**SECTION 23 34 00**

**HVAC Fans**

**PART 1 GENERAL**

**1.1 SUMMARY**

1. Section Includes
2. The ceiling-mounted high volume, low speed ceiling fan is the model scheduled with the capacities indicated. The fan shall be furnished with standard mounting hardware and a digital variable speed wall controller to provide cooling and destratification.
3. Summary of Work
4. 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**

1. 21 00 00 Fire Suppression
2. 23 00 00 Heating, Ventilating, and Air Conditioning (HVAC)
3. 23 09 13 Instrumentation and Control Devices for HVAC
4. 25 00 00 Integrated Automation
5. 25 50 00 Integrated Automation Facility Controls
6. 26 00 00 Electrical

**1.3 REFERENCES**

1. National Fire Protection Association (NFPA)
2. Underwriters Laboratories (UL)
3. Restriction of Hazardous Substances (RoHS)
4. Canadian Standards Association (CSA)
5. National Electrical Manufacturers Association (NEMA)
6. National Electrical Code (NEC)
7. Occupational Safety and Health Administration (OSHA)
8. International Organization for Standardization (ISO)
9. Nationally Recognized Testing Laboratory (NRTL)
10. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)
11. Air Movement and Control Association (AMCA)
	* 1. AMCA 230-15 - Standard Laboratory Methods of Testing Air Circulating Fans for Rating and Certification
12. American National Standards Institute (ANSI)
13. Code of Federal Regulations (CFR)

**1.4 SUBMITTALS**

1. Shop Drawings: Drawings detailing product dimensions, weight, and attachment methods.
2. Product Data: Specification sheets on the ceiling-mounted fan, specifying electrical and installation requirements, features and benefits, and controller information.
3. Building Information Modeling (BIM) Files: Files provided for architectural design.
4. 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.
5. Fan/Equipment Schedule
6. 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 55-2022: 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**

1. Certifications
2. The fan assembly, as a system, 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. 60335-2-80.
3. 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).
4. Controllers shall comply with National Electrical Code (NEC) and Underwriters Laboratories (UL) standards and shall be labeled where required by code.
5. Fans shall be tested in accordance with ANSI/AMCA Standard 230-15/10 CFR 430 in an AMCA accredited laboratory.
6. Manufacturer Qualifications
7. The fan and any accessories shall be supplied by Big Ass Fans, which has a minimum of twenty (20) years of product experience.
8. 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**

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

**1.7 WARRANTY**

1. 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† 7 years

Electrical†† 3 years

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.

††† 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.

1. 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.
2. The warranty shall not require the periodic submission of maintenance records for the warranty to remain in effect.

**PART 2 PRODUCT**

**2.1 MANUFACTURER**

1. 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. Substitutions not permitted.

**2.2 HIGH VOLUME, LOW SPEED FANS – BIG ASS FANS POWERFOIL® 5**

1. Complete Unit
2. Regulatory Requirements:
	1. The entire fan assembly, as a system, shall be Nationally Recognized Testing Laboratory (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. 60335-2-80.
	2. Ceiling fans greater than 7 ft (2.14 m) in diameter shall be tested and have performance data determined in accordance with 10 CFR Appendix U to Subpart B of Part 430 - Uniform Test Method for Measuring the Energy Consumption of Ceiling Fans and shall be listed in the US DOE Compliance Certification Database (CCD).
	3. Ceiling fans greater than 7 ft (2.14 m) in diameter shall exceed the US DOE minimum-efficiency requirement of CFEI 1.00 at high speed and CFEI 1.31 at 40 percent speed or the nearest speed that is not less than 40 percent speed.
	4. HVLS fans shall be listed in the California Energy Commission's Modernized Appliance Efficiency Database System of Appliance Models (MAEDbS), as required by Section 1606 of California Title 20.
	5. 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 shall accept any interference received, including interference that may cause undesirable operation.
3. Sustainability Characteristics:
	1. The fan shall be designed to move an effective amount of air for cooling and destratification in industrial applications 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.
	2. The Wired Standard Control 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. 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.
4. Good workmanship shall be evident in all aspects of construction. Field balancing of the airfoils shall not be necessary.
5. Onboard Fan Control
6. 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 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). A 15-ft (4.6-m) incoming power cord shall be pre-wired to the controller.
7. For fans with single-phase input, conversion to three-phase output takes place at the VFD.
8. The VFD shall have a minimum rating of IP56.
9. Airfoil System
10. The fan shall be equipped with five (5) 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.
11. The fan shall be equipped with five (5) Powerfoil winglets on the ends of the airfoils. The winglets shall be molded of a polypropylene blend. The standard color of the winglet shall be “BAF Yellow.”
12. Airfoil Restraint System
	1. 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.
	2. The airfoil restraint system shall be comprised of durable, lightweight nylon safety straps that shall extend from the winglets through the airfoils and secure to the fan hub with 12-gauge stamped steel safety clips.
	3. 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.
	4. The straps shall be precisely matched to each fan’s diameter, eliminating the need for a tensioning mechanism and reducing the opportunity for noise.
	5. The straps shall run along the inside of the airfoils for an uninterrupted look.
	6. 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.
13. Motor
14. The fan motor shall be an AC induction type inverter rated at 1725 RPM, 200–240/400–480 VAC, 50/60 Hz, three-phase.
15. The motor shall be totally enclosed, fan cooled (TEFC) with an IP56 rating. A B5 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 5oF to 104oF (-15oC to 40oC) ambient conditions.
16. Gearbox
17. The gearbox shall be a helical gear reducer, precision finished from hardened steel for low noise and long service life with double lip seals to retain oil and prevent contamination. The gearbox shall be lubricated for life. The gear reducer shall have a standard backlash of less than 25 arc minutes and be equipped with a 17-4 stainless steel shaft of 1-1/4” (3.2 cm) diameter.
18. Motor Frame
19. The motor frame and mount shall be constructed of steel and powder coated for corrosion resistance and appearance.
20. Mounting System
21. 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.
22. 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.
23. All mounting hardware shall be SAE Grade 8 or equivalent.
24. Hub
25. 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, five (5) 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.
26. The hub shall be secured to the output shaft of the gearbox by means of a steel couplinginterface. The hub shall incorporate five (5) safety retaining clips made of 1/4” (0.6 cm) thick steel that shall restrain the hub/airfoil assembly.
27. Safety Cables
28. 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 Ø1/4” (0.6 cm).
29. 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).
30. 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).
31. Field construction of safety cables is not permitted.
32. Wired Standard Control
33. The fan shall be equipped with the digital Wired Standard Control. The user interface shall be an intuitive wall-mounted, touch interface.
34. The controller shall be mounted to a standard rectangular or square outlet box.
35. 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.
36. The controller mounting location shall meet the requirements of OSHA standard 29 CFR 1910.303(g) for accessibility minimum clearances.
37. The controller shall have an IP55 rating.
38. The controller shall provide fan start/stop, speed, and direction control functions.
39. 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.
40. The controller interface shall be able to be secured with a passcode to prevent unauthorized access to fan controls and settings.
41. The controller shall operate out of the box without setup and upon connection to CAT5 cable.
42. BAFCon Controller (Optional)
43. The fan shall have the option of operating with the BAFCon controller.
44. 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.
45. The digital controller shall be mounted to a standard rectangular or square outlet box.
46. 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.
47. The digital controller shall not require a 120 V power supply at the controller mounting location.
48. The digital controller mounting location shall meet the requirements of OSHA standard 29 CFR 1910.303(g) for accessibility minimum clearances.
49. The digital controller shall support up to 24 fans controlled as a group or individually.
50. The digital controller shall provide fan start/stop, speed, and direction control functions.
51. 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.
52. 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.
53. 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.
54. The digital controller interface shall be able to be secured with user and admin passcodes to prevent unauthorized access to fan controls and settings.
55. The digital controller shall be BACnet-compatible.
56. BAFCon Multi-Fan Accessory Kit (Optional)
	1. If multiple fans will be installed with the BAFCon controller, the BAFCon Multi-Fan Accessory Kit shall be available.
57. Fire Control Panel Integration
58. 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.
59. Guy Wires
60. 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**

1. 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.
2. Mounting structure shall be able to support weight and operational torque of fan. Consult structural engineer if necessary.
3. Fan location shall be free from obstacles such as lights, cables, or other building components.
4. Check fan location for proper electrical requirements. Consult installation guide for appropriate circuit requirements.
5. Each fan requires dedicated branch circuit protection.
6. The fan system and the fan controller shall be installed according to the instructions in the fan installation guide.
7. Install an appropriate outlet box at the wall controller mounting location.
8. For multi-fan installations with the optional BAFCon controller, ensure the appropriate accessory kit is included. The accessory kit shall be installed according to the instructions included with the kit.

**3.2 INSTALLATION**

1. The fan and wall controller shall be installed 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.
2. Minimum Distances
3. Airfoils shall be at least 10 ft (3.05 m) above the floor.
4. 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.
5. 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.
6. In buildings equipped with sprinklers, including ESFR sprinklers, fan installation shall comply with all of the following:
7. The maximum fan diameter shall be 24 ft (7.3 m).
8. The HVLS fan shall be centered approximately between four adjacent sprinklers.
9. The vertical clearance from the HVLS fan to the sprinkler deflector shall be a minimum of 3 ft (0.9 m).
10. 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.
11. 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 shall meet the requirements of OSHA standard 29 CFR 1910.303(g) for accessibility minimum clearances.
12. If the SmartSense feature will be used, the optional BAFCon controller shall 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