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The Description of the Project
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SPECIFICATION DIVISION 23

NUMBER SECTION DESCRIPTION

DIVISION 23 HEATING, VENTILATING AND AIR CONDITIONING (HVAC)
SECTION 234000 - HVAC AIR CLEANING DEVICES

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DIVISION 23 HEATING, VENTILATING AND AIR CONDITIONING (HVAC)
SECTION 234000 - HVAC AIR CLEANING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, Standard General and Supplementary General Conditions, Division 1 Specification Sections, and other applicable Specification Sections including the Related Sections listed below, apply to this Section.

B. Related Sections:

1. Section 019100/019110: Commissioning.
2. Division 26: Electrical.

1.2 SUMMARY

A. Section Includes:

1. Filter holding frames.
2. Pleated filters- MERV 8.
3. Bag/Pocket filters- MERV 13.
4. Bag/Pocket filters- MERV 14.
5. V-Cell filters- MERV 14
6. HEPA filters (air handler applications only).
7. Gas adsorption filters.
8. Ring Panel Filters.
9. Filter housing.
10. Filter gauges.

1.3 SUBMITTALS

A. Submit the following product data for each unit:

1. Dimensions, performance characteristics, class, details of filter rack construction, maintenance access, and information on all accessories.

1.4 QUALITY ASSURANCE

A. Manufacturers and Products: The products and manufacturers specified in this Section establish the standard of quality for the Work. Subject to compliance with all requirements, provide specified products from the manufacturers named in Part 2.

B. Reference Standards:

1. Products in this section shall be built, tested, and installed in compliance with the following quality assurance standards; latest editions, unless noted otherwise.
   a. ANSI/ASHRAE 52.2-2012 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.

b. ANSI/ASHRAE 52.2-2012 Appendix J - Optional Method of Conditioning a Filter Using Fine KCL Particles to Demonstrate Efficiency Loss That Might Be Realized in Field Applications1-Gravimetric and dust-spot procedures for Testing Air Cleaning Devices Used in General Ventilation for Removing Particulate Matter.
c. ANSI/ASHRAE 850 (I-P)-2013 - Standard For Performance Rating of Commercial and Industrial Air Filter Equipment.
d. ANSI/UL-900 -2015 Standard For Air Filter Units
e. NAFA Guide to Air Filtration, Fifth Edition, 2014
f. HEPA filters shall be tested in accordance with methodologies outlined in Recommended Practices (RP) as published by the Institute of Environmental Sciences and Technologies (IEST) and filter test method by the International Organization for Standardization (ISO).
g. UL 586-Test Performance of High Efficiency Particulate, Air Filter Units.
h. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.
i. IES-RP-CC-001 compliant HEPA and ULPA Filters.

1.5 DELIVERY, STORAGE, AND HANDLING

A. All Filters and Accessories

1. Store at least 4 inches above floor on wood pallets or similar devices. Protect from odors, dust, moisture, and other debris while stored on or off the jobsite, and when transporting to the jobsite, by tightly covering with plastic.

B. HEPA Filters

1. Delivery
   a. Inspect cartons and filters for damage when received at the job site along with an Owner-designated representative.
   b. Reject cartons with damaged corners, punctures, water damage or not stacked with up arrow in proper position. Do not stack cartons higher than 6 ft. (1.8 meters).
   c. Open cartons and inspect filter face for sagging pleats and separators, cracks, pinholes or breaks. Check gaskets for position and full adhesion to the frame. Use a 125-watt flood lamp during inspection.
   d. Do not open filters packed in sealed plastic bags during inspection unless the filter is obviously damaged.
   e. Do not attempt to repair damaged filters at the job.
2. Handling
   a. Handle filters and cartons so pleats remain vertical. Arrow on cartons indicates direction of pleats.
   b. Handle filters in sealed cartons until installed.
   c. Do not handle with chains, slings or hooks.
   d. Do not drop or jar the carton of filter.
   e. Do not lift filter from carton. Fold carton tops back and invert carton. Withdraw the carton from the filter.
   f. Lift unpacked filters only by the outer surface of cell frame.
3. Storage
   a. Repack filter after inspection and seal carton.

b. Store cartons with pleats in a vertical position.
c. Do not stack more than 6 feet high (1.8 meters).

1.6 WARRANTY

A. Provide a complete parts and labor warranty for a minimum of one year from the date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers- Pleated, Bag/Pocket and V-Cell Filters:

1. Camfil Farr.
2. Parker.
3. Airflow Products Company.
4. AAF/Flanders Corporation.
5. Mann+Hummel.
6. Mikropor.

B. Acceptable Manufacturers- HEPA Filters:

1. AAF/Flanders Corporation.
2. Camfil Farr.
3. Mikropor.
4. Mann+Hummel.

C. Acceptable Manufacturers- Gas Adsorption Filters:

1. AFF/Flanders Corporation.
2. Camfil Farr.
3. RSE Corp.
4. Parker.

D. Acceptable Manufacturers- Filter Gauges:

1. Dwyer Instruments.
2. Deiterich Standard, Inc.
3. Bacharach, Inc.
4. Moeller Instrument Co., Inc.

2.2 GENERAL

A. Base filters and filter rack design on the use of 24-inch by 24-inch filters whenever possible. The use of 12-inch by 24-inch filters to complete rack configurations is acceptable. If 24-inch by 24-inch and 12-inch by 24-inch modules are not possible, use industry standard filter sizes for basis of design.

B. Provide filters and filter holding frames by the same manufacturer.

2.3 HOLDING FRAMES

A. Provide grid type holding frames, similar to Camfil Farr Type 8 or equivalent, factory fabricated of a minimum of 16 gauge galvanized steel, capable of normal operation at twice the maximum filter drop without deformation and equipped with gaskets and 4 spring type positive sealing fasteners. Fasteners shall be capable of being attached or removed without deforming the gaskets and without the use of tools. Frames shall be capable of supporting filters of different efficiencies and depths by change of fasteners.

1. Unless indicated otherwise, provide grid type (face loading) frame in air handling units.
2. Unless indicated otherwise, provide side slide filter frames for duct applications only, up to a maximum frame size of 24 inches by 24 inches Sizes above 24 inches by 24 inches shall be face loading type frames.

B. Holding frames shall, at minimum, withstand double the scheduled dirty filter pressure drop without deformation or air bypass.

C. Design Frames so that the housing can be stacked on top of the other without deformation.

D. Completely safe off filter frame to eliminate air from bypassing filters.

E. Filters shall be inserted and seal from the upstream side of the frame.

F. Filter frame maximum allowable leakage rate 0.5 percent at 6 inches wc.

2.4 FILTERS

A. MERV 8 Standard Capacity High Velocity Pleated Filters

1. Filters: 2-inch, medium efficiency, pleated, UL Standard 900 compliant, disposable type as shown on the drawings. Each filter shall consist of a non-woven fabric media, heavy duty support grid and enclosing frame.
2. Filter media: synthetic media pleated into a wedge shaped "V" configuration.
   a. Minimum dust holding capacity shall be 60 grams.
   b. Minimum MERV 8 per ASHRAE 52.2 and a MERV-A rating of 8 when tested per Appendix J of ASHRAE 52.2.
3. Effective filter media area shall be at least 7.0 sq.ft. media per 1.0 sq.ft. filter face area and shall contain at least 10 pleats per linear foot. Initial resistance at 500 fpm face velocity shall not exceed 0.30 inch wg.
4. Media support shall be a welded wire grid or expanded metal with an effective open area of at least 96 percent. Bond the welded wire grid to the filter media to eliminate the possibility of media oscillation and media pull-away. Form the media support grid in a manner that it affects radial pleat design, allowing total use of filter media.
5. Construct the enclosing frame with a rigid, heavy duty, high wet strength clay coated kraft board, and it shall include overlapping flaps and interlocking corners. The frame shall be bonded to the pleated element at all contact points.

B. MERV 13 Bag/Pocket Filters

1. Filter: 22 inches deep, high performance, totally disposable, UL Standard 900 compliant bag/pocket type.
2. Filter media: High-density, semi-rigid, mechanical, non-stitched, non-shedding 100% synthetic.
   a. Minimum dust holding capacity shall be 596 grams.
   b. Minimum MERV 13 rating per ASHRAE 52.2 and a MERV-A rating of 13 when tested per Appendix J of ASHRAE 52.2.
3. Filter shall have a minimum of 40 support points per sq.ft.
4. Filter shall have a minimum 6 pockets or 49 sq. ft. per 24 X 24 X 22. The initial resistance at 500 fpm face velocity shall not exceed 0.30 inch wg. Final resistance at 500 fpm face velocity shall not exceed 1.50 inch wg.
5. Each individual pocket shall be fastened to the next by means of pocket support ribs, which are mechanically attached to the internal header. The entire assembly shall be encased in a galvanized steel header frame.
6. Filter headers: Constructed of a deep grooved "J" retainer channel of galvanized steel. Closure corner shall be riveted, with mitered joints sealed against air leakage. Filters shall have minimum 7/8 inch headers.

C. MERV 14 Bag/Pocket Filters

1. Filter: 22-inch-deep, high performance, totally disposable, UL Standard 900 compliant bag/pocket type.
2. Filter media: High-density, semi-rigid, mechanical, non-stitched, non-shedding 100% synthetic.
   a. Minimum dust holding capacity shall be 776 grams.
   b. Minimum MERV 14 rating per ASHRAE 52.2 and a MERV-A rating of 14 when tested per Appendix J of ASHRAE 52.2.
3. Filter shall have a minimum of 40 support points per sq.ft.
4. Filter shall have a minimum 8 pockets or 66 sq. ft. per 24 X 24 X 22. The initial resistance at 500 fpm face velocity shall not exceed 0.30 inch wg. Final resistance at 500 fpm face velocity shall not exceed 1.50 inch wg
5. Each individual pocket shall be fastened to the next by means of pocket support ribs, which are mechanically attached to the internal header. The entire assembly shall be encased in a galvanized steel header frame.
6. Filter headers: Constructed of a deep grooved "J" retainer channel of galvanized steel. Closure corner shall be riveted, with mitered joints sealed against air leakage. Filters shall have minimum 7/8 inch headers

D. MERV 14 V-Cell Filters

1. Filter: 12-inch-deep, high performance, totally disposable, 4 V-Cell type. The filter shall be MERV 14 per ASHRAE 52.2 and listed as UL 900 compliant
2. Filter media: 100 percent ultra-fine micro glass fiber construction, pleated into 1 inch packs.
3. Filter shall have a minimum of 193 sq. ft. of media.
4. Filter dimensions: 24 by 24 by 12 inches (nominal and without gaskets)
5. Filter shall have 8 - 1 inch deep “V”’s formed into 4 V-cells
6. Filter shall have 13/16 inch perimeter headers and

7. The initial resistance at 500 fpm face velocity shall not exceed 0.33 inch wg.
8. The molded end panels and center support members are to be made of ABS. (Acrylonitrile Butadiene Styrene) Plastic
9. The media packs shall be bonded to the inside periphery of an ABS enclosing frame with a polyurethane sealant. The enclosing frame shall include top and bottom molded tracks as an integral part of the frame to ensure a proper seal
10. Filter shall have a wet breach resistance of not less than 25" w.g. and supportive Third Partly Test Report. Provide gasketing on the downstream face side of standard header. Construction shall be neoprene rubber SCE-41, ¼" x ¾" wide. Or an endless polyurethane leakage free pour

2.5 HEPA HIGH CAPACITY FILTER (AIR HANDLER APPLICATIONS ONLY)

A. Filters shall have a minimum efficiency of 99.99 percent on 0.3 micron particles when tested with thermally generated DOP in accordance with the latest Industry and Military Standards. The media shall be glass paper. Filters shall be factory constructed and assembled of metal frames, corrugated aluminum separators and 100 percent solid resin sealant.

1. Cell sides: 20 gage galvanized steel with edges sealed and riveted to insure a strong corner joint.
2. Filter Media: 0.015-inch-thick (0.38 mm thick), plus or minus 0.003 inch (0.08 mm), waterproofed, fire retardant, 100 percent glass fiber construction, assembled in closely pleated panel packs, separated by double-thickness ribbons of filter media on both faces of the panel. Install the media packs with the metal cell sides in a multiple V-bank arrangement sealed on all edges with a thermoset bond.
3. Provide gasket on each filter, made of neoprene rubber SCE-41, 5-10 durometer, 1/4 inch (6 mm) by 3/4 inch (19 mm) wide.
4. Filter dimensions: 24 by 24 by 1.5 inches (600 by 600 by 290 mm) (without gaskets).
5. Provide filter having a nominal rating of 2400 cfm (0.94 cu. m/s) with a maximum initial pressure drop of 1.0 inch water gage (349 Pa) or less, tested in accordance with Mil-Std-282 and IES-CS-1T, and having a minimum efficiency MERV 17 per ASHRAE Standard 52.2. Provide each filter with a UL 586 label as an indication of its fire retardancy. Provide to withstand 175 deg. F (79 deg.C) continuous temperature.
6. Mark the cell sides of each filter with indelible ink showing the following information:
   a. Manufacturer's name.
   b. Style Code.
   c. Serial Number.
   d. Efficiency and resistance.

B. Holding frames shall consist of holding frame section, reinforcing flanges, annular-based dimples and mounting holes, receptacle guides, and removable swing bolt assemblies.

1. Construct the holding frame of not less than 14 gauge galvanized steel and shall be of all welded construction, factory fabricated and assembled. All welds shall be ground and smoothly finished to provide a uniform sealing surface.
2. Reinforcing flanges shall be an integral part of the holding frame in order to preclude the possibility of deflection of the sealing flange.
3. Annular-based dimples and mounting holes shall be an integral part of the holding frame to provide ease of installation and mounting, and to preclude the possibility of mounting bolt interference.
4. Four receptacle guides shall be an integral part of the holding frame and shall be mounted on the two vertical sides of the frame. They shall be designed to align the properly filter when placed into the frame and shall function as fulcrum for the swing bolt assemblies.
5. Four swing bolt assemblies shall be provided for each holding frame. Swing bolts shall be constructed of 5/16 inch zinc electroplated steel and be provided with equi-bearing clamps and hex nuts in order to affect adequate and uniform pressure against the periphery of the HEPA filter. Hex nuts shall be capable of being torqued to 30 inch/lbs. each, providing for a 50 percent gasket compression. The swing bolt assembly shall be such that it provides for individual sealing of filters.

C. HEPA Filters shall meet leak free scan test requirements of IES-RP-CC-001 Type A.

2.6 GAS ADSORPTION FILTERS

A. Gas adsorption filter manufacturer shall provide gas adsorption filter racks.

B. Gas adsorption filters shall be total-detention type.

C. Construction

1. Construct adsorbers of multiple media-filled panels. Panels shall be 1 inch (25mm) thick moisture-resistant corrugated, kraft honeycomb sealed to top and bottom end plates with non-volatile adhesive.
2. Completely fill Panels with adsorption media held in place by nylon screens.
3. Top and bottom end plates shall be injection-molded high strength ABS plastic with integral headers.
4. Assemble the cell with aerodynamically-designed vertical front struts and vertical steel rod supports on the downstream side.
5. Seal each filter in a polyethylene bag before placing in its shipping carton.

D. Media

1. Media shall be 50 percent activated carbon and 50 percent potassium permanganate coated activated alumina.
2. Activated carbon media shall be virgin coconut shell base, minimum 60 percent CTC activity by the ASTM D-3467 test method, minimum apparent density of 0.49 g/mL, minimum hardness of 97 by the ASTM D-3802 method and a minimum surface area of 1100m^2/g by the N_2 BET method.

3. At 2000 CFM (0.94 m^3 /s), the media shall have an airway resistance no greater than 0.50 inch wg (0.12 kPa) and a residence time no less than 0.030 seconds.

2.7 RING PANEL FILTER

A. Construct duct mounted filter racks for animal room exhaust of heat-sealed layers of 2-ply polyester (minimum MERV rating 6, minimum MERV-A rating 6), UL 900 Class 2, over corrosion resistant support frame. Filter shall be overcut. Media shall extend outside frame 1 inch on each side. Initial resistance shall be no more than 0.2 inch wg at 500 fpm.

2.8 FILTER GAUGES

A. Provide 1 filter gauge for each filter bank. Select the scale so it allows for 1 inch wc greater than the final filter resistance.

B. Locate static pressure taps in the airstream as recommended by the manufacturer and connect to gauges located on air handling unit casings, or on walls for in-duct filter, as indicated, with 1/4 inch o.d. aluminum or copper tubing.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install filters, filter frames, filter housings, and filter gauges in accordance with manufacturer's recommendations and approved submittals.

B. Install filters to ensure easy accessibility for service, removal and replacement of filters.

C. Do not operate any system without filters.

D. For any equipment used for temporary ventilation, install a complete set of filters prior to start-up. This set of filters shall be in addition to the final set.

1. While operating for temporary use, install a complete set of filters of the same quality and efficiency as the specified permanent filters for the project.
2. Continuously maintain filters and replace when pressure drop exceeds 1 inch wc, or at manufacturer's recommended change-out pressure drop, whichever is lower.
3. Install a new, complete set of filters just prior to final acceptance by Owner

3.2 COMMISSIONING

A. Perform the commissioning activities as outlined in the Division 01 Section Commissioning and other requirements of the Contract Documents.

END OF SECTION 234000