SECTION 234133 - HIGH-EFFICIENCY PARTICULATE AIR FILTRATION

Revise this Section by deleting and inserting text to meet Project-specific requirements.

Verify that Section titles referenced in this Section are correct for this Project's Specifications; Section titles may have changed.

This Section may include provisions for LEED 2009, LEED v4, ASHRAE 189.1, IgCC, and Green Globes. Note that some sustainable design requirements are either mandatory or optional requirements that may be inserted in the Section Text using the hypertext links. Other requirements that are associated with sustainable design, and may be considered "best practice" or retained even if a sustainable design standard is not a project requirement, are discussed in the Evaluations.

1. GENERAL
	* + 1. RELATED DOCUMENTS

Retain or delete this article in all Sections of Project Manual.

* + - * 1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
			1. SUMMARY
				1. Section Includes:

HEPA rigid-cell box filters.

HEPA V-bank cell filters.

HEPA filter diffusers.

HEPA filter fan modules.

ULPA filters.

95 percent DOP filters.

HEPA/ULPA filter holding frames.

Side-access HEPA/ULPA filter housings.

Side-access HEPA/ULPA filter containment housings.

HEPA, ULPA, and 95 percent DOP filter gauges.

* + - 1. DEFINITIONS

Retain terms that remain after this Section has been edited for a project.

* + - * 1. DOP: Dioctyl phthalate.
				2. HEPA: High-efficiency particulate air.
				3. PAO: Poly-alpha-olefin.
				4. PSL: Polystyrene latex.
				5. ULPA: Ultralow penetration air.
			1. CLOSEOUT SUBMITTALS
				1. Operation and Maintenance Data: For each type of filter and rack to include in emergency, operation, and maintenance manuals.
			2. MAINTENANCE MATERIAL SUBMITTALS
				1. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

Provide [**one**] <**Insert number**> complete set(s) of filters for each filter bank. If system includes prefilters, provide only prefilters.

* + - 1. QUALITY ASSURANCE

Retain "Testing Agency Qualifications" Paragraph below to require a UL, a CE, or an ETL marking. Qualification requirements are in addition to those specified in Section 014000 "Quality Requirements," which also defines "NRTL" (nationally recognized testing laboratory).

* + - * 1. Testing Agency Qualifications: An NRTL.
			1. DELIVERY, STORAGE, AND HANDLING
				1. Deliver and store products in a clean, dry place.
				2. Comply with manufacturer's written rigging and installation instructions for unloading and moving to final installed location.
				3. Handle products carefully to prevent damage, breaking, denting, and scoring. Do not install damaged products.
				4. Protect products from weather, dirt, dust, water, construction debris, and physical damage.

Retain factory-applied coverings on equipment to protect finishes during construction and remove just prior to operating unit.

Cover unit openings before installation to prevent dirt and dust from entering inside of units. If required to remover coverings during unit installation, reapply coverings over openings after unit installation and remove just prior to operating unit.

Replace installed products damaged during construction.

1. PRODUCTS

Manufacturers and products listed in SpecAgent and MasterWorks Paragraph Builder are neither recommended nor endorsed by the AIA or Deltek. Before inserting names, verify that manufacturers and products listed there comply with requirements retained or revised in descriptions and are both available and suitable for the intended applications. For definitions of terms and requirements for Contractor's product selection, see Section 016000 "Product Requirements."

* + - 1. PERFORMANCE REQUIREMENTS

Retain "Seismic Performance" Paragraph below with "Seismic Qualification Data" Paragraph in "Informational Submittals" Article for projects requiring seismic design. Delete paragraph if performance requirements are indicated on Drawings. Model building codes and ASCE/SEI 7 establish criteria for buildings subject to earthquake motions. Coordinate requirements with structural engineer.

* + - * 1. Seismic Performance: HEPA Filters with fan module assemblies shall withstand the effects of earthquake motions determined according to [**ASCE/SEI 7**] <**Insert requirement**>.

Retain first subparagraph below to define the term "withstand" as it applies to this Project. Definition varies with type of building and occupancy and is critical to valid certification. Option is used for essential facilities where equipment must operate immediately after an earthquake.

The term "withstand" means "the unit will remain in place without separation of any parts when subjected to the seismic forces specified[**and the unit will be fully operational after the seismic event**]."

For life-safety components required to function after an earthquake (such as fire-sprinkler systems, components that contain hazardous content, and storage racks in structures open to the public), the Component Importance Factor is 1.5. For other components, the Component Importance Factor is 1.0 unless the structure is in Seismic Use Group III and component is necessary for continued operation of facility or failure of component could impair continued operation of facility, in which case the Component Importance Factor is 1.5.

Component Importance Factor: [**1.5**] [**1.0**].

"ASHRAE 62.1 Compliance" Paragraph below may be required to comply with Project requirements or authorities having jurisdiction. LEED 2009 IEQ Prerequisite 1 and LEED v4 "Minimum Indoor Air Quality Performance" require compliance with requirements in ASHRAE 62.1, including requirements for controls, surfaces in contact with the airstream, particulate and gaseous filtration, humidification and dehumidification, drain pan construction and connection, finned-tube coil selection and cleaning, and equipment access. Consult manufacturers to verify availability of units having components and features that comply with these requirements.

* + - * 1. ASHRAE 62.1 Compliance:

Comply with applicable requirements in ASHRAE 62.1, Section 4 - "Outdoor Air Quality"; Section 5 - "Systems and Equipment"; and Section 7 - "Construction and Startup."

* + - * 1. Comply with NFPA 90A and NFPA 90B.

UL 900 no longer has dual class, Class 1/Class 2, distinctions. See the Evaluations.

* + - * 1. Comply with UL 900.
				2. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended use.
				3. Capacities and Characteristics:

If Project has more than one type or configuration of filter, delete this article and schedule filters on Drawings.

Drawing Tag No.: <**Insert designation**>.

Face Size: [**24 by 24 inches (600 by 600 mm)**] [**24 by 12 inches (600 by 300 mm)**] [**12 by 24 inches (300 by 600 mm)**] <**Insert dimensions**>.

Depth: <**Insert number**> inches (mm) nominal.

Surface Area: <**Insert number**> sq. ft. (sq. m).

Number of Filters, Wide by High: <**Insert number wide by number high**>.

System Airflow: <**Insert number**> cfm (L/s).

Maximum or Rated Face Velocity: <**Insert number**> fpm (m/s).

Initial Resistance: <**Insert number**> inches wg (Pa).

Recommended Final Resistance: <**Insert number**> inches wg (Pa).

Access: [**Front**] [**Back**] [**Side**].

Performance Level: [**99.97 percent HEPA**] [**99.9997 percent ULPA**] [**95 percent DOP**] <**Insert requirement**>.

* + - 1. HEPA RIGID-CELL BOX FILTERS
				1. Description: Factory-fabricated, disposable, packaged air filters with media perpendicular to airflow and with holding frames.

[Manufacturers:](http://www.specagent.com/Lookup?ulid=11822) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[AAF International](http://www.specagent.com/Lookup?uid=123457116159).

[AirGuard; Clarcor Air Filtration Products, Inc](http://www.specagent.com/Lookup?uid=123457116165).

[Air-Nu](http://www.specagent.com/Lookup?uid=123457116162).

[Camfil Farr](http://www.specagent.com/Lookup?uid=123457116160).

[Flanders Corporation](http://www.specagent.com/Lookup?uid=123457116161).

[Glasfloss Industries](http://www.specagent.com/Lookup?uid=123457116164).

Approved equivalent.

* + - * 1. Source Limitations: Obtain from single source from single manufacturer.
				2. Standards:

Comply with IEST-RP-CC001.6.

Comply with UL 586.

Comply with IEST-RP-CC034.4.

* + - * 1. Media: Fibrous material, constructed so individual pleats are maintained under rated-airflow conditions.

Internal Separators: [**None**] [**Corrugated aluminum**] <**Insert type**>.

Media to Filter Frame Seal Material: [**Polyurethane**] <**Insert material**>.

In "Faceguard Material" Subparagraph below, not all manufacturers offer each material type; consult manufacturers.

Faceguard Material: [**Aluminum**] [**Stainless steel**] <**Insert material**>.

Faceguard Location: [**None**] [**Upstream**] [**and**] [**downstream**].

* + - * 1. Filter-Media Frames:

Particleboard contains urea formaldehyde. Retain one of five options in "Material" Subparagraph below if required for sustainable design systems. Not all manufacturers offer each type; consult manufacturers.

Material: [**Fire-retardant plywood**] [**Aluminum**] [**Fire-retardant particleboard**] [**Galvanized steel**] [**Non-fire-retardant particleboard**] <**Insert material**>.

Filter Frame to Mounting Frame Seal Material: [**Neoprene**] [**Knife edge in silicone gel-filled channel**] [**Knife edge in urethane gel-filled channel**] <**Insert material**>.

Filter Frame to Mounting Frame Seal Location: [**Upstream**] [**Downstream**].

Style: [**Box**] [**Gel track**] <**Insert style**>.

* + - 1. HEPA V-BANK CELL FILTERS
				1. Description: Factory-fabricated, disposable, packaged air filters with media at an angle to airflow and with holding frames.

[Manufacturers:](http://www.specagent.com/Lookup?ulid=11823) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[AAF International](http://www.specagent.com/Lookup?uid=123457116166).

[Camfil Farr](http://www.specagent.com/Lookup?uid=123457116167).

[Flanders Corporation](http://www.specagent.com/Lookup?uid=123457116168).

Approved equivalent.

* + - * 1. Source Limitations: Obtain from single source from single manufacturer.
				2. Standards:

Comply with IEST-RP-CC001.6.

Comply with UL 586.

Comply with IEST-RP-CC034.4.

* + - * 1. Media: Fibrous material, constructed so individual pleats are maintained under rated-airflow conditions.

Internal Separators: [**None**] [**Corrugated aluminum**] <**Insert type**>.

Media to Filter Frame Seal Material: [**Polyurethane**] <**Insert sealant**>.

* + - * 1. Filter-Media Frames:

Particleboard contains urea formaldehyde. Retain one of five options in "Material" Subparagraph below if required for sustainable design systems. Not all manufacturers offer each type; consult manufacturers.

Material: [**Fire-retardant plywood**] [**Aluminum**] [**Fire-retardant particleboard**] [**Galvanized steel**] [**Non-fire-retardant particleboard**] <**Insert material**>.

Filter Frame to Mounting Frame Seal Material: [**Neoprene**] [**Knife edge in silicone gel-filled channel**] [**Knife edge in urethane gel-filled channel**] <**Insert material**>.

Filter Frame to Mounting Frame Seal Location: [**Upstream**] [**Downstream**].

Style: [**Box**] [**Gel track**] <**Insert style**>.

* + - 1. HEPA FILTER DIFFUSERS
				1. Description: Factory-fabricated, individually ducted, HEPA filter-holding ceiling modules.

[Manufacturers:](http://www.specagent.com/Lookup?ulid=11824) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[AAF International](http://www.specagent.com/Lookup?uid=123457116169).

[AirGuard; Clarcor Air Filtration Products, Inc](http://www.specagent.com/Lookup?uid=123457116174).

[Camfil Farr](http://www.specagent.com/Lookup?uid=123457116170).

[Envirco](http://www.specagent.com/Lookup?uid=123457116173).

[Flanders Corporation](http://www.specagent.com/Lookup?uid=123457116171).

[Microzone Corporation](http://www.specagent.com/Lookup?uid=123457116172).

Approved equivalent.

* + - * 1. Source Limitations: Obtain from single source from single manufacturer.
				2. Standards:

Comply with IEST-RP-CC001.6.

Comply with UL 586.

Comply with IEST-RP-CC034.4.

* + - * 1. Media: Fibrous glass, constructed of continuous sheets with closely spaced pleats with separators.

Media to Frame Side Bond: Urethane or polyurethane sealant.

Frame to Grid Bond: <**Insert type of gasket**> [**gasket**] [**Knife edge for gel-filled channel**].

Application: [**Class 100,000 (ISO 8)**] [**Class 10,000 (ISO 7)**] [**Class 1,000 (ISO 6)**] [**Class 100 (ISO 5)**] [**Class 10 (ISO 4)**] <**Insert class**> clean room.

* + - * 1. Casing:

Configuration: [**Ducted**] [**Plenum**] inlet.

Module Material: [**Minimum 16-gauge (0.508-mm) extruded aluminum**] <**Insert gauge and material**> with [**mill**] <**Insert type**> finish.

Suspension: [**Ceiling grid**] [**Independent**].

* + - * 1. Accessories:

[**Fixed**] [**Adjustable**] diffusion damper.

Diffusion-damper adjustment port.

Filter test port.

* + - 1. HEPA FILTER FAN MODULES
				1. Description: Factory-fabricated, HEPA filter ceiling module with fan.

[Manufacturers:](http://www.specagent.com/Lookup?ulid=11825) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[AAF International](http://www.specagent.com/Lookup?uid=123457116175).

[Camfil Farr](http://www.specagent.com/Lookup?uid=123457116178).

[Envirco](http://www.specagent.com/Lookup?uid=123457116177).

[Microzone Corporation](http://www.specagent.com/Lookup?uid=123457116176).

Approved equivalent.

* + - * 1. Source Limitations: Obtain from single source from single manufacturer.
				2. Standards:

Comply with IEST-RP-CC001.6.

Comply with UL 586.

Comply with IEST-RP-CC034.4.

* + - * 1. Media: Fibrous glass, constructed of continuous sheets with closely spaced pleats with separators.

Frame Material: [**Aluminum**] <**Insert material**>.

Media to Frame Side Bond: Urethane or polyurethane sealant.

Frame to Grid Bond: <**Insert type of gasket**> [**gasket**] [**Knife edge for gel-filled channel**].

Application: [**Class 100,000 (ISO 8)**] [**Class 10,000 (ISO 7)**] [**Class 1,000 (ISO 6)**] [**Class 100 (ISO 5)**] [**Class 10 (ISO 4)**] <**Insert class**> clean room.

Faceguard: [**Stainless steel**] <**Insert material**>.

* + - * 1. Casing:

Configuration: [**Ducted inlet**] [**Plenum inlet**] [**Plenum inlet with MERV 8 prefilter**].

Module Material: [**Minimum 16-gauge (0.508-mm) extruded aluminum**] <**Insert gauge and material**> with [**mill**] <**Insert type**> finish.

Suspension: [**Ceiling grid**] [**Independent**].

* + - * 1. Accessories: Filter test port.
				2. Motor:

Default motor characteristics are specified in Section 230513 "Common Motor Requirements for HVAC Equipment."

Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."

Type: [**Permanent-split capacitor with SCR for speed adjustment**] [**Electronically commutated motor**].

Verify enclosure types available from manufacturer for specified equipment. Delete remaining subparagraphs below if fan section characteristics are indicated on Drawings.

Fan-Motor Assembly Isolation: Rubber isolators.

Enclosure: <**Insert type**>.

Enclosure Materials: <**Insert type**>.

Motor Bearings: <**Insert special requirements**>.

Unusual Service Conditions:

Ambient Temperature: <**Insert number**>deg F (deg C).

Altitude: <**Insert number**> feet (m) above sea level.

Retain first subparagraph below if required to suit Project.

High humidity.

<**Insert conditions**>.

Efficiency: Premium efficient.

NEMA Design: <**Insert designation**>.

Service Factor: <**Insert value**>.

Motor Speed: [**Single speed**] [**Multispeed**] [**with variable-speed control**].

Retain "Electrical Characteristics" Subparagraph below if characteristics are not included on Drawings.

Electrical Characteristics:

Horsepower: <**Insert number**> hp.

Volts: [**120**] [**208**] [**230**] [**460**] <**Insert number**> V.

Phase: [**Single**] [**Three**].

Hertz: 60 Hz.

Full-Load Amperes: <**Insert number**> A.

Minimum Circuit Ampacity: <**Insert number**> A.

Maximum Overcurrent Protection: <**Insert number**> A.

* + - 1. ULPA FILTERS
				1. Description: Factory-fabricated ULPA filters with holding casing.

[Manufacturers:](http://www.specagent.com/Lookup?ulid=11826) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[AAF International](http://www.specagent.com/Lookup?uid=123457116179).

[AirGuard; Clarcor Air Filtration Products, Inc](http://www.specagent.com/Lookup?uid=123457116184).

[Camfil Farr](http://www.specagent.com/Lookup?uid=123457116181).

[Flanders Corporation](http://www.specagent.com/Lookup?uid=123457116182).

Approved equivalent.

* + - * 1. Source Limitations: Obtain from single source from single manufacturer.
				2. Standards:

Comply with IEST-RP-CC001.6.

Comply with UL 586.

Comply with IEST-RP-CC007.3.

Comply with IEST-RP-CC034.4.

* + - * 1. Media: Fibrous material, constructed of continuous sheets with closely spaced pleats that are maintained under rated-airflow conditions.

Internal Separators: [**None**] [**Corrugated aluminum**] <**Insert type**>.

Media to Filter Frame Seal Material: [**Polyurethane**] <**Insert material**>.

In "Faceguard Material" Subparagraph below, not all manufacturers offer each material type; consult manufacturers.

Faceguard Material: [**Aluminum**] [**Stainless steel**] <**Insert material**>.

Faceguard Location: [**None**] [**upstream**] [**and**] [**downstream**].

* + - * 1. Filter-Media Frames:

Particleboard contains urea formaldehyde. Retain one of five options in "Material" Subparagraph below if required for sustainable design systems. Not all manufacturers offer each type; consult manufacturers.

Material: [**Fire-retardant plywood**] [**Aluminum**] [**Fire-retardant particleboard**] [**Galvanized steel**] [**Non-fire-retardant particleboard**] <**Insert material**>.

Filter Frame to Mounting Frame Seal Material: [**Neoprene**] [**Silicone Gel**] [**Urethane Gel**] <**Insert material**>.

Filter Frame to Mounting Frame Seal Location: [**Upstream**] [**Downstream**].

Style: [**Box**] [**Gel track**] <**Insert style**>.

* + - 1. 95 PERCENT DOP FILTERS

The term "95 percent DOP filters" is still used by the majority of manufacturers as a label for this filter type. However, DOP is now considered a potentially hazardous substance and is no longer used for filter efficiency and integrity testing. PAO or PSL spheres are now used.

* + - * 1. Description: Factory-fabricated, 95 percent DOP filters with holding casing.

[Manufacturers:](http://www.specagent.com/Lookup?ulid=11827) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[AAF International](http://www.specagent.com/Lookup?uid=123457116185).

[AirGuard; Clarcor Air Filtration Products, Inc](http://www.specagent.com/Lookup?uid=123457116188).

[Camfil Farr](http://www.specagent.com/Lookup?uid=123457116186).

[Flanders Corporation](http://www.specagent.com/Lookup?uid=123457116187).

Approved equivalent.

* + - * 1. Source Limitations: Obtain filters from single source from single manufacturer.
				2. Media: Fibrous material, constructed of continuous sheets with closely spaced pleats that are maintained under rated-airflow conditions.

Internal Separators: [**None**] [**Corrugated aluminum**] <**Insert type**>.

Media to Filter Frame Seal Material: [**Polyurethane**] <**Insert material**>.

In "Faceguard Material" Subparagraph below, not all manufacturers offer each material type; consult manufacturers.

Faceguard Material: [**Aluminum**] [**Stainless steel**] <**Insert material**>.

Faceguard Location: [**None**] [**Upstream**] [**Downstream**].

* + - * 1. Filter-Media Frames:

Particleboard contains urea formaldehyde. Retain one of five options in "Material" Subparagraph below if required for sustainable design systems. Not all manufacturers offer each type; consult manufacturers.

Material: [**Fire-retardant plywood**] [**Aluminum**] [**Fire-retardant particleboard**] [**Galvanized steel**] [**Non-fire-retardant particleboard**] <**Insert material**>.

Filter Frame to Mounting Frame Seal Material: [**Neoprene**] [**Knife edge in silicone gel-filled channel**] [**Knife edge in urethane gel-filled channel**].

Filter Frame to Mounting Frame Seal Location: [**Upstream**] [**Downstream**].

Style: [**Box**] [**Gel track**] <**Insert style**>.

* + - 1. HEPA/ULPA FILTER HOLDING FRAMES

Copy and re-edit this article for each type of HEPA/ULPA filter holding frame.

* + - * 1. Description: Framing members with access for upstream (front) or downstream (back) filter servicing, cut to size and prepunched for assembly into modules, specifically designed for HEPA/ULPA/95 percent DOP filter banks.
				2. Source Limitations: Obtain from single source from single manufacturer.
				3. Material: Minimum 14-gauge (1.9-mm) [**stainless-**] [**or**] [**galvanized-**]steel framing members. Factory-prepunched holes and dimples for ease of filter alignment and assembly.
				4. Prefilters: Incorporate a separate holding frame for prefilter, removable from front or back.

Retain "Gasketed Sealing" or "Knife-Edge Sealing" Paragraph below. Coordinate with seal types retained within filter articles.

* + - * 1. Gasketed Sealing: Factory-installed, positive-sealing device for each filter to ensure seal between gasketed filter elements to prevent bypass of unfiltered air. Filter latching mechanism to seat each filter firmly against holding frame surface.
				2. Knife-Edge Sealing: Knife-edge to mate with [**HEPA**] [**and**] [**ULPA**] filter elements to prevent bypass of unfiltered air. Factory-installed, positive-locking mechanism for each filter to seat the knife edge into the gel during installation and to remove the filter from the knife edge during filter replacement.
			1. SIDE-ACCESS HEPA/ULPA FILTER HOUSINGS

Copy and re-edit this article for each type of side-access HEPA/ULPA filter housing.

* + - * 1. Description: Factory-assembled, side-access filter housings, specifically designed for HEPA/ULPA/95 percent DOP filter banks, with flanges to connect to duct or casing system.

[Manufacturers:](http://www.specagent.com/Lookup?ulid=13324) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[AAF International](http://www.specagent.com/Lookup?uid=123457116193).

[AirGuard; Clarcor Air Filtration Products, Inc](http://www.specagent.com/Lookup?uid=123457116199).

[Camfil Farr](http://www.specagent.com/Lookup?uid=123457116195).

[Flanders Corporation](http://www.specagent.com/Lookup?uid=123457116196).

Approved equivalent.

* + - * 1. Source Limitations: Obtain from single source from single manufacturer.

In "Factory Testing" Paragraph below, coordinate specified percentage leakage with manufacturers.

* + - * 1. Factory Testing: Factory pressure test housing and sealed joints at [**6.0-inch wg (1500 Pa)**] <**Insert value**>. Document and submit to confirm maximum <**Insert percentage**> leakage.

In "Materials" Paragraph below, not all manufacturers offer each option; consult manufacturers.

* + - * 1. Materials: [**Galvanized steel**] <**Insert material**> [**double-wall casing with 1-inch (25-mm) insulation**] [**double-wall casing with 2-inch (50-mm) insulation**].

Pressure taps and fittings.

DOP test ports.

Mounted magnehelic gauges.

Not all manufacturers offer both options listed in "Prefilters" Paragraph below; consult manufacturers.

* + - * 1. Prefilters: Integral tracks to accommodate [**2-inch- (50-mm-)**] [**4-inch- (100-mm-)**] <**Insert dimension**> thick, disposable [**or washable**]filters.
				2. Access Doors: [**Hinged, with continuous**] [**Continuous**] gaskets on perimeter and positive-locking devices. Arranged for filter access from [**one-side**] [**both-sides**] access door.

Retain "Gasketed Sealing" or "Knife-Edge Sealing" Paragraph below. Coordinate with seal types retained within filter articles.

* + - * 1. Gasketed Sealing: Factory-installed, positive-sealing device for each filter to ensure seal between gasketed filter elements to prevent bypass of unfiltered air. Filter latching mechanism to seat each filter firmly against side-access housing channel surface.
				2. Knife-Edge Sealing: Knife-edge to mate with [**HEPA**] [**and**] [**ULPA**] filter elements to prevent bypass of unfiltered air. Factory-installed, positive-locking mechanism for each filter to seat the knife edge into the gel during installation and to remove the filter from the knife edge during filter replacement.
			1. SIDE-ACCESS HEPA/ULPA FILTER CONTAINMENT HOUSINGS

Copy and re-edit this article for each type of side-access HEPA/ULPA filter containment housing.

* + - * 1. Description: Factory-assembled, side-access housings, with bag in/bag out feature to protect maintenance personnel from coming into direct contact with the interior of the housing and the contaminated filter media during required filter change out, with flanges to connect to duct or casing system.

* + - * 1. [Manufacturers:](http://www.specagent.com/Lookup?ulid=13321) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[AAF International](http://www.specagent.com/Lookup?uid=123457116189).

[Camfil Farr](http://www.specagent.com/Lookup?uid=123457116190).

[Flanders Corporation](http://www.specagent.com/Lookup?uid=123457116191).

Approved equivalent.

* + - * 1. Source Limitations: Obtain from single source from single manufacturer.

Although ASME AG-1 (incorporating ASME N510) primarily pertains to the nuclear industry, it is commonly accepted as a standard for any industries/applications where containment housings are applicable.

* + - * 1. Standards: Test according to ASME AG-1.
				2. Casing:

Material: Constructed of minimum 16-gauge- (1.5-mm-) thick, [**galvanized steel**] [**stainless steel**] [**, double-wall casing with 2-inch (50-mm) fiberglass insulation,**] to hold filters. Side servicing through gasketed access doors on one side. Equip housings to be capable of connection to other housings. Equip housings with metal slide channel tracks and locking mechanisms to hold filters, and the following:

Pressure gauge tap and fitting.

Although "DOP" is no longer used for filter integrity testing, the term is used as a generic term referring to filter integrity testing, which is now more commonly done with PAO or PSL spheres.

DOP test ports.

Lifting lugs.

Casing Pressure: Casing constructed for up to [**positive/negative 6.0-inch wg (1500 Pa)**] [**positive/negative 10-inch wg (2500 Pa)**] <**Insert casing pressure requirement**>.

Isolation dampers can be located on both sides of the filter and can be used to isolate the filter bank during changeout.

* + - * 1. Isolation Dampers:

Material: Stainless-steel body, blade, and flanges.

Round Damper Blade: <**Insert diameter**> damper, replaceable, solid silicone gasket sandwiched between stainless-steel plates, providing silicone gasket blade to knife edge seal.

Although ASME N509 primarily pertains to the nuclear industry, it is commonly accepted as a standard for any industries/applications where containment housings are applicable.

Bubble-tight seal at minimum 10-inch wg (2490-Pa) differential pressure to comply with ASME N509.

Not all manufacturers offer each option in "Prefilters" Paragraph below; consult manufacturers.

* + - * 1. Prefilters: Integral tracks to accommodate [**2-inch- (50-mm-)**] [**4-inch- (100-mm-)**] thick, disposable filters.

Retain first option in "Access Doors" Paragraph below for locations that require a ladder or are difficult to reach.

* + - * 1. Access Doors: Continuous gaskets on perimeter and positive-locking devices. Provide ribbed bagging rim behind access door and PVC bags for bag-in, bag-out arrangement. Arrange so filter cartridges can be loaded from an access door for each tier and section of the following:

Retain one of three subparagraphs below.

Combination prefilter and HEPA filter.

HEPA filter.

Test sections facilitate field verification of HEPA filter performance.

Upstream and downstream test section.

Retain "Gasketed Sealing" or "Knife-Edge Sealing" Paragraph below. Coordinate with seal types retained within filter articles.

* + - * 1. Gasketed Sealing: Factory-installed, positive-sealing device for each filter to ensure seal between gasketed filter elements to prevent bypass of unfiltered air. Filter locking mechanism to seat each filter firmly against side-access housing channel surface.
				2. Knife-Edge Sealing: Knife-edge to mate with [**HEPA**] [**and**] [**ULPA**] filter elements to prevent bypass of unfiltered air. Factory-installed, positive-locking mechanism for each filter to seat the knife edge into the gel during installation and to remove the filter from the knife edge during filter replacement.
				3. Accessories:

Retain first two subparagraphs below for locations that require a ladder or are difficult to reach, or for heavy filter cartridges.

Filter change-out trays.

Document-storage pocket.

Retain subparagraph below for multiple-width housings.

Filter removal rod.

* + - 1. HEPA, ULPA, AND 95 PERCENT DOP FILTER GAUGES
				1. Diaphragm type with dial and pointer in metal case, vent valves, black figures on white background, and front recalibration adjustment.

[Manufacturers:](http://www.specagent.com/Lookup?ulid=13326) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[Ashcroft Inc](http://www.specagent.com/Lookup?uid=123457116207).

[Dwyer Instruments, Inc](http://www.specagent.com/Lookup?uid=123457116209).

[Orange Research](http://www.specagent.com/Lookup?uid=123457116210).

Approved equivalent.

* + - * 1. Source Limitations: Obtain from single source from single manufacturer.

Diameter: [**4-1/2 inches (115 mm)**] [**2-1/2 inches (75 mm)**] <**Insert dimension**>.

Material: [**Stainless-steel**] <**Insert material**> case and [**die-cast aluminum**] [**stainless-steel**] <**Insert material**> body with [**wetted material matching body material**] <**Insert wetted material**>.

Accuracy: [**Plus/minus 2 percent of full scale**] <**Insert accuracy**>.

Revise scale range in first subparagraph below to match expected pressure differences.

Scale Range for Filter Media Having a Recommended Final Resistance of 2.0- to 3.0-Inch wg (500 to 750 Pa) or Less: 0- to 3.0-inch wg (0 to 750 Pa).

Scale Range for Filter Media Having a Recommended Final Resistance of 3.0- to 4.0-Inch wg (750 to 1000 Pa) or Less: 0- to 4.0-inch wg (0 to 1000 Pa).

* + - * 1. Accessories: Static-pressure tips, tubing, gauge connections, and mounting bracket.
1. EXECUTION
	* + 1. EXAMINATION
				1. Examine ducts, air-handling units, and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
				2. Proceed with installation only after unsatisfactory conditions have been corrected.
			2. INSTALLATION OF FILTERS
				1. Position each filter unit with clearance for normal service and maintenance. Anchor filter holding frames to substrate.
				2. Install filters in position to prevent passage of unfiltered air.

Air-handling units should not be used for temporary heating and ventilating unless expressly approved by Director’s Representative. If used during construction, see SMACNA's "IAQ Guidelines for Occupied Buildings under Construction" for procedures to protect HVAC system.

* + - * 1. Do not operate fan system until filters (temporary or permanent) are in place. Replace temporary filters that were used during construction and testing with new, clean filters.
				2. Coordinate filter installations with duct and air-handling unit installations.
			1. INSTALLATION OF HEPA, ULPA, AND 95 PERCENT DOP FILTER GAUGES
				1. Install filter gauge for each filter bank.
				2. Install filter-gauge, static-pressure tips upstream and downstream from filters. Install filter gauges on filter banks with separate static-pressure taps upstream and downstream from filters. Mount filter gauges on outside of filter housing or filter plenum in an accessible position. Adjust and level inclined gauges.
			2. CONTROL CONNECTIONS
				1. Install control and electrical power wiring to field-mounted control devices.

Retain paragraphs below based on types of devices retained in Part 2.

* + - * 1. Connect control wiring between pressure sensors and [**DDC system**] <**Insert system description**>.
				2. Connect control wiring between controlled devices.
				3. Connect control wiring according to Section 260523 "Control-Voltage Electrical Power Cables."
			1. FIELD QUALITY CONTROL

Retain one of first four paragraphs below. Retain first "Testing Agency" Paragraph below if Director’s Representative will hire an independent testing agency.

* + - * 1. Testing Agency: Director’s Representative will engage a qualified testing agency to perform tests and inspections.

Retain "Testing Agency" Paragraph below to require Contractor to hire an independent testing agency.

* + - * 1. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

Retain "Manufacturer's Field Service" Paragraph below to require a factory-authorized Service Advisor to perform tests and inspections.

* + - * 1. Manufacturer's Field Service: Engage a factory-authorized service company field advisor to test and inspect components, assemblies, and equipment installations, including connections.

Retain "Perform tests and inspections" Paragraph below to require Contractor to perform tests and inspections and retain option to require Contractor to arrange for the assistance of a Company authorized service agent.

* + - * 1. Perform tests and inspections[**with the assistance of a factory-authorized service Company Service Advisor**].

Retain test requirements below with any combination of paragraphs above.

* + - * 1. Tests and Inspections:

Retain "HEPA and ULPA Filters" Subparagraph below if retaining "Side-Access HEPA/ULPA Filter Containment Housings" Article.

HEPA and ULPA Filters: Pressurize housing to a minimum of [**6.0-inch wg (1500 Pa)**] <**Insert value**>, and test housing joints, door seals, and sealing edges of filter for air leaks according to pressure-decay method in ASME AG-1.

See Section 014000 "Quality Requirements" for retesting and reinspecting requirements and Section 017300 "Execution" for requirements for correcting the Work.

* + - * 1. Air filter will be considered defective if it does not pass tests and inspections.
				2. Prepare test and inspection reports.
			1. CLEANING
				1. After completing system installation and testing, adjusting, and balancing air-handling and air-distribution systems, clean filter housings and install new filter media.
			2. PROTECTION
				1. Protect installed products and accessories from damage during construction.

END OF SECTION 234133