

# UNIVERSITY OF CALIFORNIA, SANTA BARBARA

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SANTA BARBARA • SANTA CRUZ

OFFICE OF DESIGN & CONSTRUCTION SERVICES and PHYSICAL FACILITIES

CONTRACTING SERVICES

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**SENT VIA:** ☐ FAX ON THIS DATE  
☐ HAND DELIVERY ON THIS DATE  
☒ FEDERAL EXPRESS ON THIS DATE  
☐ UNITED PARCEL SERVICE ON THIS DATE

HOLDERS OF PLANS AND SPECIFICATIONS:

WUDL Lab Fumehood Installation CNSI Bldg 266,  
Rooms 2422 & 2428

Project No. FM070550S/987690/076-90

**Addendum No. 2**

August 15, 2007

Enclosed is **ADDENDUM NO. 2** to the Construction Documents on the above-captioned project.

Bid date has been changed from Tuesday, August 21, 2007 at 2:30PM to **Thursday August 23, 2007**  
**at 2:30 PM** to be held at:

CONTRACTING SERVICES  
Facilities Management, Bldg. 439,  
Door #E, Reception Counter  
University of California, Santa Barbara  
Santa Barbara, CA 93106-1030.

Late arrivals shall be disqualified. Please allow time for unforeseen traffic delays, securing a parking permit and potential parking problems.

A handwritten signature in black ink, appearing to read 'Anna Galanis'.

Anna Galanis  
Director, Contracting Services

ADDENDUM NUMBER 2  
to the  
CONSTRUCTION DOCUMENTS  
August 15, 2007

General

The following changes, additions or deletions shall be made to the following documents(s); and all other conditions shall remain the same.

I ADVERTISEMENT FOR BIDS

Item No.

1. First page, sentence beginning with "Bid Deadlind:..." **Change to read:** "Bid Deadline: Sealed bids must be received on or before 2:30 P.M. on Thursday, August 23, 2007. Sealed Bids will be received only at: Contracting Services, Facilities Management, Building #439 Door #E, Reception Counter, University of California, Santa Barbara, Santa Barbara, California, 93106-1030."

II. SUPPLEMENTARY INSTRUCTIONS TO BIDDERS

Item No.

1. Number 4, **Change to read:** "Bids will be received on or before the Bid Dealine: 2:30 P.M. Thursday, August 23, 2007. and only at: Contracting Services, Facilities Management, Building #439 Door #E, R eception Counter, University of California, Santa Barbara, Santa Barbara California 93106-1030."

III. SPECIFICATIONS

Item No.

1. Table of Contents: **Add** section 01015 – Work Sequence.
2. Section 01010, Summary of Work, 1.01 "Work required by Contract Documents", "A", #1, **CHANGE** first sentence to read: **'Provide new floor-mounted laboratory fume hood, mounting.'**

3. Section 01010, Summary of Work, 1.01: "work required by Contract Documents", **ADD #12** to read: "Contractor shall disconnect utilities and relocate the existing fumehood and base cabinets in room 2416. Cap all utilities at this location. Reinstall in room 2422 per plan."
4. Section 01010, Summary of Work, 1.01, "Work required by Contract Documents", "A", #2 **CHANGE** to read in its entirety: '**Connect cup sinks in hoods to existing lab vent.**'
5. Section 01010, Summary of Work, 1.01, "Work required by Contract Documents", "A", #3, **CHANGE** to read in its entirety '**Connect new waste from cup sinks to existing lab waste.**'
6. Section 01010, Summary of Work, 1.01, "Work required by Contract Documents", "A", #6, **CHANGE** to read in its entirety: '**Install flexible exhaust air connections to flammable storage cabinet below hood**'.
7. Section 01010, Summary of Work, 1.01, "Work required by Contract Documents", "A", #9, **CHANGE** to read in its entirety: '**Provide controls for new floor-mounted laboratory fume hood and connection to existing controls system**'.
8. Section 01010, Summary of Work, 1.01, "Work Required by Contract Documents", "A", **Add #13 to read as follows:**  
"Connect existing controls at Owner-furnished fume hood to existing controls system" (Also, put additions to 1.01 "A" as the last in this section).
9. Section 01310, Contract Schedules, Part 1, General, 1.01 "Preliminary Contract Schedule", "B", "Form", # c), **CHANGE** to read in its entirety: '**Mobilization: University removal of occupants and materials in rooms 2416 and 2422**'.
10. Section 01310, Contract Schedules, Part 1, General, 1.01, "Preliminary Contract Schedule, B, "Form": **Delete #e)** in its entirety: Installation of new equipment.
11. Section 01310, Contract Schedules, Part 1, General, 1.01, "Preliminary Contract Schedule, B, "Form": **Delete #f)** in its entirety: Connection of plumbing system to new equipment.
12. Section 01310, Contract Schedules, Part 1, General, 1.01, "Preliminary Contract Schedule, B, "Form": **Delete #g)** in its entirety: Connection of HVAC system to new equipment.
13. Section 01310, Contract Schedules, Part 1, "General", "B", "Form", #3: Add the following milestone events on the Preliminary Contract Schedule to include:
  - A. Start of Phase 1: Disconnection of utilities to existing benchtop fume hood and base cabinets in room 2416. Cap all utilities at this location.

- B. Phase 1: Reinstall existing benchtop fume hood and base cabinets in room 2422.
  - C. Phase 1: Connection of plumbing systems to equipment in room 2422.
  - D. Phase 1: Connection of HVAC system to equipment in room 2422.
  - E. Start of Phase 2: Demolition of existing HVAC system in room 2428.
  - F. Phase 2: Installation of new equipment in room 2428.
  - G. Phase 2: Connection of plumbing system to new equipment in room 2428.
  - H. Phase 2: Connection of HVAC system to new equipment in room 2428.
14. Section 11600, "Laboratory Fume Hoods", Part 2 **–Replace** in it's entirety with attached.

END OF ADDENDUM NO. 2

## SECTION 11600

### LABORATORY FUME HOODS

#### PART 1 - GENERAL

##### 1.01 DESCRIPTION OF WORK

- A. All laboratory hoods and related mechanical and electrical service fixtures specified herein and shown on the drawings shall be furnished, installed and internally wired and piped for single point final connection by Divisions 15 and 16. Each hood shall be demonstrated to properly function in accordance with the specification by the Contractor.

##### 1.02 SECTION INCLUDES

- A. Chemical fume hoods.

##### 1.03 RELATED SECTIONS

- A. The following Sections are a part of this Specification.
  - 1. Section 15410 – Plumbing Piping.
  - 2. Division 16 – Electrical.

##### 1.04 DELIVERY, STORAGE AND HANDLING

- A. Schedule delivery of equipment so that spaces are sufficiently complete that equipment can be installed immediately following delivery.
- B. Protect finished surfaces from soiling or damage during handling and installation. Keep covered with polyethylene film or other protective coating.
- C. Protect all work surfaces through construction period with 1/4" corrugated cardboard completely covering the top and securely taped to edges. Mark cardboard in large lettering "No Standing".

##### 1.05 SUBMITTALS

- A. Product Data: Submit manufacturer's data for each component and item of laboratory equipment specified. Include component dimensions, configurations, construction details, joint details, and attachments, utility and service requirements and locations. Include liner and exterior finish tests by independent third party.

- B. Shop Drawings: Indicate equipment locations, large scale plans, elevations, cross sections, rough-in and anchor placement dimensions and tolerances and all required clearances.
- C. Samples: Submit 3" x 6" samples of finish for fume hood, work surfaces and for other pre-finished equipment and accessories for selection by the University's Representative. Submit samples from manufacturer's standard color offering.
- D. Instructions: Submit for review and approval.
  - 1. Instructions to be inscribed on instruction plate to be attached to chemical fume hoods, as specified in Part 2 of this Section.
  - 2. Written instructions in booklet form providing additional details on safe and proper operation and maintenance.
- E. Test Data: Submit test reports on each size and type of chemical fume hood verifying conformance to test performance specified. Test reports must accompany each hood as part of installation and usage package. Submit independent test reports as required by specification.
- F. Independent Validation: Written verification of compliance to UL-1805 fume hood standard is mandatory.
- G. ASHRAE test report (as manufactured) for each fume hood type.
  - 1. Test one fume hood of each type and size specified in accordance with the method prescribed in ASHRAE Standard ANSI/ASHRAE 110 – 1995. the minimum overall performance rating of each test shall be 4.0 AM 0.05 with 4.0 equal to liters per minute of tracer gas release, AM identifying an as manufactured test, and 0.05 indicating the level of tracer gas control in parts per million.
  - 2. Hood test shall take place at the University with testing personnel, samples, apparatus, instruments, and test materials supplied by the contractor.
  - 3. Submit a test report, for each hood tested.
- I. All hoods provided under this contract shall be equipped with quantitative airflow monitoring devices that continually monitor whether exhaust air is flowing into the exhaust system during operation.

#### 1.06 QUALITY ASSURANCE

- A. Single Source Responsibility: Fume hood casework, work surfaces, and other laboratory equipment and accessories shall be manufactured or furnished by a single laboratory supplier. Proposals from brokers or multiple suppliers will not be accepted.

- B. Manufacturer's qualifications: Modern plant with proper tools, dies, fixtures and skilled workmen to produce high quality laboratory casework and equipment, and shall meet the following minimum requirements:
1. Five years or more experience in manufacture of laboratory casework and equipment of type specified.
  2. Ten installations of equal or larger size and requirements within the last five years. Provide contact at each.
  3. UL 1805 Specification:
    - a. Fume Hood must be Underwriters Laboratories subject 1805 classified. The 1805 standard covers electrical and mechanical hazards, investigates the flammability of materials and measures the effectiveness of airflow characteristics. Proper labeling must be affixed to the face of each fume hood indicating classification to the 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 insufficient. All factory testing shall be performed in a U.L. certified test facility.
  4. Installer's qualifications: Factory certified by the Manufacturer. Provide outline of certification program.

## 1.07 REFERENECEES

- A. Scientific Equipment and Furniture Association (SEFA) Standard 2.2, 1994 Laboratory Hoods.
- B. SEFA Standard 2.3, Recommended Installation Practices.
- C. SAMA Standard LFB-1976, Metal Laboratory Furniture.
- D. ASHRAE-110-1995.
- E. ANSI 2.95.
- F. NFPA.
- G. Underwriters Laboratories.

## PART 2 – PRODUCTS

### 2.01 CHEMICAL FUMEHOODS

- A. Fume hood and equipment manufacturer: Fisher Hamilton L.L.C., 1316 – 18<sup>th</sup> Street, Two Rivers, WI 54241.

- B. Or equal.

## 2.02 FUME HOOD GENERAL DESIGN REQUIREMENTS

- A. Fume hoods shall function as ventilated, enclosed work spaces, 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 with Polyresin liner: Minimum 80 foot-candles. Work area shall be 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 28 inches.
- D. Fume hood shall be designed to minimize static pressure loss with adequate slot area and bell shaped exhaust 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 with sash in full open position:

<u>Face Velocity</u>	<u>Measured S.P.L (W.G.)</u>
60 F.P.M.	.15 inches
100 F.P.M.	.30 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.
- F. Fume hoods shall be available in standard widths of 4, 5, 6, 7, & 8 feet. Each size will have these depths available: 31.25", 37.25" & 43.25".
- G. Noise Criteria: Test data of octave band analysis verifying hood is capable of a 50 NC value when connected to a 50 NC HVAC source. Reading taken 3" in front of open sash at 110 fpm face velocity.
- H. Interior and exterior materials of construction and finishes shall meet the usage and these specification requirements.

## 2.03 LINER SURFACE FINISH PERFORMANCE REQUIREMENTS

- A. Test procedure:
1. Test No. 1 – Spills and Splashes:



- a. Suspend in a vertical place a 42" (horizontal) by 12" (vertical) panel divided into 3/4" wide vertical columns, each column numbered 1 through 49.
- b. Apply five drops of each reagent listed with an eyedropper.
2. Test No. 2 – Fumes and Gases:
  - a. Divide 24" x 12" panel into 2" squares, each square numbered 1 through 49.
  - b. Place 25 milliliters of reagent into 100 milliliters beakers and position panel over beaker tops in the proper sequence. Note: Beaker pouring lip permits atmospheric oxygen to enter and participate in the reaction of the reagent fumes.
3. After 24 hours remove panel, flush with water, clean with naphtha and detergent, rinse, wipe dry and evaluate.
- B. Evaluation ratings: Change in surface finish and function shall be described by the following ratings:
  1. No Effect: No detectable change of finish film.
  2. Excellent: Indicated excellent to superior integrity of finish film. Includes no effect or slight change in gloss and slight discoloration.
  3. Good: Allows change of gloss or discoloration or surface discoloration while retaining integrity of finish film.
  4. Fair: Objectionable changes in appearance due to slight swelling or change in gloss while retaining integrity of finish film.
  5. Failure: Pitting, cratering or erosion of work surface material; obvious and significant deterioration.
- C. Test Results: "P" Fume Hood Liner

<u>Reagent List</u>		<u>Test No. 1</u>	<u>Test No. 2</u>
<u>Concentrations by Weight</u>		<u>Rating Spills</u>	<u>Fumes</u>
1.	Sodium Hydroxide Flake	N/A	No Effect
2.	Sodium Hydroxide, 40%	Excellent	No Effect
3.	Sodium Hydroxide, 20%	Excellent	No Effect
4.	Sodium Hydroxide, 10%	Excellent	No Effect
5.	Ammonium Hydroxide, 28%	No Effect	No Effect
6.	MethyleneChloride	No Effect	No Effect
7.	Chloroform	Excellent	No Effect
8.	LpH SE (solution)	No Effect	No Effect

9.	Trichlorethylene	Excellent	No Effect
10.	MonoChlorBenzene	Excellent	No Effect
11.	Tincture of Iodine	Excellent	Excellent
12.	Methyl Alcohol	No Effect	No Effect
13.	Ethyl Alcohol	No Effect	No Effect
14.	Butyl Alcohol	No Effect	No Effect
15.	Phenol, 85%	Excellent	No Effect
16.	Cresol	Excellent	No Effect
17.	Sodium Sulfide, Saturated	Good	No Effect
18.	Furfural	Fair	No Effect
19.	Dioxane	No Effect	No Effect
20.	Zinc Chloride, Saturated	No Effect	No Effect
21.	Benzene	Excellent	No Effect
22.	Toluene	Excellent	No Effect
23.	Xylene	Excellent	No Effect
24.	Gasoline	Excellent	No Effect
25.	Naphthalene	Excellent	No Effect
26.	Methyl Ethyl Ketone	Excellent	No Effect
27.	Acetone	Excellent	No Effect
28.	Ethyl Acetate	Excellent	No Effect
29.	Amyl Acetate	Excellent	No Effect
30.	Ethyl Ether	Excellent	No Effect
31.	Silver Nitrate, 10%	Excellent	No Effect
32.	Di methyl Formamide	No Effect	Excellent
33.	Formaldehyde, 37%	No Effect	No Effect
34.	Formic Acid, 88%	No Effect	No Effect
35.	Acetic Acid, Glacial	No Effect	No Effect
36.	Dichlor Acetic Acid, 93%	Excellent	Excellent
37.	Chromic Acid, Saturated	Good	No Effect
38.	Phosphoric Acid, 85%	No Effect	No Effect
39.	Sulfuric Acid, 33%	No Effect	No Effect
40.	Sulfuric Acid, 77%	Excellent	No Effect
41.	Sulfuric Acid, 93%	Good	No Effect
42.	Hydrogen Peroxide, 30%	No Effect	No Effect
43.	Acid Dichromate	Excellent	No Effect
44.	Nitric Acid, 20%	Excellent	No Effect
45.	Nitric Acid, 30%	Excellent	No Effect
46.	40 & 47 Equal Parts	Excellent	Good
47.	Nitric Acid, 70%	Excellent	Good
48.	Hydrochloric Acid, 37%	No Effect	Excellent
49.	Hydrofluoric Acid, 48%	No Effect	Failure

## 2.04 FUME HOOD MATERIALS

- A. Steel: High quality, cold rolled, mild steel meeting requirements of ASTM A1008; gauges U.S. Standard and galvanized.
- B. Stainless Steel: Type 304; gauges U.S. Standard.

- C. Ceiling Closure Panels: Minimum 18 gauge; finish to match hood exterior.
- D. Downdraft Bypass: Low resistant type, 18 gauge steel chamber, directional louvers – not acceptable. All bypass air shall enter top of bypass chamber and enter hood in a down flow direction. Chamber shall protect user from expelled particulate in the event of an adverse internal reaction.
- E. Safety Glass: Nominal 7/32" thick laminated safety glass or 3/8" thick laminated safety glass viewing panel.
- F. Sash Chain: ANSI #35 steel, single strand. Average tensile strength of 2,400 pounds; maximum working load of 480 pounds.
- G. Sash Guides: Extruded PVC.
- H. 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 steel with zinc dichromate finish.
- I. Sash Pull: Corrosion resistant steel with chemical resistant powder coating. Maximum 1.5" thick.
- J. Gaskets: White 70 durometer PVC for interior access panels. Gasket interior access panels to eliminate air leakage and to retain liquids inside hood.
- K. Fastenings:
  - 1. Exterior structural members attachments: Sheet metal screws, zinc plated.
  - 2. Interior concealed fastening devices: Exposed screws or screw head caps not acceptable.
  - 3. Exterior panel member fastening devices: To be corrosion resistant non-metallic material, creating a positive mechanical latch. Latch must be flush type. Exposed screws or Velcro type fasteners not acceptable.
- L. 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.

## 2.05 FUME HOOD TYPE

- A. Restricted Bypass Type Fume Hoods:
  - 1. Bypass shall be sufficient in size to allow 25% flow with sash closed. Bypass must be achieved through low resistance opening at top of front lintel panel. Bypass shall be designed to provide a smooth down flow effect.

2. Sash: Standard vertical-rising with VAV applications.

## 2.06 FUME HOOD CONSTRUCTION

- A. Superstructure: Rigid, self supporting assembly of double wall construction, maximum 4-7/8" thick.
  1. Wall consists of a sheet steel outer shell with urethane powder finish and a corrosion resistant inner liner. This wall houses and conceals steel framing members, attaching brackets and remote operating service fixture mechanisms and services. Panels must be attached to a full frame construction, minimum 14 gauge galvanized members. Panels and brackets attached to eliminate screw heads and metallic bracket from hood interior.
  2. Access to fixture valves concealed in wall provided by exterior removable access panels, gasket access panels on the inside liner walls, or through removable front posts.
- B. Exhaust Outlet: Rectangular with ends radiused, shaped and flanged, 18 gauge steel finished with urethane powder coating.
- C. 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 the closed position. Bottom foil shall not be removable without use of special tools. Bottom foil shall provide access area sufficient in size to pass through hospital grade electrical plugs. Bottom foil: Steel with urethane powder coating to increase acid and abrasion resistance. Air foil and sill to be low profile design. A secondary containment trough shall be located in front of the work surface and extend below the airfoil sill.
- D. Fume Hood Sash – Bench Top Hood: Full view type with clear, unobstructed, side to side view of fume hood interior and service fixture connections. Sash to have a 35-inch sight line and a 28.5" vertical access height.
  1. Bottom sash rail: 2" maximum, 18 gauge steel with powder coating finish. Provide integral formed, flush pull the full width of bottom rail. Full width extruded dual durometer bottom bumper and airflow control strip.
  2. Set safety glass into rails in deep form, extruded polyvinyl chloride glazing channels.
- E. Fume Hood Sash – Floor Mount Hood: Vertical and horizontal upper sash access with vertical only lower sash. Horizontal sash shall be top hung on nylon tired stainless steel ball bearing wheels. Sash frame on bottom and sides must be no more than 1.5" thick and radiused to minimize turbulence.

1. Area above the 28" vertical sash opening shall be glazed with a minimum of 3/8" thick laminated safety glass. All glass to have polished exposed edge treatment.
  2. Horizontal panels provided with finger pulls.
- F. 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 length of travel. Life cycle test sash and weight. Provide independent test data. Open and close sash against rubber bumper stops.
- G. Airfoil: The airfoil will be low profile, relatively flush to the work surface with ample room for electrical hospital grade cords to fit beneath the airfoil. Sill to be ergonomically radiused on front edge. Sill must pivot forward to provide cord and trough access. Airfoil sills that are not low profile are not acceptable.
- H. Fume Hood Liner: Poly-resin: Reinforced polyester panel; smooth finish and white color in final appearance. Flexural strength: 14,000 psi. Flame spread: 17 or less per U.L. 723 and ASTM E84-80. Baffle must be same material as liner. Metallic baffles, brackets or supports on hood interior are not acceptable. Liner and baffle material must meet 2.03 – Performance Test. Independent test validation is mandatory.
- I. Baffles: Baffles providing controlled air vectors into and through the fume hood shall be fabricated of the same material as the liner. Provide minimal exhaust slots full height on vertical sides of the baffle. High performance 2-piece baffle will be used. Baffle shall incorporate exhaust slots located to purge the upper and lower area of the hood. Baffle to be non-adjustable. Baffles with manual or automatic adjustment are not acceptable. All baffles, supports and brackets to be non-metallic.
- J. Auto-Sash: Sash shall be designed to promote usage as an upper body and face shield. Face velocities and volumes shall be based on an 18" operating opening. Sash shall have the capability to be raised to full 28.5" vertical opening for loading or unloading of large apparatus. A lock-open shall be provided. Sash shall lower automatically to the operating position or lower when released from any position above 18". Auto-sash function shall be life cycle tested and not incorporate the need for motor drives. Submit third party validation of life cycle tests.
- K. Service Fixtures and Fittings: Color-coded hose nozzle outlets and valves mounted inside the fume hood and controlled from the exterior with color-coded index handles.
1. Valves: Needlepoint type with self-centering cone tip and seat of hardened stainless steel. Tip and seat shall be removable and replaceable.
  2. Provide piping for all service fixtures from valve to outlet: Galvanized iron or copper for water, air and vacuum and black iron for gas services.

3. Fixtures exposed to hood interior: Brass with chemically resistant color-coded powder coating.
  4. Remote control handles: Four-arm handle with nylon color-coded index buttons.
  5. Services: As shown.
- L. Hood light fixture: Two lamp, rapid start, UL listed fluorescent light fixture with sound rated ballast installed on exterior of roof. Provide safety glass panel cemented and sealed to the hood roof.
1. Interior of fixture: White, high reflecting plastic enamel.
  2. Size of fixture: Largest possible up to 48" for hoods with superstructures up to seven feet. Provide two 36" fixtures for hoods with eight-foot superstructures.
  3. Include lamps with fixtures. Hoods without lamps are not acceptable.
  4. Illumination: Per performance values, Part 1 of this Section.
  5. Access to light through lintel panels – no tools required.
- M. Electrical Services: Three wire grounding type receptacles rated at 120 VAC at 20 amperes. Flush plates: Black acid resistant thermoplastic.
- N. Work Surfaces: 1-1/4" thick surface, dished a nominal 3/8" to contain spills.
1. Molded resin work surfaces for hoods with Poly-resin liners.
- O. Safety Monitor/Alarm System: Where shown or specified provide Safety Monitor/Alarm System, which monitors face velocity and provides audible and visual alarm if face velocity drops below safe levels. As the internal fume hood pressure changes as the sash opening is closed and opened, the flow passing over the thermistor is calibrated to a face velocity, which is displayed on the front of the monitor.
1. Safety Monitor: UL listed, tamper proof, with all alarm circuits, electric components, external tubing, and manifolds furnished complete and factory installed.
  2. Calibration is the responsibility of the University and is required once the hood is stationed and the hood exhausts and room supply systems are balanced. A secondary calibration has been factory set into the alarm's memory only to determine that the alarm is functional and ready for shipment. The primary calibration must be completed in the field.

3. Airflow Sensor: Thermally compensated glass-beaded thermistor, factory connected to a sidewall port on the interior of the fume hood.
4. Alarm Signal: Audible and visual signal.
  - a. Silence pushbutton, which disables the audible alarm, shall be accessible on the front of the safety monitor.
  - b. Provide alternate mode in which audible alarm is silenced indefinitely but visual alarm remains activated until the alarm condition is corrected.
  - c. When alarm condition is corrected and face velocity and volume return to specified levels, the Safety Monitor will automatically reset and begin routine monitoring.
5. Provide test circuit to verify proper Safety Monitor operation.

## 2.07 METAL FINISH

### A. 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 selected 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 the following thickness: Liquid, dipped, solvent based finished are not and will not be accepted.
  - a. Exterior and interior exposed surfaces: 1.5 mil average and 1.2 mil minimum.
  - b. Backs of cabinets and other surfaces not exposed to view: 1.2 mil average.

### B. Cabinet Surface Finish Tests: All casework construction and performance characteristics shall be in full compliance with SEFA 8 Standards. At the University's request, independent, third party performance testing must be submitted validating compliance and adheres to the finish specifications.

1. Chemical Spot Test
  - a. Purpose of Test: The purpose of the chemical spot test is to evaluate the resistance a finish has to chemical spills. Note: Many organic solvents are suspected carcinogens, toxic and/or flammable. Great

care should be exercised to protect personnel and the environment from exposure to harmful levels of these materials.

b. Test Procedure:

- 1) Obtain one sample panel measuring 14" x 24". The received sample to be tested for chemical resistance as described herein.
- 2) Place panel on a flat surface, clean with soap and water and blot dry. Condition the panel for 48 hours at 73±3°F. Test the panel for chemical resistance using 49 different chemical reagents by one of the following methods:
  - a) Method A: Test volatile chemicals by placing a cotton ball saturated with reagent in the mouth of a one-ounce bottle and inverting the bottle on the surface of the panel.
  - b) Method B: Test volatile chemicals by placing five drops of the reagent on the surface of the panel and covering with a 24mm watch glass, convex side down.
  - c) For both of the above methods, leave the reagents on the panel for a period of one hour. Wash off the panel with water, clean with detergent and naphtha, and rinse with deionized water. Dry with a towel and evaluate after 24-hours at 73±3°F and 50±5% relative humidity using the following rating system:
    - i) Level 0 – No detectable change.
    - ii) Level 1 – Slight change in color or gloss.
    - iii) Level 2 – Slight surface etching or severe staining.
    - iv) Level 3 – Pitting, cratering, swelling, or erosion of coating. Obvious and significant deterioration.

Reagent List  
Concentrations by Weight

Test Method

1.	Acetate, Amyl	A
2.	Acetate, Ethyl	A
3.	Acetic Acid, 98%	B
4.	Acetone	A
5.	Acid Dichromate, 5%	B
6.	Alcohol, Butyl	A
7.	Alcohol, Ethyl	A
8.	Alcohol, Methyl	A



9.	Ammonium Hydroxide, 28%	B
10.	Benzene	A
11.	Carbon Tetrachloride	A
12.	Chloroform	A
13.	Chromic Acid, 60%	B
14.	Cresol	A
15.	Dichlor Acetic Acid	A
16.	Dimethylformamide	A
17.	Dioxane	A
18.	Ethyl Ether	A
19.	Formaldehyde, 37%	A
20.	Formic Acid, 90%	B
21.	Furfural	A
22.	Gasoline	A
23.	Hydrochloric Acid, 37%	B
24.	Hydrochloric Acid, 48%	B
25.	Hydrogen Peroxide, 3%	B
26.	Iodine, Tincture of	B
27.	Methyl Ethyl Ketone	A
28.	Methylene Chloride	A
29.	Mono Chlorobenzene	A
30.	Naphthalene	A
31.	Nitric Acid, 20%	B
32.	Nitric Acid, 30%	B
33.	Nitric Acid, 70%	B
34.	Phenol, 90%	A
35.	Phosphoric Acid, 85%	B
36.	Silver Nitrate, Saturated	B
37.	Sodium Hydroxide, 10%	B
38.	Sodium Hydroxide, 20%	B
39.	Sodium Hydroxide, 40%	B
40.	Sodium Hydroxide, Flake	B
41.	Sodium Hydroxide, Saturated	B
42.	Sulfuric Acid, 33%	B
43.	Sulfuric Acid, 77%	B
44.	Sulfuric Acid, 96%	B
45.	Sulfuric Acid, 77% and Nitric Acid, 70%, equal parts	B
46.	Toluene	A
47.	Trichloroethylene	A
48.	Xylene	A
49.	Zinc Chloride, Saturated	B

2. Hot Water Test:

- a. Purpose of Test: The purpose of this test is to insure the coating is resistant to hot water.

- b. Test Procedure: Hot water, 190°F to 205°F, shall be allowed to trickle (with a steady stream and at a rate of not less than 6 ounces per minute on the surface, which shall be set at an angle of 45 degrees, for a period of five minutes).
  - c. Acceptance Level: After cooling and wiping dry, the finish shall show no visible effect from the hot water.
- 3. Impact Test:
  - a. Purpose of Test: The purpose of this test is to evaluate the ductility of the coating.
  - b. Test Procedure: A one-pound ball approximately 2" in diameter shall be dropped from a distance of 12" onto a flat horizontal surface, coated to manufacturer's standard manufacturing method.
  - c. Acceptance Level: There shall be no visible evidence to the naked eye of cracks or checks in the finish due to impact.
- 4. Paint Adhesion on Steel Test:
  - a. Purpose of Test: The paint adhesion test is used to determine the bond of the coating to steel. This does not apply to non-steel products.
  - b. Test Procedure: This test is based on ASTM D2197-86 "Standard Method of Test for Adhesion of Organic Coating." Two sets of eleven parallel lines 1/16" apart shall be cut with a razor blade to intersect at right angles thus forming a grid of 100 squares. The cuts shall be made just deep enough to go through the coating, but not into the substrate. They shall then be brushed lightly with a soft brush for one minute. Examine under 100-foot candles of illumination.
  - c. Acceptance Level: Ninety or more of the squares shall show finish intact.
- 5. Paint Hardness on Steel Test:
  - a. Purpose of Test: The paint hardness test is used to determine the resistance of the coatings to scratches.
  - b. Test Procedure: Pencils, regardless of their brand, are valued in this way: 8-H is the hardest, and next 11 order of diminishing hardness are 7-H, 6-H, 5-H, 4-H, 3-H, 2-H, H, F, HB, B (soft), 2-B, 3-B, 4-B, 5-B (which are softest). The pencils shall be sharpened on emery paper to a wide sharp edge. Pencils of increasing hardness shall be pushed across the paint film in a chisel-like manner until one is found that will cut or scratch the film. The pencil used before that one, that

is the hardest pencil that will not rupture the film, is then used to express or designate the hardness.

- c. Acceptance Level: The paint shall have a hardness of 4-H minimum.

## 2.08 SOURCE QUALITY CONTROL TESTING OF FUME HOODS

- A. Evaluation of manufacturer's standard product shall take place in manufacturer's own test facility, with testing personnel, samples, apparatus, instruments, and test materials supplied by the manufacturer at no cost to the University.
- B. Submit test report consisting of the following test parameters and equipment for each hood width and configuration specified.
- C. Hood shall achieve a rating of 4.0 AM 0.05 PPM or better. Tested to ASHRAE-110-1995.
- D. Test Facility: Sufficient size to provide unobstructed clearance of five feet each side and ten feet in front of fume hood. Provide make-up air to replace room air exhausted through fume hood and to obtain a negative 0.2" w.g. room pressure. Introduce make-up air in a manner that minimizes drafts in front of hood to less than 20% of the face velocity. Connect 100 feet per minute air velocity through face of fume hood. Adjustment in blower shall vary face velocity down to 75 feet per minute.
1. Examine facility to verify conformance to the requirements of this Section.
  2. Test room shall be isolated from all personnel during test procedure.
- E. Testing Equipment:
1. Properly calibrated hot wire thermal anemometer probes equal to Sierra Model 600-02; correlate with computer data acquisition format to provide simultaneous readings at all points.
  2. Pitot tube and inclined manometer with graduations no greater than 0.2 inch of water equal to F.W. Dwyer Model 400. Calibration curves based on 20. Pitot traverse readings and correlated to a digital readout indicator to provide quick and accurate adjustment of airflows.
  3. Tracer Gas: Sulfur hexa-fluoride supplied from a cylinder at a test flow rate of four liters per minute.
  4. Ejector System: Tracer gas ejector equal to IHE No. 525-014. Submit sufficient proof of ejector system calibration.
  5. Critical Orifice: Sized to provide tracer gas at four liters per minute at an upstream pressure of 30 psig.

6. Detection Instruments: Ion Track Model 61 Leak Meter II sulfur hexa-fluoride detector instrument.
7. Recorder with an accuracy better than plus or minus 0.5% of full scale.
8. Three dimensional manikin, overall height 67", clothed in a smock.
9. Titanium tetrachloride glass modules. CAUTION: Titanium tetrachloride is corrosive and irritating; skin contact or inhalation shall be avoided.

F. Preliminary Test and Data:

1. Provide sketch of room indicating room layout, location of significant equipment, including test hood and other hoods. Provide sketch of air supply system indicating type of supply fixtures.
2. Reverse airflows and dead space:
  - a. Swab strip of titanium tetrachloride along both walls and floor of hood in a line 6" behind and parallel to the hood face, and along the top of the face opening. Swab an 8" diameter circle on the back of the hood. All smoke should be carrier to the back of the hood and exhausted.
  - b. Test the operation of the bottom air bypass airfoil by running the cotton swab under the airfoil.
  - c. If visible fumes flow out of the front of the hood, the hood fails the test and receives no rating.
3. Face velocity measurements: Face velocity shall be determined by averaging minimum of four and maximum of eight readings at the hood face. Take readings at center of a grid made up of sections of equal area across the top half of the face and sections of equal area across the bottom half of the face. Take simultaneous reading at each point with a series of calibrated hot wire anemometers over a one-minute period of time. Probes shall be correlated to a computer data acquisition package, which will provide an average of each reading over that one-minute period and also an overall average. During the one-minute monitoring period, all velocities must automatically update average at a maximum of four-second intervals.

G. Test Procedure:

1. Check sash operation by moving sash through its full travel. Verify that sash operation is smooth and easy, and that vertical rising sash shall hold at any height without creeping up or down. Position sash in the full open position.
2. Measure exhaust airflow with the baffles' position to give maximum airflow. Measure exhaust air volume with baffles' position to give minimum airflow.

Verify that the air volume at minimum airflow is not less than 95% of the exhaust air volume at maximum airflow. Hoods exceeding this fail the test and receive no rating.

3. Take a static pressure reading, using methods assuring an accurate reading, in an area of the ductwork no more than three feet nor less than one foot above the exhaust collar. Static pressure loss shall not exceed values given under Design Requirements in Part 2 of this Section.
4. Install ejector in test positions. For a typical bench-type hood, three positions are required: left, center and right as seen looking into the hood. In the left position the ejector centerline is 12" from the left inside wall of the hood; center position is equal distance from the inside sidewalls; and the right position is 12" from the right inside wall. The ejector body is 6" in from the hood face in all positions. Location of ejector may require modification for hoods of unusual dimensions.
5. Install manikin positioned in front of the hood, centered on the ejector.
6. Fix detector probe in the region of the nose and mouth of the manikin. Take care that method of attachment of the probe does not interfere with the flow patterns around the manikin. Locate nose of manikin 9" in front of ejector (3" in front of sash).
7. Open tracer gas block valve. Correlate readings with a computer data acquisition package, which is capable of monitoring and visually recording a minimum of one reading per second for a minimum three minute time period at each of the three positions.
8. The control level rating of the hood shall be the maximum of the three average values for the three test positions.
9. Record performance rating of the fume hood as XXAMyyy, where XX equals the release rate in liters per minute (4.0) and AM represents the as manufactured test sequence and yyy equals the control level in parts per million.
10. All data on the above test conditions including instrumentation and equipment, test conditions, preliminary test and data information shall be provided on a one page report, including a printout of the average face velocities and a separate graph-type performance curve on all three tracer gas positions.

## PART 3 – EXECUTION

### 3.01 FUME HOOD INSTALLATION

- A. Install fume hoods and equipment in accordance with manufacturer's instructions and local code requirements.

- B. Install equipment plumb, square and straight with no distortion and securely anchored as required.
- C. Secure work surfaces to casework and equipment components with material and procedures recommended by the manufacturer.
- D. Install accessories and fittings in accordance with manufacturer's recommendations.

### 3.02 FIELD QUALITY CONTROL TESTING OF FUME HOODS

- A. ANSI/ASHRAE 110-1995, Method of Testing Performance of Laboratory Fume Hoods.
  - 1. Field testing requirements:
    - a. Perform tests in field to verify proper operation of the fume hoods before they are put in use, using only qualified personnel. Conform to University required hood testing, CAL OSHA Section 5154.1, Title 8, CCR.
    - b. Perform tests after installation is complete, the building ventilation system has been balanced, all connections have been made, and written verification has been submitted that the above conditions have been met.
    - c. Verify that the building make-up air system is in operation, the doors and windows are in normal operating position, and that all other hoods and exhaust devices are operating at designed conditions.
    - d. Correct any unsafe conditions disclosed by these tests before request of test procedures.
    - e. Test Reports: Provide the University Representative and University with a record of all tests.

### 3.03 ADJUSTING

- A. Repair or remove and replace defective work, as directed by University's Representative upon completion of installation.
- B. Adjust sash, fixtures, accessories and other moving or operating parts to function smoothly.

### 3.04 CLEANING

- A. Dust off, broom clean equipment, touch up as required.

### 3.05 PROTECTION OF FINISHED WORK

- A. Provide all necessary protective measures to prevent exposure of equipment from exposure to other construction activity.
- B. Advise contractor of procedures and precautions for protection of material and installed fume hoods from damage by work of other trades.

END OF SECTION