

**Section 23 34 00 – HVAC 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 mounting hardware relevant to the model and application space. The ceiling fan will be furnished with a MacroAir controller for 1 to 1 speed control. Alternative options include (4) fan Network Controller, (30) Fan Network Controller, or Modbus BMS system integration. The MacroAir fan will provide thorough, energy efficient air movement to achieve thermal comfort.

**B. Summary of work**

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. 21 00 00 – Fire Suppression
- B. 23 00 00 – Heating, Ventilating, and Air Conditioning (HVAC)
- C. 26 00 00 - Electrical

**1.3 REFERENCES**

- A. Underwriters Laboratories (UL)
- B. National Electric Code (NEC)
- C. National Fire Protection Agency (NFPA)
- D. Canadian Standards Association (CSA)

**1.4 SUBMITTALS**

- A. 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.
- B. Revit Files: Revit file format for architectural design
- C. Installation Manual: The manufacturer will provide an installation, operation, and maintenance document for the fan. Information included in the document may change without notice.
- D. Schedule

**1.5 QUALITY ASSURANCE****A. Certifications**

1. 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.
2. The fan shall meet the air velocity requirements of FM Global's 2.0 data sheet for ESFR sprinklers.
3. Upon fire detection as described above, the fans shall coast to stop as required by NFPA guidelines.

**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 Delivery, Storage, and Handling**

- A. Product will be delivered in original packaging.
- B. Product shall be free of any defects and inspected prior to shipment.
- C. 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 Operating Hours
    - a. Motor
    - b. Variable Frequency 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.

**PART 2 PRODUCTS**

**2.1 MANUFACTURER**

- 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

**2.2 HIGH VOLUME, LOW SPEED FANS – MACROAIR X SERIES**

- A. Regulatory Requirements: Assembly standards
  1. Sustainable Characteristics: The MacroAir X Series 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 is 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 X Series is designed with forward (counterclockwise) and reverse (clockwise) performance capabilities, for cooling and heating solutions. The MacroAir X Series HVLS fan model utilizes a radial flux permanent magnet motor and Variable Frequency Drive technology.

## B. Performance

The fan shall be listed to applicable UL Standards and requirements by UL.

Diameter	Horsepower Equivalent	Hanging Weight	Max RPM	Industry Spacing	Max Affected Area
14 ft [4.27 m]	1.25 HP	183 lbs [83.01 kg]	110 RPM	80 ft [24.4 m]	11,000 ft <sup>2</sup> [1,022 m <sup>2</sup> ]
16 ft [4.88 m]	1.25 HP	192 lbs [87.09 kg]	90 RPM	90 ft [27.4 m]	13,000 ft <sup>2</sup> [1,208 m <sup>2</sup> ]
18 ft [5.49 m]	1.25 HP	201 lbs [91.17 kg]	73 RPM	95 ft [29 m]	15,000 ft <sup>2</sup> [1,394 m <sup>2</sup> ]
20 ft [6.10 m]	2.3 HP	242 lbs [109.77 kg]	74 RPM	105 ft [32 m]	20,000 ft <sup>2</sup> [1,858 m <sup>2</sup> ]
24 ft [7.32 m]	2.3 HP	260 lbs [117.93 kg]	60 RPM	115 ft [35.1 m]	22,000 ft <sup>2</sup> [2,044 m <sup>2</sup> ]

## C. Airfoils

The fan shall be equipped with six (6) aerospace aluminum, down wash 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 14 to 24 feet. The airfoils shall be connected to six (6) 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: 6
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:** The MacroAir X Series 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

## D. Motor

The fan shall be equipped with a Radial Flux brushless DC motor designed for low speed high torque applications. The motor shall be driven sensor-less to eliminate the possibility of sensor or encoder failure.

1. Motor Type: Sensor-less Radial Flux PMAC Motor
2. Maximum Torque Observed: 136 lbf (185 Nm)
3. Pole Count: 28
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 8 (JIS SCM435)

## E. Variable Frequency Drive (off board)

1. Electrical Requirements
  - a. 208-253 VAC single (1) phase 50/60 Hz
  - b. 208-253 VAC three (3) phase 50/60 Hz
  - c. 380-480 VAC three (3) phase 50/60Hz

2. Environment
  - a. Operation: -10°C to 50°C
  - b. Humidity: 0-95% non-condensing
  - c. Cooling: Cooling fan built into drive
3. Operating Frequency: 20-50 KHz
4. Modbus RS485 (19.2 8-N-1) option available with the purchase of a separate gateway; capacities not included with the fan.
5. BACnet and LonWorks options available with the purchase of a separate gateway; capacities not included with the fan.
6. (4) Fan Network touch-screen option available with:
  - a. Live fault code monitor
  - b. Live fan speed control
7. (30) Fan Network touch-screen option available with:
  - a. Live fault code monitor
  - b. Live fan speed control
  - c. Impact and solvent resistant
  - d. IP65 rated
  - e. Run time scheduling, grouping, password protection

#### F. 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 universal mount (Rapid Mount – Optional).

The fan mount shall encompass multiple mounting options for I-beam, Purlin and Glulam applications (specified upon order).

1. Standard Mount: UMH with guy wires, SRS I-beam clamp with 3'2" drop
2. Optional Mounting Hardware: Glulam Mounting Brackets
3. Optional Mounting Hardware: Rapid Mount Industrial (guy wires optional)
4. Mounting Drops: Drop lengths available in thirteen inches (13") to ninety-six-inch (96") lengths in (1) foot increments (custom sizes available). (Three (3) foot to ten (10) foot Blade distance from ceiling (+- 2")
5. Mounting and Extension Material: Steel, Aluminum
6. Mount Finish: Black Powder coat

#### G. Hub/Motor Housing

The fan shall be equipped with an aluminum motor housing with pressed in steel studs to securely accept six (6) 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

## H. Safety System

The fan shall include six (6) airfoil retainer links to prevent airfoil separation from the motor housing and a 3/16" safety cable attached to the top of fan motor. 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: Clear Zinc

## I. Fire Control Panel Integration

1. 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.

## **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 control panel is pre fused and includes lock out 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. Maintain environmental conditions (temperature, humidity and ventilation) within limits recommended by manufacturer for optimal results. Do not install products in environmental conditions outside Macro Air's absolute limits.
- C. Fan airfoil height to be a minimum of 10 feet from the floor in accordance with MacroAir's recommendations.
- D. All safety and support features must be installed. These include any guy wires and safety cables as well as airfoil retainer locking features.
- E. Adjust unit as required for proper operation in accordance with manufacturer's installation instructions.
- F. Securely anchor units.
- G. Ensure that operating parts turn freely prior to initial startup.
- H. 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 and inspect fans per manufacturer's instructions.
- B. Remove temporary protective cover at date of Substantial Completion.

END OF SECTION