

Part 1 – GENERAL

1.01 SUMMARY

Fume Hood Specification – Section 11 53 13

A. General Requirements:

Furnish and install Hamilton Laboratory Systems Spectre fume hoods, worktops, and understructures, including filler panels, knee space panels, and scribes as shown in the drawings.

1. Pre-Plumbed and Pre-Wired Service Outlets and Accessories

Furnish and deliver all service outlets, accessory fittings, electrical receptacles, and switches as per specifications, equipment schedules, or drawings.

- a) Plumbing fittings on fume hood superstructures shall be pre-plumbed per Section 2.01.I.
- b) Electrical fixtures shall be pre-wired per Section 2.01.J.
- c) The fume hood superstructure shall meet UL Safety Standards. Final plumbing and electrical connections are the responsibility of contractors under Divisions 15 (Plumbing) and 16 (Electrical).

B. Site Clean-Up:

Remove all debris from fume hood installation and dispose of it in on-site containers provided by others, leaving the premises clean.

C. Related Divisions:

1. Division 12: Laboratory Casework
2. Division 22: Plumbing
3. Division 23: HVAC
4. Division 26: Electrical

D. Related Publications:

1. ASHRAE Standard 110-2016: Testing Performance of Laboratory Fume Hoods
2. NIH03-112C: National Institute of Health Specification
3. UL: Underwriters Laboratories
4. ASTM D552: Bending Test
5. NFPA-45: National Fire Protection Association

1.02 BASIS OF WORK

A. Intent of Specification:

This specification establishes Hamilton Laboratory Solutions at 1 Pickroy Rd, Jasper, GA, as the standard for laboratory fume hoods. The Hamilton Spectre fume hood sets the quality and installation benchmark.

B. Equipment Supply Compliance:

Equipment must comply with this specification. Any deviations require written approval at least seven (7) days before the proposal deadline.

C. Approved Manufacturer List:

Contractors must obtain the approved fume hood manufacturer list from the architect to ensure compliance. The owner/architect reserves the right to reject alternate proposals and award based on product value.

1.03 SUBMITTALS

A. Manufacturer's Data:

Submit data and installation instructions for each fume hood type. Include documentation showing ASHRAE Standard 110-2016 testing per section 1.02.C and the manufacturer's "As Manufactured" testing.

B. Samples (if requested):

Submit the following for review of color, texture, and pattern:

1. 6 x 6-inch hood interior lining sample
2. 6 x 6-inch hood enclosure sample in the selected color
3. Operation sign(s)

C. Shop Drawings:

4. Submit shop drawings showing plans, elevations, end views, cross-sections, service run spaces, and service fitting's locations.
5. Coordinate shop drawings with other work involved.
6. Provide rough-in drawings for mechanical/electrical services.
7. Include data on face opening, air volume, and static pressure drop.

D. Non-Specified Manufacturer's Samples:

Samples from non-specified manufacturers must be delivered to the architect/owner and tested per section 1.02.C by an independent agency. A passing test and written approval are required at least seven (7) days before the quotation deadline for any non-specified manufacturer's quotation.

1.04 STANDARD FUME HOOD PERFORMANCE REQUIREMENTS

A. Fume Hood Design:

Fume hoods shall be Hamilton Laboratory Solutions Spectre Fume Hoods, featuring a belted counterweight sash design and adjustable LED lighting. The sash and air entry framework shall minimize air turbulence at the hood face, and the vertical rear baffle system shall ensure smooth airflow, reducing vortices inside the hood.

B. Standard Hamilton Spectre Fume Hood:

Constant Volume Fume Hood

1. Designed to maintain a 60 FPM face velocity
2. Maximum sash opening: 28 inches, ensuring a minimum face velocity of 60 FPM
3. Chain and sprocket sash system
4. Auto sash stop at 18 inches
5. LED lighting with adjustable intensity and color range

C. Performance Criteria:

Fume hoods must operate as ventilated, enclosed workspaces to capture, confine, and exhaust fumes, vapors, and particulates produced within. Airflow through the hood face must be consistent and safe, with no more than 20% deviation from the average face velocity at any measuring point.

1. Average Illumination: Minimum of 80 foot-candles inside the work area (Polyresin liner). Work area shall be defined as the area inside the superstructure from side-to-side, from face of baffle to the inside face of the sash, and from the working surface to a height of 28 inches.
2. Static Pressure Loss: 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:
 - a) 0.15 inches W.G. (static pressure loss) at 60 FPM
 - b) 0.30 inches W.G. (static pressure loss) at 100 FPM

D. Airflow and Exhaust Control:

Fume hoods shall maintain constant exhaust volume at any sash position, with no more than 5% variation in CFM or static pressure. Restricted bypass models of the Spectre are available for use with combination and horizontal sashes, and for use with variable air volume hood controls (mfg by others). See 2.04 of this specification for more details of Bypass and Restricted Bypass designs.

E. Hood Dimensions:

1. Standard widths: 48", 60", 72", 96"
2. Standard depths: 31", 37", 43"

H. Noise Criteria:

Noise levels shall not exceed 50 NC when connected to a 50 NC HVAC source, as measured 3 feet in front of the hood with the sash open and 5 feet above the floor at 100 FPM face velocity.

I. Materials and Finishes:

Interior and exterior materials must meet specifications for durability, chemical resistance, and intended use.

J. UL 1805 and NFPA Specification (Mandatory):

1. 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 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.
2. Fume hood must comply with NFPA requirements concerning materials and construction, as well as the National Electrical Code (NEC). UL 1805 certification indicates that the wiring and electrical components used meet NEC standards, and that the materials used adhere to NFPA guidelines, featuring a flame spread rating of less than 25.

1.05 QUALITY ASSURANCE

A. Single source responsibility:

Fume hoods and casework shall be manufactured or furnished by a single laboratory furniture company.

B. Manufacturer's qualifications:

Modern plant with proper tools, dies, fixtures and skilled employees to produce high quality laboratory casework and equipment.

C. Installer's qualifications:

Factory certified by the manufacturer. Provide outline of certification program.

D. Build America Buy American:

The domestic content procurement preference requires that all iron, steel, manufactured products, and construction materials used in covered infrastructure projects are produced in the United States.

PART 2 – PRODUCTS

2.01 MANUFACTURER

A. Design and Quality Standards:

The design, materials, construction, and finish of the laboratory furniture specified establish the minimum acceptable quality standard for fume hoods. Hamilton Laboratory Solutions, located at 1 Pickroy Road, Jasper, GA 30143, serves as the basis for this specification. All equipment must be produced by a single manufacturer at one U.S. location to ensure consistent shipping and single-source responsibility. Quotations from manufacturers other than Hamilton Laboratory Solutions must include:

1. A list of engineering and manufacturing personnel
2. Proof of financial capacity to fulfill the contract
3. A list of at least ten (10) comparable installations completed within the last five (5) years

B. Warranty:

The selected manufacturer must provide a one-year warranty starting from the date of acceptance or occupancy (whichever comes first), guaranteeing all products are free from defects in material and workmanship. The purchaser must notify the manufacturer's representative immediately if any defects are identified, allowing the manufacturer an opportunity to inspect the goods. Products should not be returned until written shipping instructions are received from the manufacturer.

C. Alternate Manufacturers:

Manufacturers not listed in Section 2.01.A must submit samples in accordance with Section 1.03.B of the specifications. Proposals from alternate manufacturers are only invited if they meet the minimum design and performance requirements set by SEFA 1 – Laboratory Fume Hoods, and UL 962 standards. A notarized letter stating full compliance, signed by an independent testing laboratory recognized by ASTM E 548, must be included with alternate proposals.

D. Sample Compliance:

Samples from the selected manufacturer will be impounded by the architect or owner to ensure that all materials delivered to the job site conform to the approved samples.

E. UL Certification:

A copy of the UL (Underwriters Laboratories) certification must be included with any alternate proposal, confirming full compliance with UL1805 testing and approvals.

2.02 FUME HOOD MATERIALS

1. **Steel:** High-quality, cold-rolled mild steel, ASTM A1008, U.S. Standard gauges.
2. **Stainless Steel:** Type 304, U.S. Standard gauges.
3. **Ceiling Closure Panels:** Minimum 18-gauge steel, finish to match hood exterior.
4. **Downdraft Bypass:** Low-resistance, 18-gauge steel chamber; directional louvers are not acceptable. Bypass air enters from the top, ensuring user safety from particulates.
5. **Safety Glass:** Laminated safety glass, 7/32" or 3/8" thick.
6. **Sash Chain:** ANSI #35 steel, single strand, tensile strength of 2,400 lbs, maximum working load 480 lbs.
7. **Sash Guides:** Extruded PVC.
8. **Pulley Assembly for Sash Chain:** Finish bored steel drive sprockets and keyed drive, ½" diameter front connector shaft. Rear idler sprockets: double sealed ball bearings, lubricated. All sprockets steel with zinc dichromate-finish.
9. **Sash Pull:** Corrosion-resistant steel with chemical-resistant powder coating, max 1.5" thick.
10. **Gaskets:** White 70-durometer PVC for interior access panels. Gasket interior access panels to prevent air leakage and to retain liquids inside the hood.
11. **Fastenings:**
 - a) Exterior structural members' attachments: Zinc-plated sheet metal screws.
 - b) Interior fastening devices concealed. Concealed fastenings: exposed screws and Velcro fasteners are not acceptable.
12. **Instruction Plate:** Corrosion-resistant or plastic plate with operational information attached to the fume hood exterior.

2.03 FUME HOOD CONSTRUCTION

A. Superstructure:

1. Rigid, self-supporting, double-wall assembly with a maximum thickness of 4 7/8".
2. Exterior panels: Sheet steel with urethane powder finish. 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 painted steel members. Panels and brackets attached to eliminate screw heads and metallic bracket from hood interior.
3. [Specified option] Exterior sidewalls and upper front panel to 304 stainless steel.
4. The front vertical fascia shall radiused corners on front access posts to reduce airflow turbulence.
5. 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, tapered to reduce turbulence, 18-gauge steel, finished with urethane powder coating, and sized appropriately to fume hood width.

C. Access Opening Perimeter:

Radiused front corner access posts to reduce airflow turbulence. Airfoil is ergonomically designed to provide obstruction free access to the hood interior while minimizing air turbulence entering the hood. A secondary trough is an additional safeguard for the containment of spills not secured by the dished work surface. Bottom airfoil provides a 1-inch bypass when the sash is closed, designed for easy tool-free removal.

D. Sash Types:

1. Vertical Sash:

- a) Full view design, clear side-to-side view with 35" sightline, 28" access height.
- b) Bottom sash rail: 2" maximum, 18-gauge steel with powder coating finish, with integral formed, flush pull the full-width of the bottom rail. Full width extruded dual durometer bottom bumper and airflow control strip. Safety glass set into rails in deep form, extruded poly-vinyl chloride glazing channels.

2. Combination Sash (Restrictive Bypass only):

- a) Vertical and horizontal access, 35" sightline, top-hung on stainless steel ball bearings. Laminated safety glass with polished edges.
- b) Bottom and side frames shall be no more than 1.5 inches thick. Frames are radiused to minimize turbulence.
- c) Area above the 28-inch vertical sash opening shall be glazed with a minimum of 3/8-inch thick laminated safety glass.
- d) Horizontal panels to be provided with finger pulls.

E. Counterbalance System:

1. Single weight, sprocket, and chain system preventing sash tilting and permits ease of operation with alignment shaft and sash leveling system. Requires no more than 7 lbs of pull to operate across the full width. Support system to be rated to 300,000 cycles (one cycle = one full up and one full down sash motion) without a failure. Sash support system to employ retainers to ensure sash remains level and square throughout use.

H. Airfoil:

1. Low-profile, flush to the work surface, providing access for electrical cords. Ergonomically radiused front edge. A secondary trough provides an additional safeguard for the containment of spills not secured by a dished work surface.
2. Airfoil sill that are not low profile are not acceptable.

I. Fume Hood Liner:

1. Polyresin: reinforced white polyester panel, smooth finish, non-corrosive, with 14,000 psi flexural strength, flame spread < 17 per UL 723. Liner and baffle made of the same material. Liner and baffle must meet 2.06 liner finish performance test. Metallic baffles, brackets or supports for hood interior are not acceptable.

J. Baffles:

1. Baffles that provide controlled airflow and purge zones throughout the fume hood are non-adjustable baffles made from liner material. Provide minimal exhaust slots full height on vertical sides of baffle. High-performance two-piece baffle with exhaust slots functionally located to purge the upper and lower area of the hood. Mechanically or manual adjustable baffles are not acceptable. Metallic components are not acceptable.

K. Auto-Sash:

1. Sash shall be designed to promote usage as an upper body and face shield. Automatically lowers to the operating position (18" opening) and locks open at 28" for loading or unloading large apparatus. A lock-open shall be provided and sash lowers automatically. Auto-sash function shall be life cycle tested and no motor drives required.
2. **OPTION:** Auto-Sash Controller - ensures safe and controlled operation of the sash.
3. Motion Detection: A presence sensor shall be mounted on the top front panel of the fume hood to monitor movement in front of the hood. If no movement is detected, the system will automatically close the sash at a slow and safe rate. When the operator is present, the sash shall be manually opened and closed.
4. Photoelectric Obstruction Sensor - placed on the sash will create a light beam that scans the sash area for obstructions. If an obstruction is detected during the descent of the sash, the system shall halt the sash and activate a warning light to signal that an obstruction is present.
5. Obstruction Removal: Once the obstruction is cleared, the sash operator warning light will reset, and the sash will re-engage for normal operation.
6. Factory Installation shall be factory-installed, including all required mechanical connections to the sash shaft for proper operation. The system shall be pre-wired to a junction box located on the top of the hood, simplifying field installation.

L. Service Fixtures and Fittings:

1. Plumbing fittings shall be factory installed and piped between the valve and the outlet. Inlet piping shall be carried to a point 6" above the fume hood roof or 6" below the work top rear corner depending on the rough-in locations shown in the drawings. Points of final service connection by other trades shall be at the stub provided by the fume hood manufacturer.
2. Fixtures exposed to hood interior must have a chemically resistant finish.
3. Choose One:
 - a) Front Mounted Remote-Control Fittings:
 - i. Service fitting valves shall be needle valve design and mounted on the hood front vertical fascia with the working components of the valve accessible from the hood exterior. Valves shall be furnished with molded nylon hooded handles with color-coded index buttons and color-coded service outlet.
4. Rod Type Remote Control Fittings:
 - b) Service fitting valves shall be needle valve design and be mounted to the hood interior sidewall liner with extension rods to the front vertical fascia. Valves shall be furnished with molded nylon handles with color-coded index buttons and color-coded service outlet.

M. Fume Hood Electrical Fixtures:

1. The hood superstructure shall be pre-wired in compliance with UL 61010A-1 and contain a UL label certifying acceptable wire gauge, connections, fixtures and wire color-coding. Electrical fixtures shall be specification grade and consist of two side-by-side duplex receptacles per vertical fascia, and a light switch. The receptacles shall be 20 Amp, 125 volt AC, and 3-wire polarized grounded. Each fascia shall be prewired to a single circuit and have a minimum of (1) ground fault interruption device. The light, light switches and electronic sash stop shall be low voltage. Final wiring and circuit dedication shall be by others.
2. Fan and Blower switch shall have a motor-rated starter switch with pilot light mounted in a single-gang receptacle box complete with face plate, 120-volt pilot light, and double-pole toggle switch with thermal overload protection for up to 1 HP single phase, 60 hertz 120/240-volt AC motors.

N. Fume Hood Lighting:

1. Illumination meets Part 1 performance criteria.
2. Standard LED Interior Lighting package:
 - a) Provide two 24VDC LED light bars with a 24VDC power supply enclosed in a sheet metal fixture, installed on the exterior of the hood roof. A safety glass panel shall be cemented and sealed to the hood roof.
3. Size of fixture:
 - a) For hoods with superstructures up to seven feet, provide the largest possible fixture up to 48 inches.
 - b) For hoods with eight-foot superstructures, provide two 36-inch fixtures.
4. Access to the light fixture shall be through a lintel panel, requiring hand tools. Provide three-wire ground fault type receptacles rated at 120 V.A.C. at 20 amperes. Flush plates shall be made of black acid-resistant thermoplastic.
 - a) Option: 250 V.A.C. receptacle
 - b) Option: Explosion proof
5. Optional LED Interior Lighting package:
 - a) Brite-Aire Series LED Lighting allows adjustable lumen output and color temperatures.
 - b) Double row LED bar, tunable White TrueColor LED (2400K – 6500K) CCT (Correlated Color Temperature), wireless control, dimming capability, high brightness and efficacy, high CRI (Color Rendering Index) at 95+, optional motion sensor.

O. Work Surfaces:

1. 1 1/4" thick molded resin, dished to contain spills.
2. Option: cup sink flush with the recessed work surface, or raised above the work surface shall be provided when shown.

P. Paper Screen:

1. Cold rolled expanded metal and applied with Electro statically applied finish to prevent corrosion. The expanded metals are 18 gauge with spacing not to exceed 1-1/4".

Q. Safety Monitor/Alarm System:

1. Monitors face velocity and provides audible and visual alarms if face velocity drops below safe levels. Includes calibration responsibility for the owner once hood systems are balanced.
2. Audible alarm can be silenced indefinitely but visual alarm remains activated until the alarm condition is corrected. Safety Monitor will automatically reset and begin routine monitoring upon conditions corrected and face velocity and volume return to specified levels.
3. Safety monitor: UL listed, tamper proof, with all alarm circuits, electric components, external tubing, and manifolds furnished complete and factory installed.
4. Calibration is the responsibility of the owner 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.
5. Airflow sensor: Thermally compensated glass-beaded thermistor, factory connected to a sidewall port on the interior of the fume hood.
6. As the internal fume hood pressure changes while the sash is closed and opened, the flow passing over the thermistor is calibrated to a face velocity, which is displayed on the monitor.
7. Provide test circuit to verify proper Safety Monitor operation.

2.04 RESTRICTED AND BYPASS FUME HOODS

A. Restricted Bypass:

1. Sufficient bypass for 25% airflow with the sash closed, achieved via a low resistance opening at the front lintel.
2. Widths: 48", 60", 72", 84", 96".

B. Bypass Type:

1. Constant volume with an automatic compensating bypass. Bypass opening ensures a smooth downflow effect.
2. Widths: 48", 60", 72", 84", 96".

2.05 FUME HOOD BASE CABINETS

A. Standard Steel:

1. Base units under hoods shall be fabricated of cold-rolled prime grade roller leveled furniture steel. Gauges used shall be 18 gauge, except:
 - a) Corner gussets for leveling bolts and apron corner braces: 11 gauge.
 - b) Hinge reinforcements: 16 gauge.
 - c) Top/intermediate front horizontal rails, apron rails, and reinforcement gussets: 16 gauge.
 - d) Door assemblies and adjustable shelves: 20 gauge.
2. Painted surfaces must match the fume hood outer panels.

B. Special Purpose Cabinets for Use Under Fume Hoods:

1. **Acid Storage Cabinets**
 - a) Use the same steel gauges and construction features as other base cabinets, with the addition of a one-piece liner insert made of linear low-density polyethylene, forming a one-inch pan to retain spillage. Vented into the fume hood with a 1-1/2" flexible vent pipe for direct airflow into the fume hood exhaust system.
2. **Solvent Storage Cabinets:**
 - a) Must be FM or UL labeled, designed for the storage of flammable liquids, and meet UFC, OSHA, and NFPA No. 30 requirements. The cabinet must be fully insulated, self-closing, and equipped with a fusible-link hold-open feature.

2.06 LINER SURFACE FINISH PERFORMANCE

A. Test Procedures:

1. Spills and Splashes Test:
 - a) Apply five drops of each reagent to a vertical panel (42" x 12"). Allow liquid to flow down the full height of the panel.
2. Fumes and Gases Test:
 - a) Expose a panel (24" x 12") divided into 2" squares to reagent fumes from beakers. Evaluate after 24 hours.

B. Evaluation Ratings:

1. No Effect: No detectable change to the surface material.
2. Excellent: Slight color or gloss change, no impact on function or life.
3. Good: Discernible color/gloss change but no significant impact on function or durability.
4. Fair: Noticeable discoloration or etching, potential long-term functional deterioration.
5. Failure: Significant surface damage or erosion.

C. Test Results: “P” Fume Hood Liner:

REAGENT LIST	Test No.1	Test No. 2
Concentrations by Weight	Rating Spills	Fumes
Sodium Hydroxide Flake	---	No Effect
Sodium Hydroxide, 40%	Excellent	No Effect
Sodium Hydroxide, 20%	Excellent	No Effect
Sodium Hydroxide, 10%	Excellent	No Effect
Ammonium Hydroxide, 28%	No Effect	No Effect
Eldorado—Plus (Solution)	No Effect	No Effect
Chloroform	Excellent	No Effect
LpH SE (Solution)	No Effect	No Effect
Trichloroethylene	Excellent	No Effect
Monochlorobenzene	Excellent	No Effect
Tincture of Iodine	Excellent	Excellent
Methyl Alcohol	No Effect	No Effect
Ethyl Alcohol	No Effect	No Effect
Butyl Alcohol	No Effect	No Effect
Phenol, 85%	Excellent	No Effect
Cresol	Excellent	No Effect
Sodium Sulfide, Saturated	Good	No Effect
Furfural	Fair	No Effect
Dioxane	No Effect	No Effect
Zinc Chloride, Saturated	No Effect	No Effect
Benzene	Excellent	No Effect
Toluene	Excellent	No Effect
Xylene	Excellent	No Effect
Gasoline	Excellent	No Effect
Naphthalene	Excellent	No Effect
Methyl Ethyl Ketone	Excellent	No Effect
Acetone	Excellent	No Effect
Ethyl Acetate	Excellent	No Effect
Amyl Acetate	Excellent	No Effect
Ethyl Ether	Excellent	No Effect
Silver Nitrate, 10%	Good	No Effect
Di Methyl Formamide	No Effect	Excellent
Formaldehyde, 37%	No Effect	No Effect
Formic Acid, 88%	No Effect	No Effect
Acetic Acid, Glacial	No Effect	No Effect
Dichloro Acetic Acid, 93%	Excellent	Excellent

Chromic Acid, Saturated	Good	No Effect
Phosphoric Acid, 85%	No Effect	No Effect
Sulfuric Acid, 33%	No Effect	No Effect
Sulfuric Acid, 77%	Excellent	No Effect
Sulfuric Acid, 93%	Good	No Effect
Hydrogen Peroxide, 30%	No Effect	No Effect
Acid Dichromate	Excellent	No Effect
Nitric Acid, 20%	Excellent	No Effect
Nitric Acid, 30%	Excellent	No Effect
40 & 47 Equal Parts	Excellent	Good
Nitric Acid, 70%	Excellent	Good
Hydrochloric Acid, 37%	No Effect	Excellent
Hydrofluoric Acid, 48%	No Effect	Failure

2.07 CONTAINMENT AND TESTING

A. Purpose:

This specification pre-qualifies the performance of the bidder’s fume hood. The owner reserves the right to require post-installation testing to ensure compliance. Tests must be witnessed by the owner or representative. Failure to meet performance requirements may result in rejection of the hood.

B. Test Methodology:

Fume hoods shall be tested according to ASHRAE Standard 110-2016 for performance validation.

C. Test Facility Requirements:

Testing must occur in a facility with at least 5 feet of clearance on all sides of the hood. The test area must have controlled air currents (less than 30 FPM) and a calibrated exhaust system to achieve specified air volumes.

D. Instrumentation and Equipment:

Testing personnel and required equipment (e.g., thermal anemometers, smoke tubes, tracer gas ejectors, mannequins) shall be provided by the bidder.

1. Tracer gas testing: The hood shall be tested with sulfur hexafluoride or equivalent at a release rate of 4.0 liters/min.
2. Test Performance: AM 0.05 PPM tracer gas concentration or better, measured with the sash fully open at a face velocity of 50 FPM.

PART 3 – EXECUTION

3.01 INSTALLATION

1. Install fume hoods and equipment in accordance with the manufacturer's instructions, ensuring all components are plumb, square, straight, and securely anchored.
2. Secure work surfaces to casework and equipment components using the manufacturer's recommended materials and methods.
3. Install accessories and fittings as per the manufacturer's recommendations.

3.02 FIELD QUALITY CONTROL TESTING OF FUME HOODS

A. Field Testing Requirements:

1. Only qualified personnel shall perform all tests in the field to verify proper operation of the fume hoods before they are put into use.
2. Tests shall be performed after installation is complete, the building ventilation system has been balanced, and verification has been submitted.
3. Ensure that the building's make-up air system is in operation, doors and windows are in normal operating positions, and that all other exhaust devices are working properly. Correct any unsafe conditions prior to testing.

B. Testing Equipment:

1. Use a properly calibrated hot wire thermal anemometer, such as the Alnor Model No. 8500D-1 Compuflow.
2. Use a supply of 30-second smoke bombs.
3. Use titanium tetrachloride (note: titanium tetrachloride fumes are toxic and corrosive; use sparingly).

C. Test Procedure:

1. Check for cross drafts using a thermal anemometer and smoke source. Cross drafts should not exceed 20% of the specified face velocity. Correct any excessive drafts before proceeding.
2. Test fume hood face velocity by averaging six readings taken at the centers of a grid (top and bottom half of the fume hood face). If results are not within the specified range, refer to the manufacturer's troubleshooting guide.
3. Verify smooth sash operation throughout its full range of motion, ensuring that the sash holds at any height without creeping.
4. Test airflow by using a cotton swab dipped in titanium tetrachloride or another smoke source. Verify that airflow is drawn into the fume hood over the entire face by traversing 6 inches inside the hood face.
5. Conduct a smoke bomb test, checking for complete containment and rapid exhaust of the smoke.
6. Calculate exhaust volume from the face velocity data and confirm performance with the auxiliary air blower off.
7. Retest any reverse flow conditions and ensure proper airflow when the sash is closed.

3.03 ADJUSTING

1. Repair or replace any defective work as directed by the Architect or Owner.
2. Adjust sash, fixtures, and all other moving parts to ensure smooth and proper function.

3.04 CLEANING

1. Clean all equipment and touch up surfaces as required after installation.

3.05 PROTECTION OF FINISHED WORK

1. Provide necessary protective measures to prevent exposure or damage to the installed equipment during any additional construction activities.
2. Notify the contractor of precautions necessary to avoid damage to fume hoods from other trades.

3.06 CERTIFICATION

1. The fume hood manufacturer shall field test 20% of the installed units, using ANSI/ASHRAE 110-2016 standards, to achieve a control level of AI 0.1 ppm or better, per ANSI Z9.5-2012.
2. Project completion will be contingent upon submission and approval of all fume hood certification letters, tests, and reports by the Architect.