

SECTION 13 XX XX

FAN FILTER UNITS (FFU) with ROOM-SIDE REPLACEABLE HEPA FILTER AND ECM MOTOR

PART 1 – GENERAL

This section specifies the requirements to furnish and install the fan powered filter units in the cleanroom ceiling.

- A. DESCRIPTION – Fan-powered Filter Unit (FFU) shall be designed to allow the HEPA final filter to be easily replaced from the room side, without having to remove the module from the ceiling. The self-contained unit shall be a complete system, including the fan/filter housing, energy saving ECM motor/blower assembly with digital readout variable speed controller, removable face screen, and downstream perimeter gel-seal HEPA final filter.
- B. DESIGN REQUIREMENTS
 - a. The Fan-powered Filter Units shall be UL/CUL listed as an appliance, and labeled.
 - b. Filters must conform to the following:
 - i. UL 507
 - ii. IEST Recommended Practice for Laminar Flow Clean Air Devices
 - iii. ASHRAE MERV Standard 52.2 for filter performance
 - c. Airborne noise due to operation of the individual units shall not exceed 50 dba, measured 30 inches below the filter face, at 90 fpm air flow velocity. Sound pressure level performance for individual units shall measure below an NC40 contour at 90 fpm.
- C. QUALITY ASSURANCE
 - a. Manufacturer Qualifications
 - i. Manufacturer shall have minimum fifteen years' manufacturing experience of the specified FFU type.
 - b. Installer Qualifications
 - i. The installer shall have minimum five years' experience installing cleanroom filters and ceilings of the specified type of application
- D. SUBMITTALS
 - a. Cross-sectioned drawings depicting the configuration of components, outside dimensions for each size unit, and weight of the complete unit
 - b. UL/CUL Listing certificate
 - c. Installation instructions
 - d. O&M manual
- E. EXTRA UNITS
 - a. Provide (specify quantity) additional FFU's for use by the owner as maintenance stock.

PART 2 – PRODUCTS

- A. ACCEPTABLE MANUFACTURERS
 - a. BASIS OF DESIGN:
 - i. The basis of design shall be the ultra low noise, energy saving, high capacity R²F ECM PHANTOM fan powered filter module, with room-side replaceable HEPA filters; manufactured by Gordon, Inc. in Bossier City, Louisiana.

- ii. Optional: Other, as approved by the specifying engineer, after evaluation and determination that the product will be equal to the specified FFU
- b. DIMENSIONS:
 - i. 2' X 4' Standard Phantoms shall measure 23-5/8" X 47-5/8" X 12.25" (Alternate: 23" x 47" x 12.25" for use in rod-suspended ceiling grids on 2'0" x 4'0" centers)
 - ii. 2' X 2' Standard Phantoms shall measure 23-5/8" X 23-5/8" X 12.25" (Alternate: 23" x 23" x 12.25" for use in rod-suspended ceiling grids on 2'0" x 4'0" centers)
 - iii. 2' X 3' Standard Phantoms shall measure 23-5/8" X 35-5/8" X 12.25" (Alternate: 23" x 35" x 12.25" for use in rod-suspended ceiling grids on 2'0" x 4'0" centers)
- c. AIR FLOW: 105 FPM, +/- 5% @ high speed / 90 FPM +/- 5% @ medium speed
- d. VOLUME: 557 CFM at 90 FPM (2' x 4')

B. CONSTRUCTION

- a. Filter housing shall be constructed from anodized aluminum, featuring a continuous downward knife edge to mate with the gel channel frame of the HEPA filter, to effect a perfectly airtight seal. All seams and penetrations shall be sealed airtight.
- b. Plenum top shall be fabricated of powder coated galvanized steel, with four threaded receptacles to accommodate ¼-20 x 1" eyebolts for suspension or seismic restraint.
- c. Grille: The room side removable perforated air diffuser face grille shall be fabricated of .063" aluminum, secured in place by stainless steel acorn nuts, and shall have guide holes for access to optional aerosol injection and read ports. Face grille finish shall have a silver powder coat finish.
- d. Optional: If desired, to facilitate periodic filter module validation testing, R2F Phantoms can be furnished with 1 each aerosol injection and concentration read ports. Aerosol port assemblies are fabricated of stainless steel and are accessible from the room-side. It is not necessary to remove the perforated face grille to access the ports, although face grille removal is usually desirable when scanning the HEPA filter.

C. FILTERS

- a. Prefilter: Fan powered filter module shall be provided with a fiberglass prefilter, MERV 4 rated per ASHRAE standard 52.2. Size: 20" X 20" X 1"
- b. Final filter shall be HEPA type; 99.99% minimum efficiency on 0.3 micron size particle challenge. HEPA filter frame shall be fabricated of anodized extruded aluminum and will have a ½-inch by ½-inch channel around the lower perimeter, filled with an elastomeric urethane filter sealant gel.
- c. The filter media pack shall be a mini-pleated microglass fiber, with 53mm pleat depth. Tested in accordance with IEST-RP-CC-034. (Note: Filters shall ship separately for field installation.)

D. MOTOR/BLOWER

- a. Blower shall be direct drive, forward curve, centrifugal type.
- b. Motor shall be 1/3 H.P. ECM-type with integrated motor control. Trivoltage supply power: 120/240/277V vac / 1-Phase / 60 Hertz, rated at 1.6 or 0.08 amps (respective to supply power voltage), operation at 1025 rpm.
- c. Actual power consumption =
- d. The motor bearing life is rated for 100,000 hours operation.

E. SPEED CONTROL

- a. Speed control and monitoring is either by digital readout VSC displaying rpm and flow index, or optional MODBUS Protocol card for interface with building monitor/control software.

F. NOISE

- a. Fan filter unit shall meet or exceed a sound level of NC-40, tested in accordance With ANSI SI.31 – 1980 and ISO 3741-1975.
- b. Tested sound levels for a single unit are as follows:

| Fan Speed | Air Volume (CFM) | Velocity (FPM) | Sound Level (dBa) * |
|------------|------------------|----------------|---------------------|
| High (max) | 718 | 110 | 53 |
| 90 FPM | 583 | 90 | 51 |
| Medium | 466 | 72 | 49 |

* Measured at 30" from the filter face.

G. SAFETY

- a. The FFU shall be a UL/CUL listed appliance.
- b. Wiring shall be in accordance with NEC.

PART 3 EXECUTION

A. DELIVERY, STORAGE, AND HANDLING

- a. FFU Housings shall be shipped fully assembled, except for HEPA final filters.
- b. HEPA final filters will drop-ship to the job site for installation after the FFU housings have been situated in the ceiling and wired.
- c. Individual units shall be sealed in polyurethane and packaged in heavy cardboard cartons for safe shipping, handling, and storage
- d. The outside of the cartons shall be adequately marked or tagged to indicate its contents by equipment name, size, model number, special handling instructions, if necessary, and any other applicable markings that may be required by the project documents.
- e. Immediately upon receipt, each carton shall be visually inspected for shipping damage, such as crushed corners or sides, punctures, or any other deformation which might indicate possible damage.
 - i. Any visible damage must be noted on the shipper's delivery receipt, and photographs should be taken as documentation for any possible claims.
 - ii. Contact manufacturer immediately to report any damage.
- f. Units must be stored in a clean, dry, indoor storage location.

B. INSTALLATION

- a. The units shall be installed according to manufacturer's written installation instructions that shall accompany each FFU, and in compliance with NEC.
- b. Units shall be supported by the ceiling system, and/or independently suspended as may be required to meet local building codes or special seismic requirements.
- c. Maintain an air tight seal at ceiling grid.
- d. After FFU housings are situated in the ceiling and input power has been attached, HEPA final filters shall be inserted into the housing and secured in place by tightening the filter retaining clips.
- e. Coordinate installation with other trades, including fire protection, electrical, mechanical, and other trades to assure proper interface with all other work.
- f. After certification testing, install the perforated face grilles over the threaded bolts and securing them in place using the stainless steel acorn nuts provided.