

## **Environmental, Health, Safety & Risk Management Fume Hood Standard**

### **GOAL**

This document is written to specify the minimum expected standards for the design, construction, maintenance and the usage of laboratory ventilation in general and research laboratories to maintain a minimum acceptable air quality for the safety of all students, faculty, staff and visitors at Texas State University. All fume hood specification stated in this standard are intended to comply with the Code of Federal Regulations Volume 29 CFR Part 1910.1450, ANSI/ASHRAE 110-1995, ANSI/AIHA Z9.5 Laboratory Ventilation Standard, NFPA 45 Chapter 8 and SEFA 1.2-1996 and ANSI/ASHRAE 111 - Testing and Balancing Standards.

### **SELECTION CRITERIA**

#### **General**

Laboratory fume hoods manufactured by Kewaunee Scientific Corporation, Mott Manufacturing, Labconco or Fisher Hamilton, meeting the requirements listed below, are strongly preferred. However, hoods from other manufactures may be used if they meet the standards below and are approved by EHS&RM. Adequate documentation must be provided to EHS&RM in order to approve the hoods.

#### **Manufacturers Information**

The following information should be obtained from the manufacturer:

The fume hood must meet the minimum design criteria outlined in CFR 29 Part 1910.1450 and meet or exceed performance standards specified by ANSI/ASHRAE 110-1995.

#### **Used Fume Hoods**

Used fume hoods must be approved by OFPDC in conjunction with the Office of EHS&RM. Persons wishing to purchase previously used fume hoods are responsible for obtaining the following:

Decontamination Certificates from previous owners for:

1. Radioactive contamination
2. Biological contamination
3. Chemical contamination

Information required from the manufacturer are:

1. Type of fume hood, exhaust system, model and serial number;
2. List of materials for of construction of the fume hood;
3. CAD drawings of the fume hood;
4. Performance rating of fume hood in a test facility;
5. Operating and maintenance instructions for all the equipment; and
6. Any specific limitations on use.

## CONSTRUCTION

### Materials

All materials, including service fittings and exhaust systems, shall be resistant to the chemicals and substances specified as permissible for use within the fume hood.

1. Only tempered plate glass shall be used.
2. All plastics used shall be a fire-retardant grade.
3. All coatings and finishes shall be fire resistant.
4. Engineered sealants and adhesives shall exhibit good chemical and thermal resistance and suitable mechanical properties.

### Cabinet

1. Work surface shall have integrated raised edges (1/2" min.) and sealed to help contain any spills.
2. Work surface shall be strong enough to bear the weight of any necessary apparatus as required by individual requesting fume hood.
3. The sash openings shall incorporate airfoils to inhibit refluxing of air at the face opening.
4. The rear and top of the hood shall be supplied with 3 baffles, the top and bottom being adjustable to accommodate changing usage of fume hood.

### Electrical

1. Fume hoods and exhaust systems shall comply with the applicable requirements in NFPA 45-8.8.4, NFPA 70 NEC 2008.
- 2.

Note: The risk assessment may identify the fume hood and immediate surroundings as hazardous locations requiring special (e.g. explosion-proof) electrical equipment. The criteria for determining the degree of hazard and the appropriate type of electrical equipment are provided in NFPA 45-8.8.4 & NFPA 70 NEC Article 500, 2008.

In order to obtain proper electrical classification of hazardous locations, it is necessary to contact the local authority having this jurisdiction.

3. All electrical receptacles shall be readily accessible and external to the fume hood interior.
4. A ground fault interrupter should be used in the electrical power supply where necessary.

### Services

1. All plumbing and electrical services shall be installed such that they can be readily connected or disconnected, either by design of the assembly or via an access panel in the fume hood interior or exterior.
2. All valves shall be accessible for maintenance.
3. All service fixture controls (e.g. gas, air, water & vacuum) shall be external to the fume hood, clearly identified and within reach.
4. All service fixtures within the workspace shall be corrosion resistant or have a corrosion resistant finish.
5. If water service is provided, the fume hood shall have provisions for a appropriately designed drain.
6. Light fixture(s) mounted exterior to the fume hood liner shall be protected from the fume hood interior by a sealed, transparent, impact-resistant vapor shield.
7. Light fixture(s) mounted inside the fume hood liner shall be protected against corrosion and vapor proof.
8. Light fixture(s) shall be capable of providing an illumination at the work surface consistent with the level required by OSHA regulations.

## Alarms

1. A fume hood shall have an audible and visual alarm to indicate to the user when the air flow deviates from the set point.
2. The alarm shall be readily visible to the user during use of the fume hood.
3. Only authorized personnel shall be able to adjust the alarm set point.
4. The alarm shall remain functional in the event of loss of mains electrical power.
5. Battery power supplies shall have a low charge indicator.

## EXHAUST SYSTEM

### General

Exhaust duct, fan, and scrubber materials should be chosen based on compatibility with the materials handled in the fume hood, as well as compatibility with the installation and maintenance of the fume hood.

### Exhaust Ducts

1. Exhaust ducts should be constructed to SMACNA Seal Class B Standards as required by SMACNA Duct Pressure Classification.
2. Exhaust ducts should be maintained under negative pressure to reduce the possibility of contaminants leaking into the building.
3. Fume hoods with integral fans shall have appropriately constructed exhaust ducts. Sealant will be used on all ductwork seams, joints, fastener penetrations and fitting connections in accordance with SMACNA Seal Classification.
4. Each fume hood should be separately ducted to a point outside the building. Perchloric acid fume hoods shall be separately ducted to a point outside the building. Radioisotope fume hoods shall be separately ducted to a point outside the building, unless located in the same room.
5. The exhaust stack shall be located so as to ensure acceptable dilution and dispersion of exhaust air and to preclude exhaust re-entry through air intakes and building openings as required in ANSI Z9.5, 29 CFR 1910.94 and 29 CFR 1926.57. This represents a minimum exhaust stack height of 10 feet above the exhausting unit or any roof line and will be a minimum of 50 feet from any fresh air intake for the building HVAC system.
6. The exhaust stack shall not be fitted with devices, which deflect the effluent or reduce the discharge velocity.

Note: Rain protection by weather caps and swan neck ducts are examples of such devices.

7. Thermoplastic materials shall not be used for duct work.
8. Fire-retardant material or carbon steel with an acid-resistant coating may be used for general chemical applications.
9. Stainless steel ducts shall be used for perchloric acid fume hoods.
10. Corrosion-resistant ducts shall be used for radioisotope fume hoods.

### Exhaust Fan

1. Exhaust fans should be positioned as close as possible to the termination (discharge end) of the duct, preferably on the roof.

Notes: From the fan position to the termination of the duct, the internal pressure is positive and any leaks in the duct will allow the escape of contaminants from the duct into the surrounding spaces. Consideration should be given to protecting the fan from the effects of adverse weather conditions.

2. The fan motor should be mounted outside the exhaust duct for easy access and to avoid contamination of the motor. Appropriate shaft seals shall be employed.
3. Glass fiber, PVC, or equivalent fans shall be used for highly corrosive conditions.
4. Coated steel, glass fiber, or PVC fans may be used for low to moderately corrosive conditions.

- Fans shall be sized to provide adequate exhaust air flow. The static pressure losses of the fume hood and associated duct work shall be included in the determination of fan size.

## TYPES OF FUME HOODS

- BYPASS
- DUCTLESS
- WALK IN
- GLOVE
- BIOLOGICAL

## Special Design Criteria for Perchloric Acid Fume Hoods

Perchloric acid fume hoods shall comply with the criteria described in this standard and with the following additional requirements:

- Fume hoods designed for and used with perchloric acid shall be identified by a prominent and permanent label indicating suitability for use with perchloric acid procedures.
- All exposed parts of the fume hood interior shall be suitable for use with perchloric acid.
- The work surface shall be watertight and furnished with a minimum ½" raised lip to contain spills and wash down water.
- The fume hood shall be provided with a water spray (wash down) system for rinsing the duct work from point of discharge to the fume hood collar and also the area behind the baffle.
- The duct work shall be self-draining with no horizontal sections.
- Service fitting controls for internal outlets and for the wash down systems shall be external to the fume hood, clearly identified, and within easy reach.
- The baffle shall be removable to allow periodic inspection for damage/corrosion.
- The fume hood shall be constructed of nonporous, inorganic, acid-resistant, non reactive material, and shall be impervious to perchloric acid.
- Specially designed fans shall be used.

## INSTALLATION

### Location

Fume hoods shall be installed according to the manufacturer's instructions.

- Fume hoods should be located out of the normal, traffic pattern and away from interfering room air currents.
- Seated work stations shall not be located directly opposite fume hood openings.
- The distance between the side of the fume hood and a wall or large architectural obstruction (e.g., an architectural column) protecting beyond the plane of the sash should be at least 16" inches.

Note: The adjoining wall may present a partial obstruction which may affect intake air flow.

- The user's unobstructed personal work area should extend at least 4' 6" from the face of the fume hood.
- The distance between the sash and an opposing wall or other obstruction likely to affect the air flow should be at least 6' feet.
- Fume hoods should not be installed face to face or opposite a biological safety cabinet unless the distance between them is at least 9' feet.
- The distance between the sash of the fume hood and a doorway should be at least 4' 6".
- The distance between the side of the fume hood and a doorway should be at least 3' feet.
- Any room air supply diffuser should not be within 4' 6" of the sash and shall not affect fume hood performance.

### Exhaust Duct Installation

- The exhaust duct should be self-draining and proceed to the discharge point with as few horizontal sections as possible.

Note: This is to minimize areas in which condensates or liquids coming in from the discharge point can collect.

2. Ducts shall be sealed, according to SMACNA Seal Class B Standards, to prevent leakage
3. The following information shall be recorded when the fume hood and exhaust system is installed:
  - "as built" drawings showing the complete installation;
  - identification of the materials of construction;
  - operating and maintenance instructions; and
  - make, model, and serial number

## COMMISSIONING

After installation OFPDC shall notify EHS&RM to commission the fume hood.

Commissioning shall include, but not be limited to, determinations of the following:

1. Electrical safety;
2. Adequate lighting;
3. Noise level; (OSHA standard levels are indicated below)
4. The functioning of components and services; and
5. Field performance test results as specified in ANSI/ASHRAE 111-2008.

Duration Per Day, Hr	Permissible Exposure "Slow" Response, dBA
8	90
6	92
4	95
3	97
2	100
1.5	102
1	105
0.5	110
0.25 or less	115

## Field Test

1. All test and measurement equipment shall be accurate and properly calibrated as specified in ANSI/ASHRAE 111-2008.
2. The building ventilation system shall be operating correctly, the room doors and windows in their normal position, and all other fume hoods and exhaust systems operating at design conditions.
3. Fume hoods shall normally be tested empty. However, in exceptional circumstances, it may be essential for the safety of the verifier to test a fume hood with fixed equipment in place.

4. Face velocity shall be measured and the test results shall be compared with the values provided by the manufacturer. The test results shall be documented and provided to the user.
5. The sash is open to a normal working height. (approximately 12")
6. The minimum face velocity is between 80 to 120 fpm.
7. The maximum sash working height will be marked at the minimum face velocity.

## Sash Operation

1. Sash operation shall be smooth and easy throughout its travel.
2. The Sash shall be operable from either end with one hand.
3. Sash counterbalances should operate without interference or restriction.
4. Vertical rising sashes shall hold at any set height without creeping up or down.
5. All adjustable baffles shall operate freely without binding or restriction.
6. The alarm shall function properly and indicate unsafe conditions when the air flow is restricted.

## WARRANTY

The manufacturer will provide a minimum warranty period of two (2) years from date of receipt of unit on Texas State University campuses (The University) loading dock. The manufacturer will warrant their product to be free from defects in material and workmanship. The manufacturer will repair or replace any product, or parts thereof, that are found to be defective. The manufacturer will provide 24 hour per day service during the warranty period, with a maximum response time of four (4) hours. The manufacturer will accept warranty claims made by The University within a reasonable time of The University's discovery of defects prior to the expiration of the applicable warranty period.

## MAINTENANCE

### General

Before an inspection or any maintenance work is performed, the extent of hazards resulting from contaminated surfaces shall be assessed and any necessary personal protective equipment or clothing shall be used. The laboratory supervisor is responsible for removal of any material located in the fume hood.

Wash down systems should-be regularly used and properly maintained.

Note: This is to facilitate the removal of corrosive condensates from the interior surface before damage occurs.

### Preventative Maintenance

At least once a year, the following maintenance procedures will be performed by the Texas State University Facilities Electrical Department and/or EHS&RM:

1. inspect the fans, motors, drives, and bearings for correct operation;
2. inspect the fire damper and the release mechanism;
3. measure the fume hood face velocity and compare to fume hood specifications, correct as necessary;
4. test the operation of the air flow alarm; and
5. repair defects and lubricate as necessary.