

## **Section 23 34 39 – High Volume, Low Speed Propeller Fans**

### **MacroAir AirVolution-D3 HVLS Fans**

#### **PART 1 GENERAL**

##### **1.1 SUMMARY**

- A. Section Includes
  - 1. The large diameter ceiling fan is the model scheduled with the performance capabilities expressed. Included with the ceiling fan will be the select mounting hardware relevant to the model and application space. The ceiling fan may be furnished with a MacroAir controller model for speed control. Alternative option includes Modbus BMS system integration. The MacroAir fan will provide thorough, energy efficient air movement to achieve thermal comfort.
- B. Work Summary
  - 1. Any and all work outside the scope of the installation guide shall be outsourced. Factory trained installers are recommended and available upon request. MacroAir certified installers will not install equipment from other manufacturers.

##### **1.2 RELATED SECTIONS**

- A. 23 00 00 – Heating, Ventilating, and Air Conditioning (HVAC)
- B. 23 34 00 – HVAC Fans

##### **1.3 REFERENCES**

- A. CE
- B. IP
- C. National Fire Protection Agency (NFPA 13)

##### **1.4 SUBMITTALS**

- A. Submit under provisions of Section 01300
- B. Product Data: Manufacturer's data sheets on each product to be used shall include:
  - 1. Storage and handling requirements and recommendations
  - 2. Power and mounting requirements
  - 3. Application Drawings: Submit plan, section, elevation and isometric views as necessary to convey the information required to detail all installation conditions for each unit specified.
- C. Revit Files: Revit file format for architectural design
- D. Installation Manual: The manufacturer will provide an installation, operation, and maintenance document for the fan. Information included in the document may change without notice.
- E. Schedule

##### **1.5 QUALITY ASSURANCE**

- A. Certifications
  - Product details
- B. Manufacturer Qualifications
  - 1. MacroAir shall provide sole source for design, engineering, manufacturing and warranty claims handling.
  - 2. The fan and any accessories shall be supplied by MacroAir Fans, which has a minimum of fifteen (15) years of product experience.

## 1.6 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity and ventilation) within limits recommended by manufacturer for optimal results. Do not install products in environmental conditions outside MacroAir's absolute limits. The storage of all MacroAir products prior to installation will be in an "out of weather" position. Failure to maintain the integrity of the shipment is not the responsibility of MacroAir.

## 1.7 WARRANTY

- A. MacroAir shall repair or replace warranted defective parts as follows:
  - 1. Lifetime warranty on airfoils and mounting
  - 2. 50,000-hour warranty on all other components, which include but are not limited to:
    - a. Motor
    - b. Integrated Drive
    - c. Controller/Remote
- B. At project closeout, provide to Owner or Owner's Representative an executed copy of MacroAir's standard limited warranty against manufacturing defect, outlining its terms, conditions and exclusions from coverage.

## 1.8 COORDINATION

- A. The fan shall be capable of receiving a stop command from the fire panel, an ASD (Aspirating Smoke Detection) device, or any number of smoke, flame or heat detectors.
- B. The fans shall be as follows:
  - 1. The fan shall meet the air velocity requirements of FM Global's 2.0 data sheet for ESFR sprinklers.
  - 2. If required by the local fire prevention authority or desired by the purchaser, the fan shall be wired into the building's fire suppression system so that the fan will automatically shut off within a maximum of 90 seconds after sprinklers are activated. To facilitate this automatic shut-down, the low voltage wire and relay needed to accomplish this must be supplied by the Fire Alarm installer. See Manufactures installation instructions for further details.
  - 3. Upon fire detection as described above, the fans shall coast to stop as required by NFPA guidelines.

## PART 2 PRODUCTS

### 2.1 APPROVED MANUFACTURERS

- A. Acceptable Manufacturer: MacroAir Technologies, Inc., which is located at: 794 South Allen Street, San Bernardino, CA 92408-2210 Toll Free Tel: 866-668-3247; Tel: 909-890-2270; Website: macroairfans.com
- B. Substitutions: Not permitted
- C. Requests for substitutions will be considered in accordance with provisions of Section 01600

**2.2 HIGH VOLUME, LOW SPEED FANS – MACROAIR AIRVOLUTION-D**

- A. Regulatory Requirements: Assembly standards
  - 1. Sustainable Characteristics: The MacroAir AirVolution-D3 is designed to generate large volumes of thorough air movement throughout a space at a low velocity to create a comfortable environment at a low energy consumption, contributing to cost-efficient facility management and operation practices. The efficiencies of the MacroAir high volume, low speed fan concept are such that air is thoroughly mixed within a space, achieving thermal equalization, and gentle air movement is delivered to occupants contributing to indoor air quality. The MacroAir AirVolution-D3 is designed with forward (counter-clockwise) and reverse (clockwise) performance capabilities, for cooling and heating solutions. **Direct Drive Motor:** The MacroAir AirVolution-D3 HVLS fan model utilizes a specialty Direct-Drive (D-Drive) transverse flux DC motor, utilizing a small ring of ultra-low resistance copper for a motor coil. Airflow performance of the MacroAir AirVolution-D HVLS fan exceeds gearbox predecessor designs.

F. Performance

Model #	Diameter	Horsepower	Hanging Weight	RPM	Industry Spacing***	Max Affected Area****	Max dBA*****
MA10XL4303	10 ft [3.05m]	1.05 HP	129lb [58.57kg]	0-166 RPM	55 ft [16.8 m]	5,200 ft2 [483m2]	56
MA12XL4303	12 ft [3.66 m]	1.05 HP	133 lbs [42.9 kg]	0-135 RPM	60 ft [18.3 m]	6,700 ft2 [622 m2]	55
MA14XL4303	14 ft [4.27 m]	1.05 HP	137 lbs [44.9 kg]	0-118 RPM	70 ft [21.3 m]	8,900 ft2 [827 m2]	54
MA16XL4303	16 ft [4.88 m]	1.05 HP	141 lbs [46.8 kg]	0-91 RPM	75 ft [22.9 m]	9,600 ft2 [892 m2]	52
MA18XL4303	18 ft [5.49 m]	1.05 HP	145 lbs [48.8 kg]	0-87 RPM	80 ft [24.4 m]	12,600 ft2 [1,171 m2]	52
MA20XL4303	20 ft [6.1 m]	1.05 HP	149 lbs [50.8 kg]	0-81 RPM	90 ft [27.4 m]	15,400 ft2 [1,431 m2]	54
MA24XL4303	24 ft [7.32 m]	1.05 HP	162 lbs [54.8 kg]	0-63 RPM	95 ft [29 m]	17,000 ft2 [1,579 m2]	51

\*\*\*Delivers 2.8-4.2 ft/s [0.86-1.27 m/s] of average air speed in the occupied space. This relates to perceived cooling or set point change of 4.9-6.1 F [2.7-4.3 C]. Consult our online AirViz tool for more details. \*\*\*\*Delivers 2.7-3.8 ft/s [0.82-1.16 m/s] of average air speed in the occupied space. This relates to a perceived cooling or set point change of 4.8-5.8 F [2.6-3.2 C]. Consult our online AirViz tool for more details. \*\*\*\*\*Sound testing taken with the sensor 5 ft above the ground and 20 ft from the center of the fan with the fan running full speed and mounted at 20 ft high. dBA levels of the fans may alter dependent upon the application space and conditions.

G. Airfoils

The fan shall be equipped with three (3) aerospace aluminum, washdown XL airfoils. The airfoils shall consist of anodized 6061 T4 precision extruded aluminum and be of the MacroAir XL design, with fan diameters ranging from 10 to 20 feet in two (2) foot increments and one (1) 24 foot diameter fan. The airfoils shall be connected to three (3) individual aluminum 6005 T6 struts by means of two (2) 5/16-24 x 2-inch grade 5 hex bolts, two (2) 5/16-inch flat washers and two (2) 5/16-inch nylon lock nuts per airfoil.

1. Number of Airfoils: 3
2. Airfoil Material: 6061 T4 Extruded Aluminum
3. Airfoil Finish: Anodized
4. Option Airfoil Finish: Custom powder coated colors per Drylac RAL color chart

Centrifugal Cooling System: As a supplement to the fan's temperature sensor, the MacroAir AirVolution-D3 is designed with hollow airfoil connected to the central fan hub so as to intake air with through the airfoil with each revolution of the fan for cooling the motor.

#### H. Motor

The fan shall be equipped with a Transverse Flux brushless DC motor designed for low speed high torque applications.

1. Motor Type: Transverse Flux brushless DC Motor
2. Continuous Torque: 51 lbf (70 Nm)
3. Pole Count: 96
4. IP Rating: 65
5. Insulation Class: K (200 C)
6. Motor Finish and Color: Black Electrophoretic Paint
7. Motor Housing: AISI 383 (ADC12)
8. Studs: AISI 4137 Grade 9 (JIS SCM435)

#### I. Integrated Drive

1. Electrical Requirements (Low Voltage)
  - a. 208-253 VAC single (1) phase 50/60 Hz, or
  - b. 208-253 VAC three (3) phase 50/60 Hz
2. Electrical Requirements (High Voltage)
  - a. 437-504 VAC three (3) phase 50/60Hz
3. Environment
  - a. Operation: -10°C to 60°C
  - b. Humidity: 0-95% non-condensing
  - c. Cooling: Centrifugal cooling through blades
4. Operating Frequency: 20-50 KHz
5. Dynamic acceleration and deceleration
6. Modbus RS485 (19.2 8-N-1)
7. BACnet and LonWorks options available with the purchase of a separate gateway; capacities not included with the fan.
8. Network touch-screen option available with:
  - a. Live fault code monitor
  - b. Live fan speed monitor

- c. Impact and solvent resistant
- d. IP65 rated

#### J. Mounting

The fan mounting system shall be equipped with hardware, no less than SAE grade 5 for safe installation. The fan shall be equipped with a stress relieving swivel (SRS) mount. The fan mount shall encompass multiple mounting options for I-beam, Purlin and Glulam applications (specified upon order).

- 1. Standard Mount: Fixed Angle Mount with guy wires, SRS I-beam clamp with 3' drop
- 2. Optional Mounting Hardware: Glulam Mounting Brackets
- 3. Optional Mounting Hardware: Universal Mount with guy wires
- 4. Mounting Drops: Drop lengths available in two (2) to ten (10) foot lengths in (1) foot increments (custom sizes available). Minimum drop length is 2ft (24")
- 5. Mounting and Extension Material: Steel, Aluminum
- 6. Mount Finish: Black Anodized

#### K. Hub/Motor Housing

The fan shall be equipped with an aluminum motor housing with pressed in steel studs to securely accept three (3) removable, black, anodized 6005 T6 aluminum beam struts. The struts shall be designed with airfoil guides to ensure precision alignment.

- 1. Material: T6 Cast Aluminum
- 2. Airfoil Strut Material: 6005 T6 Aluminum
- 3. Airfoil Strut Finish: Black Anodized
- 4. Hardware: Twelve (12) 5/16-24 x 1-3/4 inch Grade-8 pressed in studs
- 5. Hardware: Twelve (12) 5/16-inch flat washers (SAE)
- 6. Hardware: Twelve (12) 5/16-inch nylon lock nuts

#### L. Safety System

The fan shall include three (3) airfoil retainer links to prevent airfoil separation from the motor housing and a 3/16" safety cable attached to the lowest point of the fan. Each fan shall be E-stop compatible for fire and building automated systems (BAS).

- 1. Safety Cable Material: 3/16" x 7 x 19 Braided Steel
- 2. Safety Cable Finish: Galvanized
- 3. Airfoil Retainer Link Material: 10 Gauge A36 Steel
- 4. Airfoil Retainer Link Finish: Black Zinc

## **PART 3 EXECUTION**

### **3.1 PREPARATION**

- A. Fan installation location requires a typical bar joist, existing I-beam or glulam structure from which to mount the fan. Other mounting options may be available.
- B. Obstacles such as lights, racking, cables, or other structural components shall remain outside of the fan proximity. Consult the fan installation manual for proper placement.
- C. Check accuracy of dimensions indicated for openings to receive fans.
- D. Check location and availability of utility services to ensure proper voltage and installation preparation.
- E. Coordinate location and installation of the HVLS Fans.
- F. Ensure building structural members are sufficient to support the weight and operation of the fan. Consult professional engineer or registered architect as required.
- G. The fan requires a fused disconnect to be installed on the incoming power for emergency and maintenance use per national and international code compliance which may include CE, CSA, IEC, UL, and NEC.
- H. Routing power to within six (6) feet of wall controller

### **3.2 INSTALLATION**

- A. Install units per the fan installation manual.
- B. Fan airfoil height to be a minimum of 10 feet from the floor in accordance with MacroAir's recommendations.
- C. All safety and support features must be installed. These include any guy wires and safety cables as well as airfoil retainer locking features.
- D. Adjust unit as required for proper operation in accordance with manufacturer's installation instructions.
- E. Securely anchor units.
- F. Ensure that operating parts turn freely prior to initial startup.
- G. Repair or replace damaged parts, dents, buckles, abrasions or other damage affecting appearance or serviceability, as acceptable to Architect.

### **3.3 PROTECTION**

- A. Protect finished Work until date of Substantial Completion.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

### **3.4 CLEANING**

- A. Clean Work per Section 01 74 00.
- B. Clean and inspect fans per manufacturer's instructions.
- C. Remove temporary protective cover at date of Substantial Completion.

END OF SECTION