SECTION 234100 - PARTICULATE AIR FILTRATION

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:

Metal panel filters.

Flat panel filters.

Pleated panel filters.

Ring panel filters.

Nonsupported bag filters.

Supported bag filters.

Rigid cell box filters.

V-bank cell filters.

Self-supported pocket filters.

Bulk media.

Front- or back-access filter frames.

Side-access filter housings.

Filter gauges.

* + - 1. DEFINITIONS

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

* + - * 1. HIPS: High-impact polystyrene.
      1. SUBMITTALS
         1. Submittals for this section are subject to the re-evaluation fee identified in Article 4 of the General Conditions.
         2. Manufacturer’s installation instructions shall be provided along with product data.
         3. Submittals shall be provided in the order in which they are specified and tabbed (for combined submittals).
         4. Product Data: For each type of product. Include dimensions; operating characteristics; required clearances and access; rated flow capacity, including initial and final pressure drop at rated airflow; efficiency and test method; fire classification; furnished specialties; and accessories for each model indicated.
         5. Shop Drawings: For air filters. Include plans, elevations, sections, details, and attachments to other work.

Show filter rack assembly, dimensions, materials, and methods of assembly of components.

Include setting drawings, templates, and requirements for installing anchor bolts and anchorages.

Retain "Seismic Qualification Data" paragraph below if required by seismic criteria applicable to Project. Coordinate with Section 230548 "Vibration and Seismic Controls for HVAC." See ASCE/SEI 7 for certification requirements for equipment and components.

* + - * 1. Seismic Qualification Data: Certificates, for filters, accessories, and components from manufacturer.

Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

* + - * 1. Product Test Reports: For each filter, for tests performed by **<Insert qualified testing agency name>.**

Retain "Field quality-control reports" paragraph below if Contractor is responsible for field quality-control testing and inspecting.

* + - * 1. Field quality-control reports.
      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.

Provide [**one**] <**Insert number**> container(s) of red oil for inclined manometer filter gauge.

* + - 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**].

See ASCE/SEI 7, Coefficients for Architectural Component Table and Seismic Coefficients for Mechanical and Electrical Components Table for requirements to be inserted in subparagraph below.

<**Insert requirements for Component Amplification Factor and Component Response Modification Factor**>.

"ASHRAE 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 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."

Comply with ASHRAE 52.2 for MERV for methods of testing and rating air-filter units.

* + - * 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.
      1. METAL PANEL FILTERS
         1. Description: Factory-fabricated, self-supported, cleanable, all-metal, impingement-type, panel-type, permanent air filters with holding frames.

[Manufacturers:](http://www.specagent.com/Lookup?ulid=13297) 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=123457137594).

[AirGuard; Clarcor Air Filtration Products, Inc](http://www.specagent.com/Lookup?uid=123457137606).

[Camfil Farr](http://www.specagent.com/Lookup?uid=123457137597).

[Columbus Industries, Inc](http://www.specagent.com/Lookup?uid=123457137605).

[Filtration Group](http://www.specagent.com/Lookup?uid=123457137598).

[Koch Filter Corporation](http://www.specagent.com/Lookup?uid=123457137600).

[Tri-Dim Filter Corporation](http://www.specagent.com/Lookup?uid=123457137603).

Approved equivalent.

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

If Project has more than one type or configuration of filer, delete "Capacities and Characteristics" Paragraph below and schedule filters on Drawings.

* + - * 1. Capacities and Characteristics:

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

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

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

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**].

* + - * 1. Media: Minimum of [**three**] [**four**] <**Insert number**> alternate layers of [**galvanized-steel**] [**aluminum**] [**stainless steel**] flat and herringbone or serpentine-crimp mesh screen.

Non-oiled for grease removal application.

Adhesive coating.

* + - * 1. Filter-Media Frame: [**Galvanized steel**] [**Hot-dip galvanized steel**] [**Aluminum**] [**Stainless steel**], hinged, and with pull and retaining handles fastened to the media.

Drain holes.

Confirm available efficiency in paragraph below with manufacturers.

* + - * 1. Efficiency: Minimum [**90**] <**Insert number**> percent efficiency on particles [**10**] <**Insert number**> microns and larger.
      1. FLAT PANEL FILTERS
         1. Description: Factory-fabricated, self-supported, flat, nonpleated, panel-type, disposable air filters with holding frames.

[Manufacturers:](http://www.specagent.com/Lookup?ulid=13298) 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=123457137607).

[AirGuard; Clarcor Air Filtration Products, Inc](http://www.specagent.com/Lookup?uid=123457137621).

[Columbus Industries, Inc](http://www.specagent.com/Lookup?uid=123457137611).

[Flanders Corporation](http://www.specagent.com/Lookup?uid=123457137615).

[Glasfloss Industries](http://www.specagent.com/Lookup?uid=123457137622).

[Koch Filter Corporation](http://www.specagent.com/Lookup?uid=123457137616).

[Tri-Dim Filter Corporation](http://www.specagent.com/Lookup?uid=123457137618).

Approved equivalent.

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

If Project has more than one type or configuration of filter, delete "Capacities and Characteristics" Paragraph below and schedule filters on Drawings.

* + - * 1. Capacities and Characteristics:

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

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

Depth: [**4 inches (100 mm)**] <**Insert dimension**> nominal.

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: [**0.45-inch wg (112 Pa)**] <**Insert value**> at [**500 fpm (2.5 m/s)**] <**Insert value**>.

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

Retain "Minimum Efficiency Reporting Value and Average Arrestance" Subparagraph below if inserting requirement for MERV 1 to 4.

Minimum Efficiency Reporting Value and Average Arrestance: MERV [**4**] <**Insert value**>, with "Composite Average Particle Size Efficiency, Percent in Size Range, Micrometers" and "Average Arrestance" according to ASHRAE 52.2.

Retain "Minimum Efficiency Reporting Value" Subparagraph below if inserting requirements for MERV 5 and higher. LEED 2009 IEQ Prerequisite 1 and LEED v4 EQ Prerequisite "Minimum Indoor Air Quality Performance" require compliance with ASHRAE 62.1 (2007 and 2010 versions, respectively), which require a MERV rating of 6 or higher for service to occupied spaces. LEED 2009 IEQ Credit 5 and LEED v4 IEQ Credit "Enhanced Indoor Air Quality Strategies" require MERV 13 or higher. Insert values appropriate to Project sustainability goals.

Minimum Efficiency Reporting Value: MERV [**6**] <**Insert value**>, with "Composite Average Particle Size Efficiency, Percent in Size Range, Micrometers" according to ASHRAE 52.2.

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

* + - * 1. Media: [**Interlaced glass or**] [**Cotton and**] synthetic fibers coated with nonflammable adhesive.

Media shall be coated with an antimicrobial agent.

Metal Retainer: Upstream side and downstream side.

* + - * 1. Filter-Media Frame: [**Cardboard with perforated metal retainer**] [**Galvanized steel with metal grid on outlet side and steel rod grid on inlet side, hinged, with pull and retaining handles**] sealed or bonded to the media.
      1. PLEATED PANEL FILTERS
         1. Description: Factory-fabricated, self-supported, extended-surface, pleated, panel-type, disposable air filters with holding frames.

[Manufacturers:](http://www.specagent.com/Lookup?ulid=13299) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[3M](http://www.specagent.com/Lookup?uid=123457137635).

[AAF International](http://www.specagent.com/Lookup?uid=123457137623).

[AirGuard; Clarcor Air Filtration Products, Inc](http://www.specagent.com/Lookup?uid=123457137638).

[Air-Nu](http://www.specagent.com/Lookup?uid=123457137636).

[Columbus Industries, Inc](http://www.specagent.com/Lookup?uid=123457137627).

[Filtration Group](http://www.specagent.com/Lookup?uid=123457137630).

[Flanders Corporation](http://www.specagent.com/Lookup?uid=123457137631).

[Glasfloss Industries](http://www.specagent.com/Lookup?uid=123457137637).

[Koch Filter Corporation](http://www.specagent.com/Lookup?uid=123457137632).

[Tri-Dim Filter Corporation](http://www.specagent.com/Lookup?uid=123457137634).

Approved equivalent.

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

If Project has more than one type or configuration of filter, delete "Capacities and Characteristics" Paragraph below and schedule filters on Drawings.

* + - * 1. Capacities and Characteristics:

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

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

Depth: [**1 inch (25 mm)**] [**2 inches (50 mm)**] [**4 inches (100 mm)**] <**Insert dimension**> nominal.

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: [**0.25-inch wg (62 Pa)**] [**0.35-inch wg (87.2 Pa)**] [**0.45-inch wg (112 Pa)**] [**0.60-inch wg (150 Pa)**] <**Insert value**> at [**350 fpm (1.8 m/s)**] [**500 fpm (2.5 m/s)**] <**Insert value**>.

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

LEED 2009 IEQ Prerequisite 1 and LEED v4 EQ Prerequisite "Minimum Indoor Air Quality Performance" require compliance with ASHRAE 62.1 (2007 and 2010 versions, respectively), which require a MERV rating of 6 or higher for service to occupied spaces. LEED 2009 IEQ Credit 5 and LEED v4 IEQ Credit "Enhanced Indoor Air Quality Strategies" require MERV 13 or higher. Insert values appropriate to Project sustainability goals.

Minimum Efficiency Reporting Value: MERV [**6**] [**13**] <**Insert value**>, with "Composite Average Particle Size Efficiency, Percent in Size Range, Micrometers" according to ASHRAE 52.2.

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

Last option in "Media" Paragraph is not available from all manufacturers for all MERV ratings; consult manufacturers.

* + - * 1. Media: [**Interlaced glass or**] [**Cotton and**] synthetic fibers coated with nonflammable adhesive.[**Coat media with an antimicrobial agent.**]

Separators shall be bonded to the media to maintain pleat configuration.

Welded-wire grid shall be on downstream side to maintain pleat.

Media shall be bonded to frame to prevent air bypass.

Support members on upstream and downstream sides to maintain pleat spacing.

* + - * 1. Filter-Media Frame: [**Cardboard frame with perforated metal retainer**] [**Galvanized steel**] [**Aluminized steel**] [**with metal grid on outlet side and steel rod grid on inlet side, hinged, with pull and retaining handles**] sealed or bonded to the media.
      1. RING PANEL FILTERS
         1. Description: Internally supported, flat panel filters for installation in a filter track.

[Manufacturers:](http://www.specagent.com/Lookup?ulid=13300) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[AirGuard; Clarcor Air Filtration Products, Inc](http://www.specagent.com/Lookup?uid=123457137651).

[Columbus Industries, Inc](http://www.specagent.com/Lookup?uid=123457137643).

[Filtration Group](http://www.specagent.com/Lookup?uid=123457137646).

[Flanders Corporation](http://www.specagent.com/Lookup?uid=123457137647).

[Glasfloss Industries](http://www.specagent.com/Lookup?uid=123457137652).

[Koch Filter Corporation](http://www.specagent.com/Lookup?uid=123457137648).

[Tri-Dim Filter Corporation](http://www.specagent.com/Lookup?uid=123457137653).

Approved equivalent.

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

If Project has more than one type or configuration of filter, delete "Capacities and Characteristics" Paragraph below and schedule filters on Drawings.

* + - * 1. Capacities and Characteristics:

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

Face Size: <**Insert number**> inches (mm).

Depth: [**1-1/2 inches (38 mm)**] [**1-3/4 inches (44 mm)**] [**2 inches (50 mm)**] <**Insert dimension**>.

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).

LEED 2009 IEQ Prerequisite 1 and LEED v4 EQ Prerequisite "Minimum Indoor Air Quality Performance" require compliance with ASHRAE 62.1 (2007 and 2010 versions, respectively), which require a MERV rating of 6 or higher for service to occupied spaces. LEED 2009 IEQ Credit 5 and LEED v4 IEQ Credit "Enhanced Indoor Air Quality Strategies" require MERV 13 or higher. Insert values appropriate to Project sustainability goals.

Minimum Efficiency Reporting Value: MERV [**6**] <**Insert value**>, with "Composite Average Particle Size Efficiency, Percent in Size Range, Micrometers" according to ASHRAE 52.2.

Access: Side.

Last option in "Media" Subparagraph is not available from all manufacturers for all MERV ratings; consult manufacturers.

Media: [**Two**] [**Three**] [**Four**] <**Insert number**>-ply polyester with sealed edges.[**Coat with antimicrobial agent.**]

Panel Construction: [**Single**] [**with one edge unsealed for support removal**] [**Linked**].

* + - * 1. Internal Support: 9-gauge steel-wire frame.
      1. NONSUPPORTED BAG FILTERS
         1. Description: Factory-fabricated, dry, extended-surface, nonsupported filters with header frames.

[Manufacturers:](http://www.specagent.com/Lookup?ulid=13301) 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=123457137654).

[AirGuard; Clarcor Air Filtration Products, Inc](http://www.specagent.com/Lookup?uid=123457137664).

[Air-Nu](http://www.specagent.com/Lookup?uid=123457137662).

[Camfil Farr](http://www.specagent.com/Lookup?uid=123457137657).

[Columbus Industries, Inc](http://www.specagent.com/Lookup?uid=123457137665).

[Filtration Group](http://www.specagent.com/Lookup?uid=123457137663).

[Glasfloss Industries](http://www.specagent.com/Lookup?uid=123457137666).

[Koch Filter Corporation](http://www.specagent.com/Lookup?uid=123457137659).

[Tri-Dim Filter Corporation](http://www.specagent.com/Lookup?uid=123457137661).

Approved equivalent.

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

If Project has more than one type or configuration of filter, delete "Capacities and Characteristics" Paragraph below and schedule filters on Drawings.

* + - * 1. Capacities and Characteristics:

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

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

Depth: [**12 inches (300 mm)**] [**22 inches (550 mm)**] [**30 inches (750 mm)**] <**Insert dimension**>.

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

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

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).

LEED 2009 IEQ Prerequisite 1 and LEED v4 EQ Prerequisite "Minimum Indoor Air Quality Performance" require compliance with ASHRAE 62.1 (2007 and 2010 versions, respectively), which require a MERV rating of 6 or higher for service to occupied spaces. LEED 2009 IEQ Credit 5 and LEED v4 IEQ Credit "Enhanced Indoor Air Quality Strategies" require MERV 13 or higher. Insert values appropriate to Project sustainability goals.

Minimum Efficiency Reporting Value: MERV [**11**] [**13**] [**15**] <**Insert value**>, with "Composite Average Particle Size Efficiency, Percent in Size Range, Micrometers" according to ASHRAE 52.2.

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

Last option in "Media" Paragraph is not available from all manufacturers for all MERV ratings; consult manufacturers.

* + - * 1. Media: [**Glass-fiber**] [**Synthetic**] material constructed so individual pockets are maintained in tapered form under rated-airflow conditions by flexible internal supports.[**Coat media with an antimicrobial agent.**]
        2. Filter-Media Frame: [**Galvanized steel**] <**Insert material**>.
      1. SUPPORTED BAG FILTERS
         1. Description: Factory-fabricated, dry, extended surface, self-supported filters with holding frames in steel, basket-type retainer, internal metal grid retainer, or self-supporting media pockets.

[Manufacturers:](http://www.specagent.com/Lookup?ulid=13319) 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=123457137737).

[AirGuard; Clarcor Air Filtration Products, Inc](http://www.specagent.com/Lookup?uid=123457137748).

[Air-Nu](http://www.specagent.com/Lookup?uid=123457137749).

[Camfil Farr](http://www.specagent.com/Lookup?uid=123457137740).

[Columbus Industries, Inc](http://www.specagent.com/Lookup?uid=123457137741).

[Filtration Group](http://www.specagent.com/Lookup?uid=123457137744).

[Glasfloss Industries](http://www.specagent.com/Lookup?uid=123457137750).

[Koch Filter Corporation](http://www.specagent.com/Lookup?uid=123457137746).

[Tri-Dim Filter Corporation](http://www.specagent.com/Lookup?uid=123457137751).

Approved equivalent.

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

If Project has more than one type or configuration of filter, delete "Capacities and Characteristics" Paragraph below and schedule filters on Drawings.

* + - * 1. Capacities and Characteristics:

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

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

Depth: [**12 inches (300 mm)**] [**22 inches (550 mm)**] [**30 inches (750 mm)**] <**Insert dimension**>.

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

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

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).

LEED 2009 IEQ Prerequisite 1 and LEED v4 EQ Prerequisite "Minimum Indoor Air Quality Performance" require compliance with ASHRAE 62.1 (2007 and 2010 versions, respectively), which require a MERV rating of 6 or higher for service to occupied spaces. LEED 2009 IEQ Credit 5 and LEED v4 IEQ Credit "Enhanced Indoor Air Quality Strategies" require MERV 13 or higher. Insert values appropriate to Project sustainability goals.

Minimum Efficiency Reporting Value: MERV [**11**] [**13**] [**15**] <**Insert value**>, with "Composite Average Particle Size Efficiency, Percent in Size Range, Micrometers" according to ASHRAE 52.2.

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

* + - * 1. Media: Fibrous material constructed so individual pleats are maintained in tapered form under rated-airflow conditions by flexible internal supports.[**Coat media with an antimicrobial agent.**]
        2. Filter-Media Frame: [**Galvanized steel**] <**Insert material**>.
      1. RIGID CELL BOX FILTERS
         1. Description: Factory-fabricated, [**adhesive-coated,**]disposable, packaged air filters with media perpendicular to airflow, and with holding frames.

[Manufacturers:](http://www.specagent.com/Lookup?ulid=13307) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[AirGuard; Clarcor Air Filtration Products, Inc](http://www.specagent.com/Lookup?uid=123457137723).

[Air-Nu](http://www.specagent.com/Lookup?uid=123457137721).

[Camfil Farr](http://www.specagent.com/Lookup?uid=123457137712).

[Columbus Industries, Inc](http://www.specagent.com/Lookup?uid=123457137713).

[Filtration Group](http://www.specagent.com/Lookup?uid=123457137716).

[Flanders Corporation](http://www.specagent.com/Lookup?uid=123457137717).

[Glasfloss Industries](http://www.specagent.com/Lookup?uid=123457137722).

[Koch Filter Corporation](http://www.specagent.com/Lookup?uid=123457137718).

Approved equivalent.

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

If Project has more than one type or configuration of filter, delete "Capacities and Characteristics" Paragraph below and schedule filters on Drawings.

* + - * 1. Capacities and Characteristics:

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

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

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

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

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

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).

LEED 2009 IEQ Prerequisite 1 and LEED v4 EQ Prerequisite "Minimum Indoor Air Quality Performance" require compliance with ASHRAE 62.1 (2007 and 2010 versions, respectively), which require a MERV rating of 6 or higher for service to occupied spaces. LEED 2009 IEQ Credit 5 and LEED v4 IEQ Credit "Enhanced Indoor Air Quality Strategies" require MERV 13 or higher. Insert values appropriate to Project sustainability goals.

Minimum Efficiency Reporting Value: MERV [**9**] [**11**] [**13**] [**14**] <**Insert value**>, with "Composite Average Particle Size Efficiency, Percent in Size Range, Micrometers" according to ASHRAE 52.2.

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

Last option in "Media" Paragraph is not available from all manufacturers for all MERV ratings; consult manufacturers.

* + - * 1. Media: Fibrous material constructed so individual pleats are maintained in tapered form under rated-airflow conditions by flexible internal supports.[**Coat media with antimicrobial agent**].
        2. Filter-Media Frames: [**Galvanized steel**] <**Insert material**>.
      1. V-BANK CELL FILTERS
         1. Description: Factory-fabricated, [**adhesive-coated,**]disposable, packaged air filters with media angled to airflow, and with holding frames.

[Manufacturers:](http://www.specagent.com/Lookup?ulid=13303) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[3M](http://www.specagent.com/Lookup?uid=123457137679).

[AAF International](http://www.specagent.com/Lookup?uid=123457137667).

[AirGuard; Clarcor Air Filtration Products, Inc](http://www.specagent.com/Lookup?uid=123457137681).

[Camfil Farr](http://www.specagent.com/Lookup?uid=123457137670).

[Columbus Industries, Inc](http://www.specagent.com/Lookup?uid=123457137671).

[Flanders Corporation](http://www.specagent.com/Lookup?uid=123457137675).

[Glasfloss Industries](http://www.specagent.com/Lookup?uid=123457137680).

[Koch Filter Corporation](http://www.specagent.com/Lookup?uid=123457137676).

[Tri-Dim Filter Corporation](http://www.specagent.com/Lookup?uid=123457137678).

Approved equivalent.

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

If Project has more than one type or configuration of filter, delete "Capacities and Characteristics" Paragraph below and schedule filters on Drawings.

* + - * 1. Capacities and Characteristics:

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

Face Size: [**24 by 24 inches (600 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).

LEED 2009 IEQ Prerequisite 1 and LEED v4 EQ Prerequisite "Minimum Indoor Air Quality Performance" require compliance with ASHRAE 62.1 (2007 and 2010 versions, respectively), which require a MERV rating of 6 or higher for service to occupied spaces. LEED 2009 IEQ Credit 5 and LEED v4 IEQ Credit "Enhanced Indoor Air Quality Strategies" require MERV 13 or higher. Insert values appropriate to Project sustainability goals.

Minimum Efficiency Reporting Value: MERV [**11**] [**13**] [**14**] [**15**] <**Insert number**>, with "Composite Average Particle Size Efficiency, Percent in Size Range, Micrometers" according to ASHRAE 52.2.

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

Last option in "Media" Paragraph is not available from all manufacturers for all MERV ratings; consult manufacturers.

* + - * 1. Media: Fibrous material constructed so individual mini-pleats are maintained in tapered form under rated-airflow conditions by flexible internal supports.[**Coat media with an antimicrobial agent.**]
        2. Filter-Media Frames: [**HIPS**] <**Insert material**>.
      1. SELF-SUPPORTED POCKET FILTERS
         1. Description: Factory-fabricated, panel-type, disposable air filters with contoured, self-supported media for extended surface.

[Manufacturers:](http://www.specagent.com/Lookup?ulid=13304) 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=123457137682).

[AirGuard; Clarcor Air Filtration Products, Inc](http://www.specagent.com/Lookup?uid=123457137689).

[Columbus Industries, Inc](http://www.specagent.com/Lookup?uid=123457137684).

[Filtration Group](http://www.specagent.com/Lookup?uid=123457137685).

[Koch Filter Corporation](http://www.specagent.com/Lookup?uid=123457137687).

Approved equivalent.

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

If Project has more than one type or configuration of filter, delete "Capacities and Characteristics" Paragraph below and schedule filters on Drawings.

* + - * 1. Capacities and Characteristics:

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

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

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

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

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

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).

LEED 2009 IEQ Prerequisite 1 and LEED v4 EQ Prerequisite "Minimum Indoor Air Quality Performance" require compliance with ASHRAE 62.1 (2007 and 2010 versions, respectively), which require a MERV rating of 6 or higher for service to occupied spaces. LEED 2009 IEQ Credit 5 and LEED v4 IEQ Credit "Enhanced Indoor Air Quality Strategies" require MERV 13 or higher. Insert values appropriate to Project sustainability goals.

Minimum Efficiency Reporting Value: MERV [**6**] [**8**] <**Insert value**>, with "Composite Average Particle Size Efficiency, Percent in Size Range, Micrometers" according to ASHRAE 52.2.

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

Last option in "Media" Paragraph is not available from all manufacturers for all MERV ratings; consult manufacturers.

* + - * 1. Media: Fibrous material constructed so individual pleats are maintained in tapered form under rated-airflow conditions by flexible internal supports.[**Coat media with an antimicrobial agent.**]
        2. Configuration: [**Single-pocket cube**] [**Multipocket**].
        3. Filter-Media Frame: [**Galvanized steel**] <**Insert material**>.
      1. BULK MEDIA
         1. Description: Air-filter media, factory custom cut or rolled.

[Manufacturers:](http://www.specagent.com/Lookup?ulid=13305) 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=123457137690).

[AirGuard; Clarcor Air Filtration Products, Inc](http://www.specagent.com/Lookup?uid=123457137701).

[Air-Nu](http://www.specagent.com/Lookup?uid=123457137702).

[Columbus Industries, Inc](http://www.specagent.com/Lookup?uid=123457137694).

[Filtration Group](http://www.specagent.com/Lookup?uid=123457137697).

[Glasfloss Industries](http://www.specagent.com/Lookup?uid=123457137703).

[Koch Filter Corporation](http://www.specagent.com/Lookup?uid=123457137699).

[Tri-Dim Filter Corporation](http://www.specagent.com/Lookup?uid=123457137704).

Approved equivalent.

* + - * 1. Source Limitations: Obtain from single source from single manufacturer.
        2. Capacities and Characteristics:

Thickness: <**Insert number**> inches (mm).

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).

Retain "Minimum Efficiency Reporting Value and Average Arrestance" Subparagraph below if inserting requirement for MERV 1 to 4.

Minimum Efficiency Reporting Value and Average Arrestance: MERV [**4**] <**Insert number**>, with "Composite Average Particle Size Efficiency, Percent in Size Range, Micrometers" and "Average Arrestance" according to ASHRAE 52.2.

Retain "Minimum Efficiency Reporting Value" Subparagraph below if inserting requirements for MERV 5 and higher. LEED 2009 IEQ Prerequisite 1 and LEED v4 EQ Prerequisite "Minimum Indoor Air Quality Performance" require compliance with ASHRAE 62.1 (2007 and 2010 versions, respectively), which require a MERV rating of 6 or higher for service to occupied spaces. LEED 2009 IEQ Credit 5 and LEED v4 IEQ Credit "Enhanced Indoor Air Quality Strategies" require MERV 13 or higher. Insert values appropriate to Project sustainability goals.

Minimum Efficiency Reporting Value: MERV [**6**] [**8**] <**Insert value**>, with "Composite Average Particle Size Efficiency, Percent in Size Range, Micrometers" according to ASHRAE 52.2.

* + - * 1. Media: [**Spun glass**] [**Synthetic**] [**Polyester**], [**in a roll**] [**cut into pads**].

Pad Dimensions: <**Insert number**> inches (mm) by <**Insert number**> inches (mm).

* + - 1. FRONT- OR BACK-ACCESS FILTER FRAMES

Copy and re-edit this article for each type of front- and rear-access filter frame. This article is an example for filter-mounting frames for front or back loading.

* + - * 1. Description: [**Galvanized-steel**] [**Aluminum**] framing members with access for either upstream (front) or downstream (back) filter servicing, cut to size and prepunched for assembly into modules. Vertically support filters to prevent deflection of horizontal members without interfering with filter installation or operation.

[Manufacturers:](http://www.specagent.com/Lookup?ulid=13310) 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=123457137731).

[AirGuard; Clarcor Air Filtration Products, Inc](http://www.specagent.com/Lookup?uid=123457137736).

[Flanders Corporation](http://www.specagent.com/Lookup?uid=123457137733).

[Koch Filter Corporation](http://www.specagent.com/Lookup?uid=123457137734).

Approved equivalent.

* + - * 1. Source Limitations: Obtain from single source from single manufacturer.
        2. Prefilters: Incorporate a separate track[**with spring clips**], removable from front[**or back**].
        3. Sealing: Factory-installed, positive-sealing device for each row of filters, to ensure seal between gasketed filter elements and to prevent bypass of unfiltered air.
      1. SIDE-ACCESS FILTER HOUSINGS

Copy and re-edit this article for each type of side-service housing.

* + - * 1. Description: Factory-assembled, side-service housings, constructed of [**galvanized steel**] [**aluminum**], with flanges to connect to duct or casing system.

[Manufacturers:](http://www.specagent.com/Lookup?ulid=13309) 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=123457137724).

[AirGuard; Clarcor Air Filtration Products, Inc](http://www.specagent.com/Lookup?uid=123457137730).

[Camfil Farr](http://www.specagent.com/Lookup?uid=123457137726).

[Flanders Corporation](http://www.specagent.com/Lookup?uid=123457137727).

[Koch Filter Corporation](http://www.specagent.com/Lookup?uid=123457137728).

Approved equivalent.

* + - * 1. Source Limitations: Obtain from single source from single manufacturer.
        2. Prefilters: Integral tracks to accommodate [**2-inch- (50-mm-)**] <**Insert dimension**> thick, disposable [**or washable**]filters.
        3. Access Doors: [**Hinged, with continuous**] [**Continuous**] gaskets on perimeter and positive-locking devices, and arranged so filter cartridges can be loaded from either access door.
        4. Sealing: Incorporate positive-sealing gasket material on channels to seal top and bottom of filter cartridge frames and to prevent bypass of unfiltered air.
      1. FILTER GAUGES
         1. Diaphragm-type gauge 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=13306) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[AirGuard; Clarcor Air Filtration Products, Inc](http://www.specagent.com/Lookup?uid=123457137706).

[Dwyer Instruments, Inc](http://www.specagent.com/Lookup?uid=123457137707).

Approved equivalent.

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

Diameter: [**4-1/2 inches (115 mm)**] [**2 inches (50 mm)**].

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

Scale Range for Filter Media Having a Recommended Final Resistance of 0.5-Inch wg (125 Pa) or Less: 0- to 0.5-inch wg (0 to 125 Pa).

Scale Range for Filter Media Having a Recommended Final Resistance of 0.5- to 1.0-Inch wg (125 to 250 Pa) or Less: 0- to 1.0-inch wg (0 to 250 Pa).

Scale Range for Filter Media Having a Recommended Final Resistance of 1.0- to 2.0-Inch wg (250 to 500 Pa) or Less: 0- to 2.0-inch wg (0 to 500 Pa).

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. Manometer-Type Filter Gauge: Molded plastic, with epoxy-coated aluminum scale and logarithmic-curve tube gage with integral leveling gage, graduated to read from 0- to 3.0-inch wg (0 to 750 Pa), and accurate within 3 percent of the full-scale range.
        2. 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.
          3. Install filter gauge for each filter bank.

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 used during construction and testing with new, clean filters.
        2. Coordinate filter installations with duct and air-handling-unit installations.
        3. Filter Application Schedule: Install set of filters in each air-handling unit listed below:

| **APPLICATION** | **FILTER TYPE** | **FILTER THICKNESS/DEPTH**  **(inches)** | **UL** **STD** |
| --- | --- | --- | --- |
| **Single-Stage Filtration:**  Fan coil units, cabinet unit heaters, heat recovery units, energy recovery units, and unit ventilators. | Panel | 1 | UL 900 |
| **Single-Stage Filtration:**  Factory packaged air conditioners, and heating and ventilating units. | Pleated | 2 | UL 900 |
| **Single-Stage Filtration:**  Factory packaged air conditioners, heating and ventilating units, filter banks, and filter housings. | Bag | Varies with manufacturer. Depth should be consistent with system rated airflow and initial pressure drops as specified. | UL 900 |
| **Single-Stage Filtration:**  Factory packaged air conditioners, heating and ventilating units, heat recovery units, energy recovery units, filter banks, and filter housings. | Rigid  or  V-Bank | 6 or 12  12 | UL 900  UL 900 |
| **Two-Stage Filtration:**  Factory packaged air conditioners, heating and ventilating units, filter banks, and filter housings. | Pleated | 2 | UL900 |
| Bag | Varies with manufacturer. Depth should be consistent with system rated airflow and initial pressure drops as specified. | UL 900 |
| **Two-Stage Filtration:**  Factory packaged air conditioners, heating and ventilating units, heat recovery units, energy recovery units, filter banks, and filter housings. | Pleated | 2 | UL900 |
| Rigid  or  V-Bank | 6 or 12  12 | UL900  UL900 |
| **Two-Stage Filtration:**  Factory packaged air conditioners, heating and ventilating units, filter banks, and filter housings. | Pleated | 2 | UL900 |
| HEPA | 12 | UL586 |
| **Three-Stage Filtration:**  Factory packaged air conditioners, heating and ventilating units, filter banks, and filter housings. | Pleated | 2 | UL900 |
| Bag | Varies with manufacturer. Depth should be consistent with system rated airflow and initial pressure drops as specified. | UL9002 |
| HEPA | 12 | UL586 |
| **Three-Stage Filtration:**  Factory packaged air conditioners, heating and ventilating units, filter banks, and filter housings. banks, banks and filter housings. | Pleated | 2 | UL900 |
| Rigid  or  V-Bank | 6 or 12  12 | UL 900  UL 900 |
| HEPA | 12 | UL586 |

* + - 1. INSTALLATION OF 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. 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. 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 Service -authorized service agent.

* + - * 1. Perform tests and inspections[**with the assistance of a factory-authorized service company field advisor**].

Retain test requirements below with any combination of paragraphs above.

* + - * 1. Tests and Inspections:

Test for leakage of unfiltered air while system is operating.

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 of air-handling and air-distribution systems, clean filter housings and install new filter media.
         2. After completing system installation and testing, adjusting, and balancing of air-handling and air-distribution systems, clean filter housings and install new filter media.

END OF SECTION 234100