SECTION 115313 – LABORATORY FUME HOODS AND RELATED PRODUCTS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
1. Bench-top High-Performance Laboratory Fume Hoods.
2. Service fixtures (ie. water, gas, etc.) and electrical service fittings in fume hoods.
3. Piping and wiring within service fittings, light fixtures, switches, and other electrical devices.
4. Fume hood base support.
5. Work Surfaces within fume hoods.
6. Laboratory sinks and cup sinks in fume hoods.
7. Filler panels and ceiling enclosures for fume hoods.

1.02 SCOPE AND CLASSIFICATION

A. This specification covers the requirements for the purchase of bench mounted laboratory fume hoods for use with remote exhaust blower systems.

B. Bench-mounted laboratory fume hoods in 4, 5, 6 and 8-foot widths, internal depth of 27.2" and external depth of 37.7" is required.

C. This specification sets the intent for quality, performance and appearance.

1.03 REFERENCES

A. The laboratory hoods must conform to the following regulations and standards.
1. ASHRAE 110, American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Method of Testing Performance of Laboratory Fume Hoods
2. ANSI/AIHA Z9.5, American Industrial Hygiene Association, Laboratory Ventilation
3. OSHA, Federal Register 29 CFR Part 1910, Occupational Safety & Health Administration, U.S. Department of Labor, Occupational exposures to hazardous chemicals in laboratories.

B. The laboratory fume hoods must carry the listed mark for the following.
1. UL 1805, Underwriters Laboratories Inc., Standard for Laboratory Hoods and Cabinets

1.04 PERFORMANCE REQUIREMENTS

A. General Design Requirements (See Part 2 for details)
1. Fume hoods shall function as ventilated, enclosed workspaces, designed to capture, contain and exhaust fumes, vapors and particulate matter produced or generated within the enclosure.
2. Fume hood shall be factory designed to function as a by-pass fume hood or as a variable air volume fume hood without modification.
3. Structure and Materials of construction
   a. Hoods are of double-wall construction
   b. Powder-coated, cold rolled steel exterior
   c. Galvanized steel support members

d. Sheet molded composite panel internal liner

4. Baffles
   a. Perforated primary baffle designed to pull air in horizontal streams to minimize the air roll pattern associated with traditional fume hoods.
   b. Baffle slot pattern designed to optimize face velocity profile.
   c. A secondary baffle is located behind the primary perforated baffle to counteract upward air streams that produce roll.
   d. Moving or adjustable baffles are not acceptable
5. Sash
   a. Maximum opening is 28".
   b. Unobstructed viewing height is 27".
   c. Hood incorporates a perforated sash handle to bleed air into the hood chamber directing fume concentrations away from the user's breathing zone.
6. Airfoil:
   a. Hoods are provided with an airfoil across the bottom of the sash area that allows airflow into the hood regardless of user's position.
7. Hoods are provided with an upper dilution air supply for by-pass air to bathe the sash interior and upper interior and to provide 5-10% of the hood's air volume requirements.
8. Besides the exhaust blower, no additional blowers are required for specified containment.
9. Access for maintenance is from both the front, interior, and exterior sides of the hood.
10. Services:
    a. Hood manufacturer shall furnish and deliver all service outlets, accessory fittings, electrical receptacles and switches, as listed in these specifications, equipment schedules or as shown on drawings.
    b. Plumbing fittings mounted on the fume hood superstructures shall be pre-plumbed per section 2.03.
    c. Final plumbing and electrical connections are the responsibility of those contractors fulfilling requirements of Divisions [15 and 16].
    d. All electrical services are pre-wired to a single point internal junction box at the top of the hood.

B. Containment
1. The purpose of this section is to set a standard of performance for the bidder's laboratory fume hood before award of contract and may not necessarily represent the operating conditions of the hoods after installation. Before or after award of contract, owners may require representative witness to said testing at their option, with failure to meet passing criteria as grounds for rejection of the bidder. Test data shall be provided at no cost to the owner.
2. Evaluation of manufacturer's standard product shall take place in manufacturer's test facility meeting the following criteria.
   a. Lab to be located at manufacturer's place of business for the testing of bench-mounted laboratory hoods in accordance with ASHRAE Standard 110.
   b. Room shall accommodate hoods up to 16' wide, while maintaining sufficient area so that a minimum of 15 feet of clear space is available in front of and 5' on both sides of hoods for viewing tests.
   c. The facility's ventilation system shall have adequate heating and air conditioning so that room air temperatures can be maintained within the desired ranges.
   d. One hundred percent non-recirculated air to be both carbon and HEPA filtered to ensure removal of contaminants that could interfere with containment testing before entering the lab.
   e. Make-up air to the test room shall be ceiling-supplied through any combination of multiple diffusers to either minimize adverse airflow, or increase it depending on test objectives.

f. Exhaust volumes shall be computer controlled and measured via AMCA calibrated orifices and flow station at each exhaust trunk.
g. Room pressurization must be digitally monitored, and variable depending on test objectives.
h. All equipment must be properly calibrated.
i. Qualified personnel familiar with the laboratory and its operation shall be available to perform the test.
j. Include the following instrumentation and test equipment:
    1) Properly calibrated hot wire thermal anemometer capable of measuring air velocities from 10 to 600 ft/minute; correlate with computer data acquisition format to provide simultaneous readings at all points.
    2) Theatrical smoke generator or other source of high volume smoke.
    3) Smoke tubes or other source of localized smoke.
    4) Leakmeter with traceable calibration, calibrated just before test, to indicated concentration of sulfur hexafluoride.
    5) Tracer gas: Sulfur hexafluoride supplied from a cylinder with two stage regulator.
    6) Adjustable mannequin, 5' 0' to 5'8" in height, with reasonable human proportions, clothed in a smock
    7) Inclined manometer with graduations no greater than 0.2 inch of water.
    8) Ejector system: Tracer gas ejector built to specific ASHRAE-110 requirements.
    9) Critical orifice: Sized to provide tracer gas at four or eight liters per minute at an upstream pressure sufficient to maintain release rate.
    10) Data acquisition software to include HoodPro™ and LabMeasurePro™ from Exposure Control Technologies, Inc.

3. Hood shall be tested to ASHRAE 110 modified test method as detailed below.
4. Some fume hoods may use face velocity controls, motorized baffles, integral auxiliary make up, or supply fans. Because all of these devices are subject to failure, containment testing shall show both operational containment and product containment with these systems off.
5. Fume hood sashes shall be placed in their full open position, at least 28” from the work surface, unless noted otherwise.
6. Ambient Temperature: 68 to 74 degrees F
7. **Average Face Velocity:** Face velocity average shall be 40 and 50fpm, as noted below in subsection 8.d, parts 1 and 2 respectively, plus or minus 5%.
    a. An imaginary grid is formed comprised of equal 12” by 12” squares, or smaller, across the face opening of the laboratory hood. Airflow velocity readings are taken at the intersections of these grids with calibrated hot wire anemometer over a twenty second period of time. Probe shall communicate readings to a computer data acquisition package, which will provide an average of each reading over the 20 second time period, and also an overall average upon completion of data acquisition. Face velocity shall be determined by averaging readings at the hood face.
    b. Average face velocity must be achieved without exceeding the CFM noted in part C.
8. **Tracer Gas Detection:** Hood shall achieve a rating of 4.0AM0.00 maximum average and 4.0AM0.01 maximum spike (unless specifically otherwise noted), wherein:
    a. 4.0 = tracer gas release in liters/minute, AM = as manufactured, 0.01 = tracer gas in parts per million (PPM)
    b. With the ejector body 6" from the rear of the sash plane, the test shall be conducted for each ejector position noted.
        1) Left position with ejector 12" from the left interior wall.
        2) Center position with ejector equidistant from the sidewalls.
        3) Right position with ejector 12" from the right interior wall.
    c. Install mannequin positioned in front of the hood, centered on the ejector.

d. Detector probes shall be placed 3" in front of the sash plane. The test shall be conducted for each detector probe position and corresponding face velocity.
    1) Detector probe in the region of the **nose and mouth of the mannequin**. Test with average face velocity of **40 fpm**.
    2) With the mannequin height reduced 4", place detector probe in the **chest of the mannequin**, and even with the height of the ejector. Test with average face velocity of **50 fpm**.
e. Open tracer gas valve, and collect readings with a computer data acquisition package, which is capable of monitoring and visually recording a minimum of one reading per second for a minimal five minute time period for each position.
f. The single control rating of the fume hood shall be the results of the test position yielding the highest average levels of tracer gas in any of the six mannequin/ejector configurations.
g. With the ejector and mannequin in the center position, detector probe in the region of the **nose and mouth of the mannequin**, average face velocity of **40 fpm**, tracer gas released, and concentration recorded, open and close the sash in a smooth motion. Test to be repeated three times, with peak values of 0.01 PPM or less.
h. With the mannequin removed, the periphery of the hood is traversed by the probe at 1" in front of the hood opening at a rate of 3 inches per second. The hood shall have a maximum perimeter reading of 0.01 PPM or less.

9. Flow Visualization:
    a. Test the operation of the lower air bypass airflow opening and hood periphery by introducing light smoke under the airfoil, and around the perimeter of the sash opening. If any smoke that enters the hood reverses directions and escapes from any of these locations, the hood fails this portion of the test and receives no rating.
    b. Introduce smoke along both walls and the hood floor in a line parallel to the hood face and 6 inches (152 mm) back into the hood. Define air movement toward the face of the hood as reverse airflow and define lack of movement as dead air space. All smoke should be carried to the back of the hood and out.
    c. Introduce a large volume of smoke at the work surface in the center of the hood, and 6" inside the plane of the sash. The smoke shall not get entrained in an interior vortex, and shall clear in a single pass.
10. All data on the above, including instrumentation and equipment, and test conditions shall be provided on a report, including the average face velocities, and a separate graph-type performance curve on all tracer gas tests for all required fume hood widths. Performance test data for a 6' representative hood shall be conducted by an independent testing agency and by a specific individual certified to perform such tests by the National Environmental Balancing Bureau (NEBB).

C. Efficiencies
1. The fume hood shall maintain constant volumetric rate (+/- 5 CFM) and static pressure losses (+/- 0.01" H2O) across all sash positions. Without any modifications, the hood shall also maintain a sufficiently restricted by-pass for use with a variable air volume (VAV) system.
2. The fume hood shall demonstrate a minimization of the volumetric rate of air (CFM) requirement at any given face velocity. Required CFM to achieve desired face velocity shall not exceed that which is noted in the chart below.
3. The fume hood shall demonstrate a minimization of static pressure loss (inches of H2O) at any given CFM. Static pressure loss at desired face velocity, and corresponding CFM, shall not exceed that which is noted on the print.

D. Illumination: Shall be a minimum average of 80 foot-candles inside the work area. Work area is defined as the area inside the lined portion of the fume hood, from the face of baffle to sash plane, from interior left to interior right, and from the work surface to a height of 28 inches.

E. Materials of Construction: Interior and Exterior materials of construction and finishes shall meet the requirements in Part 2 of this specification.

1.05 QUALITY ASSURANCE

A. Fume hoods shall be designed, including comprehensive engineering analysis, by a qualified, licensed Professional Engineer.

B. Manufacturer's Qualifications
   1. Ten installations of equal or larger size and requirements. Provide contact at each.
   2. Only hood manufacturers who have had fume hoods as a principal product for 50 years are considered.

C. Fume hoods shall be **Made in America**
   1. 95% or more of raw material and component suppliers shall be United States based.
   2. Stainless and cold rolled steel used in manufacturing shall be sourced from United States steel mills.
   3. Final product must be fabricated and assembled within the United States of America.
   4. Owner reserves the right to evaluate Made in America claims for compliance with the Bureau of Consumer Protection.

D. Supply all equipment in accordance with this specification. Offering a product differing in materials, construction, or performance from this specification requires written approval obtained seven days or more before the proposal deadline.

E. The owner/architect reserves the right to reject qualified or alternate proposals and to award based on product value where such action assures the owner greater integrity of product.

F. Manufacturer's warranty against defects in material or workmanship on its fume hoods will be for 1 year from date of installation or 2 years from date of purchase, whichever is sooner, and includes replacement of parts (except lamps) and labor.

1.06 SUBMITTALS

A. Action Submittals
   1. Laboratory hood specification sheets and product manuals shall be submitted by the hood manufacturer upon request, and include safe and proper operation and maintenance information.
   2. Shop Drawings: Include plans, elevations, sections, and details.
      a. Indicate details for anchoring fume hoods to permanent building construction including locations of blocking and other supports.
      b. Indicate locations and types of service fittings together with associated service supply connection required.
      c. Indicate duct connections, electrical connections, and locations of access panels.
      d. Include roughing-in information for mechanical, plumbing, and electrical connections.
      e. Provide face opening, volumetric rates, and static pressure drop data.

3. Submit a document detailing the information supplied on the Hood Safety Practices Label to verify compliance to specifications.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect finished surfaces during handling and installation with protective covering of polyethylene film or another suitable material.

B. Schedule delivery of equipment so that spaces are sufficiently complete that equipment can be installed immediately following delivery.

1.08 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install fume hoods until building is enclosed, wet work and utility roughing-in are complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturer: iQ Labs, 6172 Valduga Dr SW, Ste B, Byron Center, MI 49315
B. Basis-of-Design Product: iQ Labs Defender Series

2.02 MATERIALS

A. Hood Interior Liner and Baffle
   1. Liner material must comply with UL 1805, and be listed within NRTL test report as proof of compliance.
   2. General Material Properties
      a. Nonflammable, corrosion and chemical-resistant
      b. Sheet molded homogenous polyester panels
      c. Minimum thickness is 3/16"
      d. Smooth, white finish
   3. Mechanical Properties
      a. Tensile Strength: 7,500 PSI (51.7 Mpa)
      b. Tensile Modulus: 1.7 x 10^6 PSI (11,700 Mpa)
      c. Flexural Strength: 21,000 PSI (145 Mpa)
      d. Flexural Strength at 130 degrees C: 12,900 PSI (89 Mpa)
      e. Compressive Strength: 32,500 PSI (224 Mpa)
      f. IZOD Impact Strength (Notched): 8.4 Ft Lb/in (4.5 J/cm)
   4. Flame and Smoke Characteristics
      a. Flame retardant, self-extinguishing, with a flame spread rating of 25 or less in accordance with ASTM-E84
      b. Oxygen Index: 35%
      c. Smoke Density: 115
   5. Physical Properties
      a. Water Absorption: 0.4%
      b. Specific Gravity: 4.81

c. Coefficient of Thermal Expansion: 2 In/in/ degree C x 10^-5
d. Thermal Conductivity: 1.9 BTU/Hr/Ft^2/In/degree F

6. Chemical Resistance
   a. Splash and Spill Resistance:
      1) Suspend sample panel in a vertical plane
      2) Apply five drops of each reagent listed with an eyedropper
      3) Apply liquid reagents at top of panel and allow to flow down full panel height
   b. Fume Resistance:
      1) Place 25 milliliters of reagent into 100 milliliters beakers and position panel over beaker tops in the proper sequence. Ensure beaker pouring lip permits air to enter the interior atmosphere.
      2) After 24 hours remove panel, flush with water, clean with detergent, rinse, wipe dry and evaluate
   c. Evaluation ratings: Change in surface finish and function shall be described by the following numerical ratings
      1) No Effect: No change in color or gloss
      2) Excellent: Slight detectable change in color or gloss, but no change to the function or life of the work surface material
      3) Good: Clearly discernible change in color or gloss, but no significant impairment of function or life
      4) Fair: Objectionable change in appearance due to surface discoloration or etch, possibly resulting in deterioration of function over an extended period
      5) Failure: Pitting, cratering or erosion of work surface material; obvious and significant deterioration
   d. Required minimum results for each reagent (Reagent: Fume Resistance Rating, Splash and Spill Resistance Rating)
      1) Hydrochloric Acid (37%): 2,1
      2) Sulfuric Acid (33%): 2,1
      3) Sulfuric Acid (77%): 1,1
      4) Sulfuric Acid (96%): 1,2
      5) Formic Acid (90%): 2,1
      6) Nitric Acid (20%): 2,2
      7) Nitric Acid (30%): 1,2
      8) Nitric Acid (70%): 3,2
      9) Hydrofluoric Acid (48%): 2,2
      10) Phosphoric Acid (85%): 1,1
      11) Chromic Acid (60%): 1,4
      12) Acetic Acid (98%): 1,1
      13) Ammonium Hydroxide (20%): 1,1
      14) Sodium Hydroxide (10%): 1,1
      15) Sodium Hydroxide (20%): 1,3
      16) Sodium Hydroxide (40%): 1,3
      17) Sodium Hydroxide Flake: 1,-
      18) Sodium Sulfide: 1,1
      19) Zinc Chloride: 2,1
      20) Tincture of Iodine: 3,3
      21) Silver Nitrate: 2,1
      22) Methyl Alcohol: 1,1
      23) Ethyl Alcohol: 1,1
      24) Butyl Alcohol: 1,1
      25) Benzene: 1,1
      26) Xylene: 1,1
      27) Toluene: 1,1

28)	Gasoline:	1,1
29)	Dichloro Acetic Acid:	2,2
30)	Dimethyl Formanide:	2,2
31)	Ethyl Acetate:	1,1
32)	Amyl Acetate:	1,1
33)	Acetone:	1,1
34)	Chloroform:	1,1
35)	Carbon Tetrachloride:	1,1
36)	Phenol:	2,2
37)	Cresol:	1,1
38)	Formaldehyde:	1,1
39)	Trichloroethylene:	1,1
40)	Ethyl Ether:	1,1
41)	Furfural:	1,3
42)	Methylene Chloride:	1,1
43)	Mono Chloro Benzene:	1,1
44)	Dioxane:	1,1
45)	Methyl Ethyl Ketone:	1,1
46)	Acid Dichromate:	1,2
47)	Hydrogen Peroxide:	1,1
48)	Napthalene:	1,1

B. Sheet Steel
1. Side panels and access panels 20-gauge (or heavier) sheet steel.
2. Hood corner posts are 18-gauge sheet steel.
3. Ceiling enclosure panels are 18 gauge sheet steel.
4. Cold-rolled, commercial steel (CS) sheet, complying with ASTM A 1008/A 1008M.

C. Chemical Resistant Finish
1. General: Prepare, treat, and finish welded assemblies after welding. Prepare, treat, and finish components that are to be assembled with mechanical fasteners before assembling.
2. Chemical and Physical Resistance of Finish System: Finish complies with acceptance levels of cabinet surface finish tests in SEFA 8. Third party validation required.
3. Powder-coat process required. Paint processes that release Volatile Organic Compounds (VOC) are not acceptable
4. Color for Fume Hood Finish: **[Select One]**
   a. Off White
   b. Standard color selected from options

D. Safety Glass
1. Tempered
   a. Clarity and temper test to be as specified in latest edition of Glass Tempering Association, *Engineering Standards Manual*, Section 8.1.
   b. Surface and interior visible quality to be as specified per ASTM C 1036, *Standard Specification for Flat Glass*, Table 4, Quality level Q3.
2. Laminated **[The primary standard for fume hood sash construction is UL1805. Either laminated or tempered is acceptable per this standard. However, laminated glass will break under a lower stress than tempered. Typically, tempered glass can handle a 5 times greater point load than laminated without breakage. If broken, laminated glass may stay together better than tempered because of the inner layer. However, an explosion violent enough to break the inner layer will show laminated glass as more dangerous than tempered.**

2.03 CONSTRUCTION

A. Superstructure:
   1. Self-supporting, rigid structural assembly, to support inner wall consisting of fume hood liner and outer wall of sheet metal exterior.
   2. Fabricated from galvanized steel.
   3. Space shall accommodate fume hood wiring and plumbing components for service fixtures.
   4. Access to fixture valves concealed in wall provided by exterior removable access panels, gasket access panels on the inside liner walls, or through removable access panels on the front posts.

B. Exterior
   1. Fabricate from steel sheet with component parts screwed together.
   2. Apply chemical-resistant finish to interior and exterior surfaces of component parts before assembly.
   3. Interchangeable side panels shall lift off without the use of tools to allow access to plumbing lines, service fittings, electrical wiring, counterbalance sash weights, and light fixtures. Exposed fasteners or hardware, and Velcro type fasteners, are not acceptable.
   4. Corner posts
      a. Pre-punched and plugged to accommodate up to 4 service fixtures per side
      b. All services are accessible from the front of the hood.
      c. Aerodynamic shape
      d. Accommodate two electrical duplexes per side.
      e. Right hand corner post includes electrical switches and pre-cut for Airflow monitor installation.
      f. Un-used penetrations shall be plugged.
   5. Top and sides of face opening to provide an aerodynamic shape to ensure smooth, even flow of air into fume hood.
   6. Panel above header shall be removable without the use of tools to allow access to mechanical connection, electrical wiring, counterbalance sash weights, and light fixtures. Exposed fasteners or hardware, and Velcro type fasteners, are not acceptable.

C. Dimensions
   1. Overall exterior dimensions are as follows:
      a. 4 foot nominal width: 48” w x 54” h x 31.25” d
      b. 5 foot nominal width: 60” w x 54” h x 31.25” d
      c. 6 foot nominal width: 72” w x 54” h x 31.25” d
      d. 8 foot nominal width: 96” w x 54” h x 31.25” d

D. Hood Liner
   1. Adhere interior liner components to superstructure.
   2. Stainless steel fasteners shall be used on the interior ceiling for structural integrity.
   3. Fasteners exposed to chemical environment are not acceptable.
   4. Punch fume hood lining side panels to receive four service fittings, for use with remote controls, per side. Provide removable plug buttons for holes not used for indicated fittings.
   5. Each side wall shall include an oval interior access panel to provide access to the side wall of the fume hood for plumbing service access. Access panel material shall be that of the liner, and gasketed to form a vapor proof seal.

E. Hood Baffle
   1. Baffle system shall be designed to optimize the face velocity profile, and to capture a wide range of gaseous densities without adjustment or moving components.
   2. The baffle system shall be constructed with the same material as the fume hood liner.

3. The baffles shall be removable for cleaning. The primary baffles shall be two pieces to allow removal without the use of tools.
4. Exposed components to be non-metallic. Metal components exposed to chemical environment are not acceptable.
5. Moving parts or adjustment of any kind is not acceptable.

F. Exhaust Connection
1. 316 stainless steel with Chemical-Resistant Finish
2. Ducting shall go inside the duct collar to ensure condensate travels into the hood and evaporates. Duct collars that allow duct connection over the collar are not acceptable.

G. Airfoil
1. Cold Rolled Steel, 304 stainless steel, **[or 316 stainless steel]** with Chemical-Resistant Finish.
2. Airfoil shall have an aerodynamic radius to sweep the air into the hood with minimal turbulence. Airfoil directs airflow across work top to remove heavier-than-air gases.
3. Must have 5 rows of perforations to allow the air to bypass underneath and through the foil and sweep across the work surface to prevent any back flow of fumes escaping from the front of the hood opening. This airflow continues even if blocked by the presence of the operator.
4. Foil must extend back under the sash to prevent closure of the lower by-pass opening when the sash is in the fully closed position, directly on top of the airfoil.

H. Sash Assembly
1. Glass: Fully tempered safety glass **[or glaze with laminated safety glass]** with unobstructed, side-to-side view of fume hood interior and service fixture connections.
2. Dimensions: The full sash opening height is 28", the total unobstructed viewing height is 27" measured from the work surface.
3. Sash Tracks: Steel with Chemical Resistant Finish.
4. Sash Handle: e Sash handle includes a perforated air passage directly atop the handle to bleed air into the hood chamber and direct chemical fumes away from the user's breathing zone. The handle is ergonomic in design and is easy to grasp when operating
5. Sash guides: Corrosion resistant coated cold rolled steel.
6. Sash System
    a. Vertical Sash (Cable and Pulley)
        1) Hoods have a single vertical sash counterbalanced by a single weight.
        2) Sash and weight to be connected via aircraft cable meeting MIL-W-83420 Military Specification.
        3) Rear pulleys shall be connected to prevent sash tilting and permit one finger operation at any point along full width sash handle.
        4) Maximum 7 pounds pull required to raise or lower sash throughout its full length of travel.
        5) Design system to hold sash at any position without creep and to prevent sash drop in the event of cable failure.
        6) Include a defeatable, and automatically resetting sash stop positioned for an 18” sash height.
        7) Maximum 7 pounds pull required to raise or lower sash throughout its full length of travel.
        8) Design system to hold sash at any position without creep and to prevent sash drop in the event of chain failure.
        9) Include a defeatable, and automatically resetting sash stop positioned for an 18” sash height.

I. Electrical Components**[Delete this section if hoods are to be EP rated]**

1. Lighting
    a. Provide UL Listed, high-efficiency, quick-start, LED lighting systems, including bulbs.
        1) 4 Foot Hoods - 1 each, 11-watt LED lamps
        2) 5 Foot Hoods - 1 each, 17-watt LED lamps
        3) 6 Foot Hoods - 1 each, 17-watt LED lamps
        4) 8 Foot Hoods - 1 each, 11-watt LED lamps
    b. Vapor-Proof: all electrical components shall be outside of the contaminated air space. Lighting shall be located behind a laminated safety glass shield, sealed to the top of the hood liner.
    c. The LED light assemblies shall be serviceable from outside the fume hood cavity, without the use of tools.
    d. Light switch to be included on the lower right corner post, at heights compliant with the Americans with Disabilities Act (ADA).
2. Blower Switch **[Pick one]**
    a. Hoods shall be provided with blower switch, on the lower right corner post, at heights compliant with the Americans with Disabilities Act (ADA).
    b. Hoods shall be provided without a blower switch, as they will share a single mechanical system with other hoods.
3. Electrical Receptacles
    a. The hoods shall accommodate up to four (two per corner post) electrical receptacles as indicted in schedule or drawings. Options to include:
        1) 115 volt, 60 Hz, three-wire polarized and grounded electrical duplex
        2) 115 volt, 60 Hz, three-wire polarized and grounded electrical duplex, with Ground Fault Circuit Interruption (GFCI)
        3) 230volt, 60 Hz, three-wire polarized and grounded electrical duplex
    b. Receptacles shall be individually wired to field wiring box, and each rated at 20 Amperes.
    c. Cover plates shall be acid resistant thermoplastic.
4. Wiring
    a. Every electrical component shall be individually wired to a single point internal field wiring box (including individual duplexes/receptacles).
    b. Field wiring box to be 7” x 4” x 2.5”, grounded, and have (12) 7/8” diameter knock out penetrations.
    c. Final wiring and circuit dedication is to be by others.
    d. Each receptacle circuit shall accommodate being wired to a dedicated building circuit rated at 20A, or the receptacles wired to a single circuit with the total load not exceeding 20 Amperes.
5. Fume hood to have third party validation of compliance to UL 1805 and UL 61010-1 by a Nationally Recognized Testing Laboratory (NRTL)

J. Electrical Requirements

1. Hoods to be UL Listed
2. Lighting: UL Listed
3. Wiring
    a. No wiring or switches are provided.
    b. Hoods to be field wired to meet local codes for electrical equipment in a classified space having a potentially explosive atmosphere.

K. Upper Dilution Air Supply
   1. Located behind and above the sash to introduce between 5 and 10% of the required hood air volume, and maintain sufficient exhaust air volume through hood to adequately dilute hazardous fumes regardless of sash position.
   2. This device bathes the sash interior above the work area to eliminate chemical fumes along the sash plane near the operator's critical breathing zone.
   3. Shall act as a by-pass opening controlled by sash position. If on a constant volume mechanical system, the hood shall not have a change in static pressure or exhaust volume across all sash positions.
   4. Shall offer a significant restriction to the by-pass opening to allow the use of a VAV mechanical system without modification to the by-pass opening.

L. Hood Safety Practices Label: Corrosion resistant plate attached to the left corner post of the fume hood with the following Hood Safety Practices:
   1. For use with substances that produce hazardous levels of airborne chemicals: gas, fumes, vapors, dust
   2. Do not put your head in the hood.
   3. Minimize drafts and sudden movements in front of the hood.
   4. Work a minimum of six inches inside the hood.
   5. Elevate equipment above the work surface.
   6. Keep sill and baffle unobstructed.
   7. Do not use the hood for storage.
   8. Adjust the sash to smallest opening possible when in use.
   9. Close sash when unattended.
   10. Do not remove any of the hood components.
   11. Do not place flammable solvents near heat, flame or sparks.
   12. Do not evaporate large amounts of flammable liquids.
   13. Wipe up spills immediately.
   14. Routinely validate airflow.
   15. If the ventilation system malfunctions, or airflow alarm indicates unsafe condition, close sash and discontinue hood operation immediately-call for help.
   16. Do not use with Biohazards and Perchloric Acid

M. Fume Hood Accessories
   1. Service Fixtures: Color-coded hose nozzle outlets and valves mounted inside the fume hood and controlled from the exterior with color-coded index handles
      a. The hoods are equipped without service fixtures or will be provided with a total of up to 8 service fixtures as indicated in schedule.
      b. Hose connectors located inside the fume hood cavity are chemically-resistant, glass-filled polypropylene with 6 serrations.
      c. Service lines shall be factory installed from valve to outlet
         1) Copper tubing unless otherwise noted
         2) Brass service lines for gas
         3) Stainless steel service lines for Deionized Water
         4) Connections shall be made with quick-connect compression fittings on the inlet and outlet of the valve body, soldered and brazed connections not easily disassembled are not acceptable.
         5) Inlet tubing not included
      d. Valves
         1) Extruded brass valve and rotating seat, TFE-coated silicone bronze stem and TFE packing.
         2) Fixture handles are plastic or metal and color coded as well as labeled for the designated type of service.

3) Fixtures are rated at maximum pressure of 200 psi.
4) Valves are front or rear loaded, located on the fume hood corner post for remote use, and include:
a) Hot and cold tap water
b) Natural gas
c) Air
d) Vacuum
e) Nitrogen
f) Argon
g) Steam
h) Oxygen (include oxygen compatible lubricant)
i) Deionized/Distilled water (Nickel plated and stainless steel components)

2. Rear Finish Panel: Shall be the same materials and coating as the hood exterior.

N. Work Surface

1. 1.25" thick, molded from solid modified epoxy resin, with smooth, non-specular, black finish.
2. One inch radius front edge for optimal fume hood performance.
3. 3/8" dished area to match the fume hood interior work space and form a water tight pan for spill containment.
4. Include a 2.5" diameter hole on each side for service pass-through and piping. Hole to be covered by hood superstructure upon installation.
5. Include two 1.5" diameter penetrations to accommodate base cabinet venting. Holes to be located outside of dished area and under the fume hood baffles. Include plugs.
6. Physical Properties:
a. Flexural Strength: Not less than 10,000 psi (70 MPa).
b. Modulus of Elasticity: Not less than 2,000,000 psi (1400 MPa).
c. Hardness (Rockwell M): Not less than 100.
d. Water Absorption (24 Hours): Not more than 0.02 percent.
e. Heat Distortion Point: Not less than 260 deg F (127 deg C).
f. Flame-Spread Index: 25 or less per ASTM E 84.
7. Cupsink
a. 3 x 6" dimension, polypropylene construction
b. Provide with strainers and tailpieces, NPS 1-1/2 (DN 40)
c. To sit flush with dished area of work surface
d. Cupsink(s) to be located **[Select all that apply or as detailed in the schedule/drawings]**
1) Left rear
2) Left side
3) Right rear
4) Right side

2.04 EXAMINATION

A. Examine areas, with installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of fume hoods.
B. Coordinate with other trades for the proper and correct installation of plumbing and electrical rough-in and for rough opening dimensions required for the installation of the hood.
C. Proceed with installation only after unsatisfactory conditions have been corrected.

2.05 INSTALLATION

A. General: Install fume hoods according to shop drawings and manufacturer's written instructions.
B. Install level, plumb, and true; shim as required, using concealed shims, and securely anchor to building and adjacent laboratory casework.
C. Securely attach access panels, but provide for easy removal and secure reattachment. Where fume hoods abut other finished work, apply filler strips and scribe for accurate fit, with fasteners concealed where practical.
D. Neighboring splash blocks shall not be attached directly to the hood.
E. Install according to standards required by authority having jurisdiction.
F. Sequence installations to ensure utility connections are achieved in an orderly and expeditious manner.
G. Touch up minor damaged surfaces caused by installation. Replace damaged components as directed by Architect.

2.06 FIELD QUALITY CONTROL

A. NFPA 45 requires that fume hoods be field tested when installed.
B. Field test installed fume hoods according to ASHRAE 110-2016 to verify compliance with performance requirements.
    1. Adjust fume hoods, hood exhaust fans, building's HVAC system, and make other corrections until tested hoods perform as specified in fume hood schedule.
    2. After making corrections, retest fume hoods that failed to perform as specified.

2.07 ADJUSTING AND CLEANING

A. Adjust moving parts for smooth, near silent, accurate sash operation with one hand. Adjust sashes for uniform contact of rubber bumpers. Verify that counterbalances operate without interference.
B. Clean finished surfaces, including both sides of glass; touch up as required; and remove or refinish damaged or soiled areas to match original factory finish, as approved by Architect.
C. Clean adjacent construction and surfaces that may have been soiled in the course of installation of work in this section.
D. Provide all necessary protective measures to prevent exposure of equipment and surfaces from exposure to other construction activity.
E. Advise contractor of procedures and precautions for protection of material and installed equipment and casework from damage by work of other trades.