

**Part 1 GENERAL**

**1.1 REFERENCES**

- .1 American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE)
  - .1 ASHRAE 52., Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size

**1.2 DELIVERY, STORAGE, AND HANDLING**

- .1 Packing, shipping, handling and unloading:
  - .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.
  - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

**1.3 MAINTENANCE**

- .1 Extra Materials:w
  - .1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.
  - .2 Furnish list of individual manufacturer's recommended spare parts for equipment such as frames and filters, addresses of suppliers, list of specialized tools necessary for adjusting, repairing or replacing for inclusion in operating manual.
  - .3 Spare filters: in addition to filters installed immediately prior to acceptance by Departmental Representative, supply [1] complete set of filters for each filter unit or filter bank in accordance with section 01 78 00 - Closeout Submittals.

**Part 2 PRODUCTS**

**2.1 GENERAL**

- .1 Number of units, size and thickness of panels, overall dimensions of filter bank, and configuration shall be as per air handling unit provided by Department Representative.

**2.2 PLEATED PANEL FILTER**

- .1 General
    - .1 Air filters shall be medium efficiency ASHRAE pleated panels consisting of synthetic media, welded wire media support grid, and beverage board enclosing frame.
    - .2 Sizes shall be noted on drawings or other supporting materials.
    - .3 Acceptable material: Camfil Farr 30/30 or equal.
  - .2 Construction
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- .1 Filter media shall be a synthetic blend, lofted to a uniform depth of 0.15", and formed into a uniform radial pleat.
  - .2 A welded wire grid, spot-welded on one-inch centers and treated for corrosion resistance shall be bonded to the downstream side of the media to maintain radial pleats and prevent media oscillation.
  - .3 An enclosing frame of no less than 28-point high wet-strength beverage board shall provide a rigid and durable enclosure. The frame shall be bonded to the media on all sides to prevent air bypass. Integral diagonal support members on the air entering and air exiting side shall be bonded to the apex of each pleat to maintain uniform pleat spacing in varying airflows.
- .3 Performance
- .1 The filter shall have a Minimum Efficiency Reporting Value of MERV 8 when evaluated under the guidelines of ASHRAE Standard 52.2. It shall also have a MERV-A of 8 when tested per Appendix J of the same standard. ISO 16890 rating is ePM10 50
  - .2 Initial resistance to airflow shall not exceed 0.31" w.g. at an airflow of 500 fpm on 2" deep models respectively.
  - .3 The filter shall have an Energy Cost Index (ECI) value of five stars.
  - .4 The filter shall be listed by Underwriters Laboratories as UL Class 900.
  - .5 Manufacturer shall provide evidence of facility certification to ISO 9001:2015.
  - .6 Manufacturer shall guarantee the integrity of the filter pack to 2.0" w.g.
  - .7 Provide product test report including all details as prescribed in ASHRAE Standards 52.2, including Appendix J.

## **2.3 V-BANK FILTER**

- .1 General
    - .1 Air filters shall be high-efficiency ASHRAE pleat-in-pleat V-bank disposable type assembled in a compact and secure enclosing frame.
    - .2 Sizes shall be as noted on drawings or other supporting materials.
    - .3 Acceptable material: Camfil Durafil 2V or equal.
  - .2 Construction
    - .1 Filter media shall be of microfine glass formed into uniformly spaced pleats separated by glass filament separators and formed into a minipleat pack design.
    - .2 Each minipleat pack shall be assembled into a V-bank configuration with an appropriate number of packs to obtain required pressure drop.
    - .3 The media packs shall be bonded to the inside periphery of the enclosing frame with a fire-retardant phosphorus-free sealant.
    - .4 The enclosing frame shall include modular injection-molded plastic channels bonded to the media pack to prevent air bypass. Injection-molded modular plastic supports shall be placed on the air entering and air exiting sides to promote uniform airflow and assist in structural support. Each filter shall include a handle for transport or convenience of installation.
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- .5 The filter shall have a nominal 1" solid header that is an integral component of the enclosing frame.
  - .6 Injection-molded rigid plastic end caps shall be bonded to the top and bottom of the enclosing structure to ensure a rigid and durable filter.
  - .7 A gasket shall be included on header-to-header sealing surfaces to eliminate air bypass between headered filters.
  - .8 Filter shall be bi-directional with regard to airflow.
- .3 Performance
- .1 The filter shall have a Minimum Efficiency Reporting Value of MERV 14 when evaluated under the guidelines of ASHRAE Standard 52.2. It shall have an efficiency of ePM1-70 when evaluated per ISO filter testing standard 16890.
  - .2 Initial resistance to airflow shall be 0.55" w.g at an airflow of 500 fpm.
  - .3 Filter shall be qualified by Underwriters Laboratories as UL 900.
  - .4 Manufacturer shall provide evidence of facility certification to ISO 9001:2008.
  - .5 The filter shall be capable of withstanding 10" w.g. without failure of the media pack.
  - .6 Provide product test reports for each listed efficiency including all details as prescribed in ASHRAE Standard 52.2.

## **2.4 HEPA ABSOLUTE PACKAGE FILTERS 99.97% EFFICIENCY**

- .1 General:
- .1 The manufacturer shall have an ISO 9001 or ASME NQA-1 quality based system at the manufacturing facility. The manufacturer shall make available documentation showing independent third party certification or acceptable audit approvals and adherence to these systems.
  - .2 If requested, manufacturer shall make available a copy of their Corporate Quality Manual and references from clients of similar sized projects or scope within the last 5 years.
  - .3 Acceptable material: AAF Flanders AstroCel I or equal.
- .2 Construction
- .1 Filters construction shall be 18 ga. galvanized steel, 16 ga. type 304 stainless steel or 0.063 inch thick mill finish aluminum for use in clean air delivery devices such as Air Handler Units (AHU), Make-Up Handlers (MAH) or others. Frame style will be determined by filter application. The term "HEPA" shall be used generically to describe all high-efficiency filters that meet the following specifications. If possible, the filter and housing shall be from the same manufacturer to ensure form, fit, and function are maximized.
  - .2 The filter shall be constructed in accordance with the recommended construction requirements of IEST-RP-CC001, latest version.
  - .3 The media shall be borosilicate microfiber type with manufacturer QC data to ensure quality requirements and traceability are maintained. The pleats shall be equally spaced and supported with 0.0125 inch thick corrugated aluminum separators. Actual filter depth shall be 11.5 or 5.875 inches.
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- .4 The media pack shall be affixed permanently to the filter frame assembly by means of a solid, continuous, fire retardant, phosphorous free polyurethane sealant, forming a leak free bond between the filter pack and filter frame. The sealant will be uniform off-white in color; will not exhibit any form of leaching, and no more than 1/4" of wicking into the media. The sealant will be qualified at incoming inspection as well as point of dispensing to ensure homogenization and adequate curing and adhesion properties.
  - .5 Filter frame shall be designed for use in Gasket Seal or Fluid Seal systems. The filter frame shall have tight corners. Corners must contain no cracks or uneven areas.
  - .6 Gasket system filters shall have:
    - .1 Factory installed 1/4" thick by 3/4" wide dovetailed, close celled neoprene, silicone or EPDM gasket affixed to the filter frame sealing surface.
    - .2 Filter Frame sealing surface to have a flatness tolerance of +/-1/32"
  - .7 Fluid Seal system filters shall have:
    - .1 Filter shall have a continuous trough around the perimeter of the filter. The fluid seal trough shall be filled at the factory.
    - .2 Filter fluid seal must be comprised of a two component high molecular weight, polysiloxane elastomeric sealant and be self-leveling.
      - .1 Fluid seal material shall be characterized for all salient mechanical, physical, and chemical properties such as Hardness/Penetration, Tack, and Migration of free silicone (i.e. Blot Plot testing).
      - .2 Fluid seal material shall be characterized for chemical resistance to known industry accepted decontamination agents, cleaning agents, and filter testing reagents.
      - .3 Fluid seal material shall be tested for chemical compatibility to all materials in contact during manufacturing including gloves, tools, mixing equipment, dispensing equipment, and packaging materials, as well as potential airborne contaminants & poisons.
      - .4 Fluid seal material shall demonstrate resistance to accelerated life cycle testing.
      - .5 Fluid Seal shall withstand knife edge insertion to partial depth without complete depth cutting or full length splitting.
  - .8 Each filter shall have a unique label indicating filter size, lot number, unique serial number, model number, tested efficiency, pressure drop at volumetric test airflow, and UL compliance.
- .3 Shipping, Storage and Handling of HEPA/ULPA Filters
- .1 Filter Assemblies are to be packaged discretely in double wall corrugated carton of sufficient strength.
  - .2 Manufacturer shall characterize packaging against industry standards for:
    - .1 Drop
    - .2 Compression (i.e. stacking of cartons)
    - .3 Vibration
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- .3 The carton shall be labeled with the manufacturer's part number, serial number, and test performance data.
  - .4 Palletized cartons shall be protected with corner posts and retained via stretch wrap.
  - .5 Filter Assemblies shall be shipped in fully enclosed trailers and in original, unopened packaging.
  - .6 Appropriate care must be exercised in handling cartons to avoid dropping, vibration, and rough handling to prevent potential for damage.
  - .7 HEPA filter Assemblies shall be stored per manufacturer's instructions for proper orientation, stacking configuration and limitations, and must remain in unopened cartons to prevent damage and exposure to potential contaminants.
  - .8 Cartons stored longer than one week shall remain unopened and in a climate controlled environment of 60-80F and 30-70%RH.
  - .9 Filter Assemblies shall remain in the sealed, unopened carton until inspection, testing and installation.
  - .10 Filter Performance Criteria/Factory testing:
    - .4 Factory Efficiency and Resistance Test:
      - .1 The filter shall have a minimum overall efficiency of 99.97%, on 0.3 micron particles and shall be tested and constructed in accordance with IEST-RP-CC001, latest version.
      - .2 The filter efficiency will be determined using a thermal condensation aerosol generator and photometer which will measure gross downstream penetration as compared to the upstream concentration.

### **Part 3 EXECUTION**

#### **3.1 MANUFACTURER'S INSTRUCTIONS**

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

#### **3.2 HEPA FILTERS**

- .1 Use components and devices recommended by manufacturer to ensure complete integrity and to ensure easy removal and replacement, even when dressed in anti-contamination clothing.
- .2 Provide proper permanent facilities for challenging integrity with aerosol injector downstream of pre-filters and test sampling manifold downstream of HEPA filter. Location of injector and sampling manifold approved by manufacturer.
- .3 During TAB, install substitute media having similar pressure drop.
- .4 Before acceptance, perform tests to demonstrate integrity of complete installation.