

## University of Houston Master Specification

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<Insert U of H Proj #>

<Insert Issue Name>  
<Insert Issue Date>

### SECTION 23 4000 - FILTERS AND ACCESSORIES

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

Maintain Section format, including the UH master spec designation and version date in the center columns of the header and footer. Complete the header and footer with Project information.

This Section uses the term "Engineer." Change this term to match that used to identify the design professional as defined in the General and Supplementary Conditions.

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

Delete hidden text after this Section has been edited for the Project.

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. The Contractor's attention is specifically directed, but not limited, to the following documents for additional requirements:
  - 1. The current version of the *Uniform General Conditions for Construction Contracts*, State of Texas, available on the web site of the Texas Facilities Commission.
  - 2. The University of Houston's *Supplemental General Conditions and Special Conditions for Construction*.

##### 1.2 DESCRIPTION OF WORK

- A. Work Included: Provide filters and accessories as specified, scheduled, and shown on the Drawings.
- B. Types: The types of filters required for the project include, but are not limited to:
  - 1. Unit mounted pleated filters.
  - 2. **[Unit mounted roll filters.] [Used for renovation projects only.]**

##### 1.3 QUALITY ASSURANCE

- A. Manufacturers: Provide filters and accessories complying with these specifications and produced by the following:
  - 1. American Air Filter.
  - 2. Cam-Farr.

##### 1.4 SUBMITTALS

- A. Shop drawing submittals shall include, but are not limited to, the following:
  - 1. Cut sheets on all filter types required for the project, clearly indicating type, construction, materials, sizes, ratings, classification, and other pertinent filter information.
  - 2. A listing of all filter types and sizes to be provided for the project.
  - 3. Cut sheet on all filter housings and assemblies clearly indicating sizes, construction, connection types, ratings, features controls, and other pertinent information.

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4. Certification that filters and filter housings and assemblies have been coordinated with served equipment and with filter racks/banks furnished by air handling equipment manufacturers.
5. Additional information as required in Section 23 0100 "Mechanical General Provisions."

### 1.5 PRODUCT DELIVERY, STORAGE AND HANDLING:

- A. Deliver filters and accessories in factory-fabricated water resistant packaging.
- B. Handle filters and accessories carefully to avoid damage to material components and enclosures.
- C. Store filters in a clean, dry space and protect from the weather.

## PART 2 - PRODUCTS

### 2.1 PLEATED FILTERS

- A. General: Provide high efficiency, pleated, disposable type filters where scheduled or shown on the Drawings.
- B. UL-listing: Filters shall be listed by Underwriters' Laboratories, Inc. as Class **[1] [2]**.
- C. Filter Media: Filter media shall be of the nonwoven cotton fabric type. The filter media shall have an average efficiency of at least 40% in accordance with ASHRAE Test Standard 52-76.
- D. Capacity: Ratings and capacity for pleated filters shall be as follows:
  - a. Final filters shall be MERV 13 High Efficiency rated. Pre-filters shall be MERV 8 rated
  - b. Four Inch: The effective filter media shall be not less than 7.0 square feet of media per 1.0 square foot of filter face area and shall contain not less than 11 pleats per linear foot. Initial resistance of 600 fpm approach velocity shall not exceed 0.35 inch w.g.
  - c. Two Inch: The effective filter media shall be not less than 4.6 square feet of media per 1.0 square foot of filter face area and shall contain not less than 15 pleats per linear foot. Initial resistance of 500 fpm approach velocity shall not exceed 0.28 inch w.g.
  - d. One Inch: The effective filter media shall be not less than 2.3 square feet of media per 1.0 square foot of filter face area and shall contain not less than 16 pleats per linear foot. Initial resistance at 500 fpm approach velocity shall not exceed 0.45 inch w.g.
- E. Media Support Grid: The filter media support shall be a welded wire grid with an effective open area of not less than 96%. The welded wire grid shall be bonded to the filter media to eliminate the possibility of media oscillation and media pull away. The media support grid shall be formed in such a manner that it effects a radial pleat design, allowing total use of filter media.
- F. Enclosing Frame: The filter enclosing frame shall be constructed of a rigid, heavy-duty, high wet-strength beverage board, with diagonal support members bonded to the air entering and air exit side of each pleats, to ensure pleat stability. The inside periphery of the enclosing frame shall be bonded to the filter pack, eliminating the possibility of air bypass.
- G. Manufacturers: American Air Filter PerfectPleat, Farr 30-30 or an approved equal.

### 2.2 PLEATED FILTER RACKS

- A. General: Pleated filters shall be installed in V-bank or flat filter racks as required to provide maximum filter velocity as scheduled or shown on the Drawings. Racks shall be provided **[with air handling units and are] [under this Section for installation on air handling units which are]** specified in Section 23 7416 "Packaged Air Handling Units" and Section 23 7420 "Custom Air Handling Units".
- B. **[Filter Racks: Provide American Air Filter, Farr or equal galvanized steel [V-bank] [flat] filter racks suitable for mounting on the air handling equipment which it serves. Racks shall be equipped with**

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**gaskets and spring type positive sealing fasteners to hold filters in place. Fasteners shall be removable without the use of tools.]**

### 2.3 ROLL FILTERS [To be used for renovation projects only.]

- A. General:** Provide side access automatically renewable roll filter assemblies for air handling units and other applications where scheduled or shown on the Drawings. Filter sizes and capacities shall be as scheduled and required for the intended application.
- B. Operation:** Rolls of media shall be installed at one side of the filter and intermittently moved into the airstream so as to maintain a substantially constant dirt load. The media shall be compactly rerolled automatically on disposable spools at the other side of the filter after it has accumulated its dirt load. The filter shall be equipped with a full height spring load pressure bar to ensure compact rewinding of the media. Each rewind spool section shall incorporate a mechanical anti-sag device to prevent air leakage past the upper horizontal edge of the media blanket. Both clean and dirty media rolls shall be completely enclosed and out of contact with the moving airstream.
- C. Construction:** Filter assembly shall be constructed of galvanized sheet metal with suitable provisions for connection to the served air handling unit and associated ductwork. A metal media feed tape, reel and hook shall be supplied to install new media across the filter face, making it unnecessary to enter the duct to replace media.
- D. Filter Media:** Media shall be of spun glass fibers bonded with a cured thermosetting resin, and shall have a nominal thickness of 2 inches. It shall have a graduated density in the direction of the airflow, with the larger interstices on the air entering side, with a corresponding decrease in glass fiber size.
  - 1. Media shall have a compressibility which will allow approximately 65 feet of material to be wound on a 13 inch diameter, expandable, steel core spool with integral steel guide flanges at both ends.
  - 2. Media shall be charged with an odorless and flameproof adhesive which shall not flow while in storage nor when subjected to temperatures up to 175°F.
  - 3. Media shall be reinforced with multifilament fiber glass cord running parallel to the media length.
  - 4. The media shall be supported on both faces in the airstream by No. 8 wire rods parallel to the direction of media travel. Rod spacing shall be on not more than 3 inch centers on the air leaving face and on not more than 6 inch centers on the air entering face.
  - 5. The roll media shall be UL-listed and classified Class 2 when tested in accordance with UL 900.
  - 6. Filter media shall be tested by an independent test laboratory in accordance with ASHRAE Standard 52 as outlined in Section 11.2 Dynamic Procedure for Self-Renewable Devices. The performance of the filter media shall not be less than the following based on a velocity of 500 fpm: Initial resistance of 0.18 inch w.g., average synthetic duct weight arrestance of 83%, and dust holding capacity of 98 grams per square foot.
- E. Operator/Controls:** The filter assembly operator and controls shall be completely factory-assembled and prewired, with the only field-wiring required being the 120 volt power supply to the control box.
  - 1. Each filter shall be complete with initial loading of filter media and a 1/6 hp, 120 volt, 1-phase gear motor with thermal overload protection and chain drive, NEMA 1 control box containing a low voltage transformer for the photoelectric media control circuit, warning light and dry

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alarm contact to indicate either supply lamp failure or media runout, and hand-off-auto selector switch. The alarm contact shall be monitored by [\_\_\_\_\_].

2. The controls shall be factory-wired and interconnected electrically to ensure fail safe operation. All factory and field wiring shall meet the requirements of the National Electrical Code.
3. The drive motor shall be actuated by a photo-electric solid state control which shall cause the media to be advanced in small increments when and only as dust accumulation dictates.
4. The control circuit shall ensure that no media is fed when the system is inoperative, shall feed the uniform small increments of media for constant dirt load and shall not require recalibration if the actual start-up airflow is different from design or if the system is of the variable air volume type.

- F. **Manufacturers:** Roll filter assemblies shall be American Air Filter Roll-O-Matic or an approved equal.

### 2.4 FILTER MANOMETERS

- A. [General: Provide a Dwyer 200 Series "Dura-Block" solid plastic, stationary inclined gauge manometer with red gauge oil for each filter bank of each air handling unit. Provide not less than 2 ounces of red gauge oil for replacement of each manometer furnished under this Section.]

[OR]

- B. [General: Provide filter manometers for each individual filter or filter bank handling [2,000] [\_\_\_\_\_] cfm or more and each high efficiency filter. Manometers shall be diaphragm-actuated dial and pointer type magnahelic filter pressure drop gauges mounted on the unit exterior. Gauges installed on filters installed in finished areas shall be flush-mounted. All gauges for a single filter housing shall be mounted in a single group on the unit exterior in an accessible location as the unit is installed and shall have an engraved nameplate identifying the filter monitored. Gauges shall be Dwyer Model No. 2003-AF (0-3 inch w.g. range) or an approved equal. [A Dwyer Model No. 1823-5 differential pressure switch or an approved equal with No. A-603 "T" kit shall be furnished and installed with each magnahelic gauge for remote monitoring by the BCAS. The differential pressure switch shall be set as recommended by the filter manufacturer.] The magnahelic gauge shall be provided with red and green scale overlays located on highlight safe and dangerous readings as recommended by the filter manufacturer.]

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. General: Install filter racks, housings, and filters in accordance with the manufacturers' written installation instruction.
- B. Coordination: Division 23 contractor shall coordinate equipment and filter bank connection requirements and provide transitions as required for proper installation of filters.

### 3.2 AIR FILTERS

- A. General: Install all filters protecting equipment prior to unit startup. Under no circumstances shall any air handling unit or fan and coil unit which is shown or specified to be furnished with filters be operated without filters in-place. Filters on units used during construction shall be replaced as necessary and as directed by General Contractor.

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- B. Coil Cleaning: In the event that units are operated without filters in-place or with filters which have been damaged so as to allow air to bypass filter, the Division 23 Contractor shall steam clean all coils and fans in that particular system before balancing the system.
- C. Filter Sizes: In all cases, filters shall be of the proper size and installed in filter racks in such a manner that there will be no leakage of air around filters. Filters which have been torn, distorted, or damaged in any other way will not be acceptable.
- D. Temporary Pre-filters: Provide blanket insulation or roll filter media over pleated filters as temporary pre-filter during construction.
- E. Testing and Balancing: All testing and balancing of air-side systems shall be done using clean filters. Where required, filters which have been used, shall be replaced prior to testing and balancing of air systems.
- F. Clean Filters: Upon completion of the Project and before final acceptance, all disposable media filters shall be replaced with new media.
- G. Spare Filters: Furnish one complete stock of replacement filters and media, sufficient to replace all filters on the project, to the Owner for maintenance use. Filters shall be delivered in their original, unopened containers, and stored as directed by the Owner.

### 3.3 FILTER MANOMETERS

- A. General: Install filters manometers **[and differential pressure switches]** per the manufacturer's written installation instructions. Where multiple filter banks (e.g. pre-filters and final filters) are installed, individual manometers **[and differential pressure switches]** shall be provided for each filter bank.
- B. Differential Pressure Switches: Coordinate remote monitoring connections for filter differential pressure switches with Division 25 requirements.
- C. Gauge Oil: Provide extra red gauge oil in original, unopened containers to the Owner for maintenance use.

END OF SECTION 23 4000

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