The following standard specification is intended to be edited according to the specifics of the project. Brackets [ ] and areas shaded in gray [e.g. format] indicate requirements that are optional depending upon the type of system being provided or per instructions associated with the [ ] and project requirements. Consult with University's Representative and campus stakeholders.

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SECTION 11 53 13 LABORATORY FUME HOODS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Chemical Fume Hoods, including bench and floor mounted hoods.

B. Specialty Fume Hoods

1.2 RELATED SECTIONS

A. Division 12: Countertops and Casework

B. Division 22: Plumbing

C. Division 23: Mechanical

D. Section 25 95 05 Laboratory Air Flow Controls

E. Division 26: Electrical

1.3 REFERENCES

A. Reference Standards, latest editions of the following:

1. ASHRAE 110, Method of Testing Performance of Laboratory Fume Hoods.
2. ASHRAE Current Applications: Chapter 16 - Laboratories: Part VIII: Laboratory Fume Hoods - American Society of Heating, Refrigeration, and Air Conditioning Engineers.
3. ANSI Z 9.5 Laboratory Ventilation Standard
4. California Code of Regulations, Title 8
5. Guidelines for Design and Construction of Health Care Facilities - Facility Guidelines Institute; Part 6 Ventilation of Health Care Facilities - Sections 410: Laboratory Ventilating Systems and Hoods.
6. Industrial Ventilation Handbook
7. NFPA 45 – Chapters on Standard on fire protection for laboratories using chemicals, Ventilating System, and Laboratory Hoods
8. Scientific Equipment and Furniture Association (SEFA) SEFA 1 and SEFA 8, latest editions.
9. NFPA 30: Flammable and Combustible Liquids Code

1.4 PERFORMANCE REQUIREMENTS

A. 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.

B. Face Velocity: In accordance with CAL/OSHA 8CCR5154.1 for any combination of sash position at any designated measuring point.

C. Static Pressure Loss: Average of four measurements taken 90 degrees apart, shall not exceed the listed maximums when measured three diameters above the hood outlet.

D. Variation in exhaust CFM, static pressure and average face velocity as a result of baffle adjustment shall not exceed 10 percent for any baffle position at the specified face velocity.

E. Average illumination of Work Area: 80 foot-candles for the area inside the superstructure from side to side and from face of baffle to the inside face of the sash, and from the working surface to a height of 28 inches.

F. Noise Criteria: 60dBA with sash in any position; measured 0.5 feet from open sash and by pass at 100 fpm face velocity. Sound pressure levels will be measured during Performance testing.

1.1 SUBMITTALS

A. Submit under provisions of Section 01 33 23 Shop Drawings Product Data and Samples.

B. Materials List/Product Data: Submit complete materials list, including catalog data of materials, equipment, and products for Work specified in this Section.

C. Shop Drawings: Submit complete shop fabrication and installation drawings, including plans, elevations, sections, details and schedules.

1. Show relationship to adjoining materials and construction and required clearances.
2. Include size, dimensioned location and height above floor, and
3. Indicate capacity of all mechanical and electrical services required.
4. Indicate duct connections, electrical connections, and locations of access panels.
5. Include rough-in information for mechanical, plumbing, and electrical connections.
6. Provide face opening, volumetric rates, and static pressure drop data.

D. Submit detailed anchorage and attachment drawings and calculations provided by a licensed Structural Engineer complying with the California Building Code Earthquake Regulations and the California Administrative Code, Title 24 Seismic Restraint requirements.

E. Samples: Submit two samples of each type of specified finish and color range available.

F. "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 0.01 ppm with 4.0 Lpm tracer gas release rated when tested in accordance with ASHRAE 110, latest edition.

G. 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 100 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 inches in front of open sash at 100 fpm face velocity.

H. Operations and Maintenance Manuals: Submit for University's use, complete operating and maintenance manuals that describe proper operating procedures, maintenance and replacement schedules, component parts list, and closest factory representative for components and service.

I. As Installed 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 use. As installed, under the ASHRAE 110 test method, fume hoods shall meet the testing criteria 4.0AI0.05 as specified in the Industrial Ventilation Handbook (4.0 liters/minute release rate of tracer gas, as-installed, less than 0.05 ppm of tracer gas detected by the mannequin).

J. Balancing report

K. ASHRAE 110 test

L. Certification of compliance with the UC Davis Fire Prevention Bureau requirements for under hood flammable liquid storage cabinets.

M. Certification of compliance with NFPA 30 for under hood flammable liquid storage cabinets.

1.2 QUALITY ASSURANCE

A. Manufacturer's Qualifications

1. ISO 9001 Certified manufacturing plant and processes.

2. Five years successful experience in the manufacture of equipment of the type specified.

3. Ten installations of equal or larger size and requirements.

B. 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.

1.3 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.

C. 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

2.1 MANUFACTURERS

A. Labconco Protector XL Fume Hood, Labconco Corporation (basis of design)

B. Supreme Air Fume Hood, Kewaunee Scientific Corporation

C. SafeAire II Fume Hood, Hamilton Laboratory Solutions

D. Or equal

2.2 MATERIALS

A. The following materials shall be provided, unless superseded by the requirements listed below for specific fume hood types.

1. Steel:
   a. ASTM 1008 mild steel, furniture stock, cold-rolled, pickled, double annealed, and free from rust, scale, scratches, buckles, ragged edges, and other defects. Conform to flatness tolerances for stretcher-leveled material in ASTM A 568.
   b. Minimum thickness: 18 gauge.
2. Stainless Steel:
   a. Type 316, ASTM 240, with exposed surfaces ground and polished to a No. 4 finish.
   b. Minimum thickness: 16 gauge.
   c. Welding: 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. Galvanized Steel:
   a. ASTM A366 high quality, cold rolled, mild steel. Hot dipped or galvanized to ASTM A123.
4. Glass: Minimum 7/32 inch laminated safety glass.

a. Glass shall not be etched with manufacturer's name, logo, or other permanent markings, other than to identify the glass as safety glass.

5. Polyvinyl Chloride: Type 1 unplasticized polyvinyl chloride (PVC).
6. Reinforced Phenolic Resin Lining:
   a. Interior liner panels shall be 1/4 inch thick made from a compression molded cellulose fiber reinforced phenolic resin core with integrally cured white melamine surfaces. Interior liner panels shall be fastened using stainless steel screws with plastic covered heads.
7. Epoxy Resin Components: Specifically for laboratory use, in the thicknesses required. Solid, homogeneous modified epoxy resin not dependent on finish or coatings for performance characteristics. [Comply with Section 11 60 20 requirements.]
   a. Color: Integral and homogeneous; [Match work of Section 11 60 20 Laboratory Casework.]
8. Polyester, Fiberglass Reinforced Components: ASTM D 3841, 0.1875 inch thick sheet.
   a. Sheets: Laminated to acceptable backing or otherwise supported to provide a smooth stable surface and prevent deflection. Integral and homogeneous white color unless otherwise required.
   b. Flame Spread: 15 or less per ASTM E84-80.
9. Mineral Fiberboard: Asbestos free, chemically resistant, homogeneous mixture of portland cement and mineral fibers formed under heat and pressure into rigid, dense, and smooth 0.25 inch thick boards.
   a. Flame Spread: ASTM E 84, 0.
   b. Modulus of Rupture (longitudinal): 5,511 psi.
10. Fasteners: Concealed from view and match base metal, alloy and finish of metal fastened unless otherwise required.
    a. Exterior Structural Member Attachment: Sheet metal screws, zinc plated.
11. Elastomeric Sealant: ASTM C 920, chemically curing, chemical resistant clear silicone.
    a. Grade and Hardness: Recommended by manufacturer for optimal performance in application, self-leveling for horizontal joints otherwise nonsag.
       1) Self Leveling: Hardness 55; modulus not greater than 150 psi.
       2) Nonsag: Hardness 20 to 30; modulus not greater than 75 psi.
    b. Modulus of Elasticity: Unless otherwise required, lowest available consistent with joint configuration, and conditions of service, including movement.
    c. Tooling of Sealant Joints: Flush and conforming to ASTM C 1193, Figure 8. Smooth, uniform bead, free of air pockets, ensure contact, and full adhesion with no excess sealant.

2.3 GENERAL FUME HOOD 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. Side panels and access panels 20-gauge (or heavier) sheet steel.

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. Shall be 16-gauge sheet steel.
   b. Pre-punched and plugged to accommodate up to 4 service fixtures per side
   c. All services shall be accessible from the front of the hood.
   d. Aerodynamic shape
   e. Accommodate two electrical duplexes per side.
   f. Right hand corner post includes electrical switches and pre-cut for Airflow monitor installation.
   g. 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.
7. Ceiling enclosure panels shall be 18 gauge sheet steel.
   a. Provide filler panels matching fume hood exterior to enclose space above fume hoods at front and sides of fume hoods and extending from tops of fume hoods to ceiling.
   b. Exposed fasteners are not acceptable.
   c. Height adjustment to be within the following ranges as specified in the schedule.
      1) 11.0 - 14.0 inch
      2) 14.0 – 18.6 inch

3) 18.6 – 24.4 inch
4) Fixed height of [Insert required height in inches, or delete item 4.]

8. Rear Finish Panel: Shall be the same materials and coating as the hood exterior.
9. Chemical Resistant Finish
   a. General: Prepare, treat, and finish welded assemblies after welding. Prepare, treat, and finish components that are to be assembled with mechanical fasteners before assembling.
   b. Chemical and Physical Resistance of Finish System: Finish complies with acceptance levels of cabinet surface finish tests in SEFA 8. Third party validation required.
   c. Powder-coat process required. Paint processes that release Volatile Organic Compounds (VOC) are not acceptable
   d. Color for Fume Hood Finish:
      1) As selected by architect from Manufacturer's full range

C. Hood Liner

1. Chemically compatible sheet molded homogenous composite board liner, durable, nonflammable, smooth, highly chemical resistant material and finish. Shall comply with UL 1805, and be listed within NRTL test report as proof of compliance. Minimum thickness is 3/16 inch.
2. Adhere interior liner components to superstructure.
3. Stainless steel fasteners shall be used on the interior ceiling for structural integrity.
4. Fasteners exposed to chemical environment are not acceptable.
5. 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.
6. Each side wall shall include an 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.
7. 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)
8. 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
9. 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

10. 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

D. Work Surface

1. Chemically compatible and configured for containment of spilled fluids.
2. Minimum 1.25 inch thick, molded from solid modified epoxy resin, with smooth, non-specular finish. [Specifier to select color]
3. One inch radius front edge for optimal fume hood performance.
4. Minimum 3/8 inch dished area to match the fume hood interior work space and form a water tight pan for spill containment.
5. Include a 2.5 inch diameter hole on each side for service pass-through and piping. Hole to be covered by hood superstructure upon installation.
6. Cupsink
   a. Cupsink(s) as indicated on drawings
   b. [Specify size or use 3 x 6 inch dimension], polypropylene construction
   c. Provide with strainers and tailpieces, NPS 1-1/2 (DN 40)
   d. To sit flush with dished area of work surface

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. Shall provide a continuous horizontal slot at the work surface. Baffle panels shall be perforated or have horizontal slots. Slot pattern shall be proven to optimize face velocity profile and designed to maximize capture of contaminants in the fume hood.
3. The baffle system shall be constructed with the same material as the fume hood liner.
4. The baffles shall be removable for cleaning with three fixed horizontal slots or perforated baffles only. If slots are to be provided, they shall be continuous across the back of the fume hood. Engineered perforations are acceptable. Operator adjustable baffles and monolithic rear panels are not acceptable.
5. Exposed components to be non-metallic. Metal components exposed to chemical environment are not acceptable.
6. Moving parts or mechanically actuated baffles are not acceptable.

F. Exhaust Connection

1. 316 stainless steel with Chemical-Resistant Finish
2. Connection shall accommodate any 12 inch nominal duct without the need for a transition adapter. 3, 4, 5, and 6-foot hoods have one exhaust connection, 7 and 8-foot hoods have two exhaust connections.
3. 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. Air Foil shall provide an air sweep across the work surface with the sash in the fully lowered position.
2. Cold Rolled Steel [or 316 stainless steel] with Chemical-Resistant Finish.
3. A streamlined airfoil shall be integral at the bottom of the hood opening on bench and distillation hoods. This foil shall provide a nominal 1 inch open space between the foil and the top front edge of the work surface to direct an air stream across the work surface to prevent back flow of air. The airfoil shall extend back under the sash, so that the sash does not close the 1 inch opening. The foil shall be removable to allow large equipment into the hood. The foil shall be of 12-gauge steel to resist denting and flexing. Walk-in hoods shall have a stop located at the bottom of the sash track that will ensure a nominal 1 inch opening between the bottom of the sash and the floor.
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. Provide vertical rising sash having the required open dimensions measured at the fume hood face.
2. 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.
3. Dimensions: The full sash opening height shall be of 24 inch minimum, the total unobstructed viewing height shall be 32 inch minimum measured from the work surface.
4. Sash Tracks: Steel with Chemical Resistant Finish. Provide sash mechanical stop at 18 inches as measured from the bottom of the dished work surface to the bottom of the sash. Friction stops are not acceptable.
5. Sash Handle: Extruded aluminum with Chemical Resistant Finish. The handle shall be ergonomic and aerodynamic in design and easy to grasp when operating
6. Sash guides: Shall be corrosion resistant.
7. Sash System [Specifier to select one]
    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 via timing shaft to prevent sash tilting and permit one finger operation at any point along full width sash handle. Maximum 7 pounds pull required to raise or lower sash throughout its full length of travel.
        4) Design system to hold sash at any position without creep and to prevent sash drop in the event of cable failure.
        5) Include a defeatable, and automatically resetting sash stop positioned for an 18 inch sash height.
    b. Vertical Sash (Chain and Sprocket)
        1) Multiple sashes shall be individually counter-balanced.
        2) Sash and weight to be connected via #35 chains.
        3) Rear sprockets shall be connected via timing shaft to prevent sash tilting and permit one finger operation at any point along full width sash handle. Maximum 7 pounds pull required to raise or lower sash throughout its full length of travel.
        4) Design system to hold sash at any position without creep and to prevent sash drop in the event of chain failure.
        5) Include a defeatable, and automatically resetting sash stop positioned for an 18 inch sash height.

I. Blower Switch

1. Hoods shall be provided without a blower switch, as they will share a single mechanical system with other hoods.

J. Electrical Receptacles

1. The hoods shall accommodate up to four (two per corner post) electrical receptacles as indicted in schedule or drawings.
   a. 115 volt, 60 Hz, three-wire polarized and grounded electrical duplex, with Ground Fault Circuit Interruption (GFCI)
2. Receptacles shall be individually wired to field wiring box, and each rated at 20 Amperes.
3. 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 inch x 4 inch x 2.5 inch, grounded, and have (12) 7/8 inch diameter knock out penetrations.
   c. Each receptacle circuit shall accommodate being wired to a dedicated building circuit rated at 20A, or the receptacles ganged together on a building circuit with the total load not exceeding 20 Amperes.
   d. Fume hood to have third party validation of compliance to UL 1805 and UL 61010-1 by a Nationally Recognized Testing Laboratory (NRTL)

K. Lighting

1. UL listed, high efficiency, rapid start, fluorescent with sound rated ballast with laminated safety glass lens cemented and sealed to the hood liner. Fixture shall be serviceable from the front of the hood. Maintenance of fixture from within the hood shall not be acceptable.

L. By-Pass Opening [Specifier to select one of the following.]

1. The size of the by-pass opening shall be controlled by sash position for use with a constant volume mechanical system. The hood shall not have a change in static pressure or exhaust volume across all sash positions.
2. Shall offer a significant restriction to the by-pass opening to allow the use of a VAV mechanical system.

M. Fume Hood Accessories [Specifier to select applicable items]

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. Hose connectors located inside the fume hood cavity shall be chemically-resistant.
   b. 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 [or services pre-piped to the top of the hood][or services include a coil of tubing to be routed below the hood at time of installation]

c. Valves
1) Extruded brass valve and rotating seat, TFE-coated silicone bronze stem and TFE packing.
2) Fixture handles shall be plastic and color coded as well as labeled for the designated type of service.
3) Fixtures shall be rated at maximum pressure of 200 psi.
4) Coefficient of flow for the valve, Cv=0.43.
5) Valves shall be front loaded, located on the fume hood corner post for remote use, and include: [Specifier to select appropriate valves.]
a) Hot and cold tap water (flow rate 3.5 GPM or 13.25 LPM at 67 psi at full open
b) Natural gas (theoretical flow rate of 71CFM at 100 psi, provides 1095 BTU/Sec at a density of .667 Lbs/CU. FT.)
c) Air (theoretical flow rate of 59 CFM at 100psi)
d) Vacuum (theoretical flow rate of 6 CFM at 10 psi)
e) Nitrogen
f) Argon
g) Steam
h) Oxygen (include oxygen compatible lubricant)
i) Deionized/Distilled water (Nickel plated and stainless steel components)

2. Tissue Screen: Provide chemically-resistant screen to prevent paper from being drawn into the exhaust plenum behind baffles.
3. Distillation Grid: Include stainless steel rods, connectors, and factory drilled liner.
4. Face Velocity Monitor/Alarm [Specifier to select one option below for EMS system or factory-installed.]
a. Fume hood Air Flow Indicator/Alarm: Provide an airflow alarm. The hood shall be prepared at the factory to receive the specified alarm/monitor. As a minimum, the alarm shall accommodate the following:
b. Variable Air Volume (VAV) Prepared: Fume hoods shall come factory prepared with the proper cutouts and brackets to field mount specified [Insert Section, or VAV controller make and model] face velocity monitor alarm.

c. Monitor/alarm requirements:
   1) The Safety Monitor/Alarm System shall monitor face velocity and provide audible and visual alarm if face velocity is less than 80 percent or more than 120 percent of the required airflow. Audible alarm shall pulse at 80 dbA.
   2) The monitor shall be UL listed, with all alarm circuit electric components, external tubing, restrictors and manifolds furnished complete. Monitor shall have light emitting diode display, which provides clear indication of airflow conditions. Safety monitor shall be tamperproof.
   3) All Fume Hoods, whether constant volume or variable volume, must be equipped with a factory installed sash position switch or sash position sensor that will trigger the Air flow Indicator/Alarm at a sash position above the University's maximum allowed operating sash height. (Normally 18-inches).
   4) Alarm Signal: Audible pulsating signal and a visual, large flashing red light emitting diode.
      a) Silence push button, which temporarily overrides the audible alarm for a period no longer than 5 minutes, shall be accessible on the front of the Safety Monitor. Note: Teaching laboratory hood alarm override shall not exceed a one-minute period. Once the fault operating condition has been corrected, the audio alarm shall automatically reset.
      b) During temporary silence of audible alarm the visual alarm remains activated until the alarm condition is corrected.
      c) It shall not be possible to routinely disable the alarm signal. Locate electrical outlet on top of hood.
      d) When alarm condition is corrected and face velocity and volume is return to specified levels, the safety monitor shall automatically reset and begin routine monitoring.
   5) Test circuit shall be provided to verify proper safety monitor operation.
   6) Electrical Rating: Maximum 15 VDC and maximum current rating of 200 MA.
   7) Flow tube device (floating indicators), magnehelic, or ribbons hanging in the air stream are not acceptable airflow indicators.

N. Supporting Base Cabinets [Optional]

1. Base cabinets shall be sizes, quantities, and types called out in the drawings, and meet the requirements of this specification.
2. Construction requirements for all cabinets

a. Exterior construction shall be 18 gauge (or heavier) cold rolled sheet steel with Chemical Resistant Finish.
b. Minimum 14 gauge hinges
c. The rear panel will feature a [Specify dimensions] removable plumbing access panel.
d. Units 24 inch wide or less have only one door.
e. Each cabinet includes four leveling feet.
f. Capable of supporting up to 800 pounds.
g. Provide a 14 inch filler panel to increase the cabinet depth to 36 inches.

3. Corrosive Storage
   a. Completely lined with a corrosion resistant liner with a corrosion resistant pan at the bottom to contain spills. Each door shall have a corrosion resistant liner.
   b. The cabinet shall be labeled: "CORROSIVES".
   c. [Note to Specifier: Corrosive storage cabinets do not require venting. If corrosive storage cabinets are vented, they shall be separate from the fume hood exhaust. The vent may be connected at the point where the fume hood exhaust duct enters the general fume hood exhaust manifold. Cabinets shall not be vented directly into the fume hood, through the fume hood work surface. Vents shall be PVC, polypropylene, or other appropriate material.]
   d. Supply an epoxy coated steel shelf with PVC liner pan if indicated in the schedule.
   e. Corrosive cabinets with louvers are not acceptable
4. Flammable Storage Cabinets:
   a. Comply with NFPA 30, and CA Fire Code; conform to UCD Fire Prevention Branch (UCDFPB) certification requirements. Cabinet UL-listed for the storage of flammables are preferred.
   b. Solvent storage cabinets shall be specifically designed for the storage of flammable and combustible liquids.
   c. [Note to Specifier: Corrosive storage cabinets do not require venting. If corrosive storage cabinets are vented, they shall be separate from the fume hood exhaust. The vent may be connected at the point where the fume hood exhaust duct enters the general fume hood exhaust manifold. Cabinets shall not be vented directly into the fume hood, through the fume hood work surface.]
   d. Two diametrically opposed flame arrestor vents with spark screens and caps shall be provided, as well as a grounding screw.
   e. The cabinet has an interior finish same as the exterior.
   f. Screen print the following label on the exterior of the cabinet: "FLAMMABLE - KEEP FIRE AWAY".
   g. The door(s) shall be well fitted, self-closing, and equipped with a three point latching device.
   h. Door handles shall include a key lock.

i. Self-closing/self-latching mechanism shall be integral to the doors and shall not project into storage space. Fusible-link feature shall be provided to ensure the doors will close if the temperature outside the cabinet exceeds 165 degrees Fahrenheit. The doors shall be synchronized so that both doors will fully close.

2.4 Specific Purpose Fume Hoods

A. Hot Acid Fume Hoods

1. In addition to the requirements in the “General Fume Hood Construction Requirements”, provide the following for Hot Acid Fume Hoods:
   a. Constant volume hood with by-pass feature.
   b. Flammable liquid storage cabinets shall not be installed under acid fume hoods.
   c. Fume hood shall be constructed with PVC liner
   d. Shall have an automatic wash down system which shall thoroughly wash in sequence from the exhaust stack, fan, exhaust duct and behind fume hood baffles. Wash down shall not include the interior fume "cupboard."
   e. Sash: No combination sash allowed.

B. Hydrofluoric (HF) Acid Fume Hoods

1. In addition to the requirements in the “General Fume Hood Construction Requirements”, provide the following for Hydrofluoric Acid Fume Hoods:
   a. Constant volume hood with by-pass feature.
   b. Flammable liquid storage cabinets shall not be installed under HF acid fume hoods.
   c. Fume hood shall be constructed with PVC liner
   d. Interior shall be non-metallic, non-fiberglass, non-glass.
   e. No adjustable baffles.
   f. Sash shall be polycarbonate resin (Lexan). No combination sash allowed.
   g. Lens on light fixture shall be polycarbonate resin (Lexan).

PART 3 - EXECUTION

3.1 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.

3.2 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. Apply a continuous bead of silicone caulk along the intersection of the liner panels and work surface to provide a water-tight seal.

E. Neighboring splash blocks shall not be attached directly to the hood.

F. Install according to standards required by authority having jurisdiction.

G. Sequence installations to ensure utility connections are achieved in an orderly and expeditious manner.

H. Touch up minor damaged surfaces caused by installation. Replace damaged components as directed by Architect.

3.3 FIELD QUALITY CONTROL

A. Chemical Fume Hoods:

1. Fume hood field tests shall be performed by a qualified independent testing company on each hood to determine face velocity and air flow patterns.
2. Each fume hood shall be tested as installed for cross drafts perpendicular, parallel and in a vertical direction to the face of the hood.
    a. Cross drafts measured at the fume hood face in the horizontal and vertical direction should be less than 20% of the face velocity. This is not pass/fail criteria but is used to diagnose potential problems in lab airflow control systems.
3. Fume hoods shall achieve an AI performance rating equal or better than 0.05 ppm with 4.0 Lpm tracer gas release rate when tested in accordance with ASHRAE 110-current edition.
    a. Recorder shall indicate the Y-axis 100 percent equal to 0.360 ppm on a 3x scale.
    b. University’s Representative reserves the right at time of testing to increase rate to 8 liters per minute which approximates violent boiling of water on a 500 watt hotplate.

c. Face velocity test shall have an overall average velocity as required for each type of hood with a maximum range plus or minus of 10 percent.

4. Fume Hood installer shall adjust, rework and coordinate with the work of Division 23 to make each fume hood pass the ASHRAE 110--current edition series of tests as installed.
5. Balancing of the system is in the scope of Work of Division 23.
6. Verification of Performance: University's Representative reserves the right to require random testing of the work to verify compliance with required tests and performances.
7. Test results shall be submitted to the University's Representative.

3.4 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.

3.5 MAINTENANCE

A. Perform any scheduled maintenance required in compliance with the final approved Operations and Maintenance Manual submitted per Section 017800 Close-Out Submittals.

END OF SECTION 11 53 13