MANUAL
FUME HOOD

A PRODUCT OF

Aakar
CUSTOMIZED LAB SOLUTIONS

AAKAR SCIENTIFIC PVT. LTD

Fume Hood

Dear Customer,

We are proud to be associated with you as a supplier of Laboratory Fume hood System to your esteemed Organization. We assure you that the AAKAR product purchased by you is a Quality product and tested in the various laboratories for years at users' end. Aakar products are certainly value for money which is made user-friendly by taking utmost care looking to style of working of laboratory people and lab environment.

1.0 Definition:
A Laboratory fume hood is a type of local exhaust ventilation system inside the laboratory. It is a typical enclosed cabinet except front face. The front opening will be equipped with a moving sash made out of toughened / safety glass. Air is drawn in to the hood under and through the opened sash and is exhausted through openings in the rear and top of the cabinet to a remote point such as an exhaust stack on the roof of the building.

Other widely used names of Fume hood are: Fume Cupboard, Chemical Fume Hood, Chemical Hood, Fume Chamber and hood but as per the proper terminology it is known as "Laboratory fume hood".

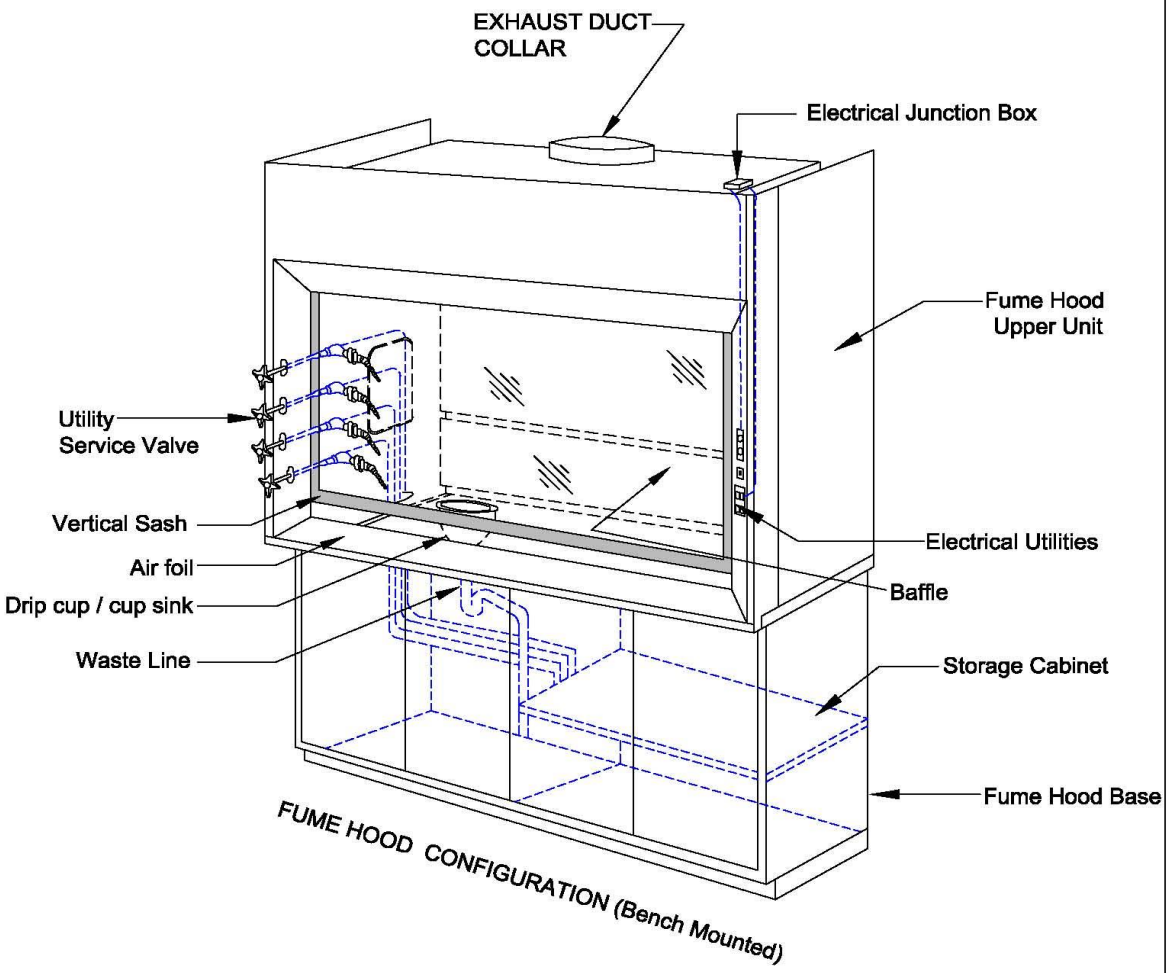
1.1 Purpose:
Laboratory fume hoods are one of the most important equipments used to protect laboratory personnel from exposure to toxic gases, hazardous chemicals fumes and harmful vapors generated during experiments inside the fume hoods.

1.1.1 Caution:
Chemical fume hoods may not provide protection from highly toxic (LD_{50} <5 mg/kg) or highly reactive materials. Operation involving these materials must be carried out in a glove box or other closed system.

1.2 Function:
A laboratory fume hood is made primarily from the flame resistant materials. The face opening will have profiled entry and usually the airfoil designed to sweep and reduce reverse airflow on the lower surface. A laboratory fume hood is equipped with a baffle designed to control air flow patterns within the enclosure and manage the even distribution of air at the opening. When connected to properly designed exhaust system, the fume hood will carry the undesirable effluents -generated within the enclosure during a laboratory procedure- away from laboratory personnel. When used properly, they can provide an effective backup safety device for the containment and exhaust of toxic, offensive or flammable materials.

2.0 Laboratory Fume Hood – General Specifications:
There are verities of laboratory fume hoods available for specific purpose. They generally share a number of similar characteristics and components.

LABORATORY FUME HOOD



FUME HOOD CONFIGURATION (Bench Mounted)

The above is a sketch of standard fume hood (Bench Mounted type). The sketch is shown for reference only, it's design and other specifications may change as per the need time to time without intimation. Size may vary as per the requirement. Piping, conduit and cables are not included in supply. The exact routing of service lines will vary depending upon the site condition.

2.1 Laboratory Fume Hood components:

2.1.1 Majority fume hood types are bench mounted. Mainly, there are two parts of Fume Hood.

a) Fume Hood Upper Unit

b) Fume hood Base cum storage

(In case of Walk-in type Fume Hood there is Upper Unit only)

2.1.2 ***Fume Hood Upper Unit***: is made of heavy and sturdy basic structure of CRCA angle of 14 gauge which is a back bone of the unit. The outer main body is also made of CRCA steel of 18G. Upper Unit will consist of following:

a) Airfoil: Fume hood entrance is called airfoil. Airfoil is designed aerodynamically to ensure smooth path for air to enter.

b) Inside lining (inside wall): Interior lining are panels; used for sides, back and top enclosure. The linings are made of various corrosion resistant materials: like – FRP, composite panel, Polypropylene, stainless steel etc.

c) *Hood Baffle:* The baffle is a panel on rear interior wall which is designed to control airflow distribution within the hood. The baffle slots are some times adjustable. Generally the baffle is made of the same material as interior linier.

d) *Work Surface:* Work surfaces are made of a material that provides good heat & corrosion resistance and easily cleaned & decontaminated. Dished or recessed area on work surface is designed to provide containment of small spills and provide demarcation of the recommended work area inside the fume hood.

e) *Hood Sash:* The sash is a moveable panel (most probably transparent) made of toughened glass that is inbuilt at the front side of fume hood. This provides a protective barrier between the operator and the experiment. Sashes are available in verity of configurations Like: Vertical (Up & down) movement, Horizontal (Left & Right) movement and combination of vertical-Horizontal (Up-Down & Left-Right) movement. The sash is normally designed to move freely. Force to open the sash shall be reasonable for the size and weight of the sash. Typically a six feet hood with a vertical rising sash shall require no more than Five pounds of force to operate a sash.

f) *Hood Exhaust collar / opening:* The exhaust collar / opening that connects the hood to the exhaust duct & is located on the top of Fume Hood. The proper design of the exhaust collar affects the hood static pressure drop and noise level. The number of exhaust collar varies depending up on the length of hood. Typically hoods longer than six feet have more than one exhaust collar for connection to the exhaust duct.

g) *Hood illumination:* Fume Hoods are equipped with proper lighting arrangement that provides cool & adequate light. This is normally fit inside the hood at top which is operated from outside panel of the hood. Flame proof / explosion proof lights are available on request.

h) *Hood Utility Services:* Fume Hoods are equipped with variety of utilities as per the need. The most common services are electrical outlets, water & gas services. For safety reasons, as a standard practice, utility controls and electrical fixtures are made accessible from out side the fume hood opening. For better safety, all electrical fixtures are mounted on separate panels than that of other utility services like water and gas. *It is strongly recommended that electrical outlet should not be located inside the fume hood especially when the flammable or corrosive materials are present*. Connections for services will vary, depending on the point of origin and number of fixtures. Service lines may be brought in from below, down from ceiling or from the back wall.

2.2 Fire suppression systems: (optional)

2.2.1 Any fire suppression system used in a laboratory fume hood should be compliant with local codes and regulations and NEPA 17.

2.2.2 The recommended fire suppression for laboratory fume hood is a dry powder rated A, B or C. Other water or liquid based systems may be acceptable if appropriate testing and certifications are available.

2.2.3 Flammable materials should never be stored below the fume hood.

3.0 LABORATORY FUME HOODS – AS INSTALLED:

3.1 Location in Laboratory:

3.1.1 Laboratory fume hood systems should be balanced with room exhaust system and may be used in conjunction with room exhaust to provide the necessary room ventilation. Constant operation of fume hood will also provide fume control during non-working hours.

3.1.2 Sufficient make up air must be available within the laboratory to permit fume hoods to operate at their specific face velocity.

3.1.3 Laboratory fume hoods should be so located within the laboratory to avoid crosscurrents at fume hood face to heating, cooling or ventilating inlets.

3.1.4 It is recommended that the fume hoods to be placed adjacent / nearer to the wall standing by OTS (open to sky) space so that the duct route shall be minimized resulting effective suction.

3.2 Safety Considerations:

Please observe following safety considerations for the safe use of Fume hood.

3.2.1 Laboratory fume hoods are potential locations for fires and explosions due to the types of experiments conducted in these units therefore fume hood are located in such a way that in the event of fire or explosion within the fume hood, exit from the laboratory would be easy and quick.

3.2.2 Laboratory fume hoods are recommended to be placed away from high traffic lanes within the laboratory because personal walking past the sash opening may cause air turbulence that may affects the performance of exhaust system.

3.2.3 Sufficient aisle space should be kept in front of the fume hood enabling operator to run safely in case of emergency.

3.2.4 Safety devices such as eye wash, body shower, fire extinguishers, first aid kits and fire blankets must be accessible at convenient distance to fume hood operator with due identification mark.

3.2.5 In case of cluster of two or more fume hoods, ensure that fumes gathered in duct are not reacting amongst them.

3.3 Fume hood Evaluation – As installed:

3.3.1 Room conditions: Check room conditions in front of the fume hood using anemometer and a smoke source to verify that the velocity of cross drafts does not exceed 20 percent of the specified average fume hood face velocity. Please see that any cross drafts that exceed these values are eliminated before proceeding with fume hood test.

3.3.2 *Sash Operations:* Check operation by moving sash through its full length travel. Sash operation shall be smooth and easy. Vertical rising sash shall hold at any height without

creeping up or down, unless designed otherwise. Force applied to open / close the sash shall be reasonable for the size and weight of the sash. Typically, a six feet hood with a vertical rising sash requires no more than five pounds of force to operate a sash.

3.3.3 *Face Velocity:* Face velocities of laboratory fume hoods are established on the basis of the toxicity or hazard of the materials used or the operations conducted within the fume hood. The most widely requested target average face velocity is 100 FPM (feet per minute) OR 0.5 mps (meter per second). The measured deviation across the face may vary ± 20 FPM (For more information on this topic, refer to section 12.0 Regulatory and Industry Consensus standards). *Please note:*
Face velocity shall be adequate to provide containment. Face velocity is not a measure of safety.

3.3.4: *Measuring Face Velocity:* Check face velocity at the front of sash opening with the help of low air flow monitor (optional) fixed on the panel. This gives online velocity check. As inbuilt airflow monitor for each and every fume hood becomes a costly affair, one can measure face velocity with anemometer which are available at very low cost (Aakar also can provide on request). All Fume Hoods can be validated with one anemometer.

3.4 Trouble Shooting:

When fume hoods are found improper functioning, the cause is frequently due to insufficient quantity of air flowing through the hood or due to turbulence of the air generated across the face of fume hood or probably due to both the reasons. Following are the suggestions offered to resolve the problems.

3.4.1 *Insufficient Air:* Insufficient airflow through the fume hood may be caused by various reasons. Each reason should be checked properly and catch the root cause.

3.4.1.1 Double check the readings taken for face velocity.

3.4.1.2 Check Air flow velocity meter. When was it calibrated last? Is its battery Ok? Was the instruments zeroed before taking readings?

3.4.1.3 Check the measuring instrument is recommended for low air velocity includes 50 to 150 FPM (feet per minute).

3.4.1.4 If possible, try it with another velocity meter to verify the readings.

3.4.1.5 Ensure that the baffle openings are open & not blocked with large and bulky apparatus.

3.4.1.6 Ensure that the Fume Hood face opening is not blocked by people surroundings while taking readings.

3.4.1.7 Ensure that the make up air is sufficient (check the room ventilation system).

3.4.2 *Room Cross Drafts:* Following are the various possibilities to generate cross drafts within the room. Ensure the same are resolved:

3.4.2.1 If the fume hood is located near the door / window, the air moving through an open door/window may cause cross draft.

3.4.2.2 High velocity air from ceiling-mounted diffusers or room air supply may cause cross drafts or down drafts.

3.4.2.3 The room conditions mentioned above should be avoided by changing the location / position of fume hoods to over come their effect. The velocity of the cross drafts shall not exceed 20 to 50 percent of the fume hood face velocity (as per SEFA).

3.4.3 *Exhaust Unit & Duct Consideration:* Where ever possible, Centrifugal blower (or exhaust unit) is recommended to mount on the roof of the building to provide a negative pressure in that portion of the duct system within the building. Please check the following parameters:

3.4.3.1 Ensure that the blower's capacity is properly defined in such a way that blower can exhaust sufficient volume of air so that the desired face velocity at the face of the fume hood is achieved at total system static pressure loss.

3.4.3.2 Ensure blower's proper design to minimize noise level (recommended 60db at one meter distance from Fume Hood).

3.4.3.3 Duct work shall be designed and constructed in accordance with approved standards (ASHRAE, NEPA, SMACNA) and regulations. For minimal friction losses within duct, smooth interior surfaces are recommended. Elbows, bends and off sets within a duct system should be minimum in order to minimize static pressure loss.

3.4.3.4 Ensure that fume hood and other exhaust devices shall not interconnect with re-circulating system.

3.4.4 *Make up Air:* Make-up Air is ventilation term indicating out door air to the room replacing air which is removed / displaced by exhaust ventilation system. In general laboratories require four to twelve total air volume changes per hour depending on type of work. Refer to OSHA 1910.1450, page 492 and NEPA 45, 2000, page 45-27, A.6.3.3. Special applications may require more air changes per hour.

3.4.4.1 Make sure that a sufficient quantity of make air is available to allow fume hoods to develop required face velocity.

3.4.4.2 In order to provide a balanced and functioning system, all factors such as fume hood exhaust volume, air change data, make up air systems and auxiliary air performance, if applicable must be considered.

3.4.4.3 Laboratories using chemicals should operate at a slight negative pressure as compared to remainder of the building.

3.4.5 *Laboratory fume hood Inspection::*

3.4.5.1 Inspection procedure consists of physical examination of liner condition, over all cleanliness, baffle and sash operational condition, counter balance cables, lighting operation and condition and utilities function.

3.4.5.2 Inspection results should be properly recorded and reported to the proper authority for any required action. Low-flow or no-flow alarms should be tested for correct operation at regular intervals.

3.4.5.3 Blower should be inspected regularly.

3.4.6 *Laboratory fume hood Maintenance:*

3.4.6.1 Fume Hood maintenance procedures consists primarily of cleanup, adjustments, lubrication and replacement of worn, damaged or non-functioning parts.

3.4.6.2 Use good house keeping in laboratory fume hoods at all times.

3.4.6.3 Periodically clean sash exterior and interior surfaces, including light panel.

3.4.6.4 Replace lamps periodically to maintain adequate illumination.

3.4.6.5 Wipe off / Flush all spills immediately using neutralizing compounds as required and clean thoroughly.

4.0 LABORATORY FUME HOODS – AS USED:

4.1 Safe Work Practice:

The employer is responsible for ensuring that the fume hood meets satisfactory safety standards. A fume hood operator is responsible for ensuring that the hood is used in a safe manner according to organization's safety guidelines.
The following guidelines are provided to help reduce your potential for exposure while working with harmful / hazardous material inside Fume Hood.

- Plan for conducting experiments
- Wear appropriate personal protection
- Verify proper system operation.
- Implement proper work practice.

4.1.1 Plan for conducting experiments:
Prior to begin the experiment, check out the answers for following points:

- What are the probable hazards associated with the procedure?
- What special precautions are required?
- Is this the right type of Fume hood?
- Is the space available inside the Fume hood adequate for the apparatus?
- Does the fume exhaust system work properly?
- Is "run-away" path clear without any obstacle in case of hazards?

4.2 Wear Appropriate Personal Protections:

Get ready for conducting experiment by wearing required personal protective apparel. It is generally accepted that at a minimum, the appropriate apparel for working at laboratory fume hood includes; Eye protection glasses, lab coat, gloves, long pants and safety shoes.
(Ensure that the clothing and glove materials are appropriate for the required work. E.g. vinyl gloves provide excellent resistance to formaldehyde but poor resistance to chloroform).