

**SECTION 11 53 13**  
**FUME HOODS AND EXHAUST DEVICES (Revised AD-2, AD-8)**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Chemical Fume Hoods, including bench mounted hoods, floor-mounted hoods, and high performance/low velocity hoods.
- B. Fume Extractor Arms (Snorkels).
- C. Ventilated Balance Safety Enclosures.
- D. Custom Ventilated Enclosures (Exhaust Enclosure).

**1.2 UNDIVIDED RESPONSIBILITY**

- A. Unless specified otherwise, because of special coordination requirements, the scope of work described in this Section shall be provided by the supplier of the Section 12 35 53 scope of work.

**1.3 RELATED SECTIONS**

- A. Canopy hoods and low slotted exhausts are specified in Section 12 35 53 under Stainless Steel Fabrications.

**1.4 DESCRIPTION**

- A. Provide chemical fume hoods, fume extractor arms, ventilated balance safety enclosures, and custom enclosures complete with accessories as described herein, and shown on Laboratory Furnishings drawings.
- B. Fume hoods with accessories shall be pre-piped and pre-wired:
  - 1. Pre-pipe service fittings to single point connection for each service at 6 IN above top of hood or as otherwise shown. Cup sink tailpiece shall be provided with fume hood. Refer to Section 11 53 43 and details on Laboratory Furnishings drawings for service fittings. P-trap, waste piping and tailpiece extensions for cup sinks, if required, shall be furnished and installed by Division 22. Comply with Division 22 requirements for piping and installation requirements.
  - 2. Pre-wire all electrical devices to junction box at top of hood. Provide wire terminal blocks and terminal identification. Comply with Division 26 requirements for electrical work. Lighting fixtures, electrical outlets, switches, wiring, terminal blocks, terminal boxes, safety alarms and other electrical devices mounted on or in fume hoods shall be approved for use in any Class 1, Division 2 locations indicated on the drawings.
  - 3. Work of this Section requires close coordination with Work of Divisions 22, 23, 25 and 26, as well as installation of BNL furnished components and Work specified in other Sections. Sequence all Work to ensure an orderly progress in the project without removal of previously installed Work and so as to prevent damage to finishes and products.

**1.5 REFERENCES**

- A. ASHRAE 110, latest edition, Method of Testing Performance of Fume Hoods.
- B. Work shall conform to the recommended practices of the Scientific Equipment and Furniture Association (SEFA), current version, except as superseded by this specification:
  - 1. SEFA 1 - Fume Hoods.
  - 2. SEFA 2 - Installation.
  - 3. SEFA 3 - Laboratory Work Surfaces.

4. SEFA 7 - Fixtures.
  5. SEFA 8 M - Laboratory Grade Metal Casework.
  6. SEFA 8 P - Laboratory Grade Polypropylene Casework.
- C. Occupational Safety and Health Administration, Federal Register 29 CFR Part 1910, "Occupational Exposures to Hazardous Chemicals in Laboratories."
  - D. American National Standards Institute/American Industrial Hygiene Association (ANSI/AIHA) Z9.5 "Standard for Laboratory Ventilation."
  - E. National Fire Protection Association (NFPA) 45 "Standard on Fire Protection for Laboratories Using Chemicals."
  - F. American Conference of Government Industrial Hygienists (ACGIH) "Industrial Ventilation."

## **1.6 SUBMITTALS WITH PROPOSAL**

- A. Description of hoods, including construction details, materials, gauges, sash lock and release procedure, hardware cut sheets, piping of equipment and description of re-lamping procedures.
- B. Statement giving face velocity, operating volume and pressure drop at operating sash position for each size hood.
- C. Description of proposed factory dynamic testing procedures.

## **1.7 SUBMITTALS**

- A. Submit as specified herein and under provisions of Section 01 33 00.
- B. Materials List/Product Data: Submit complete materials list, including catalog data of all materials, equipment, fan curves, test designs, performance charts, and products for Work specified in this Section.
- C. Shop Drawings:
  1. Submit complete shop fabrication and installation drawings, including plans, elevations, sections, dimensions, materials and metal gauge sizes, details, fittings, duct connections, schedules, and steam table piping and vents from cabinets below where applicable. Show relationship to adjoining materials and construction. Identify all connection points, locations and sizes to building services and systems. Provide clear identification where equipment requirements deviate from the service/utility provisions in the Construction Documents. Shop Drawings shall be in the form of reproducible or photocopies, not to exceed 11 IN by 17 IN in size. Blue line prints are not acceptable.
  2. Coordinate shop drawing submittals of both this Section and Section 12 35 53 so that each recognizes and incorporates each others products.
- D. Submit detailed anchorage and attachment drawings and calculations provided by a licensed Structural Engineer complying with the applicable Building Code seismic restraint requirements:
  1. Fume hoods shall be designed and anchored in accordance with IBC 2000 Seismic Design Category C requirements.
- E. Samples: Submit two (2) samples of each type of specified finish and color range available, or as identified in the Finish Schedule.
- F. Certification: Submit certification by an independent testing company stating that equipment is installed per applicable and referenced codes and standards, adjusted and balanced for design operations, and is complete and ready for intended function:
  1. Certify that fume hoods will not exceed design maximum at specified operating conditions.
- G. "As Manufactured" (AM) Fume Hood Testing in Manufacturing Facility: Provide certification that each type and size of fume hood has achieved an AM performance rating equal or better than 0.05 ppm with 4.0 Lpm tracer gas release rate when tested in accordance with ASHRAE 110-1995 at 60 fpm face velocity at operating sash opening.

- H. Fume Hood Sound Level Certification: Provide certification of fume hood compliance with design criteria for maximum allowable noise within laboratories:
  - 1. For fume hoods operating with a face velocity of 80 fpm, test data of octave band analysis verifying hood is capable of a 50 NC value when connected to a 50 NC HVAC source. Measurements shall be taken 36 IN in front of open sash, 60 IN above the floor, at 80 fpm face velocity.
- I. Informational Submittals:
  - 1. Provide piping, wiring, and/or control diagrams, including all connection points and sizes to building services and systems. Provide flow rates, pressure drops, voltage and amperage, etc.
- J. Closeout Submittals:
  - 1. Operations/Maintenance Manuals: Accompanying certification, submit for Architect's review and BNL's use, complete operating and maintenance manuals that describe proper operating procedures, maintenance and replacement schedules, component parts list, wiring diagrams, and closest factory representative for components and service.

## **1.8 QUALITY ASSURANCE**

- A. Coordinate work of this Section with Section 12 35 53 Laboratory Casework and Furnishings.
- B. Provide interface products of style, material, finish, and color in order to produce a homogenous installation.
- C. Fume Hoods shall be UL tested and labeled and conform to Class A requirements of ANSI Z9.5 Laboratory Ventilation.

## **1.9 QUALIFICATIONS**

- A. Fume Hood Manufacturer:
  - 1. Work in this Section shall be manufactured by a firm having a minimum eight years documented experience, and an established organization and production facilities including all tools, equipment and special machinery necessary for specializing in the fabrication and installation of the type of equipment required with skilled personnel, factory trained workmen and an experienced engineering department. Each shall have the demonstrated knowledge, ability and the proven capability to produce the specified equipment of the required quality and the proven capacity to complete an installation of this size and type within the required time limits.
  - 2. Manufacturer shall maintain a factory test facility which provides variable exhaust and make-up air control. Test facility shall contain, as permanent equipment, ANSI/ASHRAE 110 testing equipment as specified for performance testing.

## **PART 2 - PRODUCTS**

### **2.1 EXHAUST REQUIREMENTS**

- A. Refer to Exhaust Schedule for requirements.
- B. Fume hoods and exhaust devices shall be designed to operate safely within the values provided on the Exhaust Schedule. The airflow values provided on the Exhaust Schedule represent the total airflow through the fume hood or exhaust device, including the airflow through the sash or work opening, airfoil, bypass, and leakage, respectively, as they apply to particular devices. Exhaust devices shall operate at specified face velocity within total airflow scheduled.
- C. Proposed modifications or corrections shall be reviewed and approved by Laboratory Planner and Mechanical Engineer for any device that requires adjustment to operate within specified design requirements.

## 2.2 CHEMICAL FUME HOODS

- A. Manufacturers: Products complying with this specification may be provided by the following manufacturers. All chemical fume hoods shall be the product of a single manufacturer:
1. Hamilton Products, a part of Thermo Fisher Scientific, 1316 18th Street, Two Rivers, WI 54241 Tel: 920 793-1121. website: <http://www.hamiltonlab.com/>
  2. LabCrafters, 2085 Fifth Avenue, Ronkonkoma, NY 11779, [Tel:631 471-7755](tel:6314717755). website: <http://www.lab-crafters.com/>
  3. Mott Manufacturing Limited. 452 Hardy Road, P. O. Box 1120, Brantford, ON, Canada N3T 5T3 Tel: 519 752-7825. website: <http://www.mott.ca>
  4. Kewaunee Scientific Corporation, P O Box 1842, Statesville, NC 28687 Tel: 704 873-7202. - website: <http://www.kewaunee.com/>
  5. Advanced Lab Concepts, 15900 Bratton Lane, Austin, TX 78728, Tel: 800 711-5227. – website: <http://www.alc-corp.com>
  6. Bedcolab Limited, 2305 Francis-Hughes Avenue, Laval QC Canada H7S 1N5 Tel: 514 384-2820 website: [www.bedcolab.com](http://www.bedcolab.com)
  7. Substitutions are not permitted.
- B. Underwriters Laboratory Listing: Fume hoods shall be UL subject 1805 classified. Label shall be attached to the face of each fume hood indicating classification to the UL 1805 standard for Laboratory Fume Hoods.
- C. Materials: The following materials shall be provided, unless superseded by the requirements listed below for specific fume hood types:
1. Steel:
    - a. ASTM A366 high quality, cold rolled, mild steel, and free from rust, scale, scratches, buckles, ragged edges, and other defects.
    - b. Minimum Thickness: 18 gauge.
  2. Stainless Steel:
    - a. Type 304, ASTM 240, with exposed surfaces ground and polished to a No. 4 finish.
    - b. Minimum Thickness: 16 gauge.
    - c. Welding: All stainless steel welding material shall be of similar type to sheet material. Welds shall be made without discoloration, ground, polished, and passivated to blend with a No. 4 finish.
  3. Liner and Baffle:
    - a. Typical: Glass-reinforced polyester panel, flame-retardant and self-extinguishing with smooth finish and white color. Flexural strength: 14,000 psi. Flame spread: 15 or less per U.L. 723 and ASTM E84-80. Baffle shall be same material as liner. Liner thickness: 3/16 IN; baffle thickness: 1/4 IN, minimum. Liner performance characteristics shall be as specified below.
    - b. For Stainless Steel Hood Liner as noted on the drawings: 16 gauge Type 304 stainless steel. Continuously weld liner top to sides; grind welds smooth. Radius all vertical corners 1/2 IN.
  4. Glass: 7/32 IN laminated safety glass. Glass shall not be etched with manufacturer's name, logo, or any other permanent markings, other than to identify the glass as safety glass. Light fixture lens may be tempered safety glass. Safety glass shall be in compliance with ANSI Z97.1.
  5. Sash Guides: Extruded PVC.
  6. Sash pull: Full width corrosion-resistant steel with chemical resistant powder coating, stainless steel, or plastic.
  7. Gaskets: White 70 durometer PVC for interior access panels. Gasket interior access panels to eliminate air leakage and to retain liquids inside hood.
  8. Fasteners:
    - a. Exterior structural member attachments: Sheet metal screws, zinc plated.
    - b. Exposed exterior fastening devices shall be corrosion-resistant, non-metallic material; exposed screws are not acceptable.

- c. Interior fastening devices: Except where specifically allowed by this Specification, interior fastening devices shall be concealed; exposed screws are not acceptable. (Screw head "caps" not acceptable).
- 9. Instruction Plate: Corrosion resistant or plastic plate attached to the fume hood exterior with condensed information addressing the recommended locations for apparatus and accessories, baffle settings, if adjustable, and use of sash.

D. Construction:

- 1. Superstructure: Rigid, self-supporting assembly of double wall construction, maximum 4 7/8 IN thick. Wall shall consist of a sheet steel outer shell and a corrosion resistant inner liner, and shall house and conceal steel framing members, piping, wiring, attaching brackets, and remote operating service fixture mechanisms and services. Panels shall be attached to a full frame construction, minimum 14 gauge galvanized members. Panels and brackets attached to eliminate screw heads and metallic bracketry from hood interior. Front panels shall be factory-punched for service fittings, electrical, control, and monitoring equipment. Provide stainless steel or epoxy- or urethane-coated plug buttons for holes not used.
- 2. Access Panel: Access to fixture valves and piping concealed in wall shall be through flush access panels on the inside liner walls, or through removable front posts. Panels shall be secured with fitted gasket, tamperproof, epoxy- or urethane-coated, countersunk, flat head screws, or similar method, providing a tight fit. Hook and loop type attachments and panels held by gravity are not acceptable.
- 3. Baffle Adjustment: In standard chemical fume hoods, if adjustable baffles are provided, the adjustment control shall be operable from outside the hood without exposing the user to the hood interior environment and, for ADA compliant hoods, shall be within the reach of a wheel chair bound operator. All baffles, supports, and brackets to be non-metallic. Baffles may be made fixed. Baffles shall be removable for cleaning.
- 4. Baffles: In high performance/low velocity fume hoods, baffles shall be fixed and non-adjustable. Baffles shall be removable for cleaning.
- 5. Ceiling Closure Panels: Provide 18 gauge steel paneled enclosure from top of hood to the ceiling. Enclosure shall include hinged door to access hood lighting fixture, and HEPA filter module where applicable. Finish shall match superstructure exterior. Panels shall terminate 1/4 IN below finished ceiling, where provided, or at 9'-0" above finished floor where there is no finished ceiling.
- 6. Vertical Sash Enclosure:
  - a. Fume hoods shall be provided with sash enclosures, gasketed or sealed penetrations and connections, as required, which limit air leakage to 1 percent of the design air flow quantities indicated on the Exhaust Schedule. Fume hood manufacturer shall remain responsible for achieving the required capture velocity at the specified operating sash height.
  - b. Provide sheet metal enclosure to completely encase vertically operated or combination sashes when sash is in the full open position.
  - c. Enclosure shall prevent air of fume leakage above the fume hood.
  - d. Enclosure shall be easily removed and replaceable to allow access to light fixture housing.
- 7. Trim and Side Panels: Provide matching steel trim and side panels, as required, to finish any openings around and between hoods. Finish shall match superstructure exterior.
- 8. Finished Back: Provide for any fume hood where back of hood is exposed to view. 18 gauge steel sheet. Finish shall match superstructure exterior.
- 9. Exhaust Collar:
  - a. Provide contoured 20 gauge exhaust collar and transition piece, if necessary, to receive circular exhaust duct connection by Division 23. Collar and transition piece shall receive urethane powder coating. Collar shall be stainless steel if hood has stainless steel liner.
  - b. Every hood to have combination exhaust collar 13-1/2 IN high.
- 10. Exhaust Filter Pack Assembly:

- a. All hoods designated as HEPA on the plans should be provided with HEPA filter pack assembly.
  - b. Provide access panel in ceiling enclosure panel to easily change out filter below ceiling.
  - c. Provide 99.99% efficient bagout HEPA filter.
11. Cup Sink:
- a. Oval with raised rim (CS-h), material and color to match work surface, sizes in accordance with drawings. Comply with Section 11 53 43 requirements.
  - b. Rectangular with raised rim (ES-h), color to match work surface, size in accordance with drawings. Comply with Section 11 53 43 requirements.
  - c. For floor-mounted hoods (CS-h), wall-mounted oval molded black epoxy resin complete with strainer, outlet and wall mounting bracket. Comply with Section 11 53 43 requirements.
  - d. Raised Rim Height: 1/4 IN.
12. Piping shall be as specified in Division 22 for respective system.
13. Service Fittings: As shown on Laboratory Furnishings Drawings and specified in Section 11 53 43, factory-installed and complete with all gaskets, grommets and sleeves.
14. Alarm and Controls: Coordinate cut outs for fume hood alarm and controls to be provided under Division 25. All cut outs for alarm and controls shall be made in the factory; field cutting is not acceptable.
15. Electrical Receptacles:
- a. Flush mounting, 120V/20A duplex type, single gang, NEMA 5-20R, 3-wire, grounding type receptacle, one per side, or as indicated on the Fume Hood Schedule, with brushed stainless steel cover plate.
  - b. Flush mounting, 208V/20A single gang, NEMA 6-20R, 3-wire, grounding type receptacle, as indicated on the Fume Hood Schedule, with brushed stainless steel cover plate.
  - c. Color: Receptacles shall be brown with hoods painted dark colors and white for hoods painted white, off white, grey, yellow, or similar colors.
  - d. Interior Receptacles: Factory install flush mount GFCI receptacles on the interior fume hood wall as noted on the Fume Hood Schedule. Receptacles must have a self closing cover plate. Receptacle must have a power kill switch mounted on the fume hood post and clearly labeled as such. This system must be included in the manufacturer's UL 1805 file and approved by UL.
16. Interior Hood Lighting:
- a. Lighting within hood shall be provided by a protected fluorescent lighting fixture with two lamps (32W T8, electronic ballast, rapid start) operated by an exterior switch with stainless steel cover plate located on the face of the fume hood. Lamp size shall not exceed 48 IN; provide multiple fixtures as required.
  - b. Provide safety glass panel cemented and vapor-tight sealed to the hood roof.
  - c. Light level: Average light level on the work surface shall be 80 footcandles, minimum.
  - d. Relamping shall be achieved from outside the hood enclosure.
  - e. Light fixture shall be U.L. listed.
  - f. Color: Switch shall be brown with hoods painted dark colors and white for hoods painted white, off white, grey, yellow, or similar colors.
17. Safety label: Provide self-adhesive polyester label, as described on the drawings. Labels shall indicate safe operating conditions with respect to fume hood sash position. Labels solely indicating 80 fpm face velocity sash position are not acceptable. Manufacturer: Lab Safety Supply Inc., P. O. Box 1368, Janesville, WI 53547 Tel: 800 356-0783, or approved substitution.
18. Hood Finish: Fume hood finish shall comply with SEFA 8 M Cabinet Surface Finish performance requirements.
19. Exterior Color: As selected by Architect from manufacturer's full color line and complying with finish requirements.
20. Through Port: 3 IN inside diameter (or as noted on drawings) threaded polypropylene or polyolefin sleeve with threaded pipe flanges and end caps. Provide rubber membrane inside each end cap with radiating cuts to allow for easy passage of cords and tubing.

21. Pass Thru: 12 IN by 12 IN pass thru sleeve between hoods as noted on drawing.

E. High Performance/Low Velocity Chemical Fume Hoods:

1. Basis of Design: Hamilton Products, a part of Thermo Fisher Scientific, Concept Hood, or equal, as specified herein.
2. Drawing Designations:

*AD-2: Section 11 53 13: Revise paragraphs 2.2.E.2.a. thru 2.2.E.2.c.*

- a. 4 FT benchtop: CFH48V-xx.
- b. 5 FT benchtop:CFH60V-xx.
- c. 6 FT benchtop: CFH72V-xx.

*AD-2: Section 11 53 13: Add paragraph 2.2.E.2.d.*

- d. 8 FT benchtop: CFH96V-xx.
3. Depth: See hood schedule. 22 IN interior with 31-1/4 IN exterior, and 28 IN interior with 37-1/4 IN exterior.
4. Design:
  - a. Restricted bypass fume hoods for variable air volume or constant volume exhaust systems with airfoil. Bypass shall be sufficient in size to allow 25 percent 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.
  - b. Design fume hoods for consistent and safe air flow through the hood face. Negative variations of face velocity shall not exceed 20 percent of the average face velocity at any designated measuring point as defined in this section:
    - 1) Fume hoods shall be designed to operate safely at face velocities between 60 FT per minute and 80 FT per minute.
5. Work Surface: 1-1/4 IN dished epoxy resin, as in compliance with Section 12 35 53 requirements. Color: Black.
6. Downdraft bypass: Low resistant type, 18 gauge steel chamber; directional louvers are not acceptable. All bypass air shall enter top of bypass chamber and enter hood in a downflow direction. Chamber shall protect user from expelled particulate in the event of an adverse internal reaction.
7. Airfoil: The airfoil shall allow ample room for electrical hospital grade cords to fit beneath the airfoil. Sill must pivot forward to provide cord and trough access. Bottom horizontal foil shall provide nominal 1 IN bypass when sash is in the closed position. Bottom foil shall not be removable without use of special tools. Airfoil shall be steel with urethane or epoxy powder coating:
  - a. Sill shall consist of a half-round bullnose on front edge. Air foil and sill to be flush with the height of the work surface; airfoil sills that are not flush with the top plane of the work surface dish are not acceptable. A secondary containment trough shall be located in front of the work surface and extend below the airfoil sill.
8. Fume hood sash (Vertical): Full-view, frameless type with clear, unobstructed, side-to-side view of fume hood interior and service fixture connections. Sash to have a 35 IN, nominal, sight line and a 28-1/2 IN, nominal, vertical access height.
9. Counter balance system: Single weight, sprocket and chain, counter balance system to prevent sash tilting and permit 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 operating sash opening. Design system to hold sash at any position without creep and to prevent sash drop in the event of chain failure. Sash shall open and close against rubber bumper stops:
  - a. Sash shall have the capability to be raised to full 28-1/2 IN, nominal, vertical opening for loading or unloading of large apparatus.
  - b. Sash shall lower automatically to the operating position when released from any position above 18 IN.
10. Automatic Sash Positioning System: All hoods to include Automatic Sash Positioning System – as specified within this section.

- F. High Performance/Low Velocity Floor-Mounted Fume Hoods:
1. Basis of Design: Hamilton Products, a part of Thermo Fisher Scientific, Concept Hood, or equal, as specified herein.
  2. Drawing Designations:
    - a. 6 FT floor-mounted: FMFH72-xx.

*AD-2: Section 11 53 13: Add paragraph 2.2.F.2.b.*

- b. 4 FT floor-mounted: FMFH48-xx.

*AD-2: Section 11 53 13: Revise paragraph 2.2.F.3.*

3. Depth:
  - a. 24-1/2 IN interior for 35 IN exterior, nominal.
  - b. 30-1/2 IN interior for 41 IN exterior, nominal.
4. Design:
  - a. Restricted bypass fume hoods for variable air volume or constant volume exhaust systems with airfoil. Bypass shall be sufficient in size to allow 25 percent 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.
  - b. Design fume hoods for consistent and safe air flow through the hood face. Negative variations of face velocity shall not exceed 20 percent of the average face velocity at any designated measuring point as defined in this section:
    - 1) Fume hoods shall be designed to operate safely at face velocities between 60 FT per minute and 80 FT per minute.
5. Downdraft bypass: Low resistant type, 18 gauge steel chamber; directional louvers are not acceptable. All bypass air shall enter top of bypass chamber and enter hood in a downflow direction. Chamber shall protect user from expelled particulate in the event of an adverse internal reaction.
6. Fume hood sash (Vertical): Full-view, frameless type with clear, unobstructed, side-to-side view of fume hood interior and service fixture connections. Sash to have a 35 IN, nominal, sight line and a 28-1/2 IN, nominal, vertical access height.
7. Counter balance system: Single weight, sprocket and chain, counter balance system to prevent sash tilting and permit 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 operating sash opening. Design system to hold sash at any position without creep and to prevent sash drop in the event of chain failure. Sash shall open and close against rubber bumper stops:
  - a. Sash shall have the capability to be raised to full 77 IN, nominal, vertical opening for loading or unloading of large apparatus.
  - b. Sash shall lower automatically to the operating position when released from any position above 66-1/2 IN.
8. Sash Stop: Rubber bumper stops to allow manual override with automatic reset for an 18 IN sash opening.
9. Fume Hood Floor: Provide 14 gauge Type 316L stainless steel fume hood floor with raised lip at sash opening. Lip shall have chamfered corners. Stainless steel shall have a No. 4 finish.
10. Automatic Sash Positioning System: All hoods to include Automatic Sash Positioning System – as specified within this section.

G. Automatic Sash Positioning System:

1. The sash positioning system (sPs) shall consist of motion-presence sensor mounted on the front of the hood, a digital controller receiving signals from the motion-presence sensor, a 120 v.a.c power source and an electrical motor served and controlled by the controller that is connected to and causes a jack shaft with timing pulleys or sprockets for driving by imparting motion to the suspension chains of a fume hood which are in turn connected to the hood sash and counterweight:
  - a. When programmed to close the sash without user presence:

- 1) sPs shall fully close the sash from any opening after an adjustable delay from 1 to 9999 seconds when the user exits the user presence zone.
- 2) Opening of the sash shall be accomplished manually by the user.
- b. Should the user re-enter the presence zone during closure, the sPs shall immediately disengage downward motion of the sash. When the user exits the presence zone, after a delay the sPs controller will again initiate downward sash motion until full sash closure is achieved.
- c. Use of an Under Sash Pressure Sensitive Safety Switch attached to the bottom edge of the sash that, when activated by a contact force of 24 ounces or more disengages the downward motion of the sash. The sPs controller resets when the interference load is removed from the switch.
2. The sPs shall incorporate the following features:
  - a. Sash shall open when user walks into user detection area and push to open button is activated by user.
3. General:
  - a. Power supply and wiring to include 120 VAC, 60 Hz shall be provided by Division 26.
  - b. Low voltage power supplies, wiring, and other devices shall be furnished and installed as a part of the sPs.
4. Specific sPs Performance REQUIRED ELEMENTS and Features:
  - a. Electronic sPs controller, drive, and dc power supply.
  - b. The electronic sPs controller shall consist of a standalone digital programmable relay logic controller (PLR) complete with electric drive motor, motor drive controller and clutching mechanism:
    - 1) The sPs controller shall have:
      - a) Independently adjustable forward and reverse current limiter to motor.
      - b) Built in time delay ranging from 1 sec to 9999 sec.
      - c) Built in Real Time Clock for time of day resets.
      - d) Externally adjustable potentiometers for setting rate of sash opening and closing speed.
      - e) Externally adjustable open sash and close sash set points.
      - f) Connectivity for program changes.
    - 2) The electric drive motor shall be a variable speed dc driven with metal geared drive train complete with clutch that disengages the motor and allows the sash assembly to be free wheeling when the motor is not engaged.
  - c. The 24 vdc power supply shall be UL 60950 listed and approved.
  - d. Drive train and Motor Sub-Assembly:
    - 1) Motor sub-assembly shall consist of geared electric dc motor, clutching mechanism, primary belt drive, belt drive bearing supports, and sheet metal housing:
      - a) All belt drive timing pulleys material shall be aluminum or equivalent, no plastics allowed.
      - b) All timing belts shall have .200" pitch.
      - c) Primary belt drive bearing supports shall be oillite bronze bushings (SAE 660) or equivalent.
      - d) All sprockets shall be steel or cast iron with 3/8" pitch (#35).
    - 2) Motor Sub-Assembly with jack shaft assembly shall be attached to the top of the fume hood with drive sprockets in contact with counter weight suspension chains on both sides of the hood:
      - a) The motor sub-assembly, through a primary drive belt, shall apply clockwise or counter clockwise rotation with sufficient torque to turn jack shaft assembly via secondary belt drive or chain drive.
      - b) Motor sub-assembly jackshaft shall be supported by oillite bronze bushings (SAE 660).

- c) The jackshaft assembly, having multiple bearing supports, through sprockets mounted on either end of it, provide linear motion to the chains that are attached to both the sash and to the slab counter weight causing controlled sash assembly movement.
  - e. Motion & Presence Sensor:
    - 1) Use a floor reflection method active infrared combination motion and presence detector.
    - 2) Have adjustable detection patterns and sensitivity.
    - 3) Have a minimum of four adjustable operating frequencies.
    - 4) Include an adjustable time delay on stationary object detection timer.
  - f. Under Sash Safety Sensor Switch shall attach to the bottom of the sash and incorporate the following:
    - 1) Active when subject to a force of 24oz to stop the sash from moving, with reset accomplished by removal of the obstruction.
    - 2) A high durability PVC exterior covering for protection against chemicals splashes.
    - 3) The under sash safety switch shall be wired to the sPs controller.
  - g. Switches:
    - 1) All switches mounted on face of fume hood must have name plate or legend.
  - h. Enclosure Protection:
    - 1) All controllers, low voltage transformers, and power supplies shall be in an enclosure to protect them from small falling objects, dust, and small leaks, splashes, or drips.
    - 2) Enclosure shall be located atop the fume hood or wall mounted adjacent to the top of the fume hood.
    - 3) Electrical devices not enclosed shall have all wire junction or termination points protected against grounding or shorting out due to local environment.
  - i. Protective coatings applied to Metal Fabrication:
    - 1) All sheet metal parts that make up drive or motor box assembly must be coated to prevent rust. All finishes must be free of dirt or matter and have a uniform color drive train component additions to fume hood must be able to with stand chemical environment and mechanical loadings associated daily fume hood usage.
    - 2) Protective Coating applied to metal parts shall be a polyester triglycidyl isocyanurate (TGIC) powder, applied via an electrostatic charged process to ensure a full and uniform powder coat coverage which is then baked to yield a thickness of 6 to 8 mils to producing a high gloss smooth a chemically resistant and durable finish.
- 5. Approved Manufacturers:
  - a. Accu\*Aire – Sash Positioning System, sPs.
  - b. Lab Crafters – Sash Positioning System.
- 6. Instrumentation:
  - a. Programmable Logic Relay Controller:
    - 1) Input Power: 20-28 Vdc, 150 Ma.
    - 2) Inputs:
      - a) 12ea, 24V/3.2 mA DC Digital Input.
      - b) 4 ea, 10 bit 0-10Vdc Analog Input .
    - 3) Outputs- 8ea, Resistive: 8A/point; Inductive: 4A/point.
    - 4) Real Time Clock with power failure back up.
    - 5) Retentive Flash Memory.
    - 6) Normal Operating Temperature: +32 °F to +104°.
  - b. Low Voltage DC Motor Drive:
    - 1) Input Power: 115/230 VAC +/- 10%.
    - 2) Output Voltage: 0-12 or 0-24 Vdc.
    - 3) Continuous Output Current: 4 A.
    - 4) Max Output Current: 7.5 A for 10 sec.
    - 5) Normal Operating Temperature: +50°F to +104°.
  - c. Spring loaded Recoil Reel, Sash Position Transmitter:

- 1) Input Power: 10 V DC.
  - 2) Output Signal: 0-10V DC.
  - 3) Accuracy:  $\pm 5\%$ .
  - 4) Linearity:  $\pm 0.1\%$  across range.
  - 5) Normal Operating Temperature: +32 °F to +104°.
  - d. Presence Sensor:
    - 1) Input Power: AC/DC 12-24V,  $\pm 10\%$ .
    - 2) Power Consumption: 2VA or 80mA max.
    - 3) Normal Operating Temperature: 32 °F to +104°F.
    - 4) Max Installation Height: 9ft.
    - 5) Presence Timer Setting: 2, 15, 60 sec & infinity.
    - 6) Response Time: 0.01 seconds.
  - e. Presence Sensor Matt Switch:
    - 1) Input Power: 24 vdc.
    - 2) Force Actuation: 7 psi at any point.
    - 3) Normal Operating Temperature: 32 °F to +104°F.
  - f. Under Sash Pressure Sensitive Safety Switch:
    - 1) Input Power: 24 vdc.
    - 2) Force Actuation: 24 oz max.
    - 3) Normal Operating Temperature: 32 °F to +104°F.
  7. Provide power wiring to the unit:
    - a. Check wiring before powering.
    - b. Cycle the controller to ensure free sash movement takes place.
  8. Tune and test the functioning of the sPs controls to satisfy the Sequence of Control for the sPs:
    - a. Tune:
      - 1) Set close and open set points.
      - 2) Set rate of opening and closure.
      - 3) Set forward and reverse current limiter for drive motor.
      - 4) Set photo-eye limits and mode of operations.
    - b. Test and validate proper operation of :
      - 1) Photo-eye.
      - 2) Under sash safety switch.
      - 3) Pad switch if provided.
      - 4) Prove and validate connectivity to the BAS if Fieldbus Controller is provided.
- H. Fume Hood Liner Test: Polyresin:
1. Test No. 1: Spills and Splashes:
    - a. Suspend a 42 IN by 12 IN panel (42 IN dimension horizontal) in a position to expose the surface to be tested in a vertical plane. Divide the panel vertically into 3/4 IN spaces.
    - b. Using an eyedropper, apply five drops of each reagent as listed.
    - c. Liquid reagents shall be applied at the top of the panel and permitted to flow down full panel height. (CAUTION! Flush away any reagent drops).
  2. Test No. 2: Fumes and Gases:
    - a. Prepare a panel 24 IN by 12 IN by dividing panel into 2 IN squares. Using 100 ml beakers, place 25 ml (approximately 1/2 IN of reagent) into each beaker. Place beakers in position so that test panel may be placed over beaker tops in the proper sequence. Place panel over beakers. Note: Beaker pouring lip permits atmospheric oxygen to enter and participate in the reaction of the reagent fumes.
    - b. After a 24 hour time period has elapsed, remove panel, flush off with water, clean with naphtha and detergent, rinse and wipe dry. Evaluate.

3. Evaluating Ratings:

0	No effect	No detectable change in the material surface.
1	Excellent	Slight detectable change in color or gloss but no change in function or life of the surface.
2	Good	A clearly discernable change in color or gloss but no significant impairment of surface life or function.
3	Fair	Objectionable change in appearance due to discoloration or etch, possibly resulting in deterioration of function over an extended period of time.
4	Failure	Pitting, cratering, or erosion of the surface. Obvious and significant deterioration.

4. Performance: Test results shall equal or exceed the following:

Reagent	% by wt.	Spills	Fumes
Acetic acid, glacial		0	0
Acetone		1	0
Acid dichromate		1	0
Ammonium hydroxide	28%	0	0
Amyl acetate		1	0
Benzene		1	0
Butyl alcohol		0	0
Carbon tetrachloride		0	0
Chloroform		1	0
Chromic acid, saturated		2	0
Cresol		1	0
Dichloro acetic acid	93%	1	1
Dimethyl formamide		1	0
Dioxane		0	0
Ethyl acetate		0	0
Ethyl alcohol		0	0
Ethyl ether		1	0
Formaldehyde	37%	0	0
Formic Acid	88%	0	0
Furfural		3	0
Gasoline		1	0
Hydrochloric acid	37%	0	1
Hydrofluoric acid	48%	0	4
Hydrogen peroxide	30%	0	0
Methyl alcohol		0	0
Methyl ethyl ketone		1	0
Methylene chloride		0	0
Monochlorobenzene		1	0
Naphthalene		1	0
Nitric acid	20%	1	0
Nitric acid	30%	1	0
Nitric acid	70%	1	0
Phenol	85%	0	1
Phosphoric acid	85%	0	0
Silver Nitrate	10%	1	0
Sodium Hydroxide	10%	1	0
Sodium Hydroxide	20%	1	0
Sodium Hydroxide	40%	1	0
Sodium Hydroxide Flake		0	0

Reagent	% by wt.	Spills	Fumes
Sodium Sulfide, saturated		2	0
Sulfuric acid	33%	0	0
Sulfuric acid	77%	1	0
Sulfuric acid	93%	2	0
Sulfuric acid/Nitric acid, equal parts	77%/70%	0	1
Tincture of Iodine		1	1
Trichloroethylene		1	0
Toluene		1	0
Xylene		1	0
Zinc Chloride		0	0

Note: Maximum concentration is to be understood unless a lower concentration is shown in the table.

### 2.3 FUME EXTRACTOR ARMS (SNORKELS)

- A. Manufacturers: Products complying with this specification may be provided by the following manufacturers. All snorkel fume extractors shall be the product of a single manufacturer:
1. Nederman Inc., 39115 West Warren Road, Westland, MI 48185 Tel: 800-575-0609. website: <http://www.nederman.com/>
  2. Movex, Inc., 5966 Keystone Dr., Bath, PA 18014 Tel: 610-440-0478. website: <http://www.movexinc.com/>
  3. Plymovent Corporation, 375 Raritan Center Parkway, Edison, NJ 08837 Tel: 1-800-644-0911. - website: <http://www.plymovent.com/>
  4. Airflow Systems, Inc., 11370 Pagemill Road, Dallas, TX 75243 Tel: 214 503-8008. website: <http://www.airflowsystems.com/>
  5. Enviroflex International Inc., 1051 Clinton St., Buffalo, NY 14206 Tel: 716 883-2319. - website: <http://www.enviroflex.com/>
  6. Substitutions are permitted subject to Section 01 63 00.
- B. Basis of design: Nederman FX Original Extraction Arm 100. 4 IN hose diameter, hinged, self-supporting air extractor arm assembly, or equivalent (part no. 70570544):
1. Arm shall consist of 360 degree swivel elbow, support flange, internal support, pre-set joints with adjustable wear discs, anodized aluminum arm, hood, and flange for 4 IN exhaust duct.
  2. Fume extractor shall be constant volume device with manual damper.
  3. Mounting Bracket: Ceiling bracket. Use vibration secured fixing bolts and nuts suitable for structural ceiling mounting.
  4. Bracket Support: Provide extension arm or slotted channel framing as required to suspend and support ceiling bracket from structure above.
  5. Ceiling Cover Plate: Provide ceiling enclosure plate at ceiling.
  6. Mounting Height: Mount the Extraction Arm so that the lowest point of the assembly when retracted is 6 FT – 8 IN a.f.f.
  7. Arm Length: 94 IN.
  8. Silencer.
  9. Combination hood.
  10. No damper.

AD-2: Section 11 53 13: Add paragraph 2.3.C.

- C. Basis of design: Nederman Original Fume Extractor Arm. 6-1/4 IN (58mm) hose diameter, hinged, self-supporting air extractor arm assembly, or equivalent:
1. Arm shall consist of 360 degree swivel elbow, support flange, internal support, pre-set joints with adjustable wear discs, white fiberglass-reinforced PVC hose, hood, and flange for 6 IN (150mm) exhaust duct. Provide protective grille to prevent objects from being drawn into arm.
  2. Fume extractor shall be a constant volume device with no manual damper.

3. Mounting Bracket: 3 FT (915mm) ceiling bracket. Manufacturer shall coordinate location of duct connection with the work of Division 23. Provide ceiling escutcheon.
4. Bracket Support: Provide slotted channel framing above ceiling as required to suspend and support ceiling bracket from structure above.
5. Arm Length:
  - a. 10 FT (3.05m); horizontal and vertical joints.
6. Silencer.
7. Hood Type:
  - a. Metal hood.
8. Automatic damper.

## 2.4 VENTILATED BALANCE SAFETY ENCLOSURE

- A. Manufacturers: Products complying with this specification may be provided by the following manufacturers. All ventilated balance safety enclosures shall be the provided by a single manufacturer:
  1. Labconco Corporation, 8811 Prospect Avenue, Kansas City, MO 64132 Tel: 800 821-5525. website: <http://www.labconco.com>
  2. Flow Sciences, Inc., 2025 Mercantile Drive, Leland, NC 28451 Tel: 800 849-3429. website: <http://www.flowsciences.com>
  3. Rice Lake Weighing Systems, 230 West Coleman Street, Rice Lake, WI 54868 Tel: 800 472-6703. website: <http://www.ricelake.com>
  4. Substitutions are not permitted.
- B. Basis of Design: Labconco Corporation XPert Filtered Balance Station (4' and 5' models), or equal, as specified herein.
- C. Description: Enclosure specifically designed to provide maximum containment for balance applications. Enclosure opening shall be designed to allow turbulence-free airflow to prevent balance fluctuation. Enclosure shall have angled front for ergonomic design.
- D. Construction:
  1. Enclosure shall be constructed of 1/4 IN thick tempered safety glass front sash and sides with air plenum mounted on rear of enclosure.
  2. Base shall be black, solid epoxy.
- E. Features:
  1. Enclosure Dimensions: 48 IN wide x 29 IN deep x 49.6 IN tall. 5 FT model – 60 IN wide x 28.6 IN deep x 47.2 IN tall.
  2. Face velocity alarm, providing visual and audible alarm if flow is not maintained to the programmed parameters. Sensor shall have ability to be programmed to alarm between 30 and 150 feet per minute.
  3. Electrical: 115 Volts, 60 Hz.
  4. Provide front mounted fluorescent lamp.
  5. Face velocity alarm, providing visual and audible alarm if flow is not maintained to the programmed parameters. Sensor shall have ability to be programmed to alarm between 30 and 150 FT per minute.
  6. 4 IN diameter, 8 FT long PVC flexible hose with spring steel wire helix. Hose shall be chemical and abrasion resistant and flame resistant to UL 94V-O standards.
  7. Stainless steel fan filter housing with 6 IN duct connections.
  8. 5 IN diameter waste chute mounted in enclosure side.
  9. Provide 5 IN diameter thimble connection for connection to 4 IN diameter building exhaust duct.
  10. Provide 99.99% efficient bagout HEPA filter.

## 2.5 CUSTOM VENTILATED ENCLOSURE

*AD-8: Section 11 53 13: Revise paragraph 2.5.A.*

- A. Manufacturers: ~~To be determined.~~
1. Flow Sciences, Inc., 2025 Mercantile Drive, Leland, NC 28451 Tel: 800 849-3429. website: <http://www.flowsciences.com>
  2. Hamilton Products, a part of Thermo Fisher Scientific, 1316 18th Street, Two Rivers, WI 54241 Tel: 920 793-1121. website: <http://www.hamiltonlab.com/>
  3. LabCrafters, 2085 Fifth Avenue, Ronkonkoma, NY 11779, Tel:631 471-7755. website: <http://www.lab-crafters.com/>
  4. Mott Manufacturing Limited, 452 Hardy Road, P. O. Box 1120, Brantford, ON, Canada N3T 5T3 Tel: 519 752-7825. website: <http://www.mott.ca>
  5. Kewaunee Scientific Corporation, P O Box 1842, Statesville, NC 28687 Tel: 704 873-7202. - website: <http://www.kewaunee.com/>
  6. Advanced Lab Concepts, 15900 Bratton Lane, Austin, TX 78728, Tel: 800 711-5227. – website: <http://www.alc-corp.com>
  7. Bedcolab Limited, 2305 Francis-Hughes Avenue, Laval QC Canada H7S 1N5 Tel: 514 384-2820 website: [www.bedcolab.com](http://www.bedcolab.com)
- B. Description: Floor mounted exhaust enclosure for ventilation of odors and heat from stacked box furnaces on carts. Enclosure should be designed to provide space for up to 4 box furnaces, and is attached to a 4 IN diameter point exhaust. This exhaust enclosure is to be located in room 137 Synthesis Lab.

C. Construction:

AD-8: Section 11 53 13: Revise paragraph 2.5.C.1.

1. Enclosure shall be constructed to withstand laboratory use, and will be designed in accordance to guidance from user:-
    - a. Enclosure shall be constructed to withstand laboratory use.
    - b. Enclosure to have full sides and rear panels down to floor.
    - c. Material to be type 304 stainless steel.
    - d. Interior dimensions to be verified with mock-up to be provided.
- D. Features:
1. Dimensions: exterior dimensions to be 72 IN wide x 37-1/4 IN deep x 84 IN high.
  2. Attach to 4” diameter point exhaust.
  3. Electrical Receptacles:
    - a. 2 - 120V/20A duplex type, single gang, NEMA 5-20R, 3-wire, grounding type receptacle, one per side, with brushed stainless steel cover plate.
    - b. 4 - 208V/70A single gang, grounding type receptacles, with brushed stainless steel cover plate.
    - c. Color: Receptacles shall be white.

## **PART 3 - EXECUTION**

### **3.1 SITE CONDITIONS**

- A. Prior to installation of the Work of this Section, carefully inspect the installed Work specified in other sections and verify that all such Work is complete to the point where this installation may properly commence.
- B. Verify that all Work has been installed in complete accordance with the original design, received submittals, and the manufacturer's recommendations.
- C. In the event of discrepancy, immediately notify the Architect. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

### **3.2 INSTALLATION**

- A. Work in this Section requires close coordination with Work specified in Divisions 22, 23, 25 and 26, as well as installation by BNL of BNL furnished components. Coordinate all Work to ensure an orderly process in the Project, without removal of previously installed Work, and so as to prevent damage to finishes and products.
- B. Coordinate location and alignment of fume hoods and cabinets for proper connection of all piping and duct work.
- C. Install all equipment in accordance with manufacturer's written instructions, applicable codes and regulations, accepted Shop Drawings, and as necessary for a complete operating system.
- D. Install equipment plumb, square, and straight with no distortion and securely anchored, as required.
- E. Coordinate with Section 12 35 53 for venting corrosives storage cabinets behind rear baffle of fume hood.

### **3.3 FIELD TESTING: CHEMICAL FUME HOODS**

- A. Provide two week advance notice of scheduled testing.
- B. Balance, test and certify each fume hood in accordance with ASHRAE 110-1995 (AI) for Flow Visualization, Face Velocity, and Tracer Gas Containment Testing Requirements.
- C. ASHRAE 110-1995 (AI) test to be performed at 60 FPM face velocity. Any hood that does not pass at 60 FPM should be retested at the specified 80 FPM face velocity.
- D. Fume hood field tests shall be performed by a qualified independent testing company on each hood to determine face velocity and air flow patterns.
- E. Fume hoods shall achieve an "As Installed" (AI) performance rating equal or better than 0.10 ppm with 4.0 Lpm tracer gas release rate when tested in accordance with ASHRAE 110-1995.
- F. Balancing of the system is in the scope of work of Division 23.
- G. Verify exhaust air quantity does not exceed design, plus allowable leakage.
- H. Verify hood pressure drop does not exceed design.
- I. Adjust and retest hoods that do not meet specified performance.
- J. Replace hoods which do not meet standards after repetitive testing.

### **3.4 ADJUSTING, CLEANING, AND PROTECTION**

- A. Repair or remove and replace defective work as approved by the Architect upon completion of installation.
- B. Adjust all moving or operating parts to function within their design parameters.
- C. Clean equipment, touch up as required.
- D. Protect all units before, during, and after installation. Damaged materials due to improper protection shall be cause for rejection.

**END OF SECTION**