Section 23 40 00
AIR FILTERS AND CLEANERS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. The work of this section shall include, but is not limited to the following:
   1. Panel filters
   2. High performance filters
   3. High-efficiency particulate air (HEPA) filters
   4. Activated carbon filters
   5. Filter frames, clips, housings and holding assemblies
   6. Filter gauges

1.2 RELATED DOCUMENTS

A. Section 23 05 01 - Mechanical General Provisions

B. Section 23 05 19 - Meters, Gauges and Thermometers

C. Section 23 05 93 - Mechanical Systems Balancing

D. Section 23 09 00 - Building Management Systems (BMS)

1.3 SUBMITTALS

A. Submit manufacturer's data on Minimum Efficiency Reporting Value (MERV) rating, sizes, pressure drops, maximum velocities and weights of complete units.

B. Submit materials of construction, joining and fastening details for filters, frames and holding assemblies.

C. Submit drawings showing arrangement of multiple filter units.

D. Filter gauges, mounting hardware and wiring diagrams.

1.4 QUALITY ASSURANCE

A. All filter efficiencies are stated in MERV performance as described in ASHRAE Standard 52.2-1999, except as noted.

B. All filters shall comply with UL 586, UL 181 and UL 900 Class 1

C. Filter coatings shall comply with ASTM D93.

D. All filters shall comply with NFPA and UL standards for fuel contributed, flame spread and smoke development.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Flat Filters: Flanders/CSC, Cam/Farr, American Air Filter (AAF)

B. Bag Filters: Cam/Farr, Viledon, American Air Filter, Flanders/CSC

C. HEPA Filters: Flanders/CSC, Cam/Farr, Purolator

D. Activated Carbon Filters: Cam/Farr, or approved equal

E. Absorption Filters: Extraction Systems Inc., or approved equal

F. Filter Gauges: Dwyer, or approved equal

2.2 TYPE “A” – PANEL FILTERS

A. Provide 2-inch thick pleated, lofted, non-woven, reinforced fabric, supported and bonded to a welded wire grid, and enclosed in cardboard frame for all panel filters with a MERV 7 rating.

B. In locations where “slide-in” side access type is required, install filters with adequate provisions for preventing bypassing of air around ends.

C. Do not exceed 400 feet per minute filter bank face velocity or as scheduled on the drawings for the maximum scheduled airflow.

D. Frames shall be 16-gauge galvanized steel, complete with gaskets and spring type positive sealing fasteners.

E. Initial resistance shall be 0.3 inches water gauge, 0.9 inches water gauge recommended final resistance.

2.3 TYPE “C” – HIGH PERFORMANCE FILTERS

A. Provide filter media of high-density microfine glass fibers laminated to a non-woven synthetic backing to form a lofted filter blanket. Provide media with a MERV rating of 13.

B. Provide permanent frame of a self-sealing type to facilitate installation and prevent air leakage between the frames. Provide a seal between the frames and the filter cartridge. The filter media shall be self-supporting against the force of the airflow throughout the operating range of 40 to 120 percent of nominal capacity.

C. Filters shall consist of permanent 16-gauge galvanized steel frame and factory assembled replaceable filter cartridges, complete with installation accessories.

D. Filters shall be rated UL Class 1.

E. The rated filter face velocity shall be 500 feet per minute, with a maximum initial resistance of 0.2 inches water gauge for nominal size filter 24 inches by 24 inches by 26 inches.

F. The filter shall be classified by Underwriters Laboratories Class 2 when tested accordingly to UL Standard 900.

G. Filter shall fit into filter frames and housings without interfering with downstream components. All filters shall be the same pocket depths.

2.4 TYPE “D” – HEPA FILTERS

A. Housings shall be constructed of 16 gauge galvanized steel with extruded aluminum filter slide tracks bolted to vertical formed channel supports at 24-inch intervals across the width of the housing. Filter tracks shall include nylon pile seal to mate with the sealing face of all filters.

B. Provide hinged doors on both sides, with permanently attached positive locking door latches. Provide gaskets to prevent any leakage around doors and between the doors and the filters.

C. Provide 1½-inch outward turned duct connection flanges on entering and leaving air sides for connecting ductwork. Filters shall be supported by 3-inch by 1½-inch channel, on 24-inch centers.

D. HEPA filter modules shall be constructed of 24-gauge steel, with baked enamel corrosion resistant finish.

E. Filter media shall consist of factory assembled, high-density, sub-micron, fire retardant glass fibers, minimum tensile strength of 3 pounds per inch of width, folded into a densely pleated pack. Each cell shall be tested to demonstrate MERV 17 rating on 0.3-micron particles according to the test as

per ASHRAE 52.2.

F. Provide water-resistant, aluminum separators.

G. Media pleats shall be self-supporting under varying airflow conditions.

H. Media nominal rating to be 250 feet per minute face velocity, 1.0-inch water gauge initial resistance, 2.0-inch water gauge recommended final resistance.

I. Filter cartridges shall be listed or classified under UL 586 test standard.

J. Provide a side access housing or holding frame as specified or scheduled.

K. Provide Type **[1] [2] [4]** inch deep, Type **[B] [C]** pre-filters for all Type “D” filters.

2.5 TYPE “E” – ACTIVATED CARBON

A. Filter housing shall be two-stage filter system consisting of 16-gauge galvanized steel enclosure, adsorber panel mounting tracks, dual-access doors, filter gaskets and seals. In-line housing depth shall not exceed 30 inches.

B. The housing shall be constructed of 16-gauge galvanized steel with pre-drilled standing flanges to facilitate attachment to other system components. Corner posts of Z-channel construction shall ensure dimensional adherence. (The housing shall be raintight and suitable for rooftop/outdoor installation.)

C. The housing shall incorporate the capability of installing two stages of filtration without modification to the housing. Filter tracks of anodized aluminum construction shall facilitate the application of multiple 2 inches deep adsorber panels and an equal number of 1-inch Type A particulate filters.

D. Dual access doors, swing-open type, shall include: a sponge neoprene gasket to facilitate a door-to-adsorber panel seal. Each door shall be equipped with adjustable and replaceable positive sealing UV-resistant knobs and replaceable door hinges.

E. Each module (2000 cfm per module rated) shall include 4 adsorber panels containing 1.6 cubic feet of granular sorbent media, sufficient to provide 0.048 seconds residence time. Standard sorbent shall be coconut shell granular activated carbon with a minimum activity rating of 60. Adsorptivity shall be 40 percent by weight and retentivity shall be 29 percent by weight when evaluated with toluene.

F. Pressure drop with charged adsorber panels installed shall not exceed 0.50 inches water gauge at 500 feet per minute.

2.6 FILTER HOUSINGS (Side Access)

A. Housing shall be factory-fabricated of 16-gauge galvanized steel, welded and properly braced. Provide pre-punched standing flanges shall facilitate field installation.

B. Housing or holding frame shall be of the same manufacturer as filter media or provided by the air handling unit manufacturer. Coordinate media size with filter rack design. Contractor fabricated housings or filter racks shall not be accepted. Housing assembly shall be suitable for use in duct systems with 3 inches of water gauge static pressure.

C. Casing and tracks shall be constructed of galvanized or enameled steel or aluminum. Mounting tracks and access doors shall have gaskets to minimize air bypass around the filters.

D. Provide two doors for access from both sides. Doors shall be hinged 16-gauge galvanized steel equipped with positive sealing, heavy-duty latches and sponge neoprene gaskets. Doors shall not be secured with nuts, bolts, wing nuts, or sheet metal screws.

E. Standard filter sections provided by air handling unit manufacturers may be used for MERV 11 and 14 filters but will not be accepted for MERV 17 or above filters or activated carbon filters.

F. Insulate housings where adjacent duct or air handling apparatus is insulated. Insulation shall be contained within a 2-inch thick, double wall steel panel and meet the requirements specified for adjacent duct or apparatus.

G. Furnish housings MERV 11 and above air filter system with a lever action sealing mechanism to secure media in tracks.

H. Frames for filter system with MERV 11 and above, and activated carbon filters shall have an integral pre-filter track for installation Type A filter immediately upstream of high efficiency media. Secure pre-filters by means of spring clips or a spring-loaded mechanism. Provide leakproof gaskets between pre-filter media and holding frame.

I. Universal holding frames shall be constructed with U-type bearing channels, polyester gasketing and positive sealing clips.

J. Extrusions of heavy gauge anodized aluminum shall be provided with a replaceable woven pile seal for sealing between extrusion and holding frame.

2.7 FILTER GAUGES

A. Provide filters with direct reading gauges, 4-inch dial type, diaphragm actuated, in a metal case to monitor both primary and secondary filter banks. Dwyer Magnehelic Series 2000 or approved equal.

B. Provide direct reading gauges, 4-inch dial type, diaphragm actuated, in a metal case with electrical control contacts to provide high-pressure alarm at the BMS. Dwyer Photohelic Series 3000 or approved equal.

C. Lettering shall be black figures on white background. Provide front recalibration adjustment.

D. Provide gauges with the following differential ranges in inches water gauge:

filter	**range**
MERV 7 to 10	0.0 to 1.0
MERV 11 to 12	0.0 to 2.0
MERV 13 to 16	0.0 to 2.0
Activated carbon	0.0 to 2.0

E. Provide one gauge for each filter bank, suitable for flush or surface mounting. Include an air filter gauge accessory package consisting of mounting bracket, aluminum tubing, two static pressure tips, and vent valves for each gauge.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Reinforce all filter banks and frames by welding the frames together or with galvanized angles or channels, in accordance with the filter manufacturer's recommendations. The maximum deflection at any point shall not exceed ¼-inch with the filter bank operating at a final air pressure drop of 1.2 inches water gauge.

B. Fully gasket each filter bank to prevent air bypass around the filter sections or between the filter modules. Caulk and seal between the plenum and the holding frame.

C. Provide complete sets of type 'A' filters for each air-handling unit to be used during the construction phase. The initial set shall be factory installed and each subsequent construction set shall be installed at the direction of the owner or contractor, or when filters reach a maximum air pressure drop of 0.75 inches water gauge.

D. Provide two (2) complete sets of the filters specified for each fan coil, fan power terminal, built up filter bank and air handling unit. Install one set immediately prior to the air balance and testing required by Section 23 05 93 - Mechanical Systems Balancing. The other set shall be delivered to the owner at the time of initial occupancy of the project.

E. Maintain necessary clearance for changing filters.

F. Install filter gauge static pressure tips upstream and downstream of filters. Mount gauge on outside of filter housing or filter plenum in accessible location. Install tubing and gauge valves between gauge and sensor tips. Adjust and level each gauge.

3.2 OPERATION

A. Maximum air velocity through the filter media shall not exceed 100 feet per minute for pleated type filters or a maximum face velocity of 400 feet per minute through the filter bank at the maximum scheduled fan airflow.

B. Install filter assemblies according to manufacturer's instructions and accepted trade practice. Focus particular attention on sealing against leakage between holding frame, housing, filter headers and filters.

C. Do not operate the equipment until specified filter media has been installed. Contractor shall be responsible for maintaining the cleanliness of air handling apparatus and air distribution systems during construction through regular inspection and changing of filter media throughout the construction period.

END OF SECTION 23 40 00

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