LABORATORY FUME HOOD SPECIFICATIONS

A. GENERAL DESCRIPTION

All new hoods shall meet testing criteria established by the American Society of Heating, Refrigerating, and Air Conditioning Engineers, Inc. (ASHRAE) in ANSI/ASHRAE 110-1995, “Method of Testing Performance of laboratory Fume Hoods.” All laboratory fume hoods (i.e. standard, bench, distillation, walk-in) shall have proper aerodynamic design to minimize eddy currents and assure against air movement from the hood into the laboratory. The design shall include airfoil sides and an aerodynamic sill with a 1-inch air gap between the sill and the hood floor. An “air by-pass” shall be present on all hoods to control the range of the face velocity as the hood sash is raised and lowered. The face velocity at any sash position should never exceed three times the “open face” velocity. It is necessary to keep the air velocities within this range to reduce eddy currents around the edges of the hood face.

B. LOCATION

All new fume hoods shall be an integral part of the laboratory design and all laboratory renovations shall also rectify improper hood locations.

Fume hoods shall be located in a room so that air currents generated in the room will not interfere with the hood’s ability to capture and eliminate vapors, mists, and airborne particles. Therefore, hoods shall be located as far away as possible from:

1. Doors
2. Supply air diffusers
3. Windows which can be opened
4. Heavy traffic areas
5. Other location exhaust ventilation devices

Room air current velocities at the face of the hood should not exceed twenty linear feet per minute (LFM) from any source and should be as close to zero as practicable.

C. HOOD DESIGN AND CONSTRUCTION

In general, all fume hoods should be constructed and contain materials that will permit their planned use to be carried out safely; therefore, their intended use must be known.

Sides

Hood sidewalls shall be 3 ½ - 6 ½ inches wide, and shall be properly formed to present a smooth airfoil to the inflowing air. The hood interior lining shall be flush with the sides. These features shall, over the range of the hood’s designed air face velocity, prevent significant eddy currents from circulating air from inside the hood through the plane of the face of the hood.

Sill

A radiused stainless steel sill is required. It shall be installed at the bottom of the hood opening and extend back under the sash. An open area of approximately 1 inch shall be present under the sill to direct air across the work surface at all sash positions.

Sash

The sash may be vertically or horizontally tracked. Horizontal sash hoods shall have a device to lock the sash in its tracks. Removal of the sash must only be possible with special tools or keys. Glass used in the sash shall be at least 7/32 inches thick combination sheet. The sash shall be securely enclosed in a complete frame, welded and ground smooth at the corners. Stainless steel or a baked-on epoxy coat is to be used for the sash frame. Vertical sashes shall be counter-balanced with sash weights, suspended from each side of the sash and shall be easily operated. The sash frame must be held in a stainless steel track and have plastic guides.
**Interior**

The interior lining of the hood must be resistant to the materials and chemicals to which it will be exposed. Stainless steel is acceptable; suitable compositions, including transite, must be painted or coated with impervious sealer such as epoxy paint. The selection of resistant materials must be made through consultation with the Rutgers Environmental Health and Safety Department (REHS).

Use of perchloric acid, hydrofluoric acid, and radioisotopes require special consideration as detailed in those sections.

**Exterior**

Cold rolled steel shall be used for the hood exterior. All parts shall be joined together with screws to allow for dismantling and access for service. After fabrication and before final assembly, all component parts shall be given an acid, alkali and solvent resistant finish on both exterior and interior surfaces.

**Frame**

A full rigid frame shall support the interior and exterior walls of the fume hood.

**Working Surface**

The working surface shall be molded epoxy or stainless steel. It shall be recessed not less than ¼ inch deep and have a raised area on all sides. The raised area across the front of the hood shall be at least three inches wide.

**Hood Fixtures and Services**

The user shall specify utility service needs. Electric service shall be located on the exterior of the hood. Plumbing fixtures shall be brass, chrome-plated, or acid and organic vapor resistant plastic. All fixtures shall have color-coded end caps. All controls for plumbing services shall be located on the hood exterior.

**Lighting**

Hoods shall be equipped with sufficient fluorescent or incandescent lighting. The light fixture shall be easily accessible from the outside of the hood, shall be shielded from the hood interior by a laminated or tempered glass panel, and shall be vapor sealed.

**Air By-Pass Mechanism**

All hoods shall be equipped with an air by-pass mechanism located above the hood face opening. It shall provide an effective sight-tight barrier between the user and the hood interior. By-pass louvers shall be directed upward away from the front of the hood and provide an effective barrier and deflector for flying debris from inside the hood. The by-pass shall control the face velocity as the sash is lowered. The velocity of the air at any sash position shall never exceed three times the open face velocity. The air by-pass shall begin to operate when the sash is one-third to one-half closed.

**Plenum and Slot Arrangement**

A plenum shall be located in the rear of all fume hoods. It must have at least two but no more than three slots. The lower slot shall be furnished at the working surface level and be locked at 2 to 2 ½ inches or have the baffle removed entirely. The upper slot shall be located in the upper section of the hood. The opening shall be set at 3/8 to ½ inch maximum. A middle slot, if furnished, shall be fixed and have an opening no greater than 2 inches.
D. EXHAUST MOTORS

Exhaust motors and duct systems for hoods are to be sized and designed to provide an average hood face velocity of 80-100 LFM, as measured at the face, with the sash wide open. Deviations in this value shall not be greater than 20% at any point across the hood face. To assure this standard, the designer must work closely with the duct installer to determine the effects of duct routing on motor sizing.

Exhaust motors shall be located on the roof, or in an adequately ventilated fan loft. Exhaust motors shall be located to allow access for maintenance.

Face Velocity Control System

The fume hood shall be equipped with a device to measure and monitor airflow. At a minimum, the system shall have a visual indicator of the hood face velocity. Additionally, adjustable low flow/caution alarm setpoints with audible buzzer or alarm are recommended. The system chosen shall be approved by REHS.

E. DUCT DESIGN AND CONSTRUCTION

Ducts shall be constructed of materials compatible with the chemicals being used in the hood. Circular ductwork is preferable to other shapes as it reduces friction loss and is easier to seal.

Ducts are usually constructed of galvanized sheet steel, riveted and sealed. If reactive chemicals will be used, ducts shall be constructed of a non-reactive stainless steel, unplasticized PVC, or have an inorganic ceramic coating. Questions about duct composition should be referred to REHS.

Ductwork shall take the straightest route to the roof, minimizing bends and horizontal runs. Increased distances and bends create resistance to airflow and require exhaust motors. When elbows are necessary, they shall have proper centerline radius (1½ times the diameter of the ducts) to minimize eddying and resistance to air flow. All elbows shall have removable wear plates when operations will involve heavy dust concentrations. Ductwork shall not enter the exhaust motor on an elbow. Exhaust motors shall be located on the roof so that a negative pressure will be maintained in the ductwork and prevent escape of toxic material through holes and cracks in the duct.

HEPA or charcoal filters are not required for most routine uses of fume hoods. Install a filter or filter housing only if specified by REHS. Where filters are required, the housing shall be located in the fan room or roof before the blower. The filter housing shall be located to allow for easy filter changing by the bag-in/bag-out technique. Exhaust fans shall be sized accordingly to handle the increased pressure drop across the filter.

Any deviation from the original specifications required in the routing of ductwork during installation shall be considered by an engineer to assure that the change will not alter the designed performance of the hood.

F. DISCHARGE

The discharge point must be at a proper height above the highest point of the roof or parapet (10-15 ft.) to reduce air streaming effects of the building. Air shall be discharged vertically with at least 3500 feet per minute stack discharge velocity. The discharge stack should be located in the prevailing downwind direction of the air intake point.

The discharge stack shall be uncapped, straight, and cylindrical. The discharge duct shall overlap the fan ductwork 6 inches and have a 1 inch greater diameter, to provide for rain drip discharge. Deflecting weather caps are prohibited on discharge stacks, as they reduce the effective stack height, reduce air velocity, and are not effective rain shields, and increase final cost.
G. SPECIAL HOODS

Perchloric Acid Hood

To safely contain perchloric acid, work requirements in addition to the standard design for fume hoods are specified under this section.

Construction:

Materials of construction for the hood and ductwork shall be non-reactive, acid resistant and relatively impervious. Type 316 stainless steel, with welded joints, is preferred. Unplasticized PVC or an inorganic ceramic coating such as porcelain is acceptable.

All interior surfaces of the hood and ductwork shall be smooth and seamless, and constructed for easy cleaning. The work surface shall be smooth and watertight with a minimum of ½ inch dished front and sides and an integral trough at the rear to collect wash-down water. The hood shall be designed to allow easy visual inspection of all interior surfaces.

Ductwork and Exhaust Fans:

Each perchloric acid hood shall have an individual exhaust system (i.e. individual duct to individual fan). The ductwork shall go straight from the hood to the roof with no horizontal runs or sharp turns. “Wash-down” facilities shall be built into the hood and ductwork. An air ejector system or an exhaust fan may be used. An air ejector exhaust system eliminates the possibility of acid reaction with fan components and allows for ease of cleaning. If a fan is used, the blades shall be made of acid resistant metal or a metal protected by an inorganic coating. Fluorocarbon grease shall be used to lubricate the fan.

Hydrofluoric Acid Hoods

Hydrofluoric acid is a highly corrosive agent. Consequently, standard laboratory fume hood construction materials shall be substituted with materials resistant to hydrofluoric acid attack. For hydrofluoric acid, the standard fume hood design shall be supplemented by the following specifications on construction and materials.

Construction:

The hood and ductwork shall be constructed of non-reactive materials that are resistant to hydrofluoric acid attack and are relatively impervious. A Portland Cement hood interior or other suitable material is recommended. The hood shall be constructed to allow easy visual inspection of all interior surfaces. A transparent plastic sash and PVC ductwork is required.

Ductwork and Exhaust Fans:

Ductwork shall be constructed from PVC or equivalent material. Horizontal runs and bends in ductwork must be kept to a minimum. The motor and blower housing shall not have exposed metallic parts.

Radioisotope Hoods

In addition to meeting the standard design specifications for fume hoods, the interior of all radioisotope hoods shall be stainless steel or molded epoxy resin and must form a smooth integral unit. All interior screws shall be countersunk and joints sealed and smooth for ease of decontamination.