SECTION 15885
HIGH EFFICIENCY PARTICULATE AIR (HEPA) FILTERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

A. This Section establishes specification and test requirements for High Efficiency Particulate Air (HEPA) filters produced to provide personnel and environmental protection when installed in the SNS Target Building. The intent is to comply with filter specification used in similar DOE nuclear facilities. This specification covers open faced rectangular, cylindrical and enclosed fire resistant HEPA filters for radioactive service, clean room, and hazardous airborne dust mitigation. These filters meet the requirements of DOE-SRD-3020-97.
   1. Primary Confinement Exhaust (PCE) system HEPA Filters.
   2. Secondary Confinement Exhaust (SCE) system HEPA Filters.
   3. Process make-up and Exhaust Systems through “Glove-Box” HEPA Filters.
   4. Beam Dump Confinement Exhaust (BDCE) system HEPA filters.

B. Related Sections: The following Sections contain requirements that relate to this Section:
   1. Division 15, Section 15990, “Testing, Adjusting and Balancing”.
   2. Division 15, Section 15886, “HEPA Filter Housing & Accessories (Bag-In and Bag-Out Design).
   3. Division 18, Section 18100, “General Welding Requirements”.

1.3 REFERENCES

A. The following documents are either a part of this specification to the extent specified herein, or specify materials of HEPA filter construction. Unless otherwise stated, the current issue date and revision number of a referenced document shall apply, including addenda and/or amendments. In the event of a conflict between provisions of this specification and provisions of the referenced documents, the text of this specification shall take precedence.

B. Department of Energy Standards (DOE):
   1. DOE F 3-42-88, Operating Policy of DOE Filter Test Program.
   2. DOE F 3-43-86, Quality Assurance Testing of HEPA Filters.
   3. DOE F 3-44-86, DOE Filter Test Facility Quality Program Plan.
   4. DOE STD-3020-97, Specification for HEPA Filters Used by DOE Contractors.

C. Department of Defense Military Standards (MIL):
   1. MIL-F-51079-95, Filter Medium, Fire Resistant, High Efficiency.
   2. MIL-S-8660C-95, Silicone Compound, NATO Code Number S-726.
   3. MIL-STD-105E-96, Sampling Procedures and Tables for Inspection by Attributes.
   4. MIL-STD-282-87, Filter Units, Protective Clothing, Gas Mask Components and Related Products: Performance Test Method.

D. The American Society of Mechanical Engineers (ASME):
   1. ASME AG-1-94, Code, Section FC, HEPA Filters.
   2. ASME NQA-1-94, Quality Assurance Program Requirements for Nuclear Facilities.

E. American Society for Testing and Materials (ASTM):
1. ASTM A 176-96, A Specification for Stainless and Heat-Resisting Chromium Steel Plate, Sheet and Strip.
2. ASTM A 240-96, A Specification for Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip.
3. ASTM A 366/A 366M-96, Standard Specification for Steel, Sheet, Carbon, Cold-Rolled, Commercial Quality.
4. ASTM A 570/570M-96, Specification for Steel, Sheet and Strip, for Carbon, Hot Rolled, Structural Quality.
5. ASTM A 611-96, Specification for Steel, Cold-Rolled Sheet, Carbon, Hot Rolled, Structural Quality.
6. ASTM A 740-91, Specification for Hardware Cloth (Woven or Welded Galvanized Steel Wire Fabric).
7. ASTM B 209-96, Specification for Aluminum and Aluminum Alloy Sheet and Plate
8. ASTM D 092.
9. ASTM D 217-94, Test Method for Cone Penetration of Lubricating Grease.
10. ASTM D 1056-91, Specification for Flexible Cellular Materials - Sponge or Expanded Rubber.
11. ASTM D 3359-95, Test Methods for Measuring Adhesion by Tape Test.
12. ASTM E-84-97, Test Method for Surface Burning Characteristics for Building Materials.

F. US Product Standards:
1. APA V995-95, U.S. Product Standard (PS) for Construction and Industrial Plywood.

G. Technical Association of the Pulp and Paper (TAPPI):
1. T411-OM-89, Thickness (Caliper) of Paper and Paperboard and Combined Board.
2. T413-OM-85, Ash in Paper and Paperboard.
3. T494-OM-96, Tensile Breaking Properties of Paper and Paperboard (Using Constant Rate of Elongation Apparatus).
4. UM-440 - pH of Paper (cold extract).

H. Federal Standards:
1. FED-STD-141C-93, Paint, Varnish, Lacquer, and Related Materials; Method of Inspection, Sampling and Testing.
2. 40 CFR 261-92, Identification and Listing of Hazardous Waste.

I. Institute of Environmental Sciences, Mt. Prospect, Illinois:
1. IES-RP-CC-001.3-93, Recommended Practice for HEPA Filters.

J. Underwriter Laboratories:
1. UL-586-96, Standard for High Efficiency Particulate Air Filter Units.

1.4 SUBMITTALS

A. Submit the Following for Approval:
1. Filter manufacturers shall submit documentation verifying the filters successfully meet each of the tests performance requirements described in Paragraphs 2.4 B and C and material requirements of Paragraph 2.2.
2. Certification shall be submitted verifying the filter appears on the most recent QPL.
3. Documentation shall be submitted verifying the filter media is listed on the QPL and verifying that all other qualification tests specified in Paragraph 2.4 have been successfully performed.
4. Submit the manufacturers QA plan which controls procurement and fabrication activities, tests and inspections, and material traceability and control of non-conformances.

1.5 QUALITY ASSURANCE & TESTING

A. Manufacturer's Quality Assurance Program, procedures and Documentation:
   1. Filters shall be manufactured and shipped under a quality assurance program meeting the essential requirements of ASME NQA-1.
   2. Procurement and fabrication activities shall allow positive identification of the grades of source materials used on construction, and permit positive identification of the roll (or production run for separator-less filters) or filter medium used in the completed filter. All tests and inspections shall be conducted in accordance with documented manufacturer's procedures, and the results shall be traceable to specific lots of completed filters. The results of penetration and resistance tests specified in Paragraph 2.4 F and G shall be documented and identified by serial number for each individual filter unit. Non-conformances with the above items and documentation of problems and their resolution shall be addressed in the manufacturer's QA Plan.

B. Test Qualifications:
   1. Qualifications testing of HEPA filters must be performed and certified by an independent test laboratory.

1.6 DEFINITIONS

A. Acceptance Test: Inspection and testing of a HEPA filter to verify certain characteristics or properties which determine acceptance or rejection of that filter.

B. Airflow Resistance: An index of the energy required to maintain airflow through a filter. Airflow resistance is measured in terms of the air pressure difference (pressure drop) across a filter at a specified flow rate (e.g. see Paragraph 2.4, Table 2). Note: The initial airflow resistance of a new filter serves as an index of the filter's potential loading capacity.

C. Approved Test Aerosol: Particle-generating materials approved by DOE for performance testing. Test aerosols approved by the DOE for tests conducted in the Filter Test Facility are di-octyl phthalate (DOP), also known as DEHP and di-octyl sebacate (DOS), also known as DEHA.

D. Filter Test Facility (FTF): A facility established by the DOE specifically to conduct performance quality assurance inspections and tests of HEPA filters.

E. High Efficiency Particulate Air (HEPA) Filter: A throwaway, extended-media, dry type filter with a rigid casing enclosing the full depth of the pleats. The filter shall exhibit a minimum efficiency of 99.97% when tested at an aerosol of 0.3 micrometers diameter. The maximum airflow resistance shall be as specified in Paragraph 2.4, Table 2.

F. Nominal Air Flow Rating: The flow rate at which HEPA filters are identified by the manufacturer and confirmed at the FTF. Nominal airflow ratings for various size filters are listed in Paragraph 2.4, Table 2.

G. Nuclear Facility: A DOE-owned and operated reactor or non-reactor facility in which radioactive materials are produced or handled to the degree that environmental protection is required.

H. Penetration: The downstream test aerosol concentration, expressed as a percentage of the upstream test aerosol concentration.

I. Qualification Test: A test, often destructive, of a prototype or randomly selected production filter to establish its capability to meet certain functional and specification requirements. The results of

the test are considered to be typical of individual items or model numbers which are of the same design and are manufactured by the same process.

1.7 PACKAGING, SHIPPING, AND STORAGE

A. HEPA filters shall be packed in individual, durable containers that meet applicable shipping regulations.

B. The contractor's shipping instructions shall specify that HEPA filter cartons be crated or placed on a pallet to minimize unit handling, particularly at public carrier interchange points. Filters should be stacked no more than three (3) high. For large shipments, it is recommended that the entire shipment be shipped in a sealed, dedicated trailer or rail car. At all times the filters must be handled with care and properly orientated.

C. Packaging, shipping and storage shall be in accordance with NQA-2, level B.

PART 2 - PRODUCTS

2.1 ACCEPTABLE HEPA FILTERS

A. HEPA filters identified on the most recent Military Qualified Products List (QPL), QPL-51068-7 or a corresponding DOE QPL, meet the QA requirements of Paragraphs 1.5 and 2.4. Certification shall be submitted for approval verifying the filter is listed on the QPL.

B. HEPA filter media listed on the QPL associated with MIL-F-51079 are considered to meet the QA requirements of Paragraphs 1.5 and 2.4 for filter media only. Documentation shall be submitted for approval verifying the filters media is listed on the QPL and that all other qualification tests specified in Paragraph 2.4 have been successfully performed.

C. HEPA filters shall be provided as specified IN part 4, ATTACHMENTS: Filter Data Sheets: 1 through 10.

2.2 MATERIALS OF CONSTRUCTION

A. Filter Media
   1. Fibrous Filter Media: Non-metallic filter media shall be procured in compliance with the provisions of MIL-F-51079.
   2. Non-fibrous Filter Media: Non-fibrous or metallic filter media are acceptable provided the media meets the applicable specification and performance requirements of Paragraph 2.04 and ASME AG-1 Code, Section FC, Mandatory Appendix FC-1. Asbestos is not acceptable as a filter medium component.

B. Casing
   1. Structural Material: Metal filter case material shall be equivalent to USS 14 gage steel as a minimum, with a minimum thickness of 0.0720 inches (1.8 mm). Wood or wood substitutes are acceptable, provided it can be demonstrated that the filter frame material selected is physically equivalent to the plywood specifications in APA V995. Particle board is not acceptable.
   2. Fire Retardance: Filter case material shall have a flame spread classification of 25 or less when tested in compliance with ASTM E-84.
   3. Hazardous/TSCA/Mixed Waste: Construction materials for HEPA filters shall be selected to avoid generation of EPA regulated wastes as specified in 40 CFR 261. For this reason, cadmium shall not be acceptable for treatment of filter cases. Asbestos shall not be acceptable as a HEPA filter component.

C. Separator Material

1. Acid Resistant Separators: Authorized coatings for acid resistant separators are Teflon, epoxy resin or thermo-set vinyl. The coating shall be colored (to identify defects), shall tightly adhere to preclude cracking or delaminating when the material is corrugated, and shall be 0.0001, 0.0002 in (2.5 to 5 micrometers) thick (dry film). After corrugation and subsequent flattening, the coating shall exhibit an adhesive peel resistance of 3A or better when tested in accordance with Method A of ASTM D 3359.
2. Aluminum: Authorized aluminum separator materials are specified in ASTM B209 as Alloy 1145-H18, Alloy 3003-H10, or Alloy 5052-H38. These separators must have a minimum thickness of 0.0015 in. (0.038 mm). To protect the filter medium, the separator shall be provided with a "turned edge" prior to corrugation.
3. Asbestos: Asbestos shall not be used as a separator material. (See Paragraph B 3 above.)

D. Adhesives: Adhesives and sealants, used to seal the filter pack within the filter case and adhere gaskets to the filter case, shall be non-flammable or self-extinguishing. When the dried or cured sealant is subjected to the Spot Flame test of UL-586, it will not burn, or will not continue to support combustion after the source of combustion has been removed.

E. Gaskets and Seals: Two methods are currently employed for sealing the filter to its mounting frame, flat gaskets, and "fluid" seals. The two methods shall not be used on the same mounting frame.

1. Flat Gasket: Gasket materials shall be oil and ozone-resistant, made of synthetic rubber, closed cell sponge Grade 2C3 or 2C4 in accordance with ASTM D 1056, and shall be 1/4 in. (6 mm) thick by 3/4 in. (19 mm) wide with split or cut surfaces (i.e., no mold skin).
2. Fluid Seal: Fluid seals require a specially designed mounting frame that is not compatible with flat-gasket sealed filters. The sealant shall be nonflammable as defined in ASTM D092; e.g., no flash at 450°F (230°C) or below; with a fire retardant rating of V-0, per UL-94; hardness, as determined by Brookfield LTV Penetrometer #3, of 0.14-0.24 in (3.5-6.0 mm); and allowing no biological growth. Fluid seals must be a non-evaporating, highly viscous, self-healing non-Newtonian substance. The fluid seal substance shall be corrosion resistant, shall not relax, crack, separate, or stick or adhere to the knife-edge, and shall be insoluble in water. The substance shall be thermally stable with a serviceable range of from 40°F (4.4°C) to 450°F (230°C). If the fluid seal substance is a grease, the substance shall have a National Lubricating Grease Institute (NLGI) consistency number 2 or 4 as determined by ASTM D 217. Evaporation shall be less than 2% when tested in accordance with MIL-S-8660C for 24 hours at 390°F (197°C).

F. Face Guards: Face guards, shall be corrosion resistant and nonflammable.

2.3 FABRICATION / CONSTRUCTION

A. The configuration and dimensions of open face rectangular HEPA filters have been standardized and listed in Paragraph 2.4, Table 2. All other filter configurations are considered "special" filters whose dimensions and tolerances must be specified in the procurement documents. Dimensional tolerances of "special" HEPA filters should conform to those specified in Paragraph 2.3, Table 1.

B. Filter packs shall be constructed of a continuous sheet of filter medium which shall be pleated evenly to form a pack or panel of equal depth throughout. The filter pack shall be tight when tested according to the method described in paragraph 8.1 of Institute of Environmental Sciences (IES) Document Number IES-RP-CC-001.3. Repair of pin holes and other defects is not acceptable. The following lists construction requirements for different types of filters:

1. Pleat and Separator Filter: Separators shall extend at least 1/8 in. (3 mm) beyond the pleats of filter medium. The plane formed by the edges of the separators shall be at least

1/4 in. (6 mm) from the plane of the filter frame (less gasket). The pleats shall be straight and shall not deviate more than 1/2 in. (12 mm) from a line drawn from one end of the pleat to the other end of the pleat and shall be perpendicular to the filter case.

2. Mini-pleat Filters: Filter medium panels shall be sealed in a reservoir that is at least 1/16 in. (1.6 mm) deep. The panels shall not vary more than 1/2 in. (12 mm) from a line drawn from the top to the bottom of the panel and perpendicular to the case. Filter medium support (ribbons, strings, etc.) shall not vary more than 1/2 in (12 mm) from a straight line drawn from top to bottom of the line formed by the supports and shall be perpendicular to the case. The filter medium support shall be nonflammable. The panels on the left and right sides of the filter shall be sealed to the case with adhesive.
3. Separatorless Filters: Dividers shall be provided as appropriate for additional support. The vertical plane formed by the ends of the convolutions shall not deviate more than 3/4 in (19 mm) from the top to bottom of the pleat. It shall be recessed at least 1/16 in (1.6 mm) from the plane formed by the four sides of the filter frame. Where convolutions do not have crest-to-crest contact, spacing shall not be less than 1/16 in. (1.6 mm). Nesting of convolutions is not permitted. Abrupt kinks or deviations in the folds of the medium are not permitted. The trimmed edges of the filter element shall be firmly potted (fixed) into the sealant. The two flap edges shall have sufficient sealant to secure them to the frame sides.

C. The case shall be fabricated in compliance with the provisions of Paragraph 2.2. The completed case, less gaskets, shall conform to the dimensions listed in Paragraph 2.4, Table 2 unless alternative dimensions are specified in procurement documents. Paragraph 2.3, Table 1 lists the acceptable tolerances.
   1. Wooden Cases: Case panels shall be joined with rabetted joints which are assembled by gluing with an adhesive meeting the requirements of Paragaraph 2.2 and double nailing or double screwing with coated box nails, corrosion resistant plated screw-nails, or flathead wood screws. The end points of the fasteners shall not penetrate the inside or outside surfaces of the case. Frame faces, edges, and inner surfaces shall be thoroughly coated with sealant to minimize permeability. Frame face sealant shall not reduce the ability of the gasket to adhere to the frame. There shall be no splinters or rough edges which might penetrate or cut workers' gloves or injure the fingers of personnel handling the filters.
   2. Metal Cases: Metal cases shall have a double-turned, 3/4 in. (19 mm) wide flange on each face or a fluid-seal socket or sleeve as specified in the procurement documents. Panels shall be assembled into the frame by riveting or bolting the corners, or by potting a subassembly consisting of the filter pack and side panels into the top and bottom panels (but not the corners), using an adhesive meeting the requirements of Paragraph 2.2. For mechanically joined panels the space between abutting panels shall be sealed with an adhesive meeting the requirements of Paragraph 2.2.

D. Gaskets shall be glued firmly and continuously to the case. Loose, peeling, or distorted gaskets shall be cause for rejection of the filter. The gasket shall not extend more than 1/16 in. (1.6 mm) over either side of the seating surface at any point. Gaskets may be of one-piece or made up of strips joined at the corners by keyhole, keystone, or other interlocking type joints. Edges of the joint area shall be thoroughly coated with adhesive before assembly.

E. Face guard edges shall be firmly embedded in adhesive and shall be installed so that projecting wires or edges do not form a puncture hazard to personnel handling the filter and do not project onto or beyond the gasket mounting surface. Wire edges formed when slitting or shearing expanded-metal face guard shall be smoothed on both surfaces of the material before installation. Face guards shall be on both sides of the filter.

TABLE 1. Tolerances of Filter Cases

Face Dimensions: i. less than 18 in (45.7 cm) ii. greater than 18 in. (45.7 cm)	 +0, - 1/16 in. (1.6 mm) +0, -1/8 in. (3 mm)
Depth:	+1/16 in. (1.6 mm), -0
Width of gasket surface:	3/4 in. (19 mm) ? 1/16 in. (1.6 mm)
Squareness: i. less than 18 in. (45.7 cm) ii. greater than 18 in. (45.7 cm)	Face diagonals to be equal with the following total tolerances 1/16 in. total (1.6 mm) 1/8 in. total (3 mm)
Gasket seating surfaces:	Square with sides of frame (within 3°). Flat and parallel. 1/16 in. (1.6 mm) total allowance when measured with one face of the filter resting on a flat surface.

2.4 SOURCE QUALITY CONTROL

A. Qualification tests of filter components shall be conducted in accordance with requirements of Paragraph 2.4 B. and applicable specification and performance requirements of ASME AG-1. Filters selected for qualification testing may be prototypes of the proposed design or production filters of the specific design randomly selected from the manufacturer's stock. The number of filter units required for qualification testing shall be as specified in ASME AG-1. Modification of these requirements shall be only as specified below.

B. Test Criteria and Acceptance

1. Overpressure Resistance: The new, unused filter, when preconditioned according to ASME AG-1 Code, Section FC, Section 5140, "Resistance to Pressure," shall withstand a pressure differential of 10 inches wg +/-? 0.2 in. (2,500 Pa +/-? 50 Pa) for 60 minutes without visible evidence of damage. Within 15 minutes of pressure differential test, and while still wet, the filter shall meet the penetration requirements of Paragraph 2.4 F. at 20% of nominal airflow rating (for Size 3 and larger filters).
2. Resistance to Fire and Heated Air: The new, unused filter shall withstand exposure to air heated to 700°F ?from 50°F (368°C from? 10°C) for 5 minutes. After exposure to heat, the penetration, when tested at nominal airflow rating shall not exceed 3.0%. There shall be no evidence of sustained burning when subjected to a spot flame at any point on the filter except the gasket. Labeling or certification (by Underwriters Laboratories) in accordance with UL-586 shall provide evidence of satisfactory compliance with applicable requirements for resistance to fire and heated air.
3. Resistance to Rough Handling: The filter shall withstand shaking for 15 minutes at 3/4-in. (19 mm) amplitude and 200 cycles per minute (3.33 Hz) without evidence of filter damage. The test shall be conducted with the filters boxed, and the pleats and separators vertical. After the test, the filter shall meet the penetration requirements of Paragraph 2.4 G. at 100% (all filters) and 20%, 125 cfm (212 m3/mr) and larger at the nominal airflow rating.
4. Each filter shall be tested for penetration at 100% of nominal airflow rating. Size 3 filters (125 cfm) and greater shall also be tested for penetration at 20% of the manufacturer's nominal airflow rating (see Paragraph 2.4, Table 2).

C. Performance Requirements: Mandatory performance requirements for HEPA filters are set out below. The performance requirements must be demonstrated by manufacturer and FTF through test or inspection.

1. Penetration: Aerosol penetration for any HEPA filter shall not exceed 0.03% (0.0003) at 0.3 micrometer diameter particles.
2. Resistance: Air flow resistance across the HEPA filter shall conform to the limits listed in Table 2 below. Tests for resistance to airflow shall be conducted at flow rates expressed in actual cubic feet per minute (ACFM).
3. Media Velocity (Effective Media Area): The total effective media area provided within the filter pack shall be such that face velocity shall not exceed 5.0 ft/min (1.52 m/min) at the rated airflow.

TABLE 2. Dimensions, Nominal Airflow Ratings, and Maximum Resistance for Typical HEPA Filters[a]

Size	Dimension in inches	Dimension in millimeters	Nominal Airflow Rating		Maximum Resistance	
			cfm	m^3/hr	in.wg	Pa
1	8x8x3-1/16	203x203x78	25	42	1.3	325
2	8x8x5-7/8	203x203x149	50	85	1.3	325
3	12x12x5-7/8	305x305x149	125	212	1.3	325
4	24x24x5-7/8	610x610x149	500	850	1.0	250
5	24x24x11-1/2	610x610x292	1000	1700	1.0	250
6	24x24x11-1/2	610x610x292	1250	2125	1.0	250
7[b,c]	24x24x11-1/2	610x610x292	1500	2550	1.3	325
8[d]	24x24x11-1/2	610x610x292	2000	3400	1.3	325
9	12x12x11-1/2	305x305x292	250	425	1.0	250

[a] Non-encapsulated.
[b] Constructed with separators.
[c] Constructed without separators.
[d] Mini-pleat design.

D. HEPA filters not listed above (round, rectangular, radial, etc.) shall conform to the requirements listed in this specification for performance requirements, materials requirements, and filter construction.

E. Successful tests of filters with known material components for filter frames, filter medium, cases and adhesives, produced by a single manufacturer, can be used to qualify filters of similar construction.

F. Each filter unit shall be tested for penetration by a DOE-approved aerosol and test method at the manufacturer and at a DOE FTF as follows:
   1. Size 1 and 2 (up to 125 cfm, 212 m3/hr) filter units: 100% of rated airflow.
   2. Size 3 (125 cfm, 212 m3/hr) and larger filter units: 100% and 20% of rated airflow.
   3. Filters with penetration rates in excess of 0.03% (0.0003) measured at a particle diameter of 0.3 micrometer shall be rejected. When tested with a laser spectrometer test method, the maximum penetration and the aerosol particle size of maximum penetration shall be reported in addition to the penetration at 0.3 micrometers diameter. However, penetration at 0.3 micrometers diameter shall be the only criterion used to judge whether a filter is rejected for excess penetration.

G. The airflow resistance across the HEPA filters shall conform to the limits listed in Paragraph 2.4, Table 2. Tests for resistance to airflow shall be conducted at flow rates expressed in actual cubic feet per minute (ACFM).

H. If a filter fails any or all of the qualifications tests, the test organization shall first notify the manufacturer, and provide the manufacturer the opportunity to review test methods and results prior to removing the filter model from the QPL (or similar qualifications list) and issuing notice thereof.

I. Marking and Identification
   1. Each filter frame or case shall be indelibly marked with the following: manufacturer name and model number, filter serial number, actual percentage penetration at rated flow, airflow capacity, resistance at rated flow, direction of airflow during tests, and marking for vertical orientation.
   2. Each filter shall be marked with the UL-586 label.

PART 3 - EXECUTION

3.1 QUALITY CONTROL / ACCEPTANCE

A. Prior to installation at a DOE site, each HEPA filter shall be tested at a DOE FTF. Acceptance is contingent upon satisfactory completion of inspections and tests specified in DOE Standards. Filters will be inspected for physical damage to the packaging and filter, and for compliance with specification requirements that can be checked visually.

B. The DOE FTF shall test each HEPA filter for penetration in accordance with Paragraph 2.4 F. and for air flow resistance in accordance with 2.4 G. verifying the performance requirements of 2.4 C. are met.

C. Accepted filters shall be marked as specified in DOE standards at the FTF. The penetration for each specified airflow and the resistance at nominal airflow rating shall be marked clearly and indelibly on the case of the filter unit tested.

D. Failure to meet inspection, test, or verification requirements shall be cause for rejection of the filter(s). After the testing and inspection is completed, each filter will bear a FTF test label indicating acceptance or rejection.

E. CM reserves the right to randomly select HEPA filters from existing storage sites and perform the tests defined in Paragraph 2.4 B. If failures are noted, procurement organizations shall be notified that the failed filter model has been removed from the current DOE QPL. The manufacturer, the DOE- FTF, and procurement specialists shall be informed that the failed filter model is no longer acceptable for use at DOE facilities, pending re-qualification.

3.2 PERFORMANCE TESTING AND VERIFICATION

A. Each filter shall be tested for penetration at 100% of the nominal airflow rating by the FTF operator. Size 3 filters (125 cfm) and greater shall also be tested for penetration at 20% of the manufacturer's nominal airflow rating (see Paragraph 2.4, Table 2).

B. All non-encapsulated (open faced) HEPA filters shall be tested for airflow resistance at nominal airflow rating. Maximum acceptable resistance appears in Paragraph 2.4, Table 2 for selected filter sizes.

C. Following satisfactory completion of inspections and tests specified in Paragraphs A and B above, the FTF will repack the tested filters in a manner comparable to the as received packaging, and forward them to the address specified by the customer.

D. Rejected filters will be disposed of by the FTF in accordance with written instructions on file from the purchaser and/or the manufacturer.

PART 4 - ATTACHMENTS

Filter Data Sheet No. 1

Stores Catalog Number - 076453442

Description: +/- 11½ " deep HEPA Filter - Open faced, rectangular and fire resistant. (4 Sq. Ft. face area)

Performance: Nominal Airflow – 1,000 cfm. Media Velocity - 5 fpm (max). Clean pressure drop - not to exceed 1" w.g. at nominal airflow. Penetration - .03% (max) for .3 micron particles at 100% and 20% of nominal rated capacity.

Physical Size: 24"x24"x11 ½ ", Size 5

Construction Features: Frame - 14 ga. 409 stainless steel. Seal - gasket, upstream. Separators - .0015" thk. Aluminum. Media - 15 mil (min) pleated non-woven silicate paper. Face Guards - 4 x 4 mesh, 304 stainless steel, 17 ga, both sides.

Filter Data Sheet No. 2

Stores Catalog Number - 076455950

Description: +/- 11½ " deep HEPA Filter - Open faced, rectangular and fire resistant. (4 Sq. Ft. face area)

Performance: Nominal Airflow - 1500 cfm. Media Velocity - 5 fpm (max). Clean pressure drop - not to exceed 1.3" w.g. at nominal airflow. Penetration - .03% (max) for .3 micron particles at 100% and 20% of nominal rated capacity.

Physical Size: 24"x24"x11 ½", Size 8

Construction Features: Frame - Exterior grade plywood, ¾ " thick, fire retardant. Seal - gasket, both sides. Separators - N/A. Media - 15 mil (min) pleated non-woven silicate paper. Face Guards - 4 x 4 mesh, 304 stainless steel, 17 Gage, both sides.

Filter Data Sheet No. 3

Stores Catalog Number - 076455042

Description: +/- 11½ " deep HEPA Filter - Enclosed, rectangular and fire resistant. (4 Sq. Ft. face area)

Performance: Nominal Airflow – 1,000 cfm. Media Velocity - 5 fpm (max). Clean pressure drop - not to exceed 1.0" w.g. at nominal airflow. Penetration - .03% (max) for .3 micron particles at 100% and 20% of nominal rated capacity.

Physical Size: 24"x24"x11 ½ ", Size 5

Construction Features: Frame - 14 ga. 304 stainless steel, flange on nipple ends and drill on 45 deg. O.C>. Seal - gasket, both sides. Separators - .0015" thk. Aluminum. Media - 15 mil (min) pleated non-woven silicate paper. Face Guards - 4 x 4 mesh, 304 stainless steel, 17 ga, both sides.

Filter Data Sheet No. 4

Stores Catalog Number - 076453227

Description: +/- 11½ " deep HEPA Filter - Open faced, rectangular and fire resistant. (One Sq. Ft. face area)

Performance: Nominal Airflow - 250 cfm. Media Velocity - 5 fpm (max). Clean pressure drop - not to exceed 1.0" w.g. at nominal airflow. Penetration - .03% (max) for .3 micron particles at 100% and 20% of nominal rated capacity.

Physical Size: 12"x12"x11 ½ ", Size 9

Construction Features: Frame - Exterior grade plywood, ¾ " thk.,fire retardant. Seal - gasket, both sides. Separators - .0015" thk. Aluminum. Media - 15 mil (min) pleated non-woven silicate paper. Face Guards - 4 x 4 mesh, 304 stainless steel, 17 ga, both sides.

Filter Data Sheet No. 5

Stores Catalog Number - 076455925

Description: +/- 11 ½ " deep HEPA Filter - Open faced, rectangular and fire resistant. (One Sq. Ft. face area)

Performance: Nominal Airflow - 160 cfm. Media Velocity - 5 fpm (max). Clean pressure drop - not to exceed 1.0 w.g. at nominal airflow. Penetration - .03% (max) for .3 micron particles at 100% and 20% of nominal rated capacity.

Physical Size: 12"x12"x11 ½ ", Size 9

Construction Features: Frame - 14 ga. 304 Stainless steel. Seal - gasket, upstream. Separators - .0015" thk. Aluminum. Media - 15 mil (min) pleated non-woven silicate paper. Face Guards - 4 x 4 mesh, 304 stainless steel, 17 ga, both sides.

Filter Data Sheet No. 6

Stores Catalog Number - 076453700

Description: +/- 6" deep HEPA Filter - Open faced, rectangular and fire resistant. (4 Sq. Ft. face area)

Performance: Nominal Airflow - 575 cfm. Media Velocity - 5 fpm (max). Clean pressure drop - not to exceed 1.0" w.g. at nominal airflow. Penetration - .03% (max) for .3 micron particles at 100% and 20% of nominal rated capacity.

Physical Size: 24"x24"x6 ¼ ", Size N/A

Construction Features: Frame - 14 ga. 304 stainless steel. Seal - gasket, both sides. Separators - .0015" thk. Aluminum. Media - 15 mil (min) pleated non-woven silicate paper. Face Guards - 4 x 4 mesh, 304 stainless steel, 17 ga, both sides

Filter Data Sheet No. 7

Stores Catalog Number - 076455232

Description: +/- 6" deep HEPA Filter - Enclosed and fire resistant. (One Sq. Ft. face area)

Performance: Nominal Airflow - 125 cfm. Media Velocity - 5 fpm (max). Clean pressure drop - not to exceed 1.3" w.g. at nominal airflow. Penetration - .03% (max) for .3 micron particles at 100% and 20% of nominal rated capacity.

Physical Size: 12"x12"x5 7/8 ", Size 3

Construction Features: Frame - 14 ga. 304 stainless steel, flange on both nipple ends and drill at 45 deg o.c. Seal - gasket, both sides. Separators - .0015 thk. Aluminum. Media - 15 mil (min) pleated non-woven silicate paper. Face Guards - 4 x 4 mesh, 304 stainless steel, 17 ga, both sides.

Filter Data Sheet No. 8

Stores Catalog Number - 076455222

Description: +/- 6" deep HEPA Filter - Enclosed and fire resistant. (0.44 Sq. Ft. free area)

Performance: Nominal Airflow - 50 cfm. Media Velocity - 5 fpm (max). Clean pressure drop - not to exceed 1.3" w.g. at nominal airflow. Penetration - .03% (max) for .3 micron particles at 100% of nominal rated capacity.

Physical Size: 8" x 8"x 5 7/8 ", Size 2

Construction Features: Frame - 14 ga. 304 stainless steel, flange on both nipple end and drill at 45 deg o.c. Seal - gasket, both sides. Separators - .0015 thk. Aluminum. Media - 15 mil (min) pleated non-woven silicate paper. Face Guards - 4 x 4 mesh, 304 stainless steel, 17 ga, both sides.

Filter Data Sheet No. 9

Stores Catalog Number - 076453212

Description: +/- 6" deep HEPA Filter - Open faced, rectangular and fire resistant. (0.44 Sq. Ft. free area)

Performance: Nominal Airflow - 50 cfm. Media Velocity - 5 fpm (max). Clean pressure drop - not to exceed 1.3" w.g. at nominal airflow. Penetration - .03% (max) for .3 micron particles at 100% of nominal rated capacity.

Physical Size: 8"x8"x5 7/8 ", Size 2

Construction Features: Frame - Exterior grade plywood, ¾ " thk., fire retardant. Seal - gasket, both sides. Separators - .0015" thk. Aluminum. Media - 15 mil (min) pleated non-woven silicate paper. Face Guards - 4 x 4 mesh, 304 stainless steel, 17 ga, both sides.

Filter Data Sheet No. 10

Stores Catalog Number - 076452425

Description: +/- 6.625" deep HEPA Filter - Cylindrical and fire resistant. (0.239 Sq. Ft. free area)

Performance: Nominal Airflow - 50 cfm. Media Velocity - 5 fpm (max). Clean pressure drop - not to exceed 1" w.g. at nominal airflow. Penetration - .03% (max) for .3 micron particles at 100% and 20% of nominal rated capacity.

Physical Size: 8" diameter x 6.625" deep, Size N/A.

Construction Features: Frame - 14 ga. Carbon steel, ¾ " wide flanged end upstream, drilled w/ 8-5/16" holes, equal spacing. Seal - gasket, both sides. Separators - .0015" thk. Aluminum. Media - 15 mil (min) pleated non-woven silicate paper. Face Guards - 4 x 4 mesh, 304 stainless steel, 17 ga, both sides.

END OF SECTION 15885