**SECTION 23 34 00**

**HVAC Fans**

**PART 1 GENERAL**

**1.1 SUMMARY**

1. Section Includes
2. 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.
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. 26 00 00 Electrical

**1.3 REFERENCES**

1. National Fire Protection Association (NFPA)
2. Underwriters Laboratories (UL)
3. Restriction of Hazardous Substances (RoHS)
4. European Community (CE)
5. European Standards (EN)
6. Canadian Standards Association (CSA)
7. National Electrical Manufacturers Association (NEMA)
8. National Electrical Code (NEC)
9. Occupational Safety and Health Administration (OSHA)
10. International Organization for Standardization (ISO)
11. UK Conformity Assessed (UKCA)
12. Nationally Recognized Testing Laboratory (NRTL)

**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. Revit Files: Files provided for architectural design.
4. 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.
5. 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 55-2017: 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**

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 assembly, as a system, shall be CE- and UKCA-compliant.
4. 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).
5. Controllers shall comply with National Electrical Code (NEC) and Underwriters Laboratories (UL) standards and shall be labeled where required by code.
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. ISO 9001 compliant
9. 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 must 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† 3 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

**2.2 HIGH VOLUME, LOW SPEED FANS – BIG ASS FANS POWERFOIL® X4 WASHDOWN**

1. Complete Unit
2. Regulatory Requirements:
	1. The entire fan assembly 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. 60335-2-80.
	2. 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.
3. Sustainability Characteristics:
	1. 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.
4. Good workmanship shall be evident in all aspects of construction. Field balancing of the airfoils shall not be necessary.
5. Fan Control
6. The fan controller shall be constructed using a wall-mounted variable frequency drive (VFD) that is protected by a sealed Type 4 or 12 weather-resistant enclosure.
7. For fans with single-phase input, conversion to three-phase output takes place at the VFD.
8. The VFD shall be factory-programmed to minimize the starting and braking torques for smooth and efficient operation.
9. The fan control shall be mounted on the wall and wired to the motor using conduit that meets all local and national codes, with an earth ground conductor to minimize electromagnetic interference (EMI) and radio frequency interference (RFI). Wiring to the controller shall be enclosed in conduit that meets all local and national codes.
10. Airfoil System
11. 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 stainless steel retainers.
12. The fan shall be equipped with eight (8) Powerfoil winglets on the ends of the airfoils for performance. The winglets shall be molded of a polypropylene blend. The standard color of the winglet shall be “BAF Yellow.”
13. Motor
14. The fan motor shall be an AC induction type inverter rated at one of the following:
15. 1700 RPM, 200–240/400–480 VAC, 50/60 Hz, three-phase, 1.9 hp
16. 1700 RPM, 200–240/400–480 VAC, 50/60 Hz, three-phase, 2.5 hp
17. The motor shall be stainless steel as well as totally enclosed, fan cooled (TEFC) with an IP56 NEMA classification. A NEMA 56C standard frame shall be provided for ease of service. The motor shall be manufactured with a double baked insulation rated Class F or higher and be capable of continuous operation in 32°F to 122°F (0°C to 50°C) ambient conditions.
18. 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.
19. Gearbox
20. 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. The gearbox shall be coated in a food-grade epoxy coating. Lubrication shall be food-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).
21. Mounting Post
22. The fan shall be equipped with a mounting post that provides a structural connection between the fan assembly and extension tube.
23. Mounting System
24. 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.
25. The upper mount shall be of stainless steel at least 3/16” thick. No mounting hardware or parts substitutions, including cast aluminum, are acceptable.
26. All mounting hardware shall be stainless steel.
27. The extension tube shall be made from stainless steel and include drainage holes to prevent pooling.
28. Hub
29. 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 stainless steel 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.
30. The hub shall be secured to the output shaft of the gearbox by means of ten (10) high strength stainless steel bolts. The hub shall incorporate four (4) safety retaining clips made of 1/4” (0.6 cm) thick stainless steel that shall restrain the hub/airfoil assembly.
31. Safety Cables
32. 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 Ø3/8” (1 cm).
33. 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).
34. The safety cables shall be fabricated out of 7 x 19 stainless steel cable. The end loops shall be secured with swaged Nicopress® sleeves, pre-loaded and tested to 3,200 lbf (13,345 N).
35. Field construction of safety cables is not permitted.
36. Digital Variable Speed Wall Controller
37. The fan shall be equipped with a digital variable speed wall controller. The user interface shall be an intuitive touchscreen interface.
38. The controller shall be mounted to a standard rectangular or square outlet box.
39. 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.
40. The controller mounting location shall meet the requirements of OSHA standard 29 CFR 1910.303(g) for accessibility minimum clearances.
41. The controller shall have an IP55 rating.
42. The controller shall provide fan start/stop, speed, and direction control functions.
43. 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.
44. The controller interface shall be able to be secured with a passcode to prevent unauthorized access to fan controls and settings.
45. The controller shall operate out of the box without setup and upon connection to CAT5 cable.
46. Fire Control Panel Integration
47. 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.
48. Guy Wires
49. 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. 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.
7. Install a rectangular or square outlet box at the controller mounting location.

**3.2 INSTALLATION**

1. 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.
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 Big Ass Fans Installation Manual.
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 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.

END OF SECTION