AstroClean DAP Specification

1. Acceptable Manufacturers

    a. AAF Flanders
    b. Other Approved Manufacturer

2. Quality and Environmental Management Systems

    a. The manufacturer shall have an ISO 9000 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.

    b. 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. AstroClean DAP Testing

    a. Grid shall be factory tested for filter fit, knife edge flatness, and alignment of the filters.

    b. Lights shall be cycled on and off, to verify proper operation.

    c. Certification of each HEPA filter in accordance with applicable IES Standard(s) and specifications indicated below. Each filter shall have permanent label indicating filter type, model number and size designator, unique serial number allowing for full traceability, air resistance, airflow, target efficiency, target pressure drop and test date, average penetration and probe test certification.

4. AstroClean DAP Construction

    1. The grid section of the housing shall be constructed of 11 gauge 304 or 316L stainless steel with joints and seams fully welded. All roomside exposed surfaces below the ceiling line to be #4 finish. Interior surfaces and exterior surfaces above the ceiling line to be 2B finish.

    2. All hardware on the plenum shall be 300 series stainless steel with the exceptions of items such as electrical components, air movement components, gasket, etc.

    3. All weld joints shall be continuously welded on the filter grid and intermittently welded and caulked on the filter plenum. Exterior welds shall be ground smooth and blended to match the surrounding finish. All welding procedures, welders, and welder operators shall be qualified in accordance with ASME Boiler and Pressure Vessel Code, Section IX. Optional continuously welded filter plenum available.

    4. Lighting shall be flush mounted LED with dimmer circuit. Shall be universal 120-277V. Light lenses to be square polycarbonate lens. Shall have remote mounted light on/off switch and light dimmer.

    5. There shall be a labeled test port, accessible from the air outlet side, to measure static pressure and upstream aerosol concentration at filter inlet upstream of filter. The assembly shall have a 3/8" NPT coupling with plug for the aerosol sampling and a ¼" NPT coupling with swaglok fitting for the pressure sampling port. One port is required per 2 filters.

    6. The unit shall have ¼" thick stainless steel mounting plates with a ½"-13 collar nut welded to the bottom of each plate for mounting. There shall be a fully welded collar nut cap on the bottom side of the collar nut. The number of mounting plates is dependent on the size of the unit.

7. Housing shall have four captive retainers, per filer, to secure gel seal filters with knife-edge seal between housing and fluid-filled channel around perimeter of filter frame. Filters to be removable from the roomside.
8. Grille shall be 20 gauge 304 or 316L stainless steel with No. 4 finish room side, perforated to provide 40% free area. The grille shall be flush and be installed with 3/8" acorn nuts as standard. The perforated grille is to have a hemmed edge for rigidity.
9. The perimeter trim shall be field installed. Trim shall be 2" wide field installed trim constructed of 16 gauge type 304 or 316L stainless steel with No. 4 finish on surfaces exposed to the room.
10. Sprinkler pass-through available as an option and will be centrally located in the filtration area.
11. All units shall be visually inspected for pinholes, porosity, indentations or inclusions exceeding 10% base metal; lack of filler material, excessive weld build up and cold shunts.

5. HEPA Filters
   a. Filters construction shall be extruded anodized aluminum for use in Open Plenum, Ducted Terminal, or Fan Powered Systems. 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.

   b. Construction Criteria;

      i. The filter shall be constructed in accordance with the recommended construction requirements of IEST-RP-CC001, latest version.

      ii. The media shall be of eFRM (FlouroResin) technology and shall be produced by the filter manufacturer to ensure quality requirements and traceability are maintained. eFRM media shall consist of two membrane layers supported on each side with spun bonded synthetic scrim to eliminate media damage; glass fiber media is not allowed. The pleats shall be equally spaced using polyolefin hot melt glue beads. eFRM media shall be compatible with industry standard testing methodologies using 4cS PAO and shall have equal or better tolerance for PAO compared to conventional fiberglass HEPA media. Nominal media pack depth shall be 50mm deep.

      iii. 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 ¼" 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.

      iv. The filter frame shall be of minimum of 0.060" thick webbing anodized extruded aluminum Filter Frame shall be designed for use in Fluid Seal systems. The filter frame shall have a perpendicularity specification of no more than 1% to ensure tight miter corners and a leak free design. Corners must contain no cracks or uneven areas.

v. Fluid Seal system filters shall have:

1. A continuous trough around the perimeter of the filter with continuous, integral indication of acceptable fluid seal fill level. The fluid seal trough shall be filled at the factory.

2. Filter fluid seal must be comprised of a two component, polysiloxane elastomeric sealant and be self-leveling.
    a. 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).
    b. Fluid seal material shall be characterized for chemical resistance to known industry accepted decontamination agents, cleaning agents, and filter testing reagents.
    c. 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.
    d. Fluid seal material shall demonstrate resistance to accelerated life cycle testing.
    e. Fluid Seal shall withstand knife edge insertion to partial depth without complete depth cutting or full length splitting.

vi. 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.

vii. Manufacturing shall take place in an ISO 7 cleanroom as determined by ISO 14644. Packaging shall be in a minimum ISO 6 cleanroom as determined by ISO 14644.

6. Shipping, Storage and Handling of HEPA/ULPA Filters

a. Filter Assemblies are to be packaged discretely in sealed polyethylene bag and double wall corrugated carton of sufficient strength.
    i. Manufacturer shall characterize packaging against industry standards for:
    1. Drop
    2. Compression (i.e. stacking of cartons)
    3. Vibration

b. The carton shall be labeled with the manufacturer's part number, serial number, and test performance data.

c. Palletized cartons shall be protected with corner posts and retained via stretch wrap.

d. Filter Assemblies shall be shipped in fully enclosed trailers and in original, unopened packaging.

e. Appropriate care must be exercised in handling cartons to avoid dropping, vibration, and rough handling to prevent potential for damage.

f. 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.

g. Cartons stored longer than one week shall remain unopened and in a climate controlled environment of 60-80F and 30-70%RH.

h. Filter Assemblies shall remain in the sealed, unopened carton until inspection, testing and installation.

7. Filter Performance Criteria/Factory testing:

a. Factory Efficiency and Resistance Test:

i. The filter shall have a minimum overall efficiency of 99.99%-99.999% on 0.3 micron, H13 or H14 at MPPS. Filter shall be tested and constructed in accordance with IEST-RP-CC001, latest version for 99.99% 99.999% and EN-1822 latest version for H13 and H14.

1. The filter efficiency, as determined as the lower efficiency when tested for particle size ranges of 0.1-0.2 µm and 0.2-0.3 µm, shall be accomplished using a thermal condensation aerosol generator or Q107 Penetrometer and photometer which will measure gross downstream penetration as compared to the upstream concentration.

ii. Each Filter shall be tested for initial (clean) pressure drop at rated flow.

1. All cleanroom style filters are tested at 100 FPM, +/- 10% and are based on filter media area. For example, an actual 24" x 24" filter has an area of 4 ft^2, thus a tested flow rate of 400 CFM. The maximum initial pressure drop per overall efficiency rating is as follows:

Pack Depth	Max. initial ΔP
50mm	0.19" w.g.

a. Factory Scan Test:

i. Filters shall be factory scanned in accordance with IEST-RP-CC034 latest version, to either 0.010% maximum penetration for a Type C/J, or 0.008% for a Type K over the entire filter face including glue lines and frame joints. The maximum useable face velocity shall be 125 FPM.

ii. The scanning shall be accomplished by passing the probe with overlapping strokes so the entire filter face area is sampled. Scanning shall be performed in accordance with IES-RP-CC034, latest revision section 6.2.2 "Discrete-particle counter filter scan test method". A separate laser particle counter shall continuously monitor the upstream challenge concentration.

iii. The particle counting equipment shall have a detection limit of 0.10 micron or smaller at a sample flow rate of one (1) cubic foot per minute. The particle counting equipment should be calibrated and within its recommended calibration cycle.

iv. The challenge aerosol for factory scan testing is 4 cSt PAO (Poly Alpha Olefin). The two acceptable aerosol generation techniques are either the use of a Laskin nozzle generator or an ATI, thermal condensation aerosol generator. The challenge aerosol concentration shall be a minimum of $1x10^{8}$ particles per cubic foot.

v. An acceptable alternative to the above method is a manual scan in accordance with IEST-RP-CC034.1 with the exception that the thermal condensation aerosol generator be utilized and the penetration limit is set to 0.008%. In this case the minimum aerosol concentration should be 10µg/L (mg/m^{3}).

b. Underwriters' Laboratories (UL):
   i. Filter Assemblies shall be UL Standard 900 classified.

c. Labeling and Reporting:
   i. Each filter shall have a unique labeling indicating filter size, lot number, unique serial number, model number, tested efficiency, pressure drop at volumetric test airflow, and UL compliance.
   ii. A test certificate shall be provided for each filter indicating filter specific test data including the lot and serial number along with the pressure drop and efficiency. A test certificate at a minimum should contain filter size, lot number, the filter's unique serial number, model number, tested efficiency, tested pressure drop at volumetric test airflow, and scan test results. The challenge aerosol for both the efficiency and scan test must be outlined.