schedules for turning fans on/off and turning Auto mode on/off. The scheduling feature shall require the date and time to be set on the controller.
 12. The digital controller interface shall be able to be secured with user and admin passcodes to prevent unauthorized access to fan controls and settings.
 13. 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.
 14. The digital controller shall be BACnet-compatible.
 15. BAFCon Multi-Fan Accessory Kit (Optional)
 - a. If multiple fans will be installed, the BAFCon Multi-Fan Accessory Kit shall be available.
 - 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.
- N. 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.
- O. 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. Before the controller is installed, the fan system shall be installed by a factory-certified installer according to the instructions in the fan Installation Guide.
- G. Install a rectangular or square outlet box at the controller mounting location.
- H. If the optional BAFCon controller will be mounted more than 250 ft (76.2 m) from the fan or if multiple fans will be daisy chained, ensure the BAFCon Accessory Kit is included. The accessory kit shall be installed by a factory-certified installer according to the instructions included with the kit.

3.2 INSTALLATION

- A. The fan 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 (3.05 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 Big Ass Fans Installation Manual.
- 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 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 optional 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 fans it will control. Additional mounting guidelines can be found in the Installation Guide.

END OF SECTION