

## SECTION 115313

### LABORATORY FUME HOODS

#### PART 1 - GENERAL

##### 1.1 SUMMARY

- A. This Section includes Laboratory Fume Hoods:
- B. Related Sections include the following:
  - 1. [Division 12 Section "Painted Steel Laboratory Casework" for base unit and work surface.
  - 2. [Division 12 Section "Stainless Steel Laboratory Casework" for base unit and work surface.
  - 3. [Division 12 Section "Manufactured Wood Casework" for base unit and work surface.
  - 4. Division 15 Sections for fume hood vent connections.
  - 5. Division 16 Sections for electrical service and connections for motor operators, controls, limit switches, and other powered devices and for system disconnect switches for motorized gymnasium equipment.

##### 1.2 DESIGN REQUIREMENTS

- A. Design fume hoods as ventilated, enclosed workspaces, designed to capture, confine and exhaust fumes, vapors and particulate matter produced or generated within the enclosure.
- B. Design fume hoods for consistent and safe air flow through the hood face. Negative variations of face velocity shall not exceed 20% of the average face velocity at any designated measuring point as defined in this section.
- C. Average illumination of work area: Minimum 80 footcandles. Work area is defined as the area inside the superstructure from side to side and from face of baffle to the inside face of the sash, and from the working surface to a height of 45 inches.
- D. Design fume hood to minimize static pressure loss with stainless steel round collar configuration. Maximum average static pressure loss readings taken three diameters above the hood outlet from four points, 90 degrees apart, shall not exceed the following maximums:
  - 1. Face Velocity at sash full open - Measured S.P.L. (W.G.)
    - a. 80 F.P.M. .20 inches
    - b. 100 F.P.M. .30 inches
    - c. 120 F.P.M. .45 inches
- E. Fume hood shall maintain essentially constant exhaust volume at any baffle position for safety. Maximum variation in exhaust CFM, static pressure and average face velocity as a result of baffle adjustment shall not exceed 5% for any baffle position at the specified face velocity.

##### 1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's data and installation instructions for each type of fume hood.

- B. Shop Drawings: Submit shop drawings for fume hoods showing plans, elevations, ends, cross-sections, service run spaces, location and type of service fixtures with lines thereto; details and location of anchorages and fitting to floors, walls, and base; layout of units with relation to surrounding walls, doors, windows, lighting and air-conditioning fixtures, and other building components; connection to hood exhaust system; location of access doors, cut-off valves, junction boxes.
  - 1. Coordinate shop drawings with other work involved.
  - 2. Provide roughing-in drawings for mechanical and electrical services.
- C. Samples for Selection: Submit color samples of manufacturer's finish.
- D. Certificates: Provide test results to the owner detailing ANSI/ASHRAE 110-1995 performance for the following fume hood types:
  - 1. [Bench Bypass Hood (vertical sash)
  - 2. [Bench Bypass Hood (horizontal sash)
  - 3. [Bench Bypass Hood (combination sash)
  - 4. Data is based on the following:
    - a. A five-minute test run at 100 FPM face velocity with the fume hood sash at the owner-defined operating position. Hood tests gas challenge rate are four (4) liters per minute.
    - b. A sash movement test per above-mentioned specification.
    - c. A 1" perimeter test per above-mentioned specification.
- E. Submit manufacturer's installation instructions.

#### 1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Provide laboratory fume hoods (for integration with laboratory furniture, tops, sinks, and service fixtures, as required) manufactured or furnished by laboratory furniture company for single responsibility.
- B. Catalog Standards: Manufacturer's catalog numbers may be indicated on drawings for convenience in identifying certain fume hoods. Unless modified by notation on drawings or otherwise specified, manufacturer's current catalog description for indicated number, together with indicated or specified options or accessories, constitutes requirements for each such unit.
- C. All laboratory fume hoods are designed to provide maximum safety for the user. All manufacturers desiring approval for this project must maintain a fume hood test facility at their factory location. This facility must provide for variable exhaust and make-up air control. In addition, any facility that provides for fume hood make-up air by using floor-to-ceiling wall diffusers is unacceptable. All qualified test facilities must contain, as part of their permanent equipment, ANSI/ASHRAE 110-1995 testing hardware as specified in that standard. In addition, all data readings shall be computer-recorded.
- D. Source Quality Control: Architect reserves right to require manufacturer to demonstrate hood performance prior to shipment to prove compliance with contract requirements. Test hoods, testing facility, necessary instrumentation, apparatus and equipment will be supplied by manufacturer at no cost to Owner. Test hoods to verify performance requirements, using smoke and air flow meters and in accordance with Scientific Equipment and Furniture Association Standard SEFA 1.

#### 1.5 DELIVERY, STORAGE AND HANDLING

- A. Coordinate delivery of fume hoods with other delivery of other laboratory furniture components.
- B. Protect finished surfaces from soiling and damage during handling and installation. Keep covered with polyethylene film or other protective covering.

#### 1.6 PROJECT CONDITIONS

- A. Do not deliver or install equipment until the following conditions have been met:
  - 1. Windows and doors are installed and the building is secure and weathertight.
  - 2. Ceiling, overhead duct work and lighting are installed.
  - 3. All painting and floor tile located below casework is completed

#### 1.7 WARRANTY

- A. Warrant the sash counterweight system against defects in materials and workmanship for a period of two years from date of shipment. Any material or manufacturing defect in these components will be repaired without charge by the manufacturer.
- B. Warrant that furnished products shall be free from defects in material and workmanship for a period of two years from date of shipment. Also warrant the products to be as represented and will repair or replace any part which examination discloses to have been defective within the warranty period.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Manufacturers
  - 1. Mott Manufacturing Ltd. Harvard Series as distributed by New England Laboratory Casework Co., Inc. 781-932-9980. [www.newenglandlab.com](http://www.newenglandlab.com) email [info@newenglandlab.com](mailto:info@newenglandlab.com)
- B. Products: Subject to compliance with requirements, provide the following products:
  - 1. Harvard Series.

#### 2.2 MATERIALS

- A. Steel: High quality, cold rolled, mild steel meeting requirements of ASTM A366; 14, 16, 18, and 20 gauge U.S. Standard.
- B. Stainless steel: Type 304 or Type 316; 14, 16, and 18 gauge U.S. Standard.
- C. Galvanized steel: 18 and 20 gauge, wipe coat finish.
- D. Ceiling closure panels: Steel, painted of minimum 20 gauge; finish to match hood exterior or laminated material of specified selection.
- E. Bypass system: Transparent laminated safety glass Isolator Viewpass System allowing complete visual display of Hood Interior.

- F. Fume hood glass: 6 mm thick laminated safety glass.
- G. Sash chain: # 35 riveted case-hardened chain
- H. Sash guides: Corrosion-resistant polyvinyl chloride.
- I. Chain Assembly: Single axle locking system linked to a single full-width rear-mounted counterweight.
- J. Sash pull: Full width stainless steel sash pull.
- K. Fastenings:
  - 1. Interior fastening devices: Nylon bolts, PVC fasteners, PVC - capped stainless screws.
  - 2. Exterior panel member fastening devices: PVC - capped stainless steel screws.

## 2.3 FUME HOOD CONSTRUCTION

- A. All fume hoods are equipped with an airfoil and aerodynamically shaped top and sides to minimize turbulence. The design incorporates an automatic air bypass system so that the exhaust air volume is constant. Bypass is recessed behind plane of the sash and affords velocity tempering performance with face velocities not in excess of 4.5 times full-open face velocity.
- B. Hood Liner: Construct from the following material:
  - 1. Cement board.
  - 2. White fiberglass reinforced polyester material.
  - 3. Stainless steel, Type 304, with a No. 4 finish.
  - 4. Stainless steel, Type 316, with a No. 4 finish.
  - 5. 1/4" thick, black, epoxy resin.
  - 6. 1/4" thick, PVC white plastic sheet.
  - 7. 1/4" thick, polypropylene plastic sheet.
- C. Airfoil Construction:
  - 1. Airfoils shall be constructed with a minimum clearance of 3/4" and equipped with power cord and tube pass-troughs near each side post.
  - 2. These pass-troughs shall allow sash handle to seal tightly against airfoil without running cords and tubes under the airfoil, but by simply resting cords and tubes into the pass-through cavity.
    - a. [All fume hoods come equipped with a 16 gage, 316-4 finish stainless steel airfoil with a minimum of 3/4" clearance from the work surface to insure maximum operating efficiency and minimum eddy effects.
    - b. [All fume hoods shall come equipped with a 16 gage, 316-4 finish stainless steel flush-sill airfoil enabling the combination sash bottom rail to disappear and the horizontal elements to open flush to the work surface.
- D. Sash:
  - 1. [Fume hood comes equipped with a combination sash providing clear sliding horizontal panels no wider than 15". Sash elements are sliding laminated safety glass set into an anodized aluminum bottom rail and track housed within the sash frame. A single steel rear-hung, counterweight system is used to insure non-tilting, non-binding, and non-creeping sash performance. Rear-mounted counter weight system shall be #35 case-hardened steel chain engaging a twin sprocket, single axle system with positive master link connection points both front and rear.

2. [Fume hood comes equipped with a vertical sash consisting of a 316-4 stainless steel frame and 6 mm laminated safety glass with full width sash handle connected to a single steel rear-hung counterweight system insuring a non-tilting, non-binding, and non-creeping sash performance. Rear-mounted counter weight shall be connected to a #35 case-hardened steel chain engaging a twin sprocket, single axle system with positive master link connection points both front and rear.

E. For hood stability and liner protection, hood sidewall and rear liner panels shall be mounted into 18 gauge galvanized steel pans fastened at all corners into a stable structure.

F. All fume hoods are designed to eliminate air leakage around the sash and to conserve energy.

G. Rear baffles are designed to facilitate even air flow through all parts of the open sash. There is a top angled baffle with adjustable slots, a fixed mid-height baffle, and a stepped lower baffle.

H. All fume hoods are designed to have an interior vertical clearance of 48" in the front twelve inches of the hood depth.

I. In the LVT (Low Volumetric Throughput) configuration, hoods require no more than the following exhaust volumes at a 50% open and a face velocity of 80 FPM:

Hood Nominal Width	CFM & Static Pressure
4 foot	315 @ 0.05"
5 foot	414 @ 0.05"
6 foot	512 @ 0.05"
8 foot	709 @ 0.05"

J. The fume hood side posts extend vertically to a height of 53 inches above the work surface to facilitate mounting of additional services. They are fabricated of painted steel.

K. Hood Roof:

1. [The hood roof shall be fully framed and fabricated from the same liner material as the rest of the containment cavity.
2. [The hood roof shall be fabricated from galvanized steel with liner material identical to that used in the rest of the containment cavity mounted to the interior. Such construction affords additional containment for accidental fire.

L. Duct Collars: Exhaust outlet collars are fabricated of 18 gauge Type 316 stainless steel.

M. Interior Fastening Devices: All interior fastening devices are 410 stainless steel screws, PVC plastic fasteners, or nylon bolts.

## 2.4 FABRICATION

A. General: Design hoods to be highly fume resistant, for collection, retention and disposal of hazardous fumes with complete safety, minimum expenditure of purging air from room supply, and minimum turbulence within hood chamber.

B. Superstructure shall consist of galvanized steel pans holding liner and fastened together so that the entire structure is secure and rigid. Provide outer walls of the following material:

1. Painted steel.

- C. Airfoil: All fume hoods are equipped with a 16 gauge 316-4 finish stainless steel airfoil mounted 1" above the work surface of the fume hood. The space between the bottom of the airfoil and the work surface insures constant sweep across the work surface. The airfoil is shaped and formed the same as the top and sides of the fume hood's superstructure. The sash, when closed, sits on the airfoil and will not close off the opening under the airfoil.
- D. Interior Lighting: Provide the following:
1. Fluorescent light fixture installed on the exterior of the fume hood roof. Provide a safety glass panel with a vapor-tight seal to isolate the fluorescent fixture from the hood interior. Provide the largest possible double tube U.L. approved fixture for each hood.
  2. An incandescent, explosion-proof 150 watt light.
- E. Service Fixture Type:
1. [Provide fixtures that are rod-driven remote control valves with handles mounted at a 45 degree angle to the angled fascia post of the fume hood.
  2. [Provide fixtures that are panel-mounted remote control front loading, mounted at a 90 degree angle to the angled fascia post of the fume hood. The handles of the fixture are thus oriented toward the user's field of view and area of maximum dexterity. The valve body is easily removed for repair without entering the hood chamber.
  3. Finish: Grey, chemical-resistant finish.
  4. [Add any other type of specified plumbing.]
- F. Wiring: Specified electrical services are prewired to a junction box located on the roof of the fume hood for field connection by the electrical contractor. All services are 3-wire, 15-amp, 125/250 V.A.C. Face plates are stainless steel.
- G. Working Surface: Provide the following:
1. All work surfaces are fabricated of 18 gauge, Type 316-4 solid stainless steel formed down, making a 1 1/4" high face, and dished to form a watertight containment 1/4" deep to contain any spills within the fume hood.
  2. All fume hood work surfaces are dished 1-1/4" thick epoxy resin tops. Resin work surfaces have a 1/4" high raised edge on all four sides of the work surface. Work surfaces are non-glaring finish and (black, white, beige) in color.
- H. Fume Hood Alarms: Provide alarm system that continuously monitors fume hood face velocity by measuring the air velocity of clean air from the room passing through the air inlet on the front of the monitor. Provide both visual and audible alarms to alert the user of abnormal airflow conditions. A green indicator on the front of the monitor indicates normal flow conditions. When flow conditions lower than the setpoint are encountered, a red indicator is activated along with an audible horn. This information can be sent to a remote location by means of a dry contact relay output.
1. Alarm Range: 70 to 250 fpm (.35 to 1.25 m/s).
  2. Accuracy:  $\pm 10\%$  of set point or 10 fpm, whichever is greater.
  3. Alarm Delay: 5 seconds.
  4. Audible Alarm Indication: 85dB @ 4 inches (10 cm).
  5. Visual Alarm Indication: Red LED.
  6. Relay Output: 1.2A @ 12V DC.
  7. Horn Silence: Temporary & permanent.
  8. Input: Selectable for either horn disable or alarm input.
  9. Calibration: Alarm set point potentiometer adjustment.
  10. Instrument Dimensions:
    - a. Front Faceplate 4.75L x 3.25W x .5D inch (12.07L x 8.25W x 1.27D cm).

- b. Rear Enclosure 4.5L x 2.5W x 1.38D inch (11.43L x 6.35W x 3.50D cm).
- 11. Mounting: Flush. (Cut out required on hood surface).
- 12. Operating Conditions: 55 to 86°F (13 to 30°C), 5% to 95% RH, non-condensing.
- 13. Storage Temperature: -40 to 150°F (-40 to 65°C), 5% to 95% RH, non-condensing.
- 14. Power Requirement: (Wall plug in power supply supplied for domestic units).
  - a. Nominal Input Voltage: 12.0 ± 1.0VDC or 9.0 ± 0.5VAC.
  - b. Nominal Input Current: 0.12ADC @ 12VDC input.
- 15. Product: AirGard 200 Fume Hood Monitor by Alnor Instrument Company.

## 2.5 FUME HOOD EXTERIOR FINISH

- A. Coating Performance data is available in Appendix 1 (attached)
- B. Colors: Provide laboratory furniture paint finish in manufacturer's standard colors. A one or two color scheme may be used.
- C. Painted steel parts in the fume hood airfoil are unacceptable.  
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- D. Stainless steel shall be supplied with a #4 finish free of burrs, weld marks, or other imperfections.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for hood layout, alignment of mounting substrates, installation tolerances, operational clearances, accurate locations of connections to building electrical system, and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Install fume hoods and equipment in accordance with manufacturer's instructions.
- B. Install fume hoods plumb, level, rigid, securely anchored to building and adjacent furniture in proper location, in accordance with manufacturer's instructions. Install closures neatly. Securely attach access panels but provide for easy removal and secure re-attachment.
- C. Coordinate sequence of work with mechanical and electrical trades and with related work as related laboratory casework and fixtures specified in Division 12 Section "Laboratory Casework."

### 3.3 FIELD QUALITY CONTROL

- A. Fume Hood Performance Testing Requirements: One hood of the same design as specified herein will be successfully tested as detailed below. Production of the hoods specified herein will not commence until

the "Performance Test" has been successfully performed by the manufacturer. In general, the below detailed "Performance Test" will consist of the ANSI/ASHRAE 110-1995 test procedure using a five-minute tracer gas challenge at a rate of four (4) liters per minute. The PPM concentration outside the hood of a tracer gas released inside the hood will be measured utilizing a MIRAN 203 Gas Analyzer, or equivalent.

- B. Test Equipment shall consist of the following:
1. Tracer gas orifice and ejector as specified in ANSI/ASHRAE 110-1995.
  2. Tracer gas is sulfur hexafluoride supplied from a cylinder capable of maintaining 30 PSI pressure at the test flow rate for at least five minutes. The test flow rate is four (4) liters per minute.
  3. Detector is a MIRAN 203 Infrared Spectrophotometer capable of indicating or recording concentrations of tracer gas in the range of 0.001 PPM, with an accuracy of  $\pm 10\%$  and a response time not to exceed ten (10) seconds to 90% indication of actual concentration.
  4. "Dummy" will be a mannequin such as used in clothing display. The height of the dummy will be 67 inches with a shoulder height of 55" to 57", and otherwise represent normal proportions of the human body. Hairless dummies or torsos are unacceptable.
  5. Calibration - The detector is calibrated with a known concentration of tracer gas within 24 hours preceding a test, using the methods furnished or specified by the detector manufacturer.
- C. Test Conditions: Hood is tested with ceiling-supplied make-up air in a test area where face velocity, temperature, and room air flow can be monitored and documented.
- D. Hood Condition:
1. Vertical Sash: The sash is completely opened or tested at a position chosen by the purchaser/end user.
  2. the purchaser/end user.
  3. Combination Sash: The sash(es) is positioned at the maximum allowable face opening of the hood. (Hood is customarily tested in the 50% vertical and 50% horizontal sash open modes.)
- E. Test procedure
1. Turn on detector, allow time to equilibrate.
  2. Insert orifice in test diffuser to give (4) liter per minute release rate.
  3. Install diffuser to a central test position. This position is equidistant from the inside side walls, six inches behind the sash plane.
  4. Install dummy standing 3" from the plane of the sash.
  5. Turn on tracer gas block valve. Position the detector probe touching the face of the dummy in the region of the nose and mouth, with the long axis of the probe tip approximately parallel to the plane of the hood front.
  6. Observe and record the detector readings automatically. Background readings are to be taken before each test and subtracted from the actual test readings. The tests are run for five (5) minutes. An average reading above 0.05 PPM constitutes unsatisfactory performance under the conditions that exist for that test.
  7. During the sixth and seventh minute of testing, the sash is closed completely - then, at 420 seconds elapsed time, the sash is re-opened.
  8. Between 450 and 510 seconds elapsed time, the hood perimeter is tested at a distance of 1" outside the plane of the sash.
  9. During all these procedures, breathing zone gas concentration shall not exceed 0.05 PPM.
- F. Smoke Test
1. A 30-second smoke bomb is ignited in the hood chamber. It is moved, while ignited, throughout the chamber with the discharge orifice of the bomb directed toward the hood face. If visible smoke flows out of the front of the hood, the hood fails the test.



3.4 ADJUST AND CLEAN

- A. Moving Parts: Carefully check and adjust moving parts to insure smooth, near-silent, and accurate sash operation with one hand and with uniform contact of rubber bumpers; ensure counter-balances operate without interference.
- B. Clean surfaces, including both sides of glass.
- C. Damaged Work: Repair equal to new undamaged work, or replace with new units, as acceptable to Architect.

3.5 DEMONSTRATION

- A. [Engage a factory-authorized service representative to train Owner's personnel to adjust, operate, and maintain fume hood. Refer to Division 1 Section "Closeout Procedures."
- B. [Provide a video tape containing instructional information on proper fume hood use and maintenance.
- C. [Provide a manual demonstrating proper fume hood use and maintenance.

END OF SECTION