



## UNIVERSITY OF TORONTO

### Laboratory Fume Hood Standard: Selection, Installation, Use and Maintenance

A fume hood is an enclosed working chamber fitted with an exhaust ventilation system. It is one component of an exposure control system which is designed to contain, dilute and disperse gases, vapours and aerosols to the external environment. It is also an integral part of the building air handling system. The fume hood is the primary control device in most laboratories for protecting employees and students from exposure to hazardous chemicals; also, the efficiency of operation is essential in maintaining good air quality in laboratories. It is therefore imperative that it function properly at all times during its operation. This standard was developed in accordance with the Canadian Standards Association (CSA) Standard Z316.5-94 (Fume Hoods and Associated Exhaust Systems).

#### APPLICATION:

This standard applies to By-pass and Variable Air Volume fume hoods. Specialty fume hoods such as Recirculating, Walk-in, Explosion-Proof and Perchloric Acid fume hoods require special design considerations that are dealt with on a case-by-case basis through Facilities and Services, Capital Projects, Design and Engineering and the Office of Environmental Health and Safety. This standard is also intended to provide a standard for selection, installation, usage and maintenance of the laboratory exposure control systems.

#### RESPONSIBILITIES:

The appropriate division of Facilities and Services/Facility Resources/Facilities Management shall:

- Routinely inspect and adequately maintain all exhaust systems (ducting, exhaust fans and exhaust stacks);
- Respond when notified of a system malfunction;
- Provide appropriate service for malfunctioning fume hood cabinets (working chambers) --- eg. repair malfunctioning sashes.; and
- Ensure that new installations authorized by Property Management, Capital Projects, and Design and Engineering conform to system design specifications.

Principal Investigators/Laboratory Supervisors and all others in authority shall:

- Ensure that all fume hood users perform the necessary "Maintenance checks" on a routine basis (see Appendix A --- User Guidelines);
- Ensure that no work or experiments are conducted in a malfunctioning fume hood;
- Ensure that all fume hood users follow prudent work practices when operating fume hoods (see Appendix A --- User Guidelines).

Fumehood users shall:

- Regularly inspect the physical condition of the hood interior and the mechanical services inside the hood and report malfunctions to the appropriate authority (see Appendix A --- User Guidelines);
- Routinely test (switch on monitor) the air flow monitoring device (if present) to assure functional status;
- Rigorously follow prudent work practices (see Appendix A --- User Guidelines).

#### SYSTEM SPECIFICATION AND MAINTENANCE

The fume hood is one component of the exposure control system; its performance therefore cannot be judged in isolation from the rest of the system. The total system consists of: 1) the working chamber, 2) the exhaust system, 3) fume hood location, 4) make-up air to the fume hood, 5) system indicators, 6) operational parameters, and 7) system maintenance. The following specifications provide the standard for acceptable performance and efficiency of fume hood systems; all new installations shall conform to these specifications and existing installations should be brought to this standard as funding permits.

## 1. The Working Chamber

- By-pass type hood when constant volume systems are required. The interior of the working chamber should be constructed of non-flammable, acid resistant material.
- A back baffle system to more evenly distribute the air across the face of the chamber such that uniform air flow through the face of the hood will result.
- An airfoil along the lower edge and the tapered configuration on the other edges to provide the streamlined front entrance profile. It should be fabricated from type 316 stainless steel.
- A vertical sliding sash (with counter weights) to minimize the size of the working aperture and to act as a safety screen. The sash should be constructed of transparent glazing that is resistant to discoloration and crazing by age or exposure to chemicals.
- A recessed work surface to retain spilled liquids.

## 2. The Exhaust System

- The ducting shall be designed to provide optimum air flows in the working chamber:
  - size to minimize noise levels;
  - avoid horizontal runs to minimize collection of corrosive condensates;
  - provide circular cross-sections to reduce the number of corners and crevices where corrosion might occur;
  - construct all ductwork using type 316 stainless steel, welded construction, except where the chemicals used require compatible materials (ensure that these materials comply with the requirements of the Ontario Building Code and the Fire Code).
- The exhaust fan shall be located so as to ensure that the exhaust ducting upstream of the fan within the building remains at negative pressure, with the exception of the short ductwork on the positive side of the exhaust fan. The fan room shall be well ventilated:
  - flexible couplings (linking the ductwork to the fan unit) must be constructed of a fabric which is highly resistant to a wide range of chemicals and environmental conditions (rated as "completely air-tight and moisture proof").
- The exhaust stack shall discharge vertically upwards at the appropriate exit velocity and of sufficient height and so positioned as to ensure that emissions are unable to re-enter the building or adjacent buildings:
  - discharge stacks shall be connected to a properly installed trap and drainage system, not drain into the exhaust fan.

## 3. Fume Hood Location

- A fume hood shall be located in such a way as to minimize risks to persons in the event of fire or explosion, and away from major traffic patterns (doorway, etc.) and major air patterns (air inlets and other sources of air disturbance) that produce cross-draughts.
- Supply-air diffusers in the laboratory shall be of the low-velocity style.

## 4. Make-Up Air to the Fume Hood

- Provide make-up air to replace air exhausted by the fume hood.
- The make-up air shall be at a suitable temperature to avoid wind chill effects and be acceptable to the laboratory staff.
- Supply-air diffusers shall be sited so as to maximize the general dilution ventilation of the laboratory without disturbing the air flow pattern in the fume hood.

## 5. System Indicators

If the airflow in the system is not monitored, the hood operator may not be aware when a partial or complete failure of the exhaust system occurs.

- All new fume hoods shall be fitted with an alarming (audible & visual) air flow monitoring device. The recommended device for by-pass fume hoods is:-

*"Ventalert" Air-System Alarm*

These monitors are required and part of the installed cost when new fume hoods are purchased.

- Existing installations should be retrofitted with the same alarming air flow monitoring device.

Additional information about this air flow monitoring device may be obtained through the Property Manager for the building or by contacting the Office of Environmental Health & Safety at 978-4467.

## 6. Operational Parameters

- **For a By-Pass Fume Hood (constant volume):**

*Air flow through the hood shall provide an average face velocity of 0.4 m/sec (80 ft/min) - 0.65m/sec (130ft/min) at a working sash height of 18 inches. The low end of the face velocity range provides for adequate capture of contaminants generated within the hood while the high end of the range produces an air flow into and within the hood that is not excessively turbulent and therefore not likely to degrade hood performance.*

- **For a Variable Air Volume (VAV) Fume Hood (constant velocity):**

*Air flow through the hood shall provide an average face velocity of 0.5 m/sec (100 ft/min) - 0.65m/sec (130ft/min) regardless of sash height.*

## 7. System Maintenance

If the system is not properly maintained, it will eventually fail.

- When installed or modified, and annually thereafter, fume hoods shall be inspected and tested. This inspection should include:
  - Visual inspection of the physical condition of the hood interior, sash, and visible ductwork;
  - Face velocity;
  - Air flow indicator system.
- The ducting, exhaust fans and exhaust stacks shall be adequately maintained.

The efficiency of a fume hood is very dependent on its functional status and on how it is used.

Users must ensure proper operation of fume hoods by performing the following "**Maintenance Checks**":

- Inspect the physical condition of the hood interior, sash and visible duct work;
- Check sash for ease of operation;
- Test air-flow monitoring device (if present);
- Check mechanical services inside the hood (eg. water, steam, compressed air, gas, vacuum, etc.);
- In case of fume hood malfunction, do the following:
  - Discontinue use of fume hood
  - Inform your supervisor
  - Call Facilities and Services (St. George Campus) at 978-3000  
Facility Resources (U of T at Mississauga) at 828-5301  
Physical Plant Services (U of T at Scarborough) at 287-7579
  - Report your name, phone number, exact location and reason for call

When using a fume hood, one must remember that the hood does not provide absolute containment or absolute protection from the materials in the hood, however, a properly designed hood in a properly designed room can provide adequate protection if the following practices are observed:

#### **Prudent Work Practices**

- All work involving hazardous or odorous chemicals should be performed in a fume hood.
- All equipment and materials should be placed at least 6 inches back from the face of the hood; these items should not obstruct the movement of air into the hood.
- One should not place one's head into the hood when contaminants are being generated.
- The sash should be used to minimize the size of the working aperture and to act as a safety screen; one should use an appropriate barricade if there is a chance of an explosion.

The hood should not be used as a storage area or overloaded with unnecessary equipment and materials. The presence of these materials can seriously affect the air flow in the hood. Suitable storage facilities can often be provided underneath the fume hood or in approved safety storage cabinets.
- The hood should not be used for long-term storage of hazardous chemical wastes. To dispose of these wastes consult the pertinent procedures in your facility/campus. For additional information call the Office of Environmental Health and Safety at 978-7000 (St. George Campus).
- Electrical receptacles or other spark sources should not be placed inside the hood when flammable liquids or gases are present. Electrical connections should be made outside the hood and no permanent electrical receptacles should be permitted in the hood.
- Foot traffic past the face of the hood should be minimized. Air flow caused by such traffic can seriously disrupt the operation of the hood and cause gases and vapours to be drawn out of the hood into the room. Cross-draughts from windows and doors close to improperly located fume hoods will also affect the stability of the air flow within the fume hood.
- Keep the interior of the hood clean and tidy.
- Do not conduct work in a malfunctioning fume hood.