SECTION 234000 - HVAC AIR CLEANING DEVICES

This Section includes air filters and air cleaning devices. Specify air filters in this section and cross-referenced in other sections or, specify in equipment sections.

Manufacturers found in SpecAgent for this Section were identified as representative and not as an endorsement for meeting the requirements of this specification.

This Section includes performance, proprietary, and descriptive type specifications. Edit to avoid conflicting requirements.

This Section includes the term Architect/Engineer. "Architect" is used in AIA contract documents; "Engineer" is used in EJCDC contract documents. Retain appropriate term.

See the Drawing Coordination Considerations for information needed to coordinate this specification Section with the Drawings.

1. GENERAL
	* + 1. SUMMARY
				1. Section Includes:

Activated carbon filters.

Automatic renewable media filters.

Disposable, extended area panel filters.

Disposable panel filters.

Electronic air cleaners.

Extended surface high efficiency media filters.

Extended surface non-supported media filters.

Extended surface retained media filters.

High efficiency particulate air (HEPA) filters.

Washable permanent panel filters.

Filter frames and housings.

Filter gages.

* + - * 1. Related Sections:

Section 230513 - Common Motor Requirements for HVAC Equipment: Product requirements for motors for placement by this section.

Section 260503 - Equipment Wiring Connections: Execution requirements for wiring products for placement by this section.

* + - 1. REFERENCES

List reference standards included within text of this section. Edit the following for Project conditions.

* + - * 1. Air-Conditioning and Refrigeration Institute:

ARI 850 - Commercial and Industrial Air Filter Equipment.

* + - * 1. American Society of Heating, Refrigerating and Air-Conditioning Engineers:

ASHRAE 52.1 - Gravimetric and Dust-Spot Procedures for Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter.

* + - * 1. Military Standardization Documents:

MIL MIL-STD-282 - Filter Units, Protective Clothing, Gas-Mask Components, and Related Products: Performance-Test Methods.

* + - * 1. Underwriters Laboratories Inc.:

UL 586 - High-Efficiency. Particulate, Air Filter Units.

UL 867 - Electrostatic Air Cleaners.

UL 900 - Air Filter Units.

* + - 1. PERFORMANCE REQUIREMENTS

Use this article carefully; restrict statements to identify system performance requirements or function criteria only.

* + - * 1. Conform to ARI 850 “Commercial and Industrial Air Filter Equipment” Section 7.4.
				2. Dust Spot Efficiency: Plus or minus [**5**] <**\_\_\_\_\_\_\_\_**> percent.
			1. SUBMITTALS

Only request submittals needed to verify compliance Project requirements.

* + - * 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. Section 013300 - Submittal Procedures: Submittal procedures.
				5. Shop Drawings: Indicate filter assembly and filter frames, dimensions, motor locations, and electrical characteristics and connection requirements.
				6. Product Data: Submit data on filter media, filter performance data, dimensions, and electrical characteristics.

Include the following paragraph for submission of physical samples for selection of finish, color, texture, and other properties.

* + - * 1. Samples: Submit [**two**] <**\_\_\_\_\_\_\_\_**> samples of replacement filter media of each type and each filter frame.
				2. Manufacturer's Installation Instructions: Submit assembly and change-out procedures.
				3. Manufacturer's Certificate: Certify products meet or exceed specified requirements.
				4. Submittals for this section are subject to the re-evaluation fee identified in Article 4 of the General Conditions.
				5. Manufacturer’s installation instructions shall be provided along with product data.
				6. Submittals shall be provided in the order in which they are specified and tabbed (for combined submittals).
			1. CLOSEOUT SUBMITTALS
			2. Section 017000 - Execution and Closeout Requirements: Closeout procedures.
				1. Operation and Maintenance Data: Submit instructions for operation, changing, and periodic cleaning.
			3. QUALIFICATIONS
				1. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years' [**documented**] experience.
				2. Installer: Company specializing in performing Work of this section with minimum three years' [**documented**] experience [**approved by manufacturer**].
			4. PRE-INSTALLATION MEETINGS
				1. Section 013000 - Administrative Requirements: Pre-installation meeting.
				2. Convene minimum [**one**] <**\_\_\_\_\_\_\_\_**> week prior to commencing work of this section.
			5. WARRANTY

This article extends warranty period beyond one year. Extended warranties increase construction costs and Owner enforcement responsibilities. Specify warranties with caution.

* + - * 1. Section 017000 - Execution and Closeout Requirements: Product warranties and product bonds.
				2. Furnish [**five**] <**\_\_\_\_\_\_\_\_**> year manufacturer warranty for air cleaning devices.
			1. EXTRA MATERIALS
				1. Section 017000 - Execution and Closeout Requirements: Spare parts and maintenance products.

Extra stock is normally specified to provide completely clean set of filter media is available at Project completion. Consider specifying set for testing, adjusting, and balancing and system trial period. When project conditions warrant, retain as final filter set. Or specify an additional set for installation just before Owner occupancy.

* + - * 1. Furnish [**one set**] <**\_\_\_\_\_\_\_\_**> of [**disposable panel filters**] [**renewable media filters**].
1. PRODUCTS

In this article, list manufacturers acceptable for this Project. Most manufacturers make complete filter line, requiring only one list of "Manufacturers." When more than one manufacturer is acceptable, list with each product description as shown. Delete separate lists where not needed.

* + - 1. ACTIVATED CARBON FILTERS
				1. [Manufacturers](http://www.specagent.com/LookUp/?ulid=8283&mf=04&src=wd):

Substitutions: [Section 016000 - Product Requirements] [Not Permitted].

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

* + - * 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

Air Filters Incorporated

Approved equivalent.

* + - * 1. Furnish materials in accordance with [**State**] [**Municipality**] of <**\_\_\_\_\_\_\_\_**> [**Highways**] [**Public Work's**] standards.

Edit the following descriptive specifications to identify project requirements and to eliminate conflicts with manufacturers specified.

* + - * 1. Assembly: Galvanized steel unit incorporating extruded aluminum tracks to accommodate filter servicing trays in deep V arrangement arranged for [**upstream**] [**downstream**] [**side**] servicing with disposable panel pre-filter.

Nominal Size: [**12 x 24 x 29 inches (305 x 610 x 735 mm)**] [**24 x 24 x 29 inches (610 x 610 x 735 mm)**].

* + - * 1. Media:

Activated Carbon Density: 34 lb./cu ft (550 kg/cu m), pellets or granular [**to 6 x 10 Tyler mesh screen**].

Carbon Tetrachloride Activity: Minimum 60 percent; in thin bed.

Trays: Nominal size 24 x 24 x 5/8 inches (610 x 610 x 16 mm) thick.

Carbon: 1.42 cu ft per 1000 cfm (22 kg per 470 L/sec) nominal airflow capacity.

* + - * 1. Rating: 500 fpm (2.54 m/sec) face velocity, 0.45 inch wg (110 Pa) resistance.
			1. AUTOMATIC RENEWABLE MEDIA FILTERS

In this article, list manufacturers acceptable for this Project.

* + - * 1. [Manufacturers](http://www.specagent.com/LookUp/?ulid=8284&mf=04&src=wd):

Substitutions: [Section 016000 - Product Requirements] [Not Permitted].

* + - * 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

Permatron Corp.

All American Air Filters Inc.

Approved equivalent.

Edit the following descriptive specifications to identify project requirements and to eliminate conflicts with manufacturers specified.

* + - * 1. Assembly: Galvanized steel assembly with drive, controls, and media, feeding media across air stream and winds and compresses used media for disposal. Enclose clean media roll with hinged roll cover. Include tension panel to compress used media as media is spooled. Arrange to allow upstream replacement of filter media.
				2. Media: UL 900 “Air Filter Units” Class 2, rolled and compressed, graduated density glass fiber blanket, nominally 2 inch (50 mm) thick when expanded, [**50 feet (20 m)**] [**65 feet (20 m)**] <**\_\_\_\_\_\_\_\_**> long; factory sprayed with flameproof, non-drip, non-volatile adhesive; bonded reinforcing on leaving side of media to prevent stretching and necking.
				3. Performance Rating, ASHRAE 52.1 “Gravimetric and Dust-Spot Procedures for Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter”:

Dust Spot Efficiency: 25 percent.

Weight Arrestance: Minimum 80 percent.

Face Velocity: 500 fpm (2.54 m/sec).

Initial Resistance at Pressure: 0.17 inch wg (40 Pa).

Recommended Final Resistance: 0.50 inch wg (125 Pa).

Select drive mechanism. Controls apply only to electric motor advance. Use particular care. Usually manual control is more appropriate. Automatic controls tend to use more media than required.

* + - * 1. Drive Mechanism:

Electric gear reducer motor: <**\_\_\_\_\_\_\_\_**> hp, 120 volts, single-phase, 60 Hz.

Hand crank for manual operation to rewind spool through chain and sprocket assembly.

* + - * 1. Controls: Furnish manual switch to advance media.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

* + - * 1. Controls: Factory wired control package to advance media [**after selected operating period of time,**] [**when filter resistance exceeds selected high limit,**] with media run out switch to stop travel and indicate run out, and manual switch to override controls and advance media.
				2. Frame: Auxiliary frame on downstream side of unit for [**downstream access**] [**side access**] to extended surface [**retained media**] [**non-supported media**] [**biological**] [**HEPA**] filters.
			1. DISPOSABLE, EXTENDED AREA PANEL FILTERS

In this article, list manufacturers acceptable for this Project.

[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. [Manufacturers](http://www.specagent.com/LookUp/?ulid=8285&mf=04&src=wd):

Substitutions: **[Section 016000 - Product Requirements] [Not Permitted**].

Edit the following descriptive specifications to identify project requirements and to eliminate conflicts with manufacturers specified.

UL 900 Class 1 filters, when clean, do not contribute fuel when attacked by flame and emit negligible amounts of smoke. Class 2 filters, when clean, burn moderately when attacked by flame or emit moderate amounts of smoke. Building codes generally allow use of Class 2 filters.

* + - * 1. Media: [**UL 900 Class 1**] [**UL 900 Class 2**], pleated, [**lofted, non-woven, reinforced cotton fabric**] [**lofted, non-woven, reinforced cotton and synthetic fabric**] [**fine, glass fiber**] [**fine, glass fiber laminated to synthetic backing**]; supported [**and bonded to welded wire grid**] [**by corrugated aluminum separators**].

Frame material depends on UL Class.

Frame: [**Non-flammable**] [**Cardboard**] [**Galvanized steel**] [**Fire retardant, 3/4 inch (19 mm) thick particleboard**].

Many sizes are available. However, not all sizes are available in different combinations of thickness and rating.

Nominal size: [**12 x 24 inches (305 x 610 mm)**] [**16 x 20 inches (406 x 508 mm)**] [**16 x 25 inches (406 x 635 mm)**] [**24 x 24 inches (610 x 610 mm)**] <**\_\_\_\_\_\_\_\_**>.

Caution; some thickness available only in UL Class 2.

Nominal thickness: [**1 inch (25 mm)**] [**2 inches (50 mm)**] [**4 inches (100 mm)**] [**6 inches (150 mm)**] [**12 inches (300 mm)**].

* + - * 1. Rating, ASHRAE 52.1 “Gravimetric and Dust-Spot Procedures for Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter”:

Caution; rating depends on UL Class, thickness, and manufacturer.

Dust spot efficiency: [**20**] [**25-30**] [**40-45**] [**60-65**] [**66**] [**80-85**] [**88**] [**90-95**] percent.

Weight arrestance: [**85**] [**90-92**] [**94-96**] [**96**] [**97**] [**98**] [**99**] percent.

Initial resistance at 500 fpm (2.54 m/sec) face velocity: [**0.20 inch wg (50 Pa)**] [**0.25 inch wg (62 Pa)**] [**0.30 inch wg (75 Pa)**] [**0.40 inch wg (100 Pa)**] [**0.50 inch wg (125 Pa)**] [**0.60 inch wg (150 Pa)**] [**0.80 inch wg (200 Pa)**] <**\_\_\_\_\_\_\_\_**>

Recommended final resistance: [**0.9 inch wg (224 Pa)**] [**1.0 inch wg (250 Pa)**] [**1.2 inch wg (300 Pa)**] [**1.5 inch wg (373 Pa)**] [**2.5 inch wg (625 Pa)**].

* + - 1. DISPOSABLE PANEL FILTERS

In this article, list manufacturers acceptable for this Project.

[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. [Manufacturers](http://www.specagent.com/LookUp/?ulid=8286&mf=04&src=wd):

Substitutions: [Section 016000 - Product Requirements] [Not Permitted].

Edit the following descriptive specifications to identify project requirements and to eliminate conflicts with manufacturers specified.

* + - * 1. Media: UL 900 “Air Filter Units” Class 2, fiber blanket, factory sprayed with flameproof, non-drip, non-volatile adhesive.

Nominal Size: [**12 x 24 inches (300 x 600 mm)**] [**16 x 25 inches (400 x 625 mm)**] [**24 x 24 inches (610 x 610 mm)**] <**\_\_\_\_\_\_\_\_**>.

Thickness: [**1 inch (25 mm)**] [**2 inch (50 mm)**].

* + - * 1. Performance Rating:

Face Velocity: 500 fpm (2.54 m/sec)

Initial Resistance: [**0.15 inch wg (37 Pa)**] [**0.10 inch wg (25 Pa)**]

Recommended Final Resistance: 0.50 inches wg (125 Pa).

Select one of the following two paragraphs. Exclude cardboard option because of wet air stream or due to its combustible nature.

* + - * 1. Casing: Cardboard-frame with perforated metal retainer.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

* + - * 1. Holding Frames: 20 gage (0.90 mm) minimum galvanized steel frame with expanded metal grid on outlet side and steel rod grid on inlet side, hinged with pull and retaining handles.
			1. ELECTRONIC AIR CLEANERS

In this article, list manufacturers acceptable for this Project.

* + - * 1. [Manufacturers](http://www.specagent.com/LookUp/?ulid=8287&mf=04&src=wd):

Substitutions: [Section 016000 - Product Requirements] [Not Permitted].

* + - * 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

Air Quality Engineering Inc.

Cosatron, a division or CRS Industries, Inc.

Trion, Inc.

Approved equivalent.

Edit the following descriptive specifications to identify project requirements and to eliminate conflicts with manufacturers specified.

* + - * 1. Assembly: UL 867 “Electrostatic Air Cleaners”; galvanized steel assembly containing electronic agglomerator and [**disposable panel**] [**automatic renewable media**] [**extended surface non-supported media**] filters.
				2. Electronic Agglomerator: Independently supported and nested collection cells of aluminum construction including ionizing section consisting of alternately spaced grounded struts and charged ionizing wires, and collecting section consisting of alternately grounded and charged plates, with insulators located out of air stream.
				3. Power Pack: Self-contained, pre-wired rectifying unit to convert 120 volts, single phase, 60 Hz AC power to approximately 12,000 volts DC for ionizer and 6,000 volts DC for collector, including overload protection, on-off switch, pilot light indicating operating status.
				4. Safety Accessories: Manual reset safety switches and warning lights for filter plenum access doors, signal lights and safety switching upstream and downstream of unit within duct, and enamel high voltage warning signs.
			1. EXTENDED SURFACE HIGH EFFICIENCY MEDIA FILTERS

In this article, list manufacturers acceptable for this Project.

* + - * 1. [Manufacturers](http://www.specagent.com/LookUp/?ulid=8288&mf=04&src=wd):

Substitutions: [Section 016000 - Product Requirements] [Not Permitted].

* + - * 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

Parker

Koch Filter Group

Approved equivalent.

Edit the following descriptive specifications to identify project requirements and to eliminate conflicts with manufacturers specified.

* + - * 1. Media: Pleated, water-resistant glass fiber with [**aluminum**] [**Kraft**] separators; in 16 gage (1.5 mm) steel holding frame with corrosion resistant coating.

Nominal Size: [**24 x 24 x 6 inches (610 x 610 x 150 mm)**] [**24 x 24 x 12 inches (610 x 610 x 300 mm)**] <**\_\_\_\_\_\_\_\_**> deep.

* + - * 1. Performance Rating, ASHRAE 52.1 “Gravimetric and Dust-Spot Procedures for Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter”:

Dust Spot Efficiency: 95 percent.

MIL-STD-282 “Filter Units, Protective Clothing, Gas-Mask Components, and Related Products: Performance-Test Methods” Test 0.3 Micron Dioctyl Phthalate Smoke (DOP) Efficiency: 99 percent.

Initial Resistance at [**150 fpm (0.63 m/s)**] [**250 fpm (1.27 m/s)**] <**\_\_\_\_\_\_\_\_**> Face Velocity: [**0.35 inch wg (87 Pa)**] [**0.50 inch wg (125 Pa)**] <**\_\_\_\_\_\_\_\_**>.

Recommended Final Resistance: [**1.5 inch wg (375 Pa)**] [**2.0 inch wg (500 Pa)**] <**\_\_\_\_\_\_\_\_**>.

* + - 1. EXTENDED SURFACE NON-SUPPORTED MEDIA FILTERS

* + - * 1. [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).

Approved equivalent.

In this article, list manufacturers acceptable for this Project.

* + - * 1. [Manufacturers](http://www.specagent.com/LookUp/?ulid=8289&mf=04&src=wd):

Substitutions: [Section 016000 - Product Requirements] [Not Permitted].

Edit the following descriptive specifications to identify project requirements and to eliminate conflicts with manufacturers specified.

* + - * 1. Media: [**UL 900 Class 1**] [**UL 900 Class 2**] reinforced glass fiber performed into series of pockets with media spacing controls by variable length stitches; galvanized steel header frame.

Media Area: [**35**] <**\_\_\_\_\_\_\_\_**> sq ft of media per 1000 cfm ([**6.9**] <**\_\_\_\_\_\_\_\_**> sq m per 1000 L/sec) capacity.

Nominal size: 24 x 24 inches (610 x 610 mm) face, [**22**] [**30**] [**36**] inches ([**560**] [**760**] [**910**] mm) deep.

* + - * 1. Performance Rating, ASHRAE 52.1 “Gravimetric and Dust-Spot Procedures for Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter”:

Percent Dust Spot Efficiency: [**50**] [**80**] [**90**].

Percent Weight Arrestance: [**97**] [**98**] [**99**].

Initial Resistance: [**0.30 inch wg (75 Pa)**] [**0.40 inch wg (100 Pa)**] [**0.75 inch wg (187 Pa)**].

Recommended Final Resistance: 1.0 inch wg (250 Pa).

* + - 1. EXTENDED SURFACE RETAINED MEDIA FILTERS

In this article, list manufacturers acceptable for this Project.

* + - * 1. [Manufacturers](http://www.specagent.com/LookUp/?ulid=8290&mf=04&src=wd):

Substitutions: [Section 016000 - Product Requirements] [Not Permitted].

* + - * 1. Manufacturers: 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.

AirGuard; Clarcor Air Filtration Products, Inc.

Air-Nu.

Columbus Industries, Inc.

Filtration Group.

Glasfloss Industries.

Koch Filter Corporation.

Tri-Dim Filter Corporation.

Approved equivalent.

Edit the following descriptive specifications to identify project requirements and to eliminate conflicts with manufacturers specified.

* + - * 1. Media: [**UL 900 Class 1**] [**UL 900 Class 2**] pleated, non-woven cotton fabric, scrim reinforced; supported by welded steel retainer; in 16 gage (1.5 mm) steel holding frame with corrosion resistant coating.

Effective Media Area: [**16**] [**20**] <**\_\_\_\_\_\_\_\_**> sq ft per 1000 cfm ([**3.1**] [**3.9**] <**\_\_\_\_\_\_\_\_**> sq m per 1000 L/sec) capacity rating.

Nominal Size: [**24 x 24 x 12 inches (610 x 610 x 300 mm)**] <**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**> deep.

* + - * 1. Performance Rating: ASHRAE 52.1 “Gravimetric and Dust-Spot Procedures for Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter”:

Percent Dust Spot Efficiency: [**30**] [**50**] [**80**] [**90**].

Percent Average Weight Arrestance: [**92**] [**96**] [**98**] [**99**].

Initial Resistance at 500 fpm (2.54 m/sec) Face Velocity: [**0.20 inch wg (50 Pa)**] [**0.50 inch wg (125 Pa)**] [**0.75 inch wg (185 Pa)**].

Recommended Final Resistance: 0.50 inch wg (125 Pa) above initial resistance.

* + - 1. HIGH EFFICIENCY PARTICULATE AIR (HEPA) FILTERS

These filters are used for maximum filtration efficiency, to protect life, to eliminate objectionable materials, or to maintain dependability of delicate operations.

In this article, list manufacturers acceptable for this Project.

[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. [Manufacturers](http://www.specagent.com/LookUp/?ulid=8291&mf=04&src=wd):

Substitutions: [Section 016000 - Product Requirements] [Not Permitted].

Edit the following descriptive specifications to identify project requirements and to eliminate conflicts with manufacturers specified.

* + - * 1. Media: UL 586 “High-Efficiency. Particulate, Air Filter Units”, pleated, water-resistant glass fiber with separators of [**aluminum**] [**vinyl coated aluminum**] [**ribbons of filter media**]:

Holding Frame: [**Plywood**] [**Fire retardant plywood**] [**Particleboard**] [**Fire retardant particleboard**] [**Galvanized steel**] [**Zinc plated steel**] [**Cadmium plated steel**] [**Stainless steel**] [**Aluminum**].

Media to Frame Side Bond: [**Polyurethane foam**] [**Silicone**] [**Neoprene adhesive**] [**Fiberglass mat packing**] [**Thermosetting sealant**].

Face Gasket: [**Neoprene expanded rubber**] [**Ceramic fiber**] [**Silicone**].

Nominal Size: [**24 x 24 x 12 inches (610 x 610 x 300 mm)**] <**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**> deep.

* + - * 1. Performance Rating:

MIL-STD-282 “Filter Units, Protective Clothing, Gas-Mask Components, and Related Products: Performance-Test Methods” Test 0.3 Micron Dioctyl Phthalate Smoke (DOP) Efficiency: 99.97 percent.

Rated Airflow Capacity at 1.0 inch wg (250 Pa): [**1150 cfm (540 L/s)**] <**\_\_\_\_\_\_\_\_**>.

Recommended Final Resistance: 3.0 inch wg (750 Pa).

* + - 1. WASHABLE PERMANENT PANEL FILTERS

These filters have limited application due to their very low efficiency. They require cleaning facilities if Owner intends to maintain filters in-house.

In this article, list manufacturers acceptable for this Project.

[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. [Manufacturers](http://www.specagent.com/LookUp/?ulid=8292&mf=04&src=wd):

Substitutions: [Section 016000 - Product Requirements] [Not Permitted].

Edit the following descriptive specifications to identify project requirements and to eliminate conflicts with manufacturers specified.

* + - * 1. Media: 14 mesh [**steel screen, zinc electroplated**] [**stainless steel**] [**aluminum**], alternate layers of flat and herringbone crimp, four layers per inch (25 mm); rod reinforced.

Frame: [**16 gage (1.5 mm) galvanized steel**] [**20 gage (0.90 mm) stainless steel**] [**Aluminum**]

Nominal Size: [**16 x 20 inches (400 x 500 mm)**] [**16 x 25 inches (400 x 625 mm)**] [**20 x 20 inches (500 x 500 mm)**] [**20 x 25 inches (500 x 675 mm)**] <**\_\_\_\_\_\_\_\_**>.

Thickness: [**1 inch (25 mm)**] [**2 inches (50 mm)**] thick.

* + - * 1. Performance Rating:

Initial Resistance at 500 fpm (2.54 m/sec) face velocity: [**0.10 inch wg (25 Pa)**] [**0.12 inch wg (30 Pa)**] [**0.24 inch wg (60 Pa)**].

Recommended Final Resistance at 500 fpm (2.54 m/sec) face velocity: 0.50 inch wg (125 Pa).

* + - 1. FILTER FRAMES AND HOUSINGS

In this article, list manufacturers acceptable for this Project.

[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. [Manufacturers](http://www.specagent.com/LookUp/?ulid=8293&mf=04&src=wd):

Substitutions: [Section 016000 - Product Requirements] [Not Permitted].

Edit the following descriptive specifications to identify project requirements and to eliminate conflicts with manufacturers specified.

* + - * 1. General: Fabricate filter frames and supporting structures of [**16 gage (1.50 mm)**] galvanized steel or extruded aluminum T-section construction with necessary gaskets between frames and walls.
				2. Standard Sizes: For interchange ability of filter media of other manufacturers; for panel filters, size for [**24 x 24 inches (610 x 610 mm)**] <**\_\_\_\_\_\_\_\_**> filter media, minimum 2 inches (50 mm) thick; for extended surface and high efficiency particulate air filters, provide for upstream mounting of panel filters.
				3. Side Servicing Housings: Flanged for insertion into ductwork, of reinforced 16 gage (1.5 mm) galvanized steel; access doors with continuous gaskets and positive locking devices on both sides; extruded aluminum tracks or channels for primary [**and secondary**] [**, secondary and tertiary**] filters with positive sealing gaskets.
			1. FILTER GAGES

In this article, list manufacturers acceptable for this Project.

[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. [Manufacturers](http://www.specagent.com/LookUp/?ulid=8294&mf=04&src=wd):

Substitutions: [Section 016000 - Product Requirements] [Not Permitted].

Edit the following descriptive specifications to identify project requirements and to eliminate conflicts with manufacturers specified.

3-1/2 inch (90 mm) gage has 2 percent accuracy. 2 inch (50 mm) gage has 3 percent accuracy.

* + - * 1. Direct Reading Dial: [**3-1/2 inch (90 mm)**] [**2 inch (50 mm)**] diameter diaphragm actuated dial in metal case. Furnish vent valves, black figures on white background, front calibration adjustment, range [**0-0.5 inch wg (0-125 Pa)**] [**0-1.0 inch wg (0-250 Pa)**] [**0-2.0 inch wg (0-500 Pa)**] [**0-3.0 inch wg (0-750 Pa)**] [**0-4.0 inch wg (0-1000 Pa)**], [**2**] [**3**] percent of full scale accuracy.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

* + - * 1. Inclined Manometer: One piece molded plastic with epoxy coated aluminum scale, inclined-vertical indicating tube and built-in spirit level, range 0-3 inch wg (0-750 Pa), 3 percent of full scale accuracy.
				2. Accessories: Static pressure tips with integral compression fittings, 1/4 inch (6 mm) [**aluminum**] [**plastic**] tubing, 2-way or 3-way vent valves.
			1. ELECTRICAL CHARACTERISTICS AND COMPONENTS

Select one or more of the following subparagraphs appropriate to equipment requirements.

* + - * 1. Electrical Characteristics: In accordance with Section 260503 and the following:

[**<\_\_\_\_\_\_\_\_>hp (<\_\_\_\_\_\_\_\_> W).**] [**<\_\_\_\_\_\_\_\_> rated load amperes.**]

<**\_\_\_\_\_\_\_\_**> volts, [**single**] [**three**] phase, 60 Hz.

<**\_\_\_\_\_\_\_\_**> amperes maximum [**fuse size**] [**circuit breaker size**] [**overcurrent protection**].

<**\_\_\_\_\_\_\_\_**> minimum circuit ampacity.

<**\_\_\_\_\_\_\_\_**> percent minimum power factor at rated load.

* + - * 1. Motors: In accordance with Section 230513.
				2. Disconnect Switch: Factory mount [**in control panel**] [**on equipment**].
1. EXECUTION
	* + 1. INSTALLATION
				1. Install filters with felt, rubber, or neoprene gaskets to prevent passage of unfiltered air around filters.
				2. Install filter gage static pressure tips upstream and downstream of filters. Mount filter gages on outside of filter housing or filter plenum, in accessible position. Adjust and level.
				3. Do not operate fan system until [**temporary**] [**permanent**] filters are in place. Replace temporary filters used during construction and testing, with clean set.
				4. Install filter gages on filter banks with separate static pressure tips upstream and downstream of filters.
			2. SCHEDULES

Include schedule when many built-up or unitary filter banks are required on Project.

Consider the following examples when developing Project schedule.

* + - * 1. Air Filter Schedule:

AF-1:

Location: <**\_\_\_\_\_\_\_\_**>.

Type: <**\_\_\_\_\_\_\_\_**>.

Number: <**\_\_\_\_\_\_\_\_**>.

Size: <**\_\_\_\_\_\_\_\_**>.

Air Flow Rate: <**\_\_\_\_\_\_\_\_**>.

Face Velocity: <**\_\_\_\_\_\_\_\_**>.

Overall Width: <**\_\_\_\_\_\_\_\_**>.

Resistance:

Initial: <\_\_\_\_\_\_\_\_>.

Final: <**\_\_\_\_\_\_\_\_**>.

AF-2:

Location: <**\_\_\_\_\_\_\_\_**>.

Type: <**\_\_\_\_\_\_\_\_**>.

Number: <**\_\_\_\_\_\_\_\_**>.

Size: <**\_\_\_\_\_\_\_\_**>.

Air Flow Rate: <**\_\_\_\_\_\_\_\_**>.

Face Velocity: <**\_\_\_\_\_\_\_\_**>.

Overall Width: <**\_\_\_\_\_\_\_\_**>.

Resistance:

Initial: <**\_\_\_\_\_\_\_\_**>.

Final: <**\_\_\_\_\_\_\_\_**>.

END OF SECTION 234000