section 23 3816

FUME HOODS

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LANL MASTER SPECIFICATION

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| --- |
| Rev. 3 Summary of Changes: Clarified when to constant volume hoods can be used.Updated list of manufacturers.Updated choice of luminaires.Minor editorial updates and additional design notes. |

Word file at <https://engstandards.lanl.gov>

This template must be edited for each project.  In doing so, specifier must add job-specific requirements.  Brackets are used in the text to indicate designer choices or locations where text must be supplied by the designer.  Once the choice is made or text supplied, remove the brackets.  The specifications must also be edited to delete requirements for processes, items, or designs that are not included in the project -- and specifier’s notes such as these.  To seek a variance from requirements in the specifications that are applicable, contact the Engineering Standards Manual Mechanical[POC](http://engstandards.lanl.gov/POCs.shtml#mech). Please contact POC with suggestions for improvement as well.

When assembling a specification package, include applicable sections from all Divisions, especially Division 1, General Requirements.

This specification serves as a template. The specification was prepared by an organization operating under a quality assurance program that meets the requirements of 10 CFR 830 (suitable for ML-1 through ML-4 projects). Implementation of this specification requires modification to meet project-specific requirements. Responsibility for application of this specification to meet project-specific requirements lies with the organization modifying or implementing it. The organization modifying it shall apply a graded approach to quality assurance based on the management level designation of the project. When this specification is used with nuclear facilities subject to 10 CFR 830, modification must be performed by an individual or organization operating under a quality assurance program that meets the requirements of that CFR.

The requirements stated herein are dependent upon specific knowledge of the system, structure and component’s safety functions and interaction with other systems, structures, and components. The author of this section shall consider and apply additional safety requirements based upon knowledge of the system, structure, and component’s specific safety function as related to the project and facility. These requirements include hood related issues in nuclear facilities such as exhaust tie-in, primary exhaust, secondary exhaust, fire protection, hazard control, plans, required training, material control & accountability, waste management, required records, etc.

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1. general
	1. SUMMARY
		1. SECTION INCLUDES
			1. Laboratory Fume Hoods, including constant airflow volume open bypass hoods, variable airflow volume hoods, variable air volume restricted bypass hoods, and special purpose hoods. Equipment provisions for ADA and ABA compliance are specified where applicable.
		2. PRODUCTS SUPPLIED
			1. Based on fume hood design, furnish, and install all fume hoods and related understructures as specified and/or as shown on design drawings.
			2. Furnish and deliver all service outlets, accessory fittings, electrical receptacles and switches, as listed in this specification, equipment schedules, or as shown on design drawings.
			3. Pre-install fittings for attachment to the fume hood superstructure at the factory.
			4. Pre-plumb plumbing fixtures mounted on the fume hood superstructures per paragraph 2.3.K. Pre-wire electrical fixtures per paragraph 2.3.L.

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Edit related sections listed below to meet project requirements associated with the fume hood.

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* + 1. Related Sections
			1. Section 01 3300, *Submittal Procedures*
			2. Section 01 6000, *Product Requirements*
			3. Section 01 7700, *Closeout Procedures*
			4. [Section 01 8734, *Seismic Qualification of Nonstructural Components (IBC)*, for requirements pertaining to [manufacturer’s certification] [and][special certification].]
			5. [Section 01 8113.13, *Sustainable Design* [LEED v4 and] Guiding Principles 2020: *Requirements for water efficiency, energy efficiency, material composition, and indoor air quality requirements]*
			6. Section 01 9100, *Commissioning*
	1. References

Codes, specifications, and standards referred to by number or title form a part of this specification to the extent required by the following references and others that may exist in this document. Use codes, specifications, and standards referenced below of the latest revision at the time of award of subcontract, unless otherwise stated below.

* + 1. 10 CFR 830.122: Nuclear Safety Management Quality Assurance Criteria
		2. ACGIH Ventilation Manual
		3. ANSI/ASSP Z9.5, Laboratory Ventilation
		4. ASHRAE 110: Method of Testing Performance of Laboratory Fume Hoods
		5. ASTM E84: Standard Test Method for Surface Burning Characteristics of Building Materials
		6. LANL LIHSM: Laboratory Industrial Hygiene Safety Manual
		7. NFPA 45: Standard on Fire Protection for Laboratories Using Chemicals
		8. NFPA 255: Standard Method of Test of Surface Burning Characteristics of Building Materials
		9. SEFA 2-2010: Scientific Equipment and Furniture Association - Recommended Practices for Installation
		10. UL 723: Test for Surface Burning Characteristics of Building Materials
	1. definitions and Acronyms
		1. Access Opening: Part of a fume hood through which work is performed; entrance; sash or face opening. Also, an opening that allows service access to components normally hidden behind obstructions, structure, or panels.
		2. ABA: Architectural Barriers Act
		3. ADA: Americans with Disabilities Act
		4. Airfoil: Curved, angular, shaped, or streamlined member at the fume hood entrance and horizontally oriented across the lower part of the fume hood access opening. Shaped to provide a smooth airflow into the fume hood interior across the work surface. Type of fume hood with streamlined members at entrance opening.
		5. ANSI: American National Standards Institute
		6. ASHRAE: American Society of Heating, Refrigerating, and Air Conditioning Engineers
		7. Baffle: Panels located across hood interior back wall which control and direct the pattern of airflow moving through the hood.
		8. Bypass: Compensating opening that functions to maintain constant volume fume hood exhaust, regardless of sash position, and limit the maximum face velocity as the sash is raised or lowered.
		9. Casework: A generic term for base and wall cabinets, display fixtures, and storage shelves. Generally, includes the tops and work surfaces.
		10. CAV: Constant Airflow Volume
		11. Certificate of Conformance: A supplier’s certification that is traceable to the shipment, the items, or materials and states that the materials conform in all respects with the purchase order requirements. This certificate is signed or otherwise authenticated by the supplier’s authorized representative. The responsible person within the manufacturing organization signs and authenticates the CoC and certifies the conformance of all items shipped to purchase-order requirements.
		12. CFR: Code of Federal Regulation
		13. CoC: Certificate of Conformance
		14. Combination Sash: A fume hood sash with a framed member that moves vertically housing two or more horizontally sliding transparent viewing panels.
		15. Damper: Device installed in a duct to control airflow volume.
		16. Duct: Round, square, or rectangular tube used to enclose moving air.
		17. Entrance: Front or access opening of fume hood.
		18. Exhaust Collar: Place where exhaust duct connects to fume hood and through which all exhaust air passes.
		19. Face Velocity: Average velocity of air moving through the fume hood entrance or access opening and perpendicular to the hood face. Usually expressed in FPM and measured at the plane of the face opening.
		20. Hood Face: The plane of minimum area at the front portion of a laboratory fume hood through which air enters when the sash(es) is (are) fully opened, usually in the same plane as the sash(es) when sash(es) are present.
		21. Horizontal Sash: A fume hood sash with typically two or more framed panels that slide horizontally across the hood opening.
		22. Make-Up Air: Air needed to replace the air taken from the room by fume hoods and other air exhausting devices.
		23. NRTL: Nationally Recognized Testing Laboratory
		24. Plenum: A chamber used to equalize airflow.
		25. Penetration Portals: Engineered penetrations in the sides of the hood, and/or in the bottom airfoil that allows for the introduction of additional and/or temporary wires, hoses, and cords into the hood interior. These portals are fitted with grommets to prevent abrasion or other damage to items inserted into the portal.
		26. Rough-In: Location for point of connection of plumbing, electrical, or mechanical services within the casework service tunnel/chase. Located within fifteen feet, or as stated by local codes, whichever is less, of the final fixture location.
		27. Sash: A moveable glazed panel or door set in the hood entrance or access opening to form a protective shield and to vary the area of the sash opening.
		28. Sash Opening: Part of the fume hood through which work is performed. The area of this opening is varied by opening or closing the sash.
		29. SEFA: Scientific Equipment and Furniture Association
		30. Service Fittings: Include oxygen, gas, air, vacuum, and steam cocks; turrets; hot, cold, and distilled water faucets; remote controlled valves; filter pumps; vacuum breakers; eyewash; showerheads; steam cones and steam baths; sinks, cup sinks, traps, and plaster traps.
		31. Service Fixtures: Include electrical convenience outlet boxes, electrical pedestals, “C” type conduits, single or duplex VAC (volt alternating current) or VDC (volt direct current) receptacles; switches, variable voltage units, incandescent bulbs, and fluorescent tubes.
		32. Service Tunnel or Chase: Area in back of or between the backs of base cabinets and under the working surfaces to allow room for service lines.
		33. SPL: Static Pressure Loss. Measurement of resistance created when air moves through a duct or hood, usually expressed in inches of water gage.
		34. Standard Hood: Similar to a Constant Airflow Volume Open Bypass Hood. Sash may be vertical, horizontal, or combination type.
		35. Superstructure: Portion of a fume hood that is supported by the work surface.
		36. UL: Underwriters Laboratories
		37. VAV: Variable Airflow Volume
		38. Vertical Sash: A fume hood sash with one or more framed panels that slide up and down/vertically across the hood opening to a height required by the operator.
		39. Workspace: That part of a fume hood interior where apparatus is set up and fumes are generated. It is normally confined to a space extending from six inches behind the sash plane to the face of the baffle and extending from the work surface up to a plane parallel with the top edge of the access opening.
		40. Work Surface: The work surface is the area inside the superstructure, from side to side and from face of baffle to the inside face of the sash.

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Edit articles below to meet project requirements associated with the fume hood. Consult with the user, OSH-ISH Ventilation SME, and the area Industrial Hygienist to ensure the correct fume hood type is specified.

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* 1. design AND PERFORMANCE REQUIREMENTS
		1. Fume hoods specifically function as ventilated, enclosed workspaces designed to capture, confine, and exhaust fumes, vapors, and particulate matter produced or generated within the enclosure.
		2. Ensure the area where the fume hoods will be installed is free of undesirable air currents (i.e., > 40 fpm vertical and horizontal cross drafts with respect to the hood face) that would adversely affect hood performance.
		3. Fume hoods should not be located adjacent to a single means of access to an exit. Recommend that hoods be located at least 10 feet from any door or doorway.
		4. Face velocities of fume hoods are established based on the toxicity or hazard of the materials used or the operations conducted within the fume hood. [Hoods will be designed to meet air flow requirements in ACFM (not SCFM) per the ACGIH Ventilation Manual 31st edition.] A categorization of fume hood types based on face velocities and materials handled is as follows:
			1. Chemical Fume Hoods for areas operating under a Hazard Communication Plan. The recommended average face velocity is 80 to 120 FPM.
			2. Chemical Fume Hoods for areas operating under a Chemical Hygiene Plan. This includes radioactive activities for which the use of a laboratory chemical fume hood is acceptable. [Used for most materials and operations at LANL facilities.] The recommended average face velocity is 80 to 120 FPM. [See ANSI/ASSP Z9.5, Section 3.3.1 (2012)]
		5. Provide fume hoods of types listed below with airfoil design to ensure maximum operating efficiency and containment. Airfoil sections at the front fascia of the hood minimize the eddying of air currents at the hood face opening while the rear baffle system minimizes turbulence in the rear and upper portion of the hood interior.
		6. Hood operates on a once through airflow mode with no air recirculation back to any operating zone. Configure the hood such that no equipment can be placed within the first six inches inside the hood or placed in a way that will create an undesirable air current.
		7. Provide fume hoods with consistent and safe airflow through the hood face. Ensure that variations of face velocity do not exceed +20% of the average face velocity at any designated measuring point for the empty hood.
		8. Assure minimal SPL via adequate baffle slot area and exhaust collar configuration.
		9. Maximum allowable variation throughout the range of baffle adjustment is +5% for exhaust CFM, static pressure, and average face velocity at any baffle position.
		10. Provide “dead man” features that would automatically return valves, controls, and switches to a safe position for those valves, controls, and switches affecting processes that could create hazards due to operator inattention or incapacitation.
		11. Ensure that the average illumination of the work surface is 80 foot-candles minimum. The work surface is defined as the area inside the superstructure, from side to side and from face of baffle to the inside face of the sash.
		12. For fume hood interior materials, use only materials with a flame spread rating of less than 25 when tested in accordance with NFPA 255 or as otherwise specified.
		13. Minimum dimensions: [Specify minimum hood interior dimensions based on project requirements and fume hood type]. Verify that the hood will pass through a standard 3 ft x 7 ft doorframe with doorstops or the smallest access way the hood will need to be moved through.

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Select the type of fume hood required for the specific project. Usually only either CAV-type hoods or VAV-type hoods will be specified for a project. Additionally, Special or Specific-Purpose Hoods (e.g., perchloric acid) need to be specified as either CAV- or VAV-type hoods. CAV non-bypass hoods are not allowed since they do not provide a limit on increases in the face velocity as the sash is lowered. Low velocity hoods (high performance) are allowed if they are used within the limitations of their listing. These types of hoods are not detailed in this template since their installation requires careful consideration and approval from OSH-ISH Ventilation SME and area Industrial Hygienist.

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* + 1. Fume Hood Types

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Constant Volume Open Bypass Hoods should only be specified when a Variable Air Volume hood is not appropriate. Some examples include Perchloric Acid hoods, single hood installations, and hoods connected to systems that have exhaust quantities that fall below the ASHRAE 90.1-2019 minimum of 5000 CFM exhaust for requiring VAV.

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* + - 1. Constant Airflow Volume Open Bypass Hood:
				1. This type of hood exhausts a constant airflow volume regardless of the sash position and will automatically bypass air above and below the sash opening as the sash is lowered.
			2. Variable Airflow Volume Restricted Bypass Hood:
				1. Hood exhaust airflow volume varies proportionally to the sash position when used with a hood face velocity controller system (supplied by others). This type of hood exhausts the maximum airflow volume when the sash is fully open and the minimum airflow volume when the sash is completely closed.

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Only select the types of hoods required for the specific project. If Special or Specific-Purpose Hoods are not needed, delete this article.

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* + 1. Special or Specific-Purpose Hoods
			1. Hoods designed for specific laboratory applications, or hoods that provide unique features.
				1. Perchloric Acid Hood: For safe handling of perchloric acid.
				2. Isotope Hood: Designed for handling radioactive isotopes.
				3. Combination Hood: Providing both a work surface and floor area in one hood.
				4. California Hood: Providing sash openings (usually horizontal) on multiple sides of the hood work surface for enclosing large or complex apparatus.
				5. Floor-Mounted Hood: Providing sash configuration openings and hood interiors that extend to the floor for enclosing large or complex apparatus.
				6. Distillation Hood: Providing extra depth and 1/3 to 1/2 height benches for enclosing tall distillation apparatus.
				7. Bench Hood: A fume hood that is located on a work surface.
		2. [Seismic Requirements]

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Depending upon the quantity and characteristics of the materials being contained and the location of the fume hood installation within the LANL facility, fume hoods must be designed to withstand a design basis earthquake.

Ensure that the fume hood and its anchorage are in accordance with applicable seismic design requirements stated in the LANL Engineering Standards Manual, Chapter 5, Structural; Section 01 8734 Seismic Qualification of Non-Structural Components (IBC) or Section 01 8712 Seismic Qualification of Equipment – Nuclear-Safety Related; and other LANL Technical Area-specific documents.

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* + - 1. [Include project-specific requirements as needed]
	1. submittals
		1. Submit in accordance with Sections 01 3300, *Submittal Procedures* and 01 7700, *Closeout Procedures*.
		2. Action Submittals
			1. Product Data
				1. Catalog or manufacturer’s data for each fume hood component and associated equipment specified. Include design features, configurations, total CFM flow capacity, component dimensions, weight, furnished accessories, standard materials, construction details, utility and service requirements, and colors for each type of fume hood.
				2. Materials/parts list
				3. Provide UL Standards for Safety listing for the fume hood superstructure.
			2. Shop Drawings
				1. Shop drawings indicating component dimensions, tolerances, equipment locations, large scale plans, elevations, ends, cross sections, mechanical/electrical rough-in and anchor placement dimensions, clearances for maintenance and operation, size and location of field connections, construction details, utility requirements, service run spaces, and materials used.
				2. Wiring diagrams
			3. Samples
				1. Hood interior lining, 6” x 6” sample.
				2. Hood enclosure of color selected, 6” x 6” sample.
				3. Work surfaces, 6” x 6” sample.
				4. Other pre-finished equipment and accessories, 6” x 6” or appropriately sized sample.
				5. Operation signs, placards, and/or instruction plates that will be attached to hood.
				6. Penetration portal sample with grommet [include only when specified].
			4. Test Reports
				1. Provide test reports on each size and type of hood verifying conformance to specified parameters and regulations. A test report accompanies each hood as part of the installation and usage package. Include performance data curves and documentation that fume hoods meet the performance requirements described in ASHRAE 110 and this section.
				2. Provide test report on operation of installed fume hood after installation.
				3. [TA-55: Refer to P840-1, “Quality Assurance for Procurements” for additional requirements.]
			5. Certifications
				1. Provide certification (CoC or other equivalent document) that the fume hood was designed and factory tested to ASHRAE 110.
		3. Informational Submittals
			1. Manufacturer’s Instructions
				1. Manufacturer’s installation and assembly instructions showing the field installation of parts, components, equipment, and other similar items.
				2. Written instructions providing details on proper operation and maintenance.
			2. At closeout: Provide certification that the fume hood has been through start-up procedures and that it is functioning properly.
	2. quality assurance
		1. Use products of a company that has:
			1. Manufactured at least 50 fume hoods of the same type and size specified. [Exceptions to this are allowed for specialty hoods when needed.]
			2. Five years or more experience in the manufacture of laboratory fume hoods, casework, and equipment of type specified.
			3. Records of manufacturing facility, testing facility, assembly, and quality control procedures available for LANL inspection.
			4. [A QA program meeting the requirements of 10 CFR 830.122.]
		2. Provide fume hoods with performance conforming to related ANSI, ASHRAE, UL, and LANL requirements specified in Article 1.2 of this Section.
	3. delivery, storage, and handling
		1. Transport, handle, store, and protect product in accordance with the requirements of Section 01 6000, *Product Requirements*.
		2. Deliver equipment to site in manufacturer’s original, unopened containers and packaging, with labels clearly indicating equipment name, part numbers, quantities, and manufacturer.
	4. WARRANTY
		1. The selected manufacturer warrants all products sold to be free from defects in material and workmanship for a period of one-year minimum, or greater as negotiated within subcontract, (beginning with date of acceptance). LANL shall provide notification to the manufacturer’s representative of any defective product and provide the manufacturer a reasonable opportunity to inspect the goods. LANL shall not return defective products without written shipping instructions and authorization from the manufacturer.
	5. COMMISSIONING
		1. Provide labor, materials, and equipment to support the commissioning process. See Section 01 9100, *Commissioning*
1. products
	1. product options and substitutions
		1. For substitutions, comply with Section 01 2500, *Substitution Procedures*.
	2. MANUFACTURERS
		1. Listed below are companies with suitable experience specializing in the design and manufacture of laboratory fume hoods. Other companies may qualify provided they have suitable experience performing similar work:
			1. Hamilton Incorporated: SafeAire II Fume Hoods [Include Model number here or on drawings.]
			2. Kewaunee Scientific Corporation: Supreme Air Fume Hoods [Include Model number here or on drawings.]
			3. Labconco Corporation: Protector Premier Laboratory Hoods [Include Model number here or on drawings.]
			4. Fisher Scientific: High Performance Bench Chemical Fume Hood [Include Model number here or on drawings.]
		2. Supply all equipment in accordance with this section. The offering of a product differing in materials and construction from this section requires written approval from LANL and must demonstrate equivalent or superior performance. Obtain alternate product approval no less than seven (7) days before the proposal deadline.
		3. LANL reserves the right to reject qualified or alternate proposals and to award based on product value where such action assures equivalent or greater integrity of product.

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Edit Article 2.3 based on the type of fume hood specified.

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* 1. Manufactured units
		1. Fume Hood Superstructure Frame:
			1. A freestanding rigid frame structure of steel angles provided to support exterior and interior liner and baffle panels.
			2. Exterior steel panels can be removed without disassembly of the frame structure and inner liner panels.
			3. Provide fume hoods of non-combustible construction.
		2. Fume Hood Interior Walls:
			1. Provide double walled ends that maximize interior working area. The area between the double walled ends houses the remote-control valves, sash counterbalance weights, electrical receptacles, and wiring.
			2. To allow for plumbing and electrical system maintenance and replacements, provide removable interior liner access panels that can be removed without disassembly of the superstructure frame and exterior steel panels.
			3. Contour the front vertical fascia section at the front leading edge to provide a streamlined hood air entrance section and ensure smooth even flow of air into the hood. The vertical fascia houses the required service controls, electrical switches, and receptacles.
			4. Provide hood interior end panels and sash track flush with the fascia to prevent eddy currents and back flow of air.
		3. Fume Hood Exteriors:
			1. Construct from cold rolled steel with component parts screwed together to allow removal of the end panels, front end and top fascia pieces, and airfoil strips for replacement or to afford access to the plumbing lines, service fittings, and electrical components.
			2. Weld spacers or reinforcements to the exterior parts as required.
		4. Fume Hood Finish:
			1. Pre-treat steel component parts after welding/fabrication, but before final assembly, to provide a uniform fine-grained crystalline phosphate surface that will enhance both the final finish bond and final finish resistance to humidity, corrosion, and corrosive chemicals.
			2. Physically and chemically clean the steel by degreasing and washing with an alkaline cleaner, then follow with a complete metallic phosphate solution spray treatment. After the phosphate treatment, completely dry the steel.
			3. Apply a corrosion-resistant primer base coat using an electro-deposition dip procedure to guarantee complete paint coverage. Powder-coat or solvent-based spray paints are unacceptable for the initial base paint coat. Cure the coating by baking at elevated temperatures to provide maximum properties of corrosion and wear resistance.
			4. Provide an acid, alkali, and solvent resistant final topcoat finish on both exterior and interior surfaces of all parts.
		5. Fume Hood Airfoil:
			1. Provide an integral airfoil, streamlined similar to the sides, at the bottom of the hood opening. Provide a nominal 1” open space between the airfoil and the top front edge of the work surface to direct an airflow stream across the work surface, to prevent the back flow of air, and to purge the work surface airspace of contaminants. Extend the airfoil back under the sash, so that the sash does not close the 1-inch opening.
			2. Fabricate the airfoil from 12-gauge-minimum steel to provide rigidity and to resist denting and flexing.
			3. For floor-mounted fume hoods, provide 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.
		6. Fume Hood Top Panel:
			1. The top front panel of the hood may have an integral 1/4” thick laminated safety float glass or polycarbonate vision panel [choose one] located directly above the sash opening and in such a manner as to allow viewing the top interior portion of the hood without having the operator stoop or place their face inside the hood.
			2. For Constant Airflow Volume Open Bypass Hoods:
				1. Provide an integral grille that will bypass airflow at the top of the sash opening. The bypass will operate passively and will not rely on mechanical or electrical means to perform its function.

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Baffles may be fixed or adjustable depending on system specification and intended application. Consult with the user and the area Industrial Hygienist to determine the type of baffle needed. If adjustable baffles are needed, then direct or remote operation will need to be defined.

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* + 1. Fume Hood Baffles:
			1. Provide a baffle system with three horizontal slots designed to facilitate airflow distribution through the hood. Position horizontal slots at the low, mid, and upper sections of the hood interior back wall.
			2. Provide baffles made of the same material as the fume hood liner.
			3. Provide removable baffles to facilitate cleaning.

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Select one of the following types of baffles.

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* + - 1. Fixed Baffle: Provide acid-resistant labeling indicating the specific contaminant properties that the baffle system is configured for (i.e., lighter than air or heavier than air gases or fumes, high heat generation processes, or general conditions).
			2. Adjustable Baffle: Provide adjustability that will accommodate the airflow management requirements for various contaminant properties. As a minimum, provide adjustability for the top and bottom slots. Provide acid-resistant labeling indicating proper baffle adjustment position for various contaminant properties.
			3. Remote Adjustable Baffle: Provide adjustability that will accommodate the airflow management requirements for various contaminant properties. As a minimum, provide adjustability for the top and bottom slots. Provide a single-point remote baffle adjustment device that will allow convenient and prompt adjustment from either the hood exterior or from no further than 6” into the hood. Locate the baffle adjustment device such that it will not require the entry of the operator’s head into the hood and so that it will be accessible by both able bodied and wheelchair bound operators. Provide acid-resistant labeling indicating proper baffle adjustment position for various contaminant properties.
		1. Fume Hood Duct Collar:
			1. Provide polyethylene or stainless-steel bell-mouthed duct collar(s) located in the hood plenum chamber. [Always provide stainless steel duct collars for fume hoods with stainless steel liners.]

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* LED luminaires shall be provided for all fume hoods unless fluorescent luminaires or incandescent luminaires are needed for a specific reason. Verify with the user if specific light quality is required for an application. The only exception to this is perchloric acid fume hoods which require the use of vapor proof incandescent luminaires. Fume hoods installed in an explosives area may also require the use of explosion-proof luminaires. \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

* + 1. Fume Hood Lighting:
			1. Fluorescent Luminaires:
				1. Ensure that all fixtures are NRTL listed.
				2. Provide fluorescent lights with [T-8][T-5] bulbs.
				3. Provide electronic ballast for fluorescent luminaires.
				4. Isolate the fluorescent luminaires from the hood interior by a 1/4” thick tempered glass, safety glass, or polycarbonate [choose one] panel sealed from the hood cavity. Ensure that bulb replacement is accomplished from the hood exterior only.
				5. Provide luminaires in the top of the hood. Locate lighting power switch so that it is operable by both able bodied and wheelchair operators. The minimum illumination at the work surface is to be 80 foot-candles.
				6. Provide explosion proof luminaires where required.
				7. Provide Vapor-proof luminaires where required.

* + - 1. LED Luminaires:
				1. Ensure that all fixtures are NRTL listed.
				2. Provide luminaires in the top of the hood. Locate lighting power switch so that it is operable by both able bodied and wheelchair operators. The minimum illumination at the work surface is to be 80 foot-candles.
				3. Provide explosion proof luminaires where required
				4. Provide Vapor-proof luminaires where required.
			2. Incandescent Luminaires:
				1. Ensure that all fixtures are UL approved and labeled.
				2. Provide incandescent luminaires with vapor proof lamps and shatterproof globes.
				3. Provide incandescent luminaires in the top of the hood. Locate lighting power switch so that it is operable by both able bodied and wheelchair operators. The minimum illumination of the work surface is to be 80 foot-candles.
				4. Provide explosion proof lighting where required.
		1. Fume Hood Sash
			1. Provide a vertical, horizontal, or combination sash as specified.
			2. Produce sash frame from 18-gauge steel with mitered and welded corners ground smooth to provide a complete unit with no visible joints. Use replaceable plastic guides for the sash frames that will operate in stainless steel sash guides to prevent metal-to-metal contact.
			3. Provide sash tracks set flush with the interior liner panels to minimize turbulence.
			4. Produce the sash glass from 1/4” laminated safety float glass or polycarbonate panels. [Use polycarbonate panels on fume hoods used for hydrofluoric acid operations or for other operations where this is a better choice than glass.]
			5. Set glass/polycarbonate panels into deep form extruded polyvinyl chloride, or equivalent, channels internally interlocked with the outer member sealing and retaining the glazing.
			6. Provide rubber bumper stops for the sash to open and close against.
			7. Counterbalance System:
				1. Counterbalance up/down moving (vertical or combination) sashes with a weight and cable/chain system designed to prevent sash tilting and binding during operation. Permit one finger operation at any point on the sash pull.
				2. Ensure that the system will hold the sash at any position without creep and will prevent sash drop in the event of cable/chain failure.
				3. Provide stainless steel sash cables operating on ball bearing pulleys/sheaves. Provide stainless steel sash chains operating on ball bearing sprockets.
				4. Do not use spring type counterbalances.
		2. Fume Hood Plumbing Services
			1. Provide all plumbing fittings factory installed and piped between the valve, outlet, and service inlet. Provide inlet piping with a labeled single-point connection located on the hood exterior for each valve and route to a point that will best suit rough-in locations shown on the design drawings.
			2. Provide remote controlled valves, as selected, located within the end panels and actuated by chrome plated or plastic [choose one] 4-armed handles attached to brass extension rods that project through control panels located in the hood vertical fascias. Furnish the valve handles with color-coded and labeled service indicators.
			3. Locate all services so that they are reachable by both able bodied and wheelchair bound operators.
			4. For interior fittings supplying gases and water, provide nylon panel flanges and nylon angle serrated hose connectors, color-coded to match services. For distilled water interior fittings, provide tin lined bronze panel flanges and angle serrated hose connectors with white color-coding. For steam interior fittings, provide cast bronze flanges and angle serrated hose connectors with a chemical resistant metallic bronze finish. Provide water goosenecks in cast bronze with a chemical resistant metallic bronze finish.
		3. Fume Hood Electrical Services
			1. Pre-wire the hood superstructure and provide a UL label certifying acceptable wire gauge, connections, fixtures, and wire color coding.
			2. Provide 120 V, specification grade, 20-amp, duplex GFCI receptacles mounted on the vertical fascia. [Additional requirements may apply if outlets are to be located within the interior of the fume hood.]
			3. Locate all frequently operated services so that they are reachable by both able bodied and wheelchair bound operators.

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* Delete this paragraph if an Isotope Hood or a Perchloric Acid Hood is specified since the work surface is an integral part of the hood interior for those types of hoods.

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* + 1. Hood Work Surface
			1. Epoxy Resin:
				1. Use molded epoxy resin made in the form of a watertight pan of 3/8” minimum depth with a 6” wide safety ledge across the front edge.
				2. When water service is supplied, provide a cup drain flush with the recessed portion of the work surface.
			2. Stainless Steel:
				1. Use 14-gauge, type 304 stainless steel with a No. 4 finish made in the form of a watertight pan of 1/2” minimum depth with a 6” wide safety ledge across the front edge.
				2. When water service is supplied, provide a cup drain flush with the recessed portion of the work surface.
				3. Reinforce to support a uniform loading of 200 pounds per square foot (psf) minimum.

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* Choose the type of liner based on the specific requirements of the project. For most applications, the Epoxy Resin liner should be used. The Cement Board liner is only to be specified when it is the only acceptable material from a chemical compatibility standpoint. If a stainless steel liner is needed, look at specifying an Isotope Hood since this type of fume hood has coved corners to make it easier to clean. Delete this article if an Isotope Hood or a Perchloric Acid Hood is specified since the liner is an integral part of the hood interior for those types of hoods.

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* + 1. Fume Hood Liners
			1. Epoxy Resin:
				1. Use 1/4” thick sheets with maximum flame spread of 6.2 per ASTM E84.
				2. Fasten epoxy resin liner panels using stainless steel screws with plastic covered heads.
				3. Fiberglass reinforced plastics or polyesters are not acceptable substitute liner materials for epoxy resin.
			2. Reinforced Polyester Lining:
				1. Use 1/4” thick fiberglass reinforced polyester sheet with smooth finish, maximum flame spread of 15 per UL 723 and ASTM E84.
				2. Fasten reinforced polyester liner panels using stainless steel screws with plastic covered heads.
			3. Cement Board:
				1. Use 1/4" thick, dense, monolithic sheet with a chemically resistant, inorganic, non-asbestos mixture of fiber cement. Maximum flame spread of 0 per ASTM E84.
				2. Coat surfaces exposed to the hood interior with a white epoxy finish.
				3. Fasten cement board liner panels using non-corrosive fasteners.
			4. Reinforced Phenolic Resin:
				1. Use 1/4” thick sheet made from a compression molded cellulose fiber reinforced phenolic resin core with integrally cured melamine surfaces.
				2. Fasten reinforced phenolic resin liner panels using stainless steel screws with plastic covered heads.
			5. Stainless Steel
				1. 16-gauge, type 304 stainless steel with a No. 4 finish fastened in place with stainless steel screws.

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* Airflow Indicators are only to be specified for CAV-type fume hoods. VAV-type fume hoods will have a face velocity indicator provided by the fume hood controls vendor. Only specify a fume hood manufacturer’s face velocity indicating device after all the limitations of that device have been evaluated and deemed acceptable. Consult with the Industrial Hygiene Ventilation SME for additional information. For most fume hood installations, a pressure differential gage (e.g., Magnehelic gage with the appropriate range) measuring the static pressure in the exhaust duct just downstream of the fume hood connection but upstream of the first damper is sufficient. See LANL Standard [Drawings and Details](http://engstandards.lanl.gov/Dwgs_Details.shtml#mechanical), ST-D3040-1 for details. When additional visual (light) and/or audible alarms are needed, then a Photohelic gage can be used as basis of the monitoring alarm. These types of gages need to be specified in the system design, not here in the fume hood section. \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

* + 1. Fume Hood Monitors and Alarms
			1. Provide a safety monitoring and alarm system that monitors:
				1. Hood face velocity and provides audible and visual alarms when face velocity drops below or rises above OSH-ISH specified face velocities. [See LIHSM Chapter 39.]
				2. The audible alarm is mutable via a panel mounted manually operated switch that is accessible by both able bodied and wheelchair bound operators. The visual alarm continues to flash as long as the alarm condition exists.
		2. Fume Hood Special Requirements [Include any special requirements not specified elsewhere in this section. Examples: 1) Penetration portals needed through the side panels or through the bottom airfoil of the hood. Specify the number, location, size, and if closures are needed, etc. Be sure to provide openings with grommets to protect cords and hoses from abrasion. 2) Sliding Safety Shield. Specify material, thickness, etc. This type of shield is usually specified for hoods used for highly energetic processes (e.g., explosives and other dynamic operations)]

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* Delete this paragraph unless a perchloric acid hood is required. Consult with the area Industrial Hygienist and NFPA 45 for guidance.

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* + 1. Perchloric Acid Hoods
			1. A fume hood equipped with wash down washers, integral work surfaces, coved corners, and non-organic lining materials.
			2. Fabricate hood interior lining, including end panel and back panel, from 16-gauge, type 316 stainless steel with a No. 4 finish. Fabricate the inside back and end panels in a seamless, welded, wrap around design that is welded to the work surface. Fabricate all vertical and horizontal corners and seamless joints between inside back, end panels, and work surfaces with 1/2” internal radius. Grind all welds flush and blend to a No. 4 finish. Reinforce the entire stainless steel hood interior to provide a completely rigid, welded together, self-supporting assembly. Provide the hood end liners without access openings.
			3. Fabricate hood work surface from 14-gauge, type 316 stainless steel with a No. 4 finish in the form of a watertight pan 1/2” deep with a 6” wide safety ledge at the front edge and an integral, continuous trough sink across the full width at the back of the work surface. Provide, within the trough sink, two 1-1/2” waste outlets to drain wash down system water. Reinforce the work surface to support a uniform maximum loading of 200 pounds per square foot.
			4. Fabricate baffles and top panel from 16-gauge type 316 stainless steel with a No. 4 finish. Fasten the baffle to the hood interior with stainless steel screws. Provide easily removable baffles to facilitate cleaning of the baffles and the area behind the baffles.
			5. Provide a wash down system that includes a remote-controlled perforated spray pipe to wash down rear surface of the hood interior behind the baffles and a remote-controlled water fitting.
			6. Provide the hood with a label stating “For Perchloric Acid Operations Only” affixed to the front of the fume hood above the sash opening.

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* Delete this paragraph unless an isotope hood is needed. An isotope hood should be considered for any operation that requires the hood interior to be easily cleaned.

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* + 1. Isotope Hoods
			1. A fume hood with integral work surface, coved corners, linings impermeable to radioactive materials, and structure reinforced to support lead shielding bricks.
			2. Provide interior construction that prevents radioactive material buildup and allows complete cleaning.
			3. Fabricate hood interior lining, including end panel and back panel, from 14-gauge, type 304 or 316 stainless steel with a No. 4 finish. Fabricate the inside back and end panels in a seamless, welded, wrap around design that is welded to the work surface. Fabricate all vertical and horizontal corners and seamless joints between inside back, end panels, and work surfaces with 1/2” internal radius. Grind all welds flush and blend to a No. 4 finish. Reinforce the entire stainless steel hood interior to provide a completely rigid, welded together, self-supporting assembly. Provide the hood end liners without access openings.
			4. Fabricate hood work surface from 14-gauge, type 304 or 316 stainless steel with a No. 4 finish in the form of a watertight pan 1/2” deep with a 6” wide safety ledge at the front edge. Reinforce the work surface to support a uniform maximum loading of 200 pounds per square foot.
			5. When water service is supplied, provide a cup drain flush with the recessed portion of the work surface.
			6. Fabricate baffles and top panel from 16-gauge, type 304 or 316 stainless steel with a No. 4 finish. Fasten the baffle to the hood interior with stainless steel screws. Provide easily removable baffles to facilitate cleaning of the baffles and the area behind the baffles.
	1. source quality control
		1. Containment Performance Testing
			1. Purpose: To pre-qualify the performance of the bidder’s laboratory fume hood before award of subcontract or before acceptance of the hood after award of subcontract.
			2. Test Method
				1. Conduct pre-qualification testing of fume hoods per ASHRAE 110 at the bidder’s fume hood test facility. Conduct tests in the ASHRAE defined as-manufactured (AM) mode by personnel cognizant of the recommended test procedures. Refer to ASHRAE 110 for specific requirements, procedures, and qualification criteria.
				2. Use the following tests to judge the performance of the fume hood:

Face Velocity Test

Flow Visualization Test

Large Volume Flow Test

Tracer Gas Test

Sash Movement Test

1. execution
	1. examination
		1. Certify to LANL that building conditions are conducive to the installation of a finished goods product, including all critical dimensions.
		2. Inspect areas and conditions, with installer present, for compliance with requirements for installation tolerances and other conditions affecting the performance of the fume hood.
		3. Inspect utility rough-ins to verify actual locations of connections prior to beginning installation.
		4. Check and verify that no irregularities exist that would affect quality of execution of work specified.
		5. Formally notify LANL in writing if existing conditions will affect acceptable results.
	2. INSTALLATION
		1. Reference SEFA 2-2010 for fume hood installation information and guidelines.
		2. Arrange installation of fume hoods to provide access space for service and maintenance.
		3. Coordinate work with the schedule and requirements of other work being performed in the area at the same time, both with regard to mechanical and electrical connections to and in the fume hoods and the general construction work.
		4. Assemble and install fume hoods in accordance with approved shop drawings and manufacturer’s installation instructions. Ensure that fume hood assembly and installation are performed by or supervised by fume hood manufacturer personnel.
		5. Install fume hoods, plumb, level, square, with no distortion, and securely anchored to building and adjacent furniture in proper location.
		6. Install fume hood equipment to provide maximum safety and continuity of operation in the event of seismic activity per requirements defined in Paragraph 1.4.P [Seismic Requirements].
		7. Secure work surfaces to casework and equipment components with material and procedures recommended by the manufacturer.
		8. Install accessories and fittings in accordance with manufacturer’s recommendations.
	3. FIELD QUALITY CONTROL
		1. Site Tests, Inspection
			1. Arrange for a factory authorized service representative to inspect the field assembly and installation of the fume hoods, including piping, ductwork, and electrical connections; and to prepare a written report on findings with recommended corrective actions.
			2. Conduct as-installed (AI) testing of fume hoods at LANL per ASHRAE 110. Perform tests in field to verify proper operation of the fume hood before placing into service. Perform tests only after installation is complete, the building make-up air system is in operation, the building ventilation system has been balanced, all connections have been made, the doors and windows are in normal operating position, all other hoods and exhaust devices are operating at designed conditions, and written verification has been submitted that the aforementioned conditions have been met.
			3. Modifications to the hood, placement of new large equipment, or equipment that creates heat or mechanical air disturbances that would alter the airflow characteristics within the hood require retesting for confinement capability before the hood is placed in service.
			4. Correct any discrepancies, errant processes, or unsafe conditions disclosed by these tests before request of test procedures.
			5. Project substantial completion shall be withheld until all required fume hood certification letters, tests, and reports have been submitted and approved.
		2. Manufacturers’ Field Services
			1. Ensure that the fume hood manufacturer (or approved designated alternate) field tests 100% of the installed units per ASHRAE 110 to a control level of Al 0.01 ppm or better.
	4. ADJUSTING
		1. Adjust sash, baffles, fixtures, accessories, and other moving or operating parts for proper function and operation.
		2. Repair or remove and replace defective work as directed by LANL.
		3. Reference Section 01 7700, *Closeout Procedures*, for additional detail.
	5. cleaning
		1. Remove all debris, dirt, packing materials, and rubbish accumulated as a result of the installation of the fume hoods to an on-site container provided by LANL or others, leaving the premises clean and orderly.
		2. Clean fume hood interior and exterior to remove foreign material and construction dirt.
		3. Reference Section 01 7700, *Closeout Procedures* for additional detail.
	6. demonstration
		1. Provide written and oral instructions that detail proper operation and maintenance.
		2. Reference Section 01 7700, *Closeout Procedures* for additional detail.
	7. PROTECTION
		1. Provide necessary protective measures to prevent casework and equipment from being exposed to and damaged from other construction activity.
		2. Advise LANL of procedures and precautions for protection of material, installed laboratory casework, and fixtures from damage by work of other trades.

end of section

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Do not delete the following reference information.

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THE FOLLOWING STATEMENT IS FOR LANL USE ONLY

This project specification section is based on LANL Master Specification 23 3816 Rev. 3, dated April 30, 2024.