DEPAUL UNIVERSITY

Fume Hoods Manual

Environmental Health & Safety

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1. INTRODUCTION

Fume hoods are a type of ventilation system used in many laboratories throughout the University. Their primary function is to exhaust chemical fumes, vapors, gases, dusts, mists, and aerosols. They also serve as physical barriers between reactions and the laboratory environment, offering a measure of protection against inhalation exposure, chemical spills, run-away reactions, and fires.

A typical fume hood has a box-like structure with a moveable sash window. Experimental procedures are performed within the hood which is consistently and safely ventilated, usually by means of an extract blower and ductwork. Chemical fumes are exhausted and diluted many times over in the atmosphere and have an insignificant effect on human health.

Fume hoods function by maintaining a relatively negative interior pressure while continuously drawing air through the sash opening, which prevents contaminants from escaping. A suitable hood face velocity (the speed at which air is drawn into the hood) is critical to safe and effective operation. While excessive face velocities can result in turbulence and reduce containment, insufficient velocities also compromise performance.

In general, a hood's cubic face velocity is recommended to be between 0.3 m/s (60 cubic feet per minute) and 0.5 m/s (100 fpm).

2. TYPES OF FUME HOODS

The two main types of fume hoods used in laboratories are covered in this section. See Appendix A for descriptions of other ventilating enclosures that may be present on campus.

2.1 Conventional Fume Hoods

Conventional fume hoods draw a constant volume of air through the sash opening. They have no features to vary the velocity or volume of air entering the fume hood. Most conventional hoods have a two panel baffle system and a moveable sash.

2.2 High Performance Fume Hoods

High performance fume hoods are more energy efficient than conventional hoods because of their lower total exhaust volumes. They are designed to take air entering through the sash opening and form a roll in the upper chamber called a vortex. This vortex enhances the hood's containment capability and has been engineered so that the vortex will not break down and collapse.

Many high performance hoods have sash doors that slide side to side (horizontally) and vertically. Only open the vertical moving sash to load/unload the hood. Use the horizontal sash doors to create a splash and blast shield while working in the hood.

Typically, high performance hoods have audible and visual alarms to indicate if the air-flow is above or below preset alarm levels.

Some fume hoods are equipped with on/off switches or variable air velocity (VAV) controls that allow the user to turn the exhaust velocity down during periods of inactivity.

3. FUME HOOD COMPONENTS

Most fume hoods share common design characteristics. High performance fume hoods incorporate additional or modified components. The basic fume hood components include the hood body, sash, work surface, exhaust, and baffles.

3.1 Hood Body

The housing of the fume hood provides the containment for hazardous gases and vapors or the physical barrier between the containment and the outside air.

3.2 Work Surface

The work surface or deck is generally a laboratory bench top.

3.3 Exhaust Plenum

The shape and location of the exhaust plenum helps to distribute air flow evenly across the hood face. Materials such as paper towels drawn into the plenum can create turbulence in this part of the hood, resulting in areas of uneven air flow and poor performance.

3.4 Air Foil Sill

The air foil sill is located along the bottom edge of the fume hood. The air foil performs several important functions:

- It streamlines the airflow into the hood around the edge, reducing turbulence and loss of containment,
- The flow continually sweeps the work surface, and
- It provides a source of air for the hood to exhaust with the sash fully closed.

3.5 Baffles

The baffles are moveable partitions used to create slotted openings along the back of the hood body. Baffles keep the airflow uniform across the sash opening to optimize capture efficiency and eliminate dead spots or possible reverse flows at the sash opening which would result in a loss of containment.

Baffle Positions

Adjusting the baffles allows the user to accommodate light vapors or dense, heavy vapors as necessary. High performance fume hoods have louvered or articulated baffles that allow more flexibility. Baffle positions open and close the slots between the panels. In a three panel louvered baffle system, the baffles would be adjusted as follows to accommodate light or dense vapors:

- Light vapors: Maximum airflow is required at the top. Top slot is fully opened and the center and bottom slots are in the open position.

- Normal Operation: The top, center, and bottom slots are all open evenly to provide uniform flow.
- Heavy vapors: Maximum flow is required at the bottom near the work surface. The top slot is closed and the center and bottom slots are open.

3.6 **Sash**

The sash located at the front of the hood can be adjusted to optimize the air flow into the fume hood. It provides a protective barrier, a window to observe the activities in the containment, and protects the user's breathing zone from vapors released in the containment.

Sash Opening

The sash opening or hood face is the imaginary plane from the bottom of the sash to the air foil sill. The face velocity is measured across this plane.

Sash Positions

There are three typical sash positions to be used by the operator.

- Closed: All sashes should be closed when the fume hood is not in use.
- Operating Position or Operating Height: A maximum of 18 inches. The sash should be used at this position whenever work is being performed in the containment.
- Set-Up Position: Any opening greater than the operating position. The sash should only be used in this position for loading equipment and set-up of materials. Other work should not be performed with the sash in the set-up position.

4. FUME HOOD PERFORMANCE INDICATORS

Performance indicators are important safety devices that must be monitored regularly and are necessary for every chemical fume hood on DePaul's campus. Each hood should be equipped with a monitoring device used to continuously measure air flow, and provide a visible reading to the hood user.

The most common types of visual performance indicators found in DePaul's laboratories are differential pressure manometers or gauges, and digital monitoring devices. It is important to the health and safety of the laboratory occupants to pay close attention to the digital or posted reading. A broken or missing performance indicator may result in lab occupants being unaware of air flow changes, and increase the risk of chemical exposure. If you believe that your hood is missing a performance indicator, your current device has been damaged, or is out of range; please contact Facility Operations immediately for repair.

5. EVALUATION AND MAINTENANCE

5.1 **Annual Inspection**

On an annual basis, Facility Operations outsources inspections of all chemical fume hoods. Upon completion of the hood inspection, the outsourced company will place a certification sticker on the fume hood indicating who inspected it, the date, and "passed or failed." A report is then generated on each fume hood, the original report goes to Facility Operations and Environmental Health & Safety receives a copy.

6. USING A FUME HOOD

The fume hood is often the primary control device for protecting laboratory personnel when working with flammable and/or toxic chemicals. OSHA's Laboratory standard (29 CFR 1910.1450) requires that fume hoods be maintained and function properly when in use.

6.1 Before Using a Fume Hood

- Make sure that you are trained and understand how the hood works.
- Know the hazards of the chemical you are working with; refer to the chemical's Safety Data Sheet (SDS) if you are unsure.
- Ensure that the hood is on.
- Make sure that the sash is open to the proper operating level, which is usually indicated by arrows on the frame.
- Make sure that the air gauge indicates that air flow is within the required range.

6.2 When Using a Fume Hood

- Never allow your head to enter the plane of the hood opening. For example, for vertical rising sashes, keep the sash below your face; for horizontal sliding sashes, keep the sash positioned in front of you and work around the side of the sash.
- Use appropriate personal protective equipment: Eye protection, gloves, lab coat.
- Be sure that nothing blocks the airflow through the baffles or through the baffle exhaust slots.
- Elevate large equipment (e.g., a centrifuge) at least two inches off the base of the hood interior.
- Keep all materials inside the hood at least six inches from the sash opening.
- When not working in the hood, close the sash.
- Do not permanently store any chemicals inside the hood.
- Promptly report any hood that is not functioning properly to Facility Operations. Its sash should be closed and the hood "tagged" and taken out of service until repairs can be completed.
- When using extremely hazardous chemicals, understand your laboratory's action plan in case an emergency (e.g., power failure) occurs.

APPENDICES

APPENDIX A: Other Hood Types

- **Ductless Hood** is another type of enclosure hood. Ductless hoods pass air from the hood interior through an absorption filter and then discharge the air into the laboratory. These types of hoods are only suitable for use with nuisance vapors and dusts that do not present fire or toxicity hazards. These types of hood have very specific uses.

- **Capture Hoods** are ventilating devices that can be positioned to pull in contaminants that are produced outside of a hood. A sufficient velocity called the capture velocity is necessary to "grab" the contaminant and move it into the hood. They are generally used in welding and grinding operations.

- **Receiving Hoods** are devices generally used to exhaust heat, water vapor, odors, and other non-hazardous materials. They are not a laboratory hood and generally are not effective for exhausting toxic or flammable materials.

- **Biological Safety Cabinets** are special safety enclosures used to handle and contain pathogenic microorganisms or chemotherapeutic agents. Biological safety cabinets are **NOT** laboratory fume hoods. Biological safety cabinets provide protection for the product and also protect laboratory personnel by utilizing vertical airflow.

APPENDIX B: Program History

Date	Revision Number	Brief Description of Changes	Review Completed by
April 2017	1	No significant changes	K. Abma
June 2022	2	No changes	K. Abma

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This manual was developed using best practice examples from OSHA and the University of Chicago as well as Federal and State regulations and guidance documents.