Division 11 - Equipment

11 40 00 Food Service Equipment

1. Prepare specifications for food service equipment in close coordination with University food service personnel.
2. Specify that the Contractor is responsible for coordinating foodservice equipment with utility installation and with structural backing in walls and ceilings.

11 53 13 Fume Hoods

1. General

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 hoods, bench, distillation, or walk-in types, shall have proper aerodynamic design to minimize eddy currents and assure against air movement from the hood into the laboratory. This is accomplished by airfoil sides and an aerodynamically designed sill with a one-inch air gap between it 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.

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

   B. 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:

      - Doors
      - Supply air diffusers
      - Windows which can be opened
      - Heavy traffic areas
      - Other local exhaust ventilation devices

   C. 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.

3. Hood Design and Construction

   A. General: 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.

   B. Ducts

      1) Ducts should be constructed of materials compatible with the chemicals being used in the hood. Circular ductwork shall be used.

      2) Ducts are to be constructed of a non-reactive stainless steel, unplasticized PVC, or have an inorganic ceramic coating. Questions about duct composition should be referred to George Mason University.

      3) Fume hoods shall not be manifolded.

4) Ductwork shall take the straightest route to the roof, minimizing bends and horizontal runs. Increased distances and bends create resistance to air flow and require larger exhaust motors. When elbows are necessary, they shall have proper center-line radius (one-and-one-half 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 blower motor on an elbow. Exhaust blower 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.

C. Filter Housing

1) HEPA or charcoal filters are not required for most routine uses of fume hoods. Install a filter or filter housing only if specified by George Mason University. 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.

D. Discharge

1) 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 air intake point.

2) The discharge stack shall be uncapped, straight, and cylindrical. The discharge duct shall overlap the fan ductwork 6" and have a 1" 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, are not effective rain shields, and increase final cost.

E. Sides: Hood sidewalls shall be 3 1/2 - 6 1/2 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.

F. 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 one inch shall be present under the sill to direct air across the work surface at all sash positions.

G. 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 only is possible with special tools or keys. Glass used in the sash shall be at least 7/32" 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. Sashes shall be anti-guillotine.

H. Interior:

1) 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 composition board, must be painted or coated with an impervious sealer such as epoxy paint. The selection of

resistant materials must be made through consultation with the George Mason University Environmental Health and Safety Department.

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

I. 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.

J. Frame: The exterior and interior walls of the hood shall be rigidly supported by a full frame.

K. Working Surface: The hood working surface shall be molded epoxy or stainless steel. It shall be recessed not less than 1/4" 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.

L. Hood Fixtures and Services: All hood services shall be specified by the user. All electric service shall be located on the exterior of the hood. Plumbing services 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.

M. Lighting: Sufficient lighting shall be provided by either fluorescent, halogen, LED, or incandescent light fixtures at the top exterior of the hoods. 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.

N. 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.

O. 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 1/2 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 1/2 inch maximum. A middle slot, if furnished, shall be fixed and have an opening no greater than 2 inches.

4. Exhaust Fans and Ductwork: See Division 15

5. Face Velocity Control System

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

6. Special Hoods

A. Perchloric Acid Hood

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

2) Materials of construction for the hood and ductwork shall be nonreactive, acid resistant and relatively impervious. Type 316 stainless steel, with welded joints, is preferred. Unplasticized polyvinyl chloride or inorganic ceramic coatings, such as porcelain, are acceptable.

3) 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 1/2" 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.

4) 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. The fan shall be lubricated with fluorocarbon type grease.

B. Hydrofluoric Acid Hoods

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

2) The hood and ductwork shall be constructed of nonreactive 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 are required.

3) Ductwork and Exhaust Fans: Horizontal runs and bends in ductwork must be kept to a minimum. The motor and blower housing shall not have exposed metallic parts.

C. 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.

11 53 19 Sterilizers (Autoclaves)

1. Install a floor drain capable of handling discharge under all autoclaves.
2. Install a stainless steel drip pan under every autoclave with an opening for the floor drain. This opening is to be sealed around the edges to prevent liquids from getting between the pan and the floor.
3. Provide a fused electrical disconnect within 3' of autoclave.

11 53 33 Emergency Safety Appliances

Eyewash Units:

1. Install eyewash units at or near sinks within the hazardous operations space. Such spaces include wet laboratories, areas where dust is generated, darkrooms and other areas where liquid chemicals are used or handled. Handheld hose type units providing a soft spray of 3-7 gpm at a pressure of 30 pounds per square inch are recommended. These may be mounted bench or on the side of the bench or wall, and should be readily accessible and located in a high area or near the main door. Wall mounted units, pedestal-mounted units; eye/face wash units combination safety shower/eyewash units must provide a soft spray of 3-7 gpm at 30 pounds per square inch of pressure.

2. All eyewash units must flush both eyes simultaneously, the flow must remain on without the use of the operator's hands, the unit must remain activated until intentionally cut off and the nozzles must be protected from airborne contaminants.

3. A sign must be posted to identify the location of the eyewash unit and the area behind or around the eyewash unit must be painted with a bright color. Eyewash units for non-ADA compliant units should be installed between 2'-9" and 3'-9" from the floor. For ADA compliant stations, for dimension references CABO ANSI A117.1 standards for drinking fountains shall be followed. However, the appliance shall be eyewash units.

Safety Showers:

1. Install safety showers in a conspicuous location within the room or space they serve. Safety showers in corridors should be recessed into the corridor wall as much as possible to avoid pedestrian traffic interference and can serve several laboratories or rooms. Install safety showers in locations that are clearly marked and accessible at all times.

2. Install safety showers so that the center of the shower head is at least 25" from the nearest wall, bench or furnishing and at a safe distance away from electrical equipment or outlets. The base of the shower must be between 6'-10" and 8' above the floor. The shower head should be a deluge-type head, and should be made of plated brass or plastic. The safety shower unit be capable of providing a flow of 30-50 gallons of water per minute at 30 pounds per square inch of pressure. Provide a floor drain at the shower location capable of handling the same amount of water as the shower head and piped to the applicable drainage system.

3. Safety shower activating valves are to be operated by pulling a chain, a cord attached to die valve lever, an 8 inch minimum diameter ring or a triangle connected by a chain or cord to the lever. The lowest point of the ring, triangle or cord should be located no more than 48" from the floor for frontal approach and no more than 54" from the floor for a side approach, and should run within 1-2 inches of a wall or bench. Safety shower activating valves are to be quick-opening, self-closing globe valves. A shut off valve accessible via a 6 foot ladder is to be installed for each shower head.

4. A sign must be posted to identify the location of the safety shower, and the area behind or around the safety shower must be painted with a bright color. Exterior safety showers and water supply lines must be protected from freezing.

5. Installation and operation of safety showers and eyewash units must comply with ANSI Z358.1-1990.