SECTION 11830

LABORATORY HOOD
WITH COMBINATION SASH (Aug 2004)

PART 1 GENERAL

1.1 DESCRIPTION OF WORK

The work required under this section consists of providing and installing laboratory hoods with horizontal sashes and related items necessary to complete the work as indicated on the drawings and as described herein. Hoods shall be bench type and 1800 mm (nominal 6 ft.) wide as shown.

1.2 OTHER SECTION

Other sections of the construction specification that could impact this specification are included in Division 15 and 16. Special attention is directed to:

Division 15 Section - Testing, Adjusting and Balancing

Division 15 Section – Testing Constant Air Volume Fume Hood

Division 15 Section – Testing Variable Air Volume Fume Hood

Division 15 Section – HVAC Instrumentation and Controls

Division 15 Section – Mechanical Identification

Division 16 Section – Basic Electrical Materials and Methods

1.3 SUBMITTALS

1.3.1 SHOP DRAWINGS AND MAINTENANCE MANUALS

Submit eight (8) copies of shop drawings and maintenance manuals of specified fume hoods to the Project Officer. Shop drawings shall be complete in every detail and be approved prior to proceeding with manufacturing. At the time of submission of drawings, also submit a copy of the instructions for hood installation and use.

1.3.2 TESTING EQUIPMENT AND FACILITIES

Submit 8 copies of specification sheets on all equipment proposed for factory testing specified in Part III of this section.

1.3.3 PAINT SAMPLES

Submit a 76 x 127 mm paint sample to verify conformance with Federal Standard 595A, color #27769.

1.3.3 CERTIFICATIONS

Submit with shop drawings factory test data attesting that each type of hood to be provided has been factory tested in accordance with Modified ANSI/ASHRAE 110-1999 and meets the requirements of this specification.

1.4 DELIVERY AND IDENTIFICATION

Deliver hoods to the job site, clearly identified in plain view with easy to read lettering specifying hood manufacturer, size and type of hood, sash type and any special features included. In addition, both the shipping container and the hood shall be clearly labeled in plain view with the serial number. Include with each hood an installation manual.

1.5 APPLICABLE DOCUMENTS

- American National Standard Institute
  ANSI/ASHRAE 110-1985 Standard for Testing Performance of Fume Hoods
- National Fire Protection Association
  NFPA 45 (1986) Fire Protecting For Laboratories Using Chemicals
- General Services Administration
  Federal Standard 595A, Colors #27769
- ANSI/ASHRAE III Testing and Balancing
- ANSI/AIHA Z9.5 Laboratory Ventilation Standard

1.6 RELATED WORK SPECIFIED ELSEWHERE

For electrical, plumbing, HVAC and commissioning related to laboratory hood installation, see the appropriate sections in Division 15, 16 and 17. For testing and balancing see Section 15990, 15991 and 15992.

PART 2 PRODUCTS

2.1 CONSTRUCTION

2.1.1 END WALLS

Laboratory hoods shall have double wall (side) panels. The inner walls and baffles shall be made of molded reinforced thermoset epoxy resins that meet or exceed NFPA 45 Standard on Fire Protection for Laboratories Using Chemicals. The exterior shall be finished to match the base unit. The jambs shall be aerodynamically designed to reduce the turbulence as the air enters the hood. To achieve this, the jambs shall be radiuses or have a beveled entry with a nominal angle of 45 degrees.

The area between the double wall ends shall be used to house such utility services as are specified. In some designs, the side wall should accommodate the sash counter balance weight.

2.1.2 BAFFLE

Laboratory fume hoods shall be equipped with fixed baffle made of Grade 210 composition sheet across the top and rear of the hood. The baffle shall be fixed and designed so as to provide an average air velocity of 0.51 mps plus or minus 0.10 mps at any point on the face opening with the vertical sash closed and the horizontal sliding sashes placed to either side (so that the sash is "full open").

The face velocity measurements shall be obtained by the methods described in the ASHRAE/ANSI Standard 110-1999.

2.1.3 BENCH TOP

The working surface shall be modified epoxy resin molded to a nominal thickness of 32 mm. The center of the work surface shall be recessed 6.4 to 9.5 mm for spill control. The recessed surface shall extend to within 25 mm of the hood side walls, to just below the baffle, and no more than 50 mm beyond the airfoil at the front of the hood. Provide silicon seam between hood linings and counter top.

2.1.4 COMBINATION SASH

2.1.4.1 VERTICAL SASH

Hoods shall be equipped with a vertical sash that contains four horizontal sliding panels to ensure a leak proof chamber. The frame shall be designed to afford access to the sash balancing mechanism and to allow replacement of the horizontal sash glass. The sash frame shall be designed to ensure a leak free chamber. The sash shall be counter-balanced with a sash weight and sash cable system in a manner that sash raises and lowers in a level position and shall work smoothly and freely in the sash guides when operated from either end of the sash and with the horizontal panels in

any position. The sash cables shall be of stainless steel and shall operate on ball bearing sheaves. Spring type counterbalances will not be acceptable. The sash frames shall be equipped on each side with plastic guides to insure proper operation of the sash and to prevent metal-to-metal contact with the stainless steel sash guides. Sash shall remain at rest in any position.

The vertical opening, above the airfoil, when the vertical sash is full open shall be a minimum of 659 mm and a maximum of 762 mm.

2.1.4.2 HORIZONTAL PANELS

Hoods shall be provided with four (4) horizontal sliding panels in two tracks mounted within the vertical sash. The panels shall be sized so that each track has one panel no more than 356 mm wide, and the other panel sized so that:

a. Half the hood face is open when the panels are pushed to one side.

b. The hood face can be fully closed.

c. The panels are free moving and either half of the face can be opened.

d. The panels shall be placed so that the panels are moved to either side (two on each end) the hood will be "half" open with the open area equal to the area when all the panels are to the right or to the left.

e. The panels shall be sized so that the vertical opening, from the top of the track on the airfoil, shall be a minimum of 659 mm and a maximum of 762 mm.

f. The panels shall have rubber bumpers to prevent direct collision of the panels with the end or with each other

2.1.4.3 SASH MOVEMENT

The vertical sash and the horizontal panels shall be moveable throughout their travel by application of no more than 2.3 kg pounds of force and shall remain stationary when force is removed.

2.1.4.4 SASH DESIGN

Each horizontal panel shall have the following properties:

a. The panel shall be glazed with 5.5 mm laminated safety sheet glass. The

glass shall be set in a neoprene rubber or vinyl channel and mounted in a steel frame, fabricated from metal of 18 gauge minimum. Sash frame shall be welded at intersections, ground smooth and reinforced to support weight. The frame shall be designed to allow replacement of the sash glass.

b. The horizontal panels shall be held in place by double tracks in the top and bottom of the vertical sash.

c. The design of the track shall provide for easy cleaning.

d. Panels shall not be readily removable without the use of appropriate tools.

e. The panels shall have rubber or other master bumpers to prevent direct collision of the panels with the end jambs or with other horizontal panels.

f. Provide sash stops with override capabilities for full height opening.

2.1.5 AIRFOIL

At the bottom of the hood opening and extending across the hood front shall be an aerodynamically designed stainless steel type 316 airfoil airfoil, a nominal 152 mm wide. The airfoil shall be mounted with a 25.4 to 38.1 mm open space between the airfoil and the bottom front edge of the hood and shall direct air across the work surface of the hood. The airfoil shall extend back with 25-degree angle at front edge under the sash so that the sash closes on top of the airfoil. The back edge of the airfoil shall extend into the hood until it is no more than 50.8 mm from the front edge of the recessed work surface. Airfoil assembly shall be coated with Teflon or Kynar.

The airfoil and the vertical sash shall be designed in such a way that air enters the hood in a smooth manner when the vertical sash is closed and the horizontal panels are open. No backflow shall leave the hood at the junction of the airfoil and the vertical sash frame.

2.1.6 ACCESS PANELS

Access panels shall be installed on the interior, end wall panels of the hood. The access panels shall be located and sized to provide access to utility services and shall be attached in such a manner as to remain in place, without vibration, during normal hood operations. The access panel shall be designed so that it is either tight fitting, with an acid and solvent resistant gasket, or constructed with overlapping panels to reduce the possibility of air migration through the side wall. When necessary, fasteners shall be provided to ensure that the panel remains in

place during normal operations.

2.1.7 BYPASS

The use of a bypass is not required on Variable Air Volume (VAV) systems. Where used, it shall be designed such that when the sashes are fully closed a small volume of air shall pass over the top of the horizontal sashes to provide air to break up the vortex that forms behind the closed sash.

2.1.8 SERVICE FIXTURES

All service fixtures shall be factory mounted including connection between front-loading valves and hose end on side wall(s) of hood as indicated on drawings. Each 1800 mm hood shall be equipped with a serrated air, gas, and vacuum cock and serrated fold water faucet on both side walls. All valves shall have easily replaceable seats and washers rated at no less than the pressure specified in the plumbing specifications and the applicable codes. Moreover, NIH requires that copper shall not be used in natural gas piping, tubing or fixtures.

2.1.8.1 ADDITIONAL FIXTURES

Hot water, steam and nitrogen gas shall be available as a special order. Hot water valves and steam valves shall be rated as specified. All fixtures that serve special gases and instrument air shall be lubricated, cleaned, capped protected and delivered certified for "Oxygen" service.

2.1.9 VALVES

Piped services shall be composed of remote controlled valves located within the end wall panels and controlled by a handle projecting through the vertical fascia panel of the hood, and the rod supported by an angle type escutcheon plate. The valves shall be connected to a serrated hose connector located on the end panels within the hood. The portions of the valves exposed on the exterior shall be chrome plated or acid resisting plastic. The valve handles shall be identified in accordance with the chart below in 2.1.11.

2.1.10 CUP SINKS

Cup sinks shall be provided only where shown. When used, cup sinks shall be installed next to a side wall. Cup sinks shall be acid/solvent resistant and the center line located, not less than 203 mm nor more than 357 mm beyond the interior of the vertical sash. Cup sinks shall be centered under tips of cold water faucets.

Drain size of cup sinks shall be 38 mm in diameter. Provide removable, acid resistant drain strainer that will allow the rapid drainage of water without allowing solid objects to pass into the drain.

2.1.11 SERVICE COCK IDENTIFICATION

Utility services shall be identified as shown in table below. Handles of service cocks and faucets shall have removable colored plastic discs with identification of the service stamped in the disc as follows:

SERVICES	DISC COLOR IDENTIFICATION		LETTER COLOR
GAS	BLUE	GAS	WHITE
AIR	ORANGE	AIR	BLACK OR WHITE
VACUUM	YELLOW	VAC	BLACK
COLD WATER	GREEN	CW	WHITE
HOT WATER	RED	HW	WHITE
STEAM	BLACK	STEAM	WHITE
NITROGEN	BROWN	N2	WHITE

2.1.12 EXHAUST COLLARS

Each hood shall have one (1) minimum 102 mm high straight stainless steel type 316 exhaust collar located on the top of the hood. The collar shall connect to a 250 mm round duct. If the normal collar for the hood does not match this requirement, provide a stainless steel transition that will attach directly to the exhaust collar and achieve the specified duct size in a length of no more than 406 mm.

2.1.13 LIGHTING

The hood shall be provided with a rapid start, two tube fixture, to generate 1100 lx of illumination, fluorescent light, including bulbs, of the longest practicable length, which shall be shielded from the hood interior by a 5.5 mm laminated safety glass or a 5.5 mm tempered safety glass panel sealed with neoprene rubber gaskets into the metal frame. Bulb changing shall be accomplished from the hood exterior without major disassembly of the hood. Light switch shall be provided on vertical fascia panel of the hood.

2.1.14 ALARM

Provide a local audible and visual alarm device capable of detecting a drop or rise in airflow (not static pressure) through the hood. That is, if the hood exhaust volume falls below or rises above a preset exhaust level, the alarm will sound and the alarm

light will come on. The monitor shall use dual thermistor or dual diode sensing system to measure the velocity. The sensor must be mounted in a flow tube placed on either sidewall or front face of the fume hood but not within the hood sash opening itself. Local Audible and visual alarm must have capabilities for remote monitoring hook up.

All parts of the system which are apt to be in contact with vapors or gases in the hood shall be chemically resistant, i.e., the controller sensing device, wiring, etc.

Provide a means to shut off the audible alarm and to reset. The alarm shall have and internal timer so that the audible alarm if reactivated after a specified time (adjustable between 5 minutes and 15 minutes). The silent device shall not turn off the warning light.

Provide a means for setting the controller set point to the exhaust level desired. This adjustment shall be "internal" so that it is not readily adjustable by operating personnel.

2.1.15 SASH POSITION AND FLOW SENSORS

Where hoods are connected to a VAV system and where shown on constant air volume systems, a sash position and/or face velocity sensor shall be provided as part of the air volume and room pressure control system. This sensor shall be separate from the alarm sensor. See the controls section for specification of this sensor.

2.2 FABRICATION

2.2.1 ASSEMBLY

Exterior of the hood shall be constructed of cold rolled steel protected with a baked epoxy or enamel, acid and solvent resistant, coating and shall have the component parts screwed together, to allow for replacement of parts. Hoods shall be capable of partial disassembly to permit movement through a standard door of 889 x 2007 mm.

2.2.2 ASBESTOS

No asbestos or asbestos containing material shall be used in the construction of the hood.

2.2.3 BASE CABINET

Base cabinets for the chemical hoods shall be louvered, acid storage cabinets provided with a vent line into the hood with acid resistant, 6.4 mm thick white polypropylene lining on all interior surfaces. Where cup sink is required, fabricate cabinet with two compartments in order to isolate the cup sink/ trap assembly from the lined portion of the cabinet. This compartment shall be 300 mm wide with 300 mm wide door. If the cabinet is 1200 mm wide or more, the lined portion cabinet shall have two, 457 mm wide louvered doors. The doors shall not be self-closing or bi-fold type. The adjustable shelf shall be supported with "locking clips" to avoid inadvertent removal. Shelf shall be capable of supporting 68 kg without deflection. Provide 25 mm deep liquid tight drip pan to cover the entire floor area of the lined cabinet.

2.2.3.1 FEET

Base cabinet shall have leveling feet a minimum of 25 mm adjustment. Base cabinet shall be reinforced to support, without distortion, work top loaded with a uniformly distributed load of 682 kg.

2.2.3.2 VENT

Each acid storage cabinet shall be vented by a nominal 38 mm diameter acid resistant exhaust pipe connected to two high and two low points to be located at the rear of base cabinet to the inside hood chamber behind baffle plate and sealed.
The exhaust pipe(s) shall project up through the hood top and extend not less than 38 mm or more than 102 mm above the bottom edge of the exhaust plenum. The pipe shall be sealed into the worktop with solvent/acid resistant mastic to make a watertight joint.

2.2.4 LINER

The construction and the material of the liner in the interior of the hood shall be advanced composite construction of sufficient strength and rigidity to allow the attachment of appropriate mounting hardware to completely support a metal rod lattice. Interior liner of hoods shall be of a nonflammable material, unaffected by acid, bases or strong solvents. Cleats and battens shall be similarly resistant, with exposed edge rounded to 6 mm radius. Thickness of material shall be sufficient to withstand normal shipping, handling and installation. Non-porous liner walls shall be smooth, free from any indentations.

2.2.4.1 LINER MATERIAL

Liner shall be constructed of a white non porous modified epoxy resin with superior chemical resistance. The lining must have low flame rating to meet NFPA

45.

2.2.4.2 JOINTS

At the time of installation the joint between the molded epoxy work surface and the hood structures shall be filled with solvent and acid resistant mastic to prevent air leakage and loss of liquid through the joint under a spill condition.

2.2.4.3 HARDWARE

Reinforcements, bolts, fasteners, etc. within the work area shall be ANSI Type 304 stainless steel. All fasteners used inside hood chambers shall be provided with plastic snap on caps

2.2.4.4 CLEANLINESS FEATURES

Baffles shall be fixed but removable to allow for cleaning and decontamination of the area behind the baffle and shall be held in place with stainless steel fasteners.

Provide a powder coated stainless steel screen over the bottom slot to prevent materials, e.g., paper, from being drawn up into the duct. Screen to be installed horizontally behind baffles as low as possible. Screen to be 19 x 19 mm, 18 gauge diamond pattern.

2.2.5 RECEPTACLES

Provide two duplex, explosion proof, 3 wire, polarized, grounded, 125 volt, 20 ampere receptacle and two single 208 volt, single phase, 20 ampere, grounded receptacles. The receptacles, together with a toggle light switch, shall be located on the fascia panels.

2.2.5.1 WIRING

Hoods shall be factory complete for connection to an external power source of 120/208, 3 phase 4 wire service with separate ground. Wire shall be type FEP Teflon covered, heat resistant, in accordance with the requirements of the National Board of Fire Underwriters, in flexible metallic conduit, concealed within the hood structure. Cover plates for receptacles and switched shall be stainless steel. All raceway and outlet boxes shall be grounded to hood structure.

2.2.5.2 PREWIRING

Specified electrical services shall be prewired to a junction box located on the

roof near the right hand corner of the hood for field connection by the electrical contractor.

2.2.5.3 PREPLUMBING

All gas, air, vacuum and water fixtures shall be factory mounted in the hood. Each fixture shall be clearly marked for identification. Connection of system pipes to the fixtures shall be under another section of the specifications. The piping penetrations internal to the hood shall be pre-engineered and shall be prepunched by the fume hood manufacturer. Provide a 50 mm diameter sidewall mounted pass through access port for gas lines or cables on each side of fume hood. Port to be constructed of PVC plastic tube with threaded ends to accept locking washers and sliced neoprene membrane aligned with exterior face of the hood.

Copper tube and pipe shall not be used for natural gas.

2.2.6 FINISH

Base cabinet and superstructure shall have a chemically-resistant finish which meets tests and color requirements in Federal Standard 595A with color #27769.

PART 3 EXECUTIONS

3.1 INSTALLATION

Install fume hood base cabinets plumb and level and parallel to wall. Make plumbing, electrical and HVAC connections so that fume hoods are ready to use.

The supply and exhaust systems shall be balanced as described in Section 15990.

Hoods shall be adjusted, balanced and field tested as described in Section 15991 and 15992.

3.2 FACTORY TESTING

General: One of each type of hood manufactured according to the approved shop drawings shall be factory tested in accordance with Modified ANSI/ASHRAE 110-1999 indicated in Section 15991-Testing Of Constant Air Volume Fume Hoods and/or 15992-Testing Of Variable Air Volume Fume Hoods. NIH reserves the right to attend the hood testing. Hood Manufacturer shall provide all testing facility and all equipment necessary for the test. At least two weeks notice of proposed test date shall be provided to the NIH Project Officer. The Project

Officer and the Occupational Safety and Health Branch of NIH shall approve test certificates.

3.2.1 Test Room: The hood to be tested shall be set up in a test room of sufficient size so that a minimum of 1500 mm of clear space is available in front of and on both sides of the hood for viewing of performance tests.

3.2.2 Exhaust System: A hood exhaust system, properly calibrated so that known exhaust air volumes can be easily attained, shall be provided. The exhaust capacity shall be sufficient to exhaust the hood with a face velocity of 0.51 mps.

3.2.3 Performance Requirements: The hoods to be evaluated "AM" (as manufactured) under the Modified ANSI/ASHRAE 110-1999 and shall meet a minimum performance rating:

1. The test gas will have a 6 LPM flow rate for tracer gas and rapid walk-by test
2. Sash design position or positions: 457 mm
3. Average face velocity: 0.51 mps (plus or minus 10%)
4. Range of face velocities: No point in grid below 0.41 mps or above 0.61 mps. These are to be actual not as measured. Measured are to be adjusted for accuracy of test instrument.
5. Average face velocity for sash at 50%: 0.41 to 0.76 mps
6. Average face velocity for sash at 25%: 0.41 to 1.52 mps
7. Performance Rating: 0.05 ppm
8. Sash Movement Performance Rating: 0.10 ppm.
9. Response time for VAV hoods: less than 3 seconds
10. Percentage of auxiliary air supply: 0%. (Auxiliary air hoods are not allowed.)
11. Static Pressure Loss: Not more than 124 Pa at 0.51 mps face velocity.

3.3 OFF SITE MOCK UP FOR VAV SYSTEM TESTS

Manufacture shall furnish one fume hood of each kind as will be provided for the project to the fume hood control manufacturer’s facility for the off site mock up. Refer to Division 15 Section Testing Of Variable Air Volume Fume Hoods. Hoods can then be delivered to contractor for storage and use on the project

3.4 ON SITE TESTING

Refer to Division 15 Section Testing Of Constant Air Volume Fume Hoods and/or Testing Of Variable Air Volume Fume Hoods.

3.5 SOUND LEVEL READINGS

3.5.1 TEST CONDITIONS

Set the exhaust rate so that the hood has a face velocity at 0.51 mps with the uniformity requirements previously described. Eliminate, to the degree possible, all sources of noise in the area other than the hood.

3.5.2 TEST POSITIONS

Sound level reading shall be determined by using a calibrated type II sound level meter. The meter shall be hand held or tripod mounted near the face of the hood. The microphone shall be held 600 mm above the top of the airfoil and 76 mm in front of the sash and oriented so that the microphone is pointed into the hood. All readings shall be decibels relative to 0.00002 N/m^2, A scale weighted, and slow response. If the noise is not steady state, record the high and low level. The noise level is the average of the high and the low, but in no case shall the recorded level be less than 3 dB (A) lower than the high reading.

Obtain readings at the center of the hood with the vertical sash full open.

Repeat the readings with all sashes closed.

3.5.3 NOISE CRITERIA

The noise level recorded shall not exceed 58 dB (A) slow at all conditions.

END OF SECTION