FUME HOODS, BSCS, SPECIALTY HOODS AND ACID/FLAMMABLE CABINETS

Scope

Laboratory chemical fume hoods, biological safety cabinets (BSC), HEPA filtered laminar flow clean benches, hybrid hoods, acid and solvent chemical storage cabinets.

Related Sections

U-M Design Guidelines Sections
12345 - Laboratory Casework
15060 - Basic Pipe and Pipe Fittings
15910 - Laboratory Ventilation

U-M Master Specification Sections
11610 - Laboratory Chemical Fume Hoods
12345 - Laboratory Casework
15910 - Laboratory Terminal Air Flow Units and Controls

General

Incorporate the requirements of this section taken together with the requirements of Design Guideline 15910, Laboratory Ventilation.

Use U-M Master Specification Section 11610 Laboratory Chemical Fume Hoods as the basis for chemical fume hood specification on all U-M projects. Specification defines fume hood types in terms of face velocity characteristics. Use these definitions when specifying fume hoods and designing fume hood exhaust systems at U-M. Specification has been customized to include many of the Design Guideline requirements. For ease of identification, requirements identified in this document by gray highlighting are already incorporated in the specification. Note that the specification does not include BSCs or any specialty hoods (e.g. perchloric acid, hybrid hoods, etc.).

Edit U-M Master Specification Section 11610 to make it project specific. Extensive editor's notes are included in the specification to assist the A/E. Be sure to turn on hidden text and read those notes.

Fume Hood Design Requirements

Selection and Design

Selection:

- Select hoods in close consultation with the Project Mechanical Engineer, Design Manager and the University's Department of Occupational Safety and Environmental Health (U-M OSEH).
- Complete thorough programming effort with hood users and OSEH to determine the types of work being conducted in the fume hood, the experience of the users, the materials which will be used in the hoods, and any special requirements for the hoods.
- Consider impact on mechanical requirements.
- Select hood size and type to conserve energy. Specify the narrowest width which properly accommodates user needs. When selecting a hood type evaluate hood air volume usage in conjunction with required lab air change rates.
- Evaluate hood density. Densities above three hoods per 5000 net square feet of lab shall be justified. Consider alternatives such as snorkels and chemical storage cabinets.

Performance: Comply with the requirements of ASHRAE Standard 110-95 As Manufactured, and relevant portions of NFPA 45. U-M Master Specification Section 11610 describes the specific ASHRAE 110 performance criteria required for fume hoods used at U-M.

Location: Follow the general recommendations in the National Institutes of Health publication *Methodology for Optimization of Laboratory Hood Containment.* In addition:

- Locate hoods away from excessive traffic, cross drafts and air turbulence from windows, doors, or diffusers.
- Locate hoods such that fire, explosion or toxic material escaping the hood would not cross the immediate path of room egress.
- Perform computational fluid dynamics analysis when hood proximity or density may affect the successful operation of the hoods.

Types

Hood Types: Clearly delineate the hood types required for the project, either in the hood specification or on the drawings (preferred).

- Constant Volume: Partial bypass type are appropriate in most circumstances. Full bypass type are high energy users but may be appropriate in certain applications with U-M OSEH approval.

- Variable Air Volume (VAV) Hoods: Specify VAV hoods if energy analysis proves energy savings. Always specify VAV hoods for combination sashes. For all applications utilizing VAV hoods, specify the corresponding VAV type lab terminal air flow unit control.

- Reduced Face Velocity Hoods: RFV hoods, as defined at U-M, are those that U-M has approved to operate at a reduced average face velocity, currently 70 FPM. They are used to save energy while providing equivalent capture to a conventional hood. U-M has developed specific performance requirements for these type hoods, along with a list of approved RFV fume hood models/manufacturers. The following also applies to RFV hoods:
    - Do not vary from the approved list of manufacturers or models.
    - Do not modify the RFV hood performance criteria.
    - Maximum hood width: 6' nominal.
    - Maximum over-all hood depth: not to exceed 36".
    - Minimum ceiling height in room: 8.5'
    - Use only "bench-top" style hoods, not floor model, perchloric acid, or radioisotope hoods.
    - Balance to provide 70 FPM average face velocity and alarm at 60 FPM face velocity. Clearly indicate air balance information in the mechanical documents.

- Bench-top hood: Designed to rest atop a counter or base cabinet, usually about 36" above the finished floor. Consider accessibility requirements when specifying height and configuration.

- Floor model hood: Used where taller apparatus is required or equipment is to be rolled into the hood. Floor model hoods shall provide a minimum of 78" of working height.

- Radioisotope (RI) hood: Most low-level radioisotope work can be carried out in standard fume hoods. Therefore, if radioisotopes are to be used, consult with U-M OSEH to determine which type of hood to specify.

Sash Type

Clearly delineate the hood sash type for each fume hood, either in the hood specification or on the drawings (preferred).

- Vertical rising sash: Appropriate in most circumstances.

- Combination sash: Specify when justified by the type of hood use. Constant volume hoods of any type are not safe with combination sash arrangements because correct face velocity can't be assured as the horizontal sash is adjusted. Always specify with restricted bypass VAV hoods.

Sash Stops

Specify all fume hoods with integral sash stops. Add-on stops are not acceptable.

Height for sash stops: 14" from the work surface, with a minimum clear opening height of 12" above the airfoil. For airfoils of unconventional design, adjust the location of the sash stop to maintain the 12" clear opening height.

Equip all hoods with sash alarms.

Work Surfaces

Solid Cast Epoxy Resin: Typically specify solid cast epoxy resin tops.

Stainless Steel: Specify for specialty applications only, typically RI and perchloric acid hoods.

Linings

Specify linings to meet requirements of NFPA 45, paragraph 9-1.1 (flame spread less than 25). The following are possible choices:

- Fiberglass-Reinforced Polyester Resin Panels (FRP): Typically specify FRP. Note that FRP has limited chemical and heat resistance. Stainless Steel: Provides higher heat resistance than FRP but decreased chemical resistance. Specify only in RI hoods, perchloric acid hoods and when high heat resistance is required.

- Others: Other materials are available from some manufacturers, providing increased chemical resistance. Due to minimal thickness required by application, verify that alternate materials are properly reinforced against breakage during transport and use. Review material advantages and cost/benefit ratio compared with the typical choices listed above.

Baffles

- Fixed baffles: Specify for fume hoods in teaching labs or other locations where users may be unfamiliar with fume hood operation.

- Adjustable baffles: Typically specify for research laboratories.

Controls and Alarms

Chemical fume hood controls and alarms are specified in U-M Master Specification 15910 Laboratory Terminal Air Flow Units and Controls. Chemical fume hood controls, including low exhaust flow and sash alarms, are to be provided and installed by the laboratory air flow controls contractor under section 15910, not the fume hood manufacturer. The fume hood manufacturer provides cut-outs for the low exhaust air flow alarm and makes provisions to allow mounting of sash sensors, sash alarm, and other devices provided by the laboratory air flow controls contractor.

Mechanical Service Fittings

Mechanical service fittings for non-specialty fluids and gases (domestic water, compressed air, natural gas, etc.) used in chemical fume hoods are specified in U-M Master Specification Section 11610 Laboratory Chemical Fume Hoods. Specify factory piped units whenever possible. Piping within the fume hood shall match materials in Division 15 Mechanical Specifications.

If RO or DI water service fixtures are required, edit 11610 to include a specification for these fixtures. Specify plastic materials (PP, PVDF, etc.) and a fixture design (dead-end or re-circulating) compatible with the purity requirements of the distribution system supplying the fixture.

If other specialty fluids or gases are required (e.g. medical gases), specify compatible fixtures and fabrication techniques. The related Division 15 mechanical specification should always be referenced in such cases.

Cupsinks may be either side-mounted or mounted in the work surface (with a raised rim), depending on user needs. Coordinate location of sinks mounted in the work surface with raised rims around the perimeter of the work surface.

Electrical

Specify ground fault circuit interrupter receptacles in fume hoods and within 6 feet of fume hoods which contain sinks.

Hoods require a circuit for the hood lighting and outlets and another, separate circuit if the hood is to be equipped with an air flow monitor or similar control. These separate circuits must be indicated on the electrical drawings.

Additional Superstructure Components

Consider the following components where appropriate:

- Enclosure Panels: Where the gap between suspended ceiling and top of fume hood will expose ductwork and equipment, consider specifying removable enclosure panels to conceal dead space and neaten appearance. However, rooms without suspended ceilings rarely benefit from enclosure panels.

- Floor Model Hoods: Specify either a stainless steel or epoxy resin floor constructed so as to retain spills, but tapered to facilitate ease of move-in for roll-in items.

Base Unit Design Requirements

Coordinate the specification of base cabinets with fume hoods for size, depth and finish match. Specify products from a single distributer to facilitate construction coordination.

Typically specify both a flammable/solvent and a corrosives storage base cabinet, each equal to half the length of the hood. Where standard cabinet lengths make this impossible, or where special storage requirements dictate additional storage capacity, locate supplemental storage units elsewhere in the laboratory. Do not locate supplemental flammable/solvent storage cabinets next to the hood superstructure. Specify either wood or metal:

Corrosives Storage Units: Specify units vented directly to the fume hood exhaust duct, not the hood exhaust chamber. Provide a detail on the architectural/lab planning and the mechanical drawings. Specify polyethylene lining with coved corners.

Flammable/Solvent Liquid Storage Units: Do not vent. If the client requests venting, review with Design Manager and U-M OSEH.

Review potential conflicts between flammable storage base cabinets and cupsinks. Not all manufacturers have resolved this conflict for their standard cupsink sizes and locations. Avoid placing cupsinks over flammable storage base cabinets. Non-standard placement or non-standard size of cupsinks may also cause problems.

Biological Safety Cabinets, Laminar Flow Clean Benches, Hybrid Hoods

Before specifying, verify with the Design Manager that they are to be included as part of the fixed construction. Select the type, size and class of these units in conjunction with the Design Manager and U-M OSEH representative.

If an exhaust connection is required to a Biological Safety Cabinets, verify with U-M OSEH the type required, direct or thimble connect. Connection are typically made via an indirect, hood mfg. provided, thimble (canopy) connection.

For BSCs, provide a minimum of 12" clearance on each side of the cabinet and between the top of cabinet and the ceiling, to allow service and testing. Provide an electrical outlet for the BSC power plug in a location that allows unplugging without moving the BSC (mount the outlet on a wall or casework to the left or right of the BSC or in the leg space below the BSC).

<u>Performance and Testing: Fume Hoods/BSCs/Clean Benches/Hybrid Hoods</u>

Laboratory chemical fume hoods:

- Typically specify to meet the As Manufactured (AM) ASHRAE 110 performance requirements found in U-M Master Specification 11610 Laboratory Chemical Fume Hoods. Performance requirements for both standard (those operating at 100 fpm average face velocity) and RFV hoods are provided in 11610. These performance requirements may be inadequate for hoods which are to be used for extraordinary purposes, such as those involving highly toxic chemicals, high production volumes, or high-hazard radioactive materials. In such cases, the Design Manager and U-M OSEH shall provide direction regarding alternative AM or As Used (AU) testing.

- In some locations, additional As Installed (AI) testing may be required for a certain percentage of fume hoods. This is most likely to occur in new research buildings or areas with a high density of hoods. The Design Manager and U-M OSEH will provide direction regarding whether AI testing is required and, if so, the quantity and type to be tested. Indicate the hood quantities and types to be AI tested in the design documents.

Biological safety cabinets, laminar flow clean benches and hybrid hoods:

- Provide performance criteria for within the specification sections. When a function of these devices is to provide *personnel protection*, performance requirements *for capture* should typically match U-M's 11610 performance requirements for standard chemical fume hoods.