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Laboratory Fume Hood Guide

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What is a fume hood? How does it work, and why does it matter?

This guide will outline basic information for beginners and also offer some important safety reminders for those who have experience working with fume hoods. First, let's define some terms so we can be sure we're all speaking the same language.

What is a Fume Hood?

A fume hood is essentially an exhaust system designed, as the name implies, to remove fumes from a laboratory or work area. This is because there are chemical vapors, dust, gas, mist, or aerosol that would be harmful for workers to inhale or that would otherwise contaminate the lab environment.

For example, dust can be very damaging to a number of processes. If dust is created by a process, it is often desirable to remove it from the work area to avoid this type of damage. Usually the fume hood looks kind of like a large box with a moveable "door" called a sash. Experiments or process are conducted inside the hood, and vapors are removed or "exhausted" through ductwork usually equipped with some kind of blower.

Harmful contaminants are filtered or diluted to the point where they are no longer harmful. Some fume hoods use filters rather than outside venting to trap contaminants and keep them from entering the HVAC system of the building.

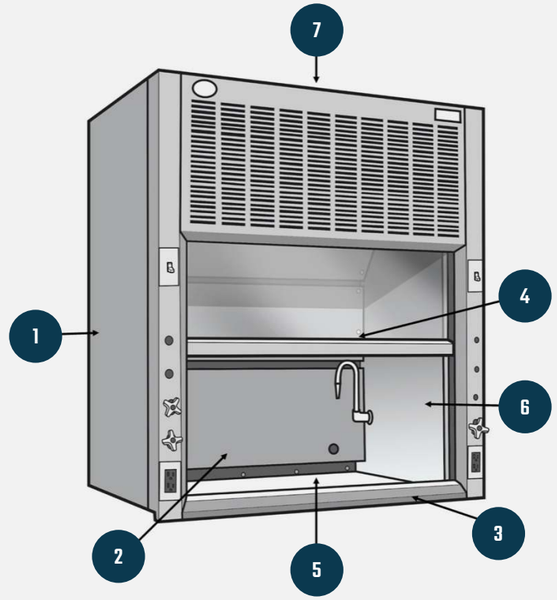
Later in this guide, we will explain how a fume hood works, but the basic principle is that a negative pressure is maintained inside the hood, and fresh air enters at a constant rate to remove undesirable materials while also serving as a physical barrier between workers and contaminants.

The velocity at which that air enters the fume hood is called Face Velocity (FV) and it can be controlled using a variety of mechanisms. This is not a case of "more is better" as more air can actually cause issues, which we'll also discuss later in this guide. Instead, the ideal face velocity is between 60-100 fpm, although it is always a good idea to consult your specific standard operating procedures (SOP) to determine the ideal FV for any particular task.

What isn't a fume hood?

Sometimes, equipment that is not actually a fume hood gets confused with fume hoods. Biological safety cabinets, glove boxes, and boxes that are used for pharmaceutical isolation are designed for specific applications. Unlike fume hoods, they are not equipped well to deal with chemicals and should not be used for dealing with them safely.

The Parts of a Fume Hood



1 **The Fume Hood Body**

This is what you see on the outside. It is the "box"

2 **Baffles**

Baffles are essentially air vents along the back of the fume hood designed to keep the face velocity constant depending on the position of the sash. Some of these sashes are controlled automatically through the use of a velocity sensor.

3 **The Airfoil**

A piece of material that streamlines the airflow into the fume hood, the airfoil works much like the air dam on a semi-truck or the front of the wing on a jet aircraft, designed to direct airflow smoothly and directly into the engine. Do not ever remove these, even if you feel they are in the way. The presence of the airfoil is vital to the function of the fume hood.

4 **The Sash**

The sash is the "door" to the fume hood. It's how technicians move things in and out of the hood. Most of them are vertical and move up and down. However, some are horizontal and move side to side, and still others are capable of both vertical and horizontal movements.

5 **Work Surface**

The surface where work is performed.

6 **Hood Face**

The face is where face velocity is measured. Technically speaking, this is an imaginary line from the work surface to the bottom of the sash.

7 **The Exhaust Plenum**

This part of the fume hood ensures that the air is distributed evenly across the face (see above).

Once you understand the various parts of a fume hood, we can look more closely at how a fume hood works. →

How a Fume Hood Works

As we stated above, a fume hood works by maintaining constant negative pressure inside in order to ventilate vapors and other materials. In order to maintain that constant velocity, baffles are often used to regulate that flow.

The flow at the face, or face velocity (FV) is often measured with a flow meter. That flow will change depending on sash position. Think of it like your thumb on a garden hose. The further the sash is closed, the greater the pressure (velocity). The further open it is, the lower the velocity.

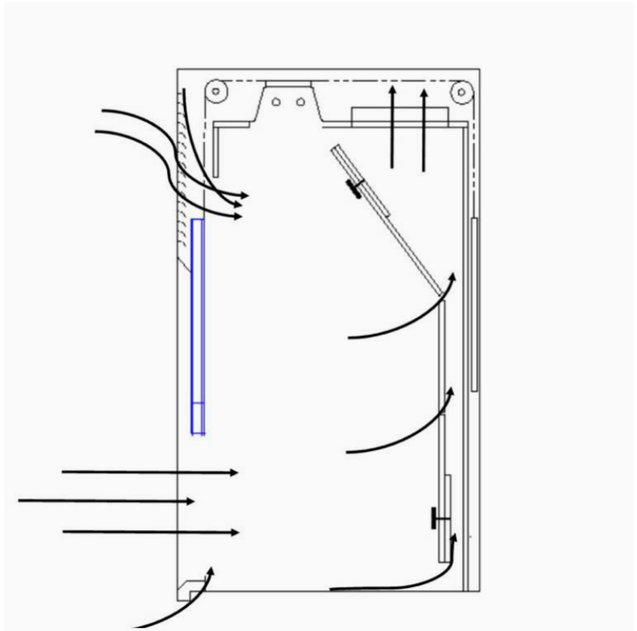
Some hoods are equipped with a system that automatically opens and closes baffles to maintain a constant velocity. It is vital that anyone using a fume hood knows the ideal pressure and monitors it.

The air foil or sill is an important part of this. Objects in the way of the sash opening, or the face, can change FV or can create disruptions or eddy's in the air current, just like a pebble thrown in water will cause ripples.

No matter how "inconvenient" these parts may seem, they should never be removed. This and other factors can cause the hood to "exhaust" vapors back into the lab.

Because of how fume hoods operate, workers should avoid sudden movements in and out of the hood. The hood should also never be installed next to a high-pedestrian traffic area, or disruptions in airflow can come from enough personnel walking by.

The vapors, gasses, or dust are often removed through dedicated ductwork and using exhaust fans. This is so it



does not mix with the regular HVAC system and reenter the air in the building. Because of this, users are often tempted to use the fume hood for things is was not intended to do. Connecting other devices and running tubing to vent things through the fume hood are not only ineffective, they can be dangerous.

The greatest danger with any fume hood is the release of contaminants into the lab, and the most common cause of this is human error. That is why it's important to follow procedures and avoid risks.

Some Types of Fume Hoods

Now that we know what a fume hood is and what it is not, it's good to understand that there are different types of fume hoods. Each is designed for a specific application or type of application.

General Purpose

This fume hood is good for dealing with general tasks that don't have specific requirements.

Distillation Fume Hood

These hoods are used mostly in labs, and they are essentially tall standard fume hoods with a low workbench height. They basically leave a lot of room for distillation equipment (generally taller than other types) and plenty of space for a person to work.

Floor Mounted Fume Hood

A floor mounted fume hood is even taller than a distillation fume hood, and has no work surface, but instead is mounted directly to the floor. They are often called "walk-in" fume hoods, but although materials are carried in and out, it is not recommended that technicians "walk in."

Demonstration Fume Hood

This type of fume hood is made of clear materials and is usually used in a classroom or other "demonstration" settings so those outside the hood can watch what the technician or professor is doing while still being protected.

Acid Digestion Fume Hood

These fume hoods have special liners that are acid resistant. For high temperature applications, they may also have additional materials added for protection, and often sashes are also made of polycarbonates to avoid acid etching and damage.

Perchloric Acid Fume Hood

This fume hood is especially designed to deal with a specific highly explosive acid. Essentially if perchloric acid interacts with organic material or it is in its dried form, it can be highly volatile. This type of fume hood is created with acid resistant materials and water wash down systems. This type of hood can't be used with any other chemical due to potential reactions.

Radioisotope Fume Hood

As the name implies, this type of fume hood is designed to protect the user from radioactivity. They generally have features that enable things like lead shielding (even in the sash) and coved corners so they can be cleaned thoroughly. Usually worktops are also designed to hold a lot of weight, like lead shields, in addition to the normal workloads.

Ductless Fume Hood

Again, the function of this fume hood is implied by its name. The ductless fume hood uses advanced filters rather than ductwork to remove particles and protect the environment. When they can be used, they are popular because they are somewhat portable and can be moved almost at will, the filters trap contaminants rather than releasing them into the air, and they generally save energy. They are a big part of "green initiatives" in labs.

Regardless of the application you need, there is likely a fume hood designed to meet those needs, and in many cases, custom hoods can be created as needed.

Procedures for Using a Fume Hood

Remember, follow all of the safety protocols outlined by your lab at all times. A fume hood is designed to work well and to protect personnel. Using it properly ensures your safety. Using it in a way it was not intended to be used can result in injury or worse.

Using a fume hood comes with some inherent risks. Training and imparting knowledge of procedures is vital. No one who is not trained to do so should use the fume hood.

1 First and foremost, make sure the fume hood is working before using it. Make sure the airflow at the face is in the ideal range. Make sure there are no obstructions in front of the face on the work surface. It is also important to check around the fume hood to make sure the area around the baffles is clear. Something inadvertently put in the way can impact the effectiveness of the fume hood.

2 Be aware of airflow changes. Even if your fume hood does not have a gauge, you can often "feel" changes or when things aren't normal. If you ever have any question, stop work, close the fume hood to the recommended level, and get help. There's nothing wrong with having a second pair of eyes check rather than risking potentially disastrous outcomes.

3 The operator should keep their face outside the hood and use the sash for protection when doing hazardous work. Remember, the fume hood is not intended to contain an explosion or other unusual events, so normal lab safety should be adhered to at all times.

4 Work at least six inches or a predetermined distance back from the hood. For hoods that are not portable, tape on the floor and the work surface itself should be in place to ensure there are no obstructions and that you are doing work far enough from the face to not disrupt airflow.

5 Use the PPE provided by your lab. Googles, gloves, face shields, and aprons are all common.

6 Using a floor fume hood or a distillation hood? If you are working with large items, put them up on blocks or stands if at all possible to allow for airflow around and underneath them.

7 Keep the hood closed whenever possible. It saves energy and it keeps the fume hood operating at its most efficient level.
Lastly, and perhaps most importantly the fume hood is not a storage unit for hazardous materials. Special vented chemical cabinets and other places are more appropriate for storage.

Avoiding Risks Associated with Fume Hoods

Although fume hoods do come with risk, as we stated above, the most common errors are due to human error. How do you avoid risks?

First understand that there are two primary risks of injury. If there is not enough airflow or it is disrupted, this causes exhausting issues, and this is usually due to the operator doing something outside of procedure or not paying attention.

There can be physical issues with the hood itself. If the exhaust fan is not running due to motor or belt failure, this can cause problems, as can physical obstructions like paper towels (a common one) or other lightweight materials that were sucked into the hood.

The most likely person to suffer injury is the operator of the fume hood, but if harmful gasses are exhausted into the lab, the consequences can be more widespread.
What about power outages? While most labs have some kind of backup power, an outage can happen. If you are using the fume hood at the time, lower the sash to a one-inch opening and stop work. This will allow for some natural airflow to create a chimney effect so gasses or other harmful substances don't leak back into the lab until poser can be restored.

Testing and Maintenance

Just like any other piece of safety equipment, a fume hood can fail for a variety of reasons. That's why testing and maintenance are so important.

Make sure the exhaust is working and there is sufficient face velocity before beginning work. It may seem like we are saying this a lot, but the importance cannot be stressed enough.

Fume hoods must be certified. Usually this process happens annually and is part of an inspection process. Smoke tests and tracer gas containments are used to reveal any faults in the system and are especially important. Nearly a third of fume hoods in use fail this test, and it is vital to either repair or replace these hoods immediately.

The number one maintenance tool is the operator. Be aware of problems. Use protective gear and fume hoods properly. If you suspect issues, stop working, shut down the fume hood, and report the issue.

If there is an exhaust system failure, turn off power and all service, lower the sash completely, and leave the area immediately. Don't return until you know it is safe to do so.

3 Myths Busted

It seems there is often someone in the lab environment who "knows better than the manual," and may spread common myths about fume hoods. Here are a few of them:

1

When working with hazardous substances, the higher the face velocity, the better.

This is not true. A higher face velocity can cause eddy's and swirling currents inside the exhaust chamber, and this can actually result in substances being released back into the lab. Operate at the recommended face velocity between the range of 60 fpm and 100 fpm.

2

You can use the fume hood to store hazardous items when a cabinet is not available.

This is not true. A higher face velocity can cause eddy's and swirling currents inside the exhaust chamber, and this can actually result in substances being released back into the lab. Operate at the recommended face velocity between the range of 60 fpm and 100 fpm.

3

You can remove the airfoil or sill. It is not important.

The airfoil or sill directs air into the fume hood properly. Removing it can cause serious issues with airflow. The same is true of coved corners and other safety items in specific types of hoods. Removing these items can cause issues like cross contamination when the fume hood is cleaned. If a safety component is in place, it should not be removed without consulting the manufacturer.

Conclusion

To conclude,

Fume hoods are simply a part of personal protective equipment in a lab, and they work well as long as they are in good working order and used properly by users. Lack of maintenance, attention to detail, or misuse of a fume hood can, just like other equipment, result in injury or even worse.

Get to know your fume hood, the parts, and how they work. Follow procedures, avoid risks, and adhere to maintenance procedures. Above all, be a myth buster, and follow policies and standard operating procedures. If you do, your fume hoods will be valuable members of your safety team.

Established in 1957, iQ Labs has been designing and manufacturing laboratory equipment for over 60 years. We specialize in both standard and custom fume hoods, casework, mobile laboratory furniture, and accessories.

If you have additional questions regarding safe fume hood operation or if you would like to speak with our sales staff, send us an email or give us a call!

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