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June 2015

Supersedes DOE-STD-3020-2005
December 2005

DOE TECHNICAL STANDARD

Specification for HEPA Filters Used by DOE Contractors

U.S. Department of Energy
Washington, D.C. 20585

AREA SAFT

FOREWORD

This U.S. Department of Energy (DOE) Standard (STD) supersedes DOE-STD-3020-2005, *Specification for HEPA Filters Used by DOE Contractors*, and is approved for use by DOE including the National Nuclear Security Administration (NNSA) and its contractors.

This Standard was developed for application in DOE programs. It provides direction to DOE contractors for procurement and required testing of high efficiency particulate air (HEPA) filters used in DOE nuclear facilities. The American Society of Mechanical Engineers (ASME) publication ASME AG-1, *Code on Nuclear Air and Gas Treatment*, was the primary national consensus standard used to develop the provisions of this Standard. This Standard also specifies additional inspection and testing that DOE requires to be performed at the independent Filter Test Facility for certain categories of HEPA filters prior to their installation at DOE nuclear facilities. The Standard is applicable to axial and radial flow HEPA filters with glass fiber medium as per Sections FC and FK of the ASME AG-1 code. There are other classes of HEPA filters with different medium, such as high-strength, metal, and ceramic, which are currently under various stages of testing, development and review by the ASME Committee on Nuclear Air and Gas Treatment for incorporation into the ASME AG-1 code. These classes of filters will be incorporated in this Standard after ASME AG-1 has developed requirements for their use.

The changes implemented in this revision of the Standard clarified the Standard's applicability and requirements, updated the provisions related to materials and construction of filters for consistency with the ASME AG-1 code, added and revised requirements for legacy filters, procurement documentation, quality assurance including compliance with the DOE Order 414.1D, *Quality Assurance*, reporting of qualification test results, and packaging shipping and storage as well as other editorial changes.

Beneficial comments (recommendations, additions, deletions) and any pertinent data that may improve this document should be sent to:

U.S. Department of Energy
Office of Nuclear Safety (AU-30)
1000 Independence Avenue SW
Washington, DC 20585.

DOE technical standards, such as this Standard, do not establish requirements. However, all or part of the provisions in a DOE standard can become requirements under the following circumstances:

- they are explicitly stated to be requirements in a DOE requirements document; or
- the organization makes a commitment to meet a standard in: 1) a contract or 2) an implementation plan or program plan of a DOE requirements document.

Throughout this Standard, the word "shall" is used to denote a requirement; the word "should" is used to denote a recommendation; and the word "may" is used to denote permission, but not a requirement or a recommendation. To satisfy this Standard, all applicable "shall" statements

need to be met. Alternate approaches that demonstrate an equivalent level of safety are also acceptable, if approved by the DOE or NNSA field element.

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1. INTRODUCTION

1.1 **Purpose**: The purpose of this Standard is to establish specifications and quality assurance (QA) requirements for the procurement, packaging, shipping and storage of high efficiency particulate air (HEPA) filters. It provides direction to Department of Energy (DOE) and DOE contractors including the National Nuclear Security Administration and its contractors for procurement and required inspection and testing of HEPA filters used in, and in support of, DOE nuclear facilities.[1] The required inspection and testing are performed by the filter manufacturer and by an independent testing facility, hereafter designated as the Filter Test Facility (FTF), under contract with DOE. This Standard specifies minimum requirements to be included in the contractor's purchase order and/or technical specification.

1.2 **Applicability**: This Standard applies to procurement of HEPA filters that are rated at a minimum of 20 actual cubic feet per minute (ACFM) airflow (34 m^3/hr) at an initial resistance not to exceed 1.3 inch (in) water gauge (wg) (325 pascal (Pa)) and that are:

- to be installed in nuclear facility (Hazard Category 1, 2, 3, and radiological facilities) confinement ventilation systems; or
- to be installed in the habitability systems (e.g., filters that protect workers who must not evacuate in emergency situations because of the necessity to shutdown or control the situation).

[1] See 10 CFR 830, *Nuclear Safety Management* for definition of nuclear facility.

2. REFERENCES

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 Standard and provisions of Sections 2.2 and 2.3, the text of this Standard shall take precedence.

2.1 Rules and Orders

10 CFR 830, *Nuclear Safety Management*

40 CFR 261, *Identification and Listing of Hazardous Waste*

DOE O 414.1D, *Quality Assurance*

2.2 DOE Standards and Handbooks

DOE-STD-3009, *Preparation of Nonreactor Nuclear Facility Documented Safety Analysis*

DOE-STD-3025, *Quality Assurance Inspection and Testing of HEPA Filters*

2.3 National Consensus Standards

2.3.1 American Society for Testing and Materials (ASTM)

ASTM A 193, *Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications*

ASTM A 194, *Standard Specification for Carbon and Alloy-Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both*

ASTM A 320, *Standard Specification for Alloy-Steel and Stainless Steel Bolting for Low-Temperature Service*

ASTM A 581, *Standard Specification for Free-Machining Stainless Steel Wire and Wire Rods*

ASTM D 92, *Standard Test Method for Flash and Fire Points by Cleveland Open Cup Tester*

ASTM F 1667, *Standard Specification for Driven Fasteners: Nails, Spikes, and Staples*

2.3.2 American Society of Mechanical Engineers (ASME)

ASME AG-1, *Code on Nuclear Air and Gas Treatment*

ASME NQA -1, *Quality Assurance Requirements for Nuclear Facility Applications*

ASME B 18.21.1, *Washers: Helical Spring-Lock, Tooth Lock, and Plain Washers (Inch Series)*

2.3.3 Society of Automotive Engineers (SAE)

SAE AS 8660, S*ilicone Compound, NATO Code Number S -736*

3. DEFINITIONS

Air Density: Air density equals 0.075 lb/ft^3 (1.201 kg/m^3) for standard air. This corresponds to air at a pressure of 29.92 inches Hg (760 mm Hg) at a temperature of 69.8°F (21°C) with a specific volume of 13.33 ft^3/lb (0.832 m^3/kg). [ASME AG-1]

Airflow (ACFM): Airflow expressed in terms of actual cubic feet of air per minute (ACFM). ACFM is a measurement of volumetric flow of air with a density at actual existing conditions. [ASME AG-1]

Airflow Resistance: The resistance to airflow at the manufacturer-rated airflow of the clean filter when tested in accordance with ASME AG-1, FC-5000 or FK-5000.

Filter Test Facility: An independent facility contracted by DOE to conduct specific QA inspections and tests of HEPA filters.

High Efficiency Particulate Air (HEPA) Filter: A throwaway, extended-medium, 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 with an aerosol of 0.3 micrometer diameter.

HEPA Filter Types:

Open-Face Filters: A filter with no restrictions over the ends or faces of the unit, as opposed to the enclosed filter with reduced-size end connections.

Axial Flow Filters: A filter with airflow in a direction essentially perpendicular to the filter face.

Legacy Filters: HEPA filter configurations allowed under historic ASME codes, DOE standards, or DOE predecessor agency contractual requirements. These configurations are needed to continue to provide confinement in existing DOE nuclear facilities.

Radial Flow Filters: A filter with airflow in essentially a perpendicular direction outward from the centerline of the inside face of the filter or, conversely, inward.

Enclosed (Encapsulated) Filters: A filter that is completely enclosed on all sides and one, or both, face(s), except for reduced end connections or nipples for direct connection into a duct system.

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

Production Testing: Testing performed by the manufacturer that demonstrates that a filter meets functional and specification requirements per ASME AG-1,FC-5000 or FK-5000, as applicable.

Qualification Test: A group of tests, some destructive, of a prototype filter or production filters that demonstrates that the design meets the appropriate requirements of ASME AG-1 and

Section 6.1 of this Standard. The results of the test are considered to typify individual items or model numbers, which are of the same design and are manufactured by the same process.

Rated Airflow: The designated airflow capacity of a HEPA filter at a not to exceed initial filter resistance. [ASME AG-1]

Test Aerosol: Dispersion of particles in the air in order to test the penetration of filter medium or filters. [ASME AG-1]

4. GENERAL REQUIREMENTS

All HEPA filters specified in Section 1.2 of this Standard, shall be purchased, inspected and tested according to the general requirements of this Section and the specific requirements of Sections 5 and 6 of this Standard.

4.1 As directed by the Secretary of Energy's June 4, 2001 memorandum, *100 Percent Quality Assurance Testing of HEPA Filters At The DOE Filter Test Facility*,[2] prior to use in DOE facilities, HEPA filters meeting the following criteria shall be delivered to the FTF for additional QA inspection and testing:

4.1.1 HEPA filters that are used in confinement ventilation systems in Category 1 and Category 2 nuclear facilities that perform a safety function in accident situations, or are designated as important to safety (i.e., safety class or safety significant per DOE-STD-3009-94).[3]

4.1.2 HEPA filters necessary for habitability systems (e.g., filters that protect workers who must not evacuate in emergency situations because of the necessity to shutdown or control the situation).

4.1.3 For all other applications where HEPA filters are used in confinement ventilation systems for radioactive airborne particulate, develop and document an independent, tailored filter QA testing program that achieves a high degree of fitness for service. The program should include the testing of a sample of filters at the FTF. The size of the sample to be tested should be large enough to provide sufficient statistical power and significance to assure the required level of performance. [4]

4.2 HEPA filters shall be manufactured and qualified per ASME AG-1, Sections FC or FK, as applicable, and Sections 5, and 6.1 of this Standard, unless otherwise noted.

4.3 All HEPA filters shall be production tested by the manufacturer per ASME AG-1, FC-5000 or FK-5000, as applicable. Additionally, those filters identified in Section 4.1 of this Standard shall be tested by the FTF to the following criteria:

- Penetration at 100% of manufacturer rated airflow;
- Penetration at 20% of manufacturer rated airflow for filters rated at 125 ACFM and greater; and
- Airflow resistance at rated airflow. Maximum acceptable resistance for selected filter sizes is specified in Section 5.2.2.

[2] Memorandum included in the Secretary of Energy's June 4, 2001 letter to the Defense Nuclear Facility Safety Board

[3] Currently DOE-STD-3009-2014, *Preparation of Nonreactor Facility Documented Safety Analysis*

[4] Clarification: 100% testing is required if the cited sampling program is not utilized

Note: The FTF is exempt from performing an airflow resistance test on enclosed filters for the purposes of meeting requirements of this Standard (see Sections 5.2.2, 5.5 and Appendix B).

5. HEPA FILTER PROCUREMENT

5.1 General: HEPA filters to be installed in facilities operated by DOE or under contract to DOE shall be purchased in compliance with the specifications of this Standard. For those filters specified in Section 4.1 requiring QA inspection and testing at the FTF, the purchaser shall provide the FTF a copy of the purchase order, including any special requirements for the filter product, as a means to determine if the purchase order includes proper specifications, and that the manufacturer meets the stipulations of the purchase order. Deviations from purchase order specifications shall be referred to the purchaser by the FTF manager before FTF inspection and testing of the filters.

5.1.1 Purchase Order Requirements: The purchase order shall specify the manufacturing and testing requirements of Sections 4.2 and 4.3, along with other information listed in Appendix A.

5.1.2 Special Purchase Order Requirements: Any special requirements (e.g., special labeling, testing, packaging, etc.) shall be properly identified in the purchase order.

5.2 Performance Requirements: Mandatory performance requirements for HEPA filters are set out below. These performance requirements shall be demonstrated through testing by the manufacturer. These performance requirements shall also be demonstrated through tests and inspection by the FTF, when applicable (see Section 4.1).

5.2.1 Penetration: Aerosol penetration limits for HEPA filters shall be as specified in ASME AG-1, FC-4000 or FK-4000.

5.2.2 Resistance: Airflow resistance across the HEPA filter shall conform to the limits listed in Table 5-1 for FC filters, Table 5-3 for FK Type 1 filters, and Table 5-4 for FK Type 2 filters. For FK Type 4 filters, the resistance at any rated airflow shall not exceed 1.3 in wg (325 pa). Tests for resistance to airflow shall be conducted at flow rates expressed in ACFM.

5.3 Materials Requirements: Construction materials for HEPA filters shall be selected to avoid generation of Environmental Protection Agency-regulated wastes as specified in 40 CFR 261, *Identification and Listing of Hazardous Waste*. For this reason, cadmium is no longer acceptable for treatment of filter cases, nor is asbestos acceptable as a HEPA filter component. State and local regulations may contain additional restrictions.

5.3.1 Filter Medium: Filter medium shall be in accordance with the provisions of ASME AG-1, FC-3000 or FK-3000.

5.3.2 HEPA Filter Case Materials: Metal or wood cases shall be in accordance with ASME AG-1, FC-3000 or FK-3000. This includes end caps and grilles for ASME AG-1, FK Type 1 filters.

5.3.3 Separator Material: Separator material, including acid resistant separators, shall be in accordance with ASME AG-1, FC-3000 or FK-3000.

5.3.4 Adhesives: Adhesives shall be in accordance with ASME AG-1, FC-3000 or FK-3000.

5.3.5 Gaskets and Seals: Two qualified methods for sealing the filter to its filter frame are elastomer gaskets and gelatinous seals. Two different methods or materials shall not be used on the same filter case. If non-qualified specialty gasket material is required, its use shall be documented as described in Section 5.5.

5.3.5.1 Elastomer Gasket: Elastomer gasket materials shall be in accordance with ASME AG-1, FC-3000 or FK-3000.

5.3.5.2 Gelatinous Seal: The sealant material shall be in accordance with ASME AG-1, FC-3000 or FK-3000. The sealant shall be nonflammable as defined in ASTM D 92 (e.g., no flash at 450 °F (232 °C) or below). The gelatinous 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. Evaporation shall be less than 2% when tested in accordance with SAE AS 8660 for 24 hours at 390 °F (198 °C).

5.3.6 Face Guards: Face guards shall be in accordance with ASME AG-1, FC-3000 or FK-3000.

5.3.7 Fasteners:

5.3.7.1 Approved fasteners for the assembly of metal HEPA filter cases are listed below:

- Stainless steel bolts: 300 series per ASTM A 320 or ASTM A 193
- Stainless steel nuts: 300 series per ASTM A 194
- Stainless steel washers: 300 series per ASME B 18.21.1
- Stainless steel rivets: 300 series per ASTM A 581

5.3.7.2 Approved fasteners for the assembly of wooden HEPA filter cases are listed below:

- Nails: carbon steel, galvanized, zinc coated, aluminum per ASTM F 1667
- Staples: carbon steel, galvanized, zinc coated, aluminum per ASTM F 1667

5.4 Filter Construction: HEPA filter construction shall conform to ASME AG-1, FC-4000 and FC-6000 or FK-4000 and FK-6000, unless otherwise noted.[5]

5.4.1 Dimensions:

5.4.1.1 FC Filters: The dimensions of open-face standard HEPA filters are listed in Table 5-1. Dimensional tolerances of standard HEPA filters shall conform to those specified in Table 5-2.[6]

5.4.1.2 FK Filters: The configuration and dimensions shall be specified in the procurement documents. Tolerances shall be as specified in ASME AG-1, FK-6210.[5]

5.4.2 Filter Pack Construction:

5.4.2.1 Separatorless Filters: Filters without separators shall be in accordance with ASME AG-1, FC-4000, Type C. Dividers shall be provided as appropriate for additional support of the case and medium. The trimmed edges of the filter element shall be firmly embedded into the sealant. The two end flap edges shall have sufficient sealant to secure them to the case sides.

5.4.2.2 The medium area shall be in accordance with ASME AG-1, FC-4110 or FK-4100.

5.4.3 Filter Case: Filter cases shall be constructed to meet the following additional requirements:

5.4.3.1 Wooden Cases: Case panels shall be joined with rabbeted joints which are assembled by gluing with an adhesive meeting the requirements of Section 5.3.4 and using fasteners that comply with Section 5.3.7. The end points of the fasteners shall not penetrate the inside or outside surfaces of the case. Faces, edges, and inner surfaces of the case shall be thoroughly coated with sealant to minimize permeability. The case face sealant shall not reduce the ability of the gasket to adhere to the case. There shall be no rough edges that might penetrate or cut workers' gloves or injure the fingers of personnel handling the filters.

5.4.3.2 Metal Cases: For mechanically joined panels the space between abutting panels shall be sealed with an adhesive meeting the requirements of Section 5.3.4. There shall be no rough edges that might penetrate or cut workers' gloves or injure the fingers of personnel handling the filters.

[5] Standard HEPA filters covered under Section 5.4 should be used where practical.
[6] Different tolerances may be specified in procurement documents if acceptable in specific application.

5.4.4 Gaskets: Gaskets shall be glued firmly and continuously to the case flat surface. Loose, peeling, damaged 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 case edge 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 (sealant meeting requirement of Section 5.3.4) before assembly.

5.4.5 Face Guards: Face guards shall be installed in each face of the filter in accordance with ASME AG-1, FC-3000 or FK-3000. Wire edges formed when slitting or shearing faceguards shall be smoothed on both faces of the material before installation to prevent a puncture hazard to personnel handing the filter.

5.4.6 Gelatinous Seals: Sealant material shall be free of foreign material and without deformation. Unless a tolerance is specified in the procurement document, the channel shall be filled uniformly to the top without over filling the channel.

5.5 Legacy HEPA Filter Configurations: The confinement ventilation systems in many DOE facilities predate ASME AG-1 and ASME N509, *Nuclear Power Plant Air-Cleaning Units and Components*. These systems contain legacy HEPA filter configurations that were permissible per the contractual requirements between DOE predecessor agencies and the contractor. Other systems were designed around HEPA filter configurations that were once permitted by the ASME code or early versions of DOE Standards (i.e., NE F 3-45, *Specifications for HEPA Filters Used by DOE Contractors*). Examples of legacy HEPA filters are listed in Appendix B; however this is not an all-inclusive list.

While the preferred option is to install a HEPA filter that complies with ASME AG-1 as stated in this Standard, this is not always feasible. A legacy HEPA filter configuration is permissible as long as it conforms to the code(s) of record for the confinement ventilation system including the requirements of Section 4.1 and Section 4.3. Additionally, to the extent practical, Section 5.3, Section 6 (excluding 6.1.1 thru 6.1.3) and Section 7 shall be followed in place of the code(s) of record. For safety applications, the legacy HEPA filter purchase documents shall specify the required performance criteria of the legacy filters identified as a credited control in the Safety Basis and if needed the methods to test, inspect or verify these performance requirements above those already required by the code(s) of record. Procurement documents shall reference the type of filter that is to serve as the basis of the legacy design (ASME AG-1, Sections FC and FK Type 1, 2 or 4 filters) to determine materials, design (i.e., maximum resistance, dimensions and tolerances), and inspection and fabrication criteria. For enclosed filters, fabrication tolerances shall be provided in the procurement documents for dimensions that are not listed in ASME AG-1, FC or FK.

Table 5-1**. Nominal Sizes and Ratings for FC HEPA Filters**

Number Designation	Dimensions (inches)	Dimensions (millimeters)	Minimum Rated Airflow		Maximum Resistance	
			ACFM	m^3/hr	in wg	Pa
1	8 x 8 x 3-1/16	203x203x78	25	42	1.3	325
2	8 x 8 x 5-7/8	203x203x150	50	85	1.3	325
3	12 x 12 x 5-7/8	305x305x150	125	212	1.3	325
4	24 x 24 x 5-7/8	610x610x150	500	850	1.0	250
5	24 x 24 x 11-1/2	610x610x292	1000	1700	1.0	250
6	24 x 24 x 11-1/2	610x610x292	1250	2125	1.3	325
7	24 x 24 x 11-1/2	610x610x292	1500	2550	1.3	325
8	24 x 24 x 11-1/2	610x610x292	2000	3400	1.3	325
9	12 x 12 x 11-1/2	305x305x292	250	425	1.3	325

Notes:

1. Adopted from ASME AG-1, Table FC-4110 (see note 5).
2. Dimensions are height by width by depth.
3. The rated airflow for Section FC filters is listed in ASME AG-1 in SCFM. However, this Standard specifies ACFM which is based on tests performed indoors at an atmospheric pressure close to sea level. The temperature and pressure under which the tests have been conducted are to be recorded, but are not to be used to correct rated flow.
4. Number designation 4 filters must be qualified independently of the qualification of any larger, similar filter sizes.
5. Table FC-4110 shows a converted value of 320 Pa for 1.3 in wg except that the actual converted value should be 325 Pa.

Table 5-2. Tolerances for FC HEPA Filter Cases and Gaskets

Face Dimensions less than 24 in. (610 mm)	-1/16 in. / +0 in. (-1.6 mm / +0 mm)
Face Dimensions 24 in. (610 mm) and greater	-1/8 in. / +0 in. (-3 mm / +0 mm)
Depth	+1/16 in. / -0 in. (+1.6 mm / -0 mm)
Width of Gasket Surface and Gasket	3/4 in. ± 1/16 in. (19 mm ± 1.6 mm)
Squareness for Filter Face Dimensions	Both face diagonals are to be equal with the following tolerance: 1/8 in. (3 mm) total
Gasket Sealing Surfaces - Flat and parallel	The faces of the case shall be flat and parallel within 1/16 in. (1.6 mm)

Table 5-3. FK Type 1 Radial Flow HEPA Filters – Nominal Rating

Maximum Rated Airflow		**Maximum Resistance**	
ACFM	m^3/hr	in wg	Pa
40	68	1.3	325
100	170	1.3	325
250	425	1.3	325
500	850	1.3	325
1000	1700	1.3	325
1500	2550	1.3	325
2000	3400	1.3	325

Notes:

1. From ASME AG-1, Table FK-4000-1.
2. The rated airflow in ACFM is based on tests performed indoors at an atmospheric pressure close to sea level. The temperature and pressure under which the tests have been conducted are to be recorded, but are not to be used to correct rated flow.

Table 5-4. FK Type 2 Axial Flow Circular HEPA Filters – Nominal Rating

Maximum Rated Airflow		Maximum Resistance	
ACFM	m^3/hr	in wg	Pa
20	34	1.0	250
35	60	1.0	250
100	170	1.0	250

Notes:

1. From ASME AG-1, Table FK-4000-2
2. The rated airflow in ACFM is based on tests performed indoors at an atmospheric pressure close to sea level. The temperature and pressure under which the tests have been conducted are to be recorded, but are not to be used to correct rated flow.

6. QUALITY ASSURANCE

6.1 Manufacturer's Quality Assurance Program, Procedures, and Documentation

Filters shall be manufactured under a QA program (QAP) which has been evaluated with documented evidence of compliance with the requirements of DOE O 414.1D and ASME NQA-1 as applicable. Procurement and fabrication activities shall allow positive identification of the grades of source materials used in construction, and permit positive identification of the roll (or production run for separatorless filters) of filter medium used in the completed filter. HEPA filter production tests and inspections shall be conducted in accordance with ASME AG-1, FC-5000 or FK-5000 and with documented manufacturer's procedures. The results shall be traceable to specific lots of completed filters. Non-conformances with the above items and documentation of problems and their resolution shall be addressed in the manufacturer's QAP.

6.1.1 Qualification: Filter manufacturers shall be required to show evidence that HEPA filter designs have successfully passed the qualification and requalification testing in accordance with ASME AG-1. As specified in this Section, qualification tests are to be performed and certified by an independent test facility as defined in ASME AG-1. Tests performed on a filter manufacturer’s equipment by an independent testing organization are not acceptable.

A filter design shall be requalified when any change is made to the design or construction or composition of construction materials that could affect filter performance. Examples of changes that require requalification include: composition of filter medium; manufacture of gasket or sealant materials; filter medium method of pleat separation; and, materials or methods used to assemble filter cases.

6.1.2 Qualification Testing: Qualification tests of filter components shall be conducted in accordance with requirements of ASME AG-1, FC-5000 or FK-5000. Filters selected for qualification testing may be prototypes of the proposed design or production filters of the specific design, as long as they have been manufactured using the same method, material, equipment and processes as used during regular production. The number of filter units required for qualification testing shall be as specified in ASME AG-1.

Qualification testing shall be accomplished in accordance with ASME AG-1, FC-5000 or FK-5000, except for the following:

- Qualification of a filter design with one allowable stainless steel case material may qualify the same design with other allowable stainless steel case material as long as the case material thickness remains the same.
- Similarly, qualifying a filter design with one allowable faceguard material may qualify the same designs with all other allowable faceguard materials.

Qualification testing of a filter listed in Table 5-1 qualifies all filters with a lower flow rate, which have similar construction except:

- The number designation 4 filters shall be qualified separately.
- The number designation 2 filters cannot qualify a number designation 1.

6.1.3 Notifications on Qualification Test

Filter manufactures shall notify DOE headquarters, purchasers and the FTF within 10 business days if the following conditions exist:

- A filter design fails any or all of the initial qualification or requalification tests; or,
- A filter design is no longer qualified.

The filter manufacturer's notification shall:

- include test results and details of the design and test failure;
- identify potential impacts to other filter designs; and
- list the customers, purchase order numbers, and item descriptions for filter designs potentially impacted by the requalification failure.

As of the date of the requalification test failure, the manufacturer shall cease shipments of filters impacted by the failed design qualification or requalification test until the design can be successfully requalified.

For any filters which have already been shipped or received, DOE shall notify DOE contractor organizations to evaluate if the filter model is no longer acceptable for use in DOE facilities.

When a filter design that has previously failed a qualification test is successfully requalified, the manufacturer shall notify DOE of the successful requalification, as well as the root cause of the initial failure and the corrective actions to provide the successful requalification.

6.1.4 Random Testing: DOE reserves the right to randomly select HEPA filters from existing storage at DOE sites and perform the tests defined in Section 6.1.2. If failures are noted, DOE shall inform the manufacturer regarding appropriate action.

6.1.5 Production Testing: The manufacturer shall perform production tests for each filter manufactured in accordance with Section 4.3. The results of the production tests shall be documented and identified by serial number for each individual filter unit.

6.1.6 HEPA Filter Labeling: HEPA filters and shipping containers shall be labeled as specified in ASME AG-1, FC-9000 or FK-9000. In addition, the label shall include the date of the tests and the filter medium area.

6.2 DOE Quality Assurance Testing, Inspection and Labeling

6.2.1 Quality Assurance Inspection and Testing: Filters specified in Section 4 will be inspected, tested and recorded at a DOE designated FTF as follows:[7]

- Filter packaging and filters will be inspected for physical damage, and for compliance with specification requirements which can be checked visually.
- Each filter that passes visual inspection will be tested for penetration and resistance in accordance with the tests specified in Section 5.2.
- After the inspection and testing is completed, each filter will bear a FTF test label indicating acceptance or rejection.

6.2.2 Failure to pass the inspections or tests in Section 6.2.1 shall be the cause for filter rejection.

6.3 Quality Assurance Records

6.3.1 Quality Assurance Record Retention: Those QA and engineering records documenting performance of HEPA filter designs (i.e., design, manufacturing methods, materials and testing) shall be classified as "Lifetime Records", per ASME NQA-1. Filter manufacturers shall retain Lifetime Records no less than 15 years from date of manufacture.

[7] See DOE-STD-3025, *Quality Assurance Inspection and Testing of HEPA Filters* for details

6. PACKAGING, SHIPPING, AND STORAGE

7.1 Packaging, Shipping and Storage

7.1.1 Packaging, shipping, and storage shall be in accordance with ASME AG-1 and ASME NQA-1, Level B requirements.

7.1.2 Filters shall not be stacked more than three (3) high. At all times, the filters shall be handled with care and properly orientated.

7.1.3 Filters sent to the FTF for testing shall include only HEPA filters. Any spare parts shall be shipped directly to the purchaser.

7.2 Packaging

7.2.1 Filter packaging shall be designed so that they can be opened, and the filter removed, without damage to the container, carton or the filter and, so that the container can be reused for shipment to alternate destinations.

7.2.2 Filters with gelatinous seals shall be packaged in a manner so as to prevent contact with or contamination of the gelatinous seal during transport or un-packaging.

7.3 Shipping

7.3.1 Shipping containers shall conform to the requirements of ASME NQA-1, Part II, Subpart 2.2, Paragraph 307 and the following requirements:

- acceptable paragraph 307.1 type containers are: (a) cleated, sheathed boxes, (b) nailed, screwed, or bolted wood box, or (e) crate;
- Styrofoam "peanuts" or shredded material shall not be used between the filter packaging and shipping container as this creates handling problems;
- barrier and wrap materials shall be noncorrosive and shall not be otherwise harmful to packaged filters;
- container lid/top shall be secured with removable screws or lag bolts;
- container shall be configured to permit movement by a pallet jack (i.e. provided with skids or placed on a pallet);
- containers shall be reusable for shipment to alternate destinations; and,
- fasteners (e.g., nails, screws, etc.) shall not protrude into the container that could potentially damage HEPA filters or place workers at risk of injury while handling filter packages before the filters are shipped.

7.3.2 The only exception to the requirements in Section 7.3.1 is for a single filter weighing less than 10 lbs. and no dimension greater than 10 inches. This filter may be shipped in a US Postal Service-acceptable cardboard shipping container via a package delivery company with the approval of the purchaser.

7.3.3 Shipping through the FTF: HEPA filters to be tested by the DOE designated FTF shall be shipped to the address below, freight prepaid, as agreed to by the purchaser and the manufacturer.

Air Techniques International
Filter Test Facility
1708 Whitehead Road
Baltimore, Maryland 21207

Following satisfactory completion of inspections and tests specified in Section 6.2, the FTF shall repack the tested filters in a manner comparable to the received packaging, and forward them to the address specified by the purchaser, freight collect.

7.3.4 Shipping Directly to the Site: HEPA filters that are not required to be tested by the FTF shall be shipped directly to the address specified by the purchaser.

7.4 Disposition of Damaged or Rejected Filters

7.4.1 Filters Damaged Before Receipt at FTF: Filter manufacturers shall notify the purchaser if filters were damaged during shipment and returned to manufacturer.

7.4.2 Filters at FTF: Purchasers shall provide written instructions for dispositioning filters found to be damaged or rejected by the FTF.

7.4.3 Site Receipt Inspection Filters: Rejected filters from site inspection shall be dispositioned by the purchaser, in accordance with written agreement between the purchaser and manufacturer.

Appendix A. Purchase Order Information

At a minimum, the following information should be included in purchase orders for filters that are to be inspected and tested at the Filter Test Facility (FTF):

- Purchaser
- Purchase order number
- Date of purchase order
- Item number
- Manufacturer
- Description of filter including:
  - Filter size;
  - Filter model number;
  - Filter type;
  - Gasket or seal types;
  - Filter case materials; and
  - Rated flow, resistance, and efficiency.
- Number of filters ordered
- Inspection and testing requirements and standards with revision number (e.g., testing to specific provisions in ASME AG-1,*Code on Nuclear Air and Gas Treatment*, DOE-STD-3020, *Specification for HEPA Filters Used by DOE Contractors*, and/or special testing provisions)
- Packaging, shipping, and storage requirements (See Section 7 of this Standard)
- Point-of-contact information including name, title, company, e-mail and phone number for the FTF to contact the purchaser for questions related to the purchase order
- Dimensions and tolerances for “legacy” filters
- Identification of any items not to be shipped with filters to the FTF
- Shipping information:
  - Shipping instructions (including ship to address);
  - Shipping authorization for filters to be shipped from FTF to the site;
  - Written instructions for dispositioning filters found to be damaged or rejected by the FTF; and
  - A requirement for the manufacture to send a return shipping authorization within 10 workings of being notified by the purchaser that filter(s) have been rejected by the FTF.

Note: This Standard specifies design and testing requirements that meet ASME AG-1. However, in certain situations, the purchaser may specify in the purchase order or in the accompanying technical specification, additional performance criteria in excess of those established by ASME AG-1 based on specific facility design requirements. In such cases, the purchaser may include technical requirements for the enhanced filter performance, and identify any additional performance tests and associated quality assurance requirements.

Appendix B. Examples of Legacy HEPA Filters

HEPA filters with ½" verse ¾" double turned flanges.

HEPA filters with gasket thicknesses greater or less than ¼" thick.

HEPA filters with extended cases to facilitate installation of disposable pre-filter pads.

Encapsulated HEPA Filter designs (included as ASME AG-1 Section FK Type 3 filters between September 2009 and March 2010).

HEPA filters that use high temperature sealant and gaskets.

HEPA filters with pipe thread connections in place of gasket or gel seals.

HEPA filters with medium velocity greater than 5 fpm (permitted per ASME N509, *Nuclear Power Plant Air Cleaning Units and Components -1980 and 1989*).

HEPA filters where design qualification was based on DOE Nuclear Standard NE F 3-45, *Specifications for HEPA Filters Used by DOE Contractors*, October 1988, which provided latitude to the DOE field elements and contractors, related to design qualification.