

**SECTION 11 53 13
LABORATORY FUME HOODS**

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies laboratory fume hoods including radioisotope (VA Type H3) and restricted bypass (VA Type H7) types, acid/base storage cabinets.

1.2 PERFORMANCE REQUIREMENTS

- A. Average Face Velocity: For bypass laboratory fume hoods, 0.51 m/s (100 fpm) with sashes at 18" open; for restricted bypass fume hoods with combination sash, 60 FPM with sashes fully open.
- B. Containment: Furnish and install laboratory fume hoods that are tested according to ASHRAE 110 at a release rate of 4.0 L/min. as follows:
 - 1. Face Velocity Variation: Not more than 20 percent of average face velocity.
 - 2. Sash Position: Fully open.
 - 3. As-Manufactured (AM) Rating: AM 0.05 (0.05 ppm).
 - 4. As-Installed (AI) Rating: AI 0.05 (0.05 ppm).
- C. Static-Pressure Loss: Not more than 93 Pa (3/8-inch wg) at 0.51-m/s (100-fpm) face velocity when tested according to SEFA 1.2.
- D. Performance Criteria:

RADIOISOTOPE HOODS (H3) PRELIMINARY EXHAUST AIR VOLUMES (For a face velocity of 100 FPM at a sash opening of 28.5" high)		
HOOD SIZE Inches (mm)	CFM (Liters/Second)	Pressure Drop Inch WG (Pascal)
60 (1500)	1000 (472)	0.18 (45)

CONSTANT EXHAUST VOLUME RESTRICTED BYPASS CHEMICAL HOOD WITH COMBINATION SASH (H7)							
Hood Width	Exhaust Volume	Vertical Sash Height	Horizontal Sash Opening	Sliding Panels	Vertical Face Velocity	Horizontal Face Velocity	Static Pressure
60"	540 CFM	24"	27" x 23.375"	2	60 FPM	100 FPM	.07"

1.3 QUALITY CONTROL

- A. Manufacturer Qualifications: A single manufacturer regularly and presently manufactures laboratory fume hoods and has tested its products according to ASHRAE 110.
- B. Electrical Components and Devices: UL listed and labeled for intended use.
 - 1. Fume Hood shall be Underwriters Laboratories subject 1805 classified.
 - 2. Proper labeling shall be affixed to face of each fume hood indicating classification to UL 1805 standard for Laboratory Fume Hoods. UL listing covering electrical components only or other listings that do not encompass all issues covered in UL 1805 is not acceptable.
 - 3. All factory testing shall be performed in a U.L. certified test facility.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data: Include the following:
 - 1. Illustrations and descriptions of laboratory fume hoods and factory-installed devices for fume hoods.
 - 2. Catalog or model numbers for each item incorporated into the work.
 - 3. Static-pressure losses and exhaust volumes for fume hoods.
 - 4. Results of testing according to ASHRAE 110.
 - 5. Provide independent test data demonstrating compliance with indicated life cycle requirements.
- C. Shop Drawings: Show details of fabrication, installation, adjoining construction, coordination with mechanical and electrical work, anchorage, and other work required for complete installation.
- D. Operating Instructions: Comply with requirements in Section 01 00 00, GENERAL REQUIREMENTS.

1.5 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE):

110-1995Method of Testing Performance of Laboratory
Fume Hoods

C. Scientific Equipment and Furniture Association (SEFA):

1-2006Recommended Practices for Laboratory Fume Hoods

2-1999Recommended Practices for Installation of
Scientific Laboratory Furniture and Equipment

PART 2 - PRODUCTS

2.1 FUME HOODS, GENERAL

- A. Furnish and install laboratory fume hoods that comply with recommendations in SEFA 1.
- B. Factory install service fixtures and electrical devices in locations indicated on drawings. Pre-wire and pre-pipe hood to above ceiling.
- C. Gas and Air Service Fixtures: Remote controlled; with valve identified by index button; with serrated tip outlets; color-code valves and outlets.
- D. Service-Fixture Color-Coding: Color-code service fixtures as follows:

Service	Color
Water	Dark Green
Air	Orange
Gas	Dark Blue
Vacuum	Yellow

- E. Lighting Fixtures: Vaporproof fixtures; 120-V 2-tube fluorescent fixtures; T8, rapid start, UL listed light fixture with sound rated ballast installed on exterior of roof.
 - 1. Provide safety glass panel cemented and sealed to hood roof.
 - 2. Interior of fixture: White, high reflecting plastic enamel.
 - 3. Size of fixture: Largest possible up to 48" for hoods with superstructures up to six feet. Provide two 36" fixtures for hoods with eight foot superstructures.
 - 4. Include lamps with fixtures.
- F. Receptacles and Switches: Include junction box and black acid resistant thermoplastic cover plate.
 - 1. Ground Fault Interrupter (GFI) Duplex Receptacles: Integral unit with 2-pole, 3-wire, 120-V, 20-A receptacle. One duplex outlet located on front face of hood, both sides of sash. (Two GFI duplex outlets required per hood.)
 - 2. Lighting Fixture Switches: Toggle, single pole, 120-277 V, 20 A.

- G. Airflow Monitor: With UL listed, tamper proof, audible alarm and warning light. Provide local and remote alarm capability at central engineering control center for each fume hood in the event of a system failure for face velocity readout outside high or low set points. Provide factory-installed monitoring for constant volume hoods and alarm units or field-installed TSI Monitoring and Control Unit under SECTION 23 09 23 for variable volume hoods.
- H. Provide factory-installed monitoring for constant volume hoods and alarm units or field-installed TSI Monitoring and Control Unit under SECTION 23 09 23 for variable volume hoods.
- I. Refer to Division 23 for Venturi exhaust valves on fume hoods as well as electronic controls for the Venturi valves installed variable volume fume hoods.
- J. Provide rectangular exhaust outlet with ends radiused, shaped and flanged, 18 gauge steel finished with urethane powder coating. Provide a stainless steel transition piece to connect hood outlet and exhaust duct.
- K. Metal finish:
 - 1. Preparation: Spray clean metal with a heated cleaner/phosphate solution, pre-treat with iron phosphate spray, water rinse, and neutral final seal. Immediately dry in heated ovens, gradually cooled, prior to application of finish.
 - 2. Application: Electrostatically apply urethane powder coat of white color and bake in controlled high temperature oven to assure a smooth, hard satin finish. Surfaces shall have a chemical resistant, high grade laboratory furniture quality finish of following thickness: (Liquid, dipped, solvent based finishes are not and will not be acceptable.)
 - 3. Exterior and Interior Exposed Surfaces: 1.5 mil average and 1.2 mil min.
 - 4. Backs of Cabinets and Other Surfaces Not Exposed to View: 1.2 mil average.
- L. Provide removable metal closure panels between fume hood and ceiling. Keep enclosure 1.5 inches maximum below ceiling grid and provide prefinished trim piece between ceiling and closure panel.
- M. Access Opening Perimeter: Air foil or streamlined shape with all right angle corners radiused or angled. Bottom horizontal foil shall provide nominal one inch bypass when sash is in closed position and be flush

with top of work surface and incorporate a trough for secondary containment of spill. Bottom foil shall not be removable without use of special tools. Bottom foil shall provide access areas for electrical cords and is to be steel with urethane powder coating to increase acid and abrasion resistance

N. Instruction Plate: Corrosion resistant or plastic plate attached to the fume hood exterior with condensed information covering recommended locations for apparatus and accessories, baffle settings and use of sash.

O. Sash, Automatically Opening

1. General Operation: Sash system can open and close a fume hood sash automatically.

a. Open and closed positions for automatic operation shall be set in a calibration mode, and shall be factory set to be fully closed and 16" open.

b. Sash opens when a person is detected by overhead passive infra-red sensor in an area roughly defined by a 45 degree cone extending out from overhead sensor.

c. Sash stays open as long as a person is detected in cone area.

d. Once a person leaves area in front of hood, system delays a fixed time amount to close, based on switch "delay" settings on controller. These delays can be 1, 3, 6, 10, 30, and 60 minutes. When no one is detected in cone area for entire delay time, sash will close.

e. Once sash opens or closes automatically, user can move sash by hand and automatic system will not interfere.

f. If sensors on bottom of sash detect an object in way of sash closing, sash will stop at that point. Sash shall remain at this position until occupancy sensor detects a person, and then returns to operating height.

g. Provide "auto-open" button that will allow user to open sash fully using motor drive (manual control shall always be available).

2. Construction/Design Criteria: Sash opening system shall consist of a motor drive to control sash, occupancy sensor to detect a person using hood, sash-mounted "line-of-sight" sensors, motor torque sensing components, sash position sensor, and a control system.

- a. Sash Motor Drive: Sash drive system shall be able to move sash up and down, and return sash to a preset position. Drive motor shall be a non-sparking type motor with no clutch.
- b. Occupancy Sensor: This system shall be able to detect when a person is using hood, in an area that is roughly width of sash and extends 2 feet out from hood. This sensor is adjustable and includes a mechanical focusing system, where "sensed area" can be made smaller or larger, by retracting sensor into a cone, and/or tilting sensor forward or back and locking position. Sensor itself can sense motion in a cone that is roughly 45 degrees in all directions.
- c. "Line of Sight" Sensor System: Sensors located along bottom of sash. Include a recessed pocket in airfoil to allow sash to close fully. Must sense if objects are in path of closing sash, and signal controller to stop downward motion. Sash shall stay in stopped position until occupancy sensor detects operator. Must detect if a user's hand is touching bottom of sash.
- d. Sash Position Sensing: A potentiometer shall be used on drive system to indicate exact position of sash. This fail-safe system cannot be affected by power loss or memory failure so sash location is always known.
- e. Controller: Controller will direct motor to move sash, read occupancy sensor, and sash position data.
 - 1) If no one is present at hood for a designated period of time (set by DELAY SWITCH discussed below), controller will close sash to preset level
 - 2) If "line-of-sight" sensor detects objects in way of sash closing will be stopped at point of detection.
 - 3) If a person walks up to hood and is detected by occupancy sensor and sash is closed, sash shall automatically move to "working level".
 - 4) Controller shall operate an LED to indicate operation of overhead sensing system and also "line-of-sight" sensor system, to provide user visual feedback as to system status.
 - 5) Controller shall incorporate a "torque-overload" system to accommodate a situation where motor drive is trying to move sash, and user is also trying to manually move sash.

Controller shall shut off drive motor when it senses that sash is moving opposite or faster than drive allows

6) Controller shall be housed in an epoxy coated steel box on top of hood.

7) Control box shall have its own power cord and accessible ON/OFF switch. This cord can be plugged into a simplex receptacle located on hood, remotely powered, or hard wired as directed by Owner.

8) Control box shall have 3 switches to allow programming of various system parameters as described below:

- i. Switch #1: Cal, Norm, Norm x 10 Calibration Mode will allow user to set sash at a "High" level and a "Low" level, and these sash locations will be stored in memory, as unit is switched out of Calibration mode. Normal position indicates normal delays set directly by switch #3. Normal x 10 indicates all delays will be 10 times longer than those selected by switch #3.
- ii. Switch #2: This 3-position switch will allow user to select "Down Only", "Normal Up and Down", and "Setup" auto-sash operation. Setup mode is used prior to entering Calibration mode to stop sash from reacting to any sensor inputs.
- iii. Switch #3: Delay 1, 2, 3 Switch: This switch selects time for how long "no one is detected" before sash goes down. 1, 3 and 6 minutes can be selected, and using Normal X 10 setting of Switch 1, these times can be 10, 30 and 60 minutes.

2.2 RADIOISOTOPE FUME HOODS (H3)

- A. General: For use with radioactive materials.
- B. Size: 31.25"d x 60"w overall and inside dimensions of 22"d x 47 5/8"h x 50 3/8" wide (all clear).
- C. Airflow Systems: Bypass; constant volume type with built in automatic compensating bypass to maintain constant exhaust volume regardless of sash position; positive in action and controlled by sash operation.
 1. Low impedance, directionally louvered panel provided in the lintel bypass area and one inch bypass provided immediately above the work surface and directly below the bottom horizontal sash rail. Designs

- which require all bypass to enter hood over front solid panel - not acceptable.
2. As sash is lowered, bypass design shall limit the increase in face velocity to maximum of four times the average face velocity with the sash full open.
 1. Liners and Work Surfaces: Stainless steel, Type 304, No. 4 finish, 16 gage; seamless construction.
- D. Lighting Fixtures: Vaporproof.
- E. Furnish HEPA filters, bag in and bag out, in exhaust air stream prior to discharge at or above the highest point of the building for installation under provisions of Division 23 Mechanical.
- F. Blowers: Under provisions of Division 23 Mechanical provide remote blowers; sized to create exhaust air volume that produces average face velocity indicated with sashes fully open.
- G. Sashes: Vertical type; laminated safety glass; full view type with clear, unobstructed, side-to-side view of fume hood interior and service fixture connections.
1. Accessories: Fixed rubber sash stops.
 2. Cables: Stainless steel, uncoated, 1/8" diameter military spec. quality (MIL-W-83420D-3).
 3. Counter Balance System: Single weight, pulley, cable, counter balance system which prevents sash tilting and permits one finger operation at any point along full width pull. Maximum 7 pounds pull required to raise or lower sash throughout its full length of travel. Design system to hold sash at any position without creep and to prevent sash drop in the event of cable failure. Life cycle test 100 pound sash weight to 100,000 cycles without sign of failure.
 4. Bottom Sash Rail: 2" maximum, 18 gauge steel with urethane powder coat finish. Provide integral formed, flush pull full width of bottom rail.
 5. Set safety glass into rails in deep form, extruded poly-vinyl chloride glazing channels.
 6. Postless sash design.
- H. Bases: Cabinet type.
- 2.3 BYPASS FUME HOODS (H7)**
- A. Provide fume hoods with partial compensating bypass above sash, which opens after sash is closed to less than 40 percent open. Design

partial bypass to maintain sufficient exhaust air volume through hood to adequately dilute hazardous fumes regardless of sash position.

- B. Variable-Air-Volume Control: Equip fume hoods with an electronic control unit with a sensing device that monitors face velocity, and a motorized damper on the exhaust connection that maintains a constant face velocity by controlling air volume in response to control unit. Equip units with manual override switch that opens motorized damper to provide maximum exhaust capacity regardless of sash position. Provide output transmitter on electronic control unit that produces 0- to 10-V dc signal proportional to fume hood exhaust volume for interface with building's HVAC control system under provisions of Division 23 - Mechanical.
- C. Size: 37.25"d x 60"w overall and inside dimensions of 28"d x 47 5/8"h x 50 3/8" wide (all clear).
- D. Liners: Reinforced polyester panels; smooth finish and white color in final appearance.
 - 1. Flexural strength: 14,000 psi.
 - 2. Flame spread: 17 or less per U.L. 723 and ASTM E84 80.
 - 3. Baffle shall be same material as liner. Metallic baffles, brackets, and supports on hood interior will not be acceptable.
- E. Lighting Fixtures: Vaporproof.
- F. Blowers: Under provisions of Division 23 Mechanical provide built-in; sized to create exhaust air volume that produces average face velocity indicated with sashes fully open.
- G. Sashes: Vertical type; laminated safety glass; full view type with clear, unobstructed, side-to-side view of fume hood interior and service fixture connections.
 - 1. Accessories: Fixed rubber sash stops.
 - 2. Auto-Sash: Sash shall have capability to be raised to full 28.5" vertical opening for loading or unloading of large apparatus. Provide a lock-open feature. Sash shall lower automatically to operating position or lower when released from any position above 18". Life cycle test 100 pound sash weight to 100,000 cycles without sign of failure.
 - 3. Sash Chain: ANSI #35 steel, single strand. Average tensile strength of 2,400 pounds; maximum working load of 480 pounds.
 - 4. Sash Guides: Extruded PVC.

- 5. Pulley Assembly for Sash Chain: Finish bored steel drive sprockets and keyed drive, 1/2" diameter front connector shaft. Rear idler sprockets; double sealed ball bearings type, lubricated. All sprockets shall be steel with zinc dichromate finish.
- 6. Counter Balance System: Single weight, sprocket and chain, counter balance system which prevents sash tilting and permits ease of operation at any point along full width pull. Maximum 7 pounds pull required to raise or lower sash throughout its full 18" height of operating sash opening. Life cycle test sash and weight.
- H. Power, Services, and Water as shown on Drawings.
- I. Fume Hood Top: Epoxy resin, 1-1/4 inch thick with 3/8 inch deep dish; color to be as selected by Resident Engineer from manufacturer's premium color range.
- J. Bases: Table type.
- K. Vacuum Service Fixtures: Remote controlled; with valve identified by index button; with serrated tip outlets; color-code valves and outlets.

2.4 ACID/BASE STORAGE CABINET

- A. Acid/Base Storage Cabinet: Steel cabinet, 18 gage thick; all joints welded; vented to fume hood; color and finish to match fume hood.
- B. Lined with molded acid-resistant, caustic-resistant, non-asbestos containing, polyethylene material with coved corners and 1" lip at front of cabinet.
- C. Lockable, 18 gage, 5-knuckle hinged, steel doors.
- D. One adjustable, half-depth, steel shelf with polyethylene spill tray.
- E. Stainless steel pulls and hinges.
- F. Provide labels on cabinets as indicated on Drawings.

2.5 LABORATORY EXHAUST ARMS OR SNORKEL

- A. General: Refer to Section 23 36 00.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install laboratory fume hoods to comply with SEFA 2.
- B. Do not connect exhaust from sources other than identical hoods to fume hood exhaust system. Heat recovery will not be allowed in fume hood exhausts.
 - 1. Type H7 bypass hoods may be grouped together to form a complete exhaust system to serve no more than four (4) hoods.

3.2 TESTS

- A. Field test installed laboratory fume hoods according to ASHRAE 110 to verify compliance with performance requirements for containment.
 - 1. For units that fail testing, make adjustments and corrections to installation, or replace fume hoods, and repeat tests until fume hoods comply with requirements.

3.3 PROTECTING AND CLEANING

- A. Protect equipment from dirt, water, and chemical or mechanical injury during the remainder of the construction period.
- B. At the completion of work, clean equipment as required to produce ready-for-use condition.

3.4 INSTRUCTIONS

Instruct personnel and transmit operating instructions in accordance with requirements in Section 01 00 00, GENERAL REQUIREMENTS.

- - - E N D - - -

