

# Biological Safety Cabinets or Fume Hoods Which one to use?

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# Objectives

## 1) To define:

- Biological Safety Cabinets (BSCs) & Fume Hoods

## 2) To describe:

- Similarities/differences
- When to use a BSC or a Fume Hood
- What type of BSC to use
- How to work safely in a BSC and Fume Hood



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# Biological Safety Cabinets

# Introduction

## What is a Biological Safety Cabinet (BSC)?

- A ventilated cabinet or enclosure
- Uses directional airflow and HEPA filters to provide:
  - personnel protection
  - environmental protection
  - varying degrees of product protection



# Introduction to BSCs

## What is NOT a BSC?

### 1) A horizontal or vertical laminar flow 'Clean Bench' or 'Tissue Culture Hood'

- Discharges HEPA-filtered air across the work surface towards the user or over the product
- Offers product protection only
- Used for sterile assembly or dust-free electronic production/tissue culture



# Introduction to BSCs

## What is NOT a BSC?

### 2) A Chemical Fume Hood

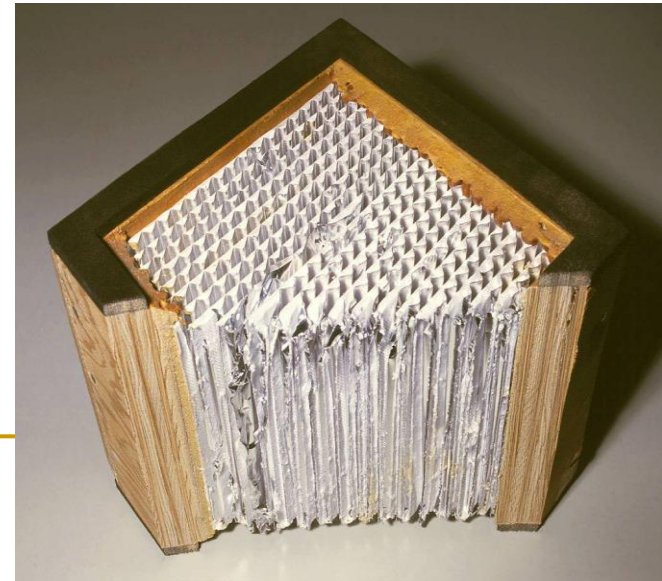


- Provides protection for the user from chemical hazards
- Must not be used with biological hazards (no HEPA filtration)

# Introduction to BSCs

## High Efficiency Particulate Air (HEPA) filters:

- Minimum filter efficiency = 99.97% removal at 0.3  $\mu\text{m}$
- Particles **larger** & **smaller** than 0.3  $\mu\text{m}$  are removed with even more efficiency
- Pleated sheets of boron silicate microfibers for increased surface area
- **Rigid casing** enclosing full depth of pleats



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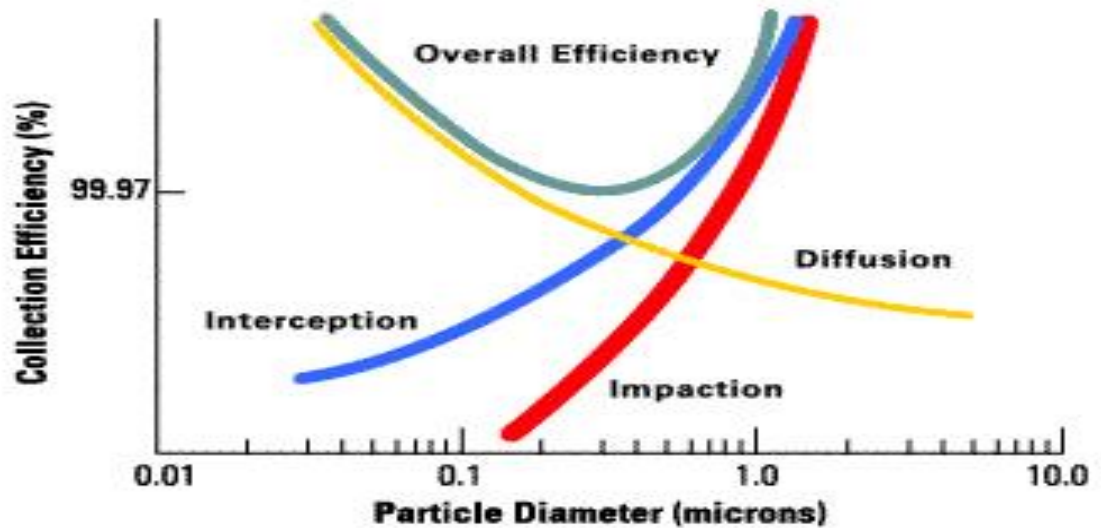
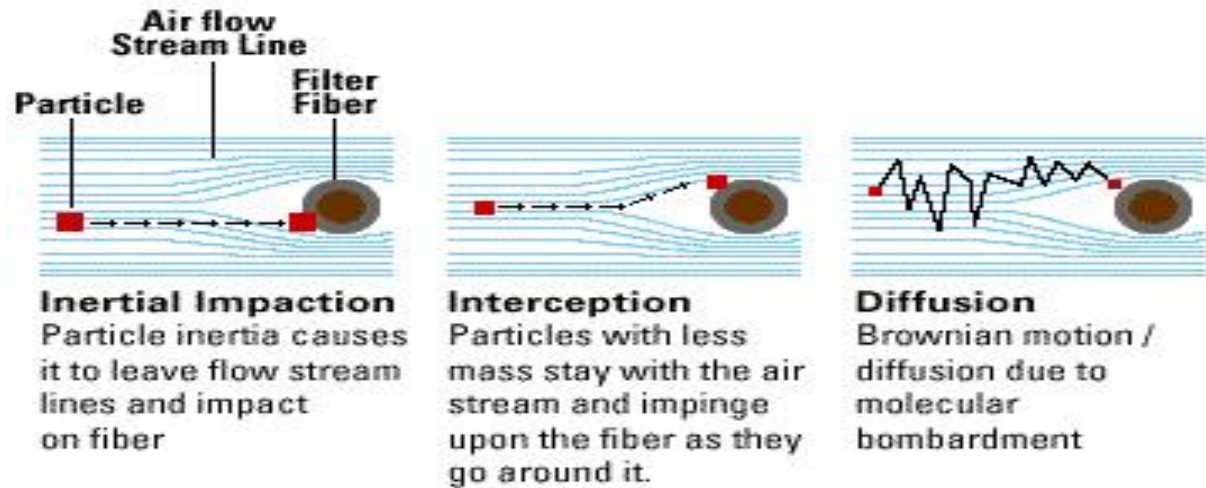


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# Introduction

## HEPA filtration



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# Introduction

## HEPA filtration



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# Introduction

## HEPA filtration



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# Introduction to BSCs

**HEPA filters DO NOT remove vapors or gases!!**



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# Introduction

## When do we use a BSC?

### In BSL2 for:

- Procedures with potential to produce infectious aerosols (incl. work with small animals)
- High concentrations or > volumes of infectious material
- Human cells
- Biological toxins



# Introduction

## When do we use a BSC?

In BSL3 & 4:

Used for *all* manipulations of infectious material, *except* necropsies



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# Introduction

## Types of BSCs

- Class I
- Class II (A1, A2, B1, B2)
- Class III (glove box)



# Class I BSC

**Personnel protection: YES**

- Inward air flow through sash opening

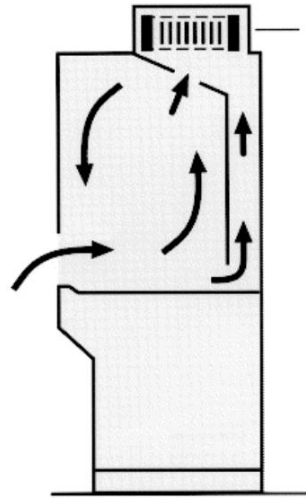
**Product protection: NO**

- Unfiltered room air drawn across work surface

**Environmental protection: YES**

- HEPA filtered exhaust air

**Used when product protection is not required.**



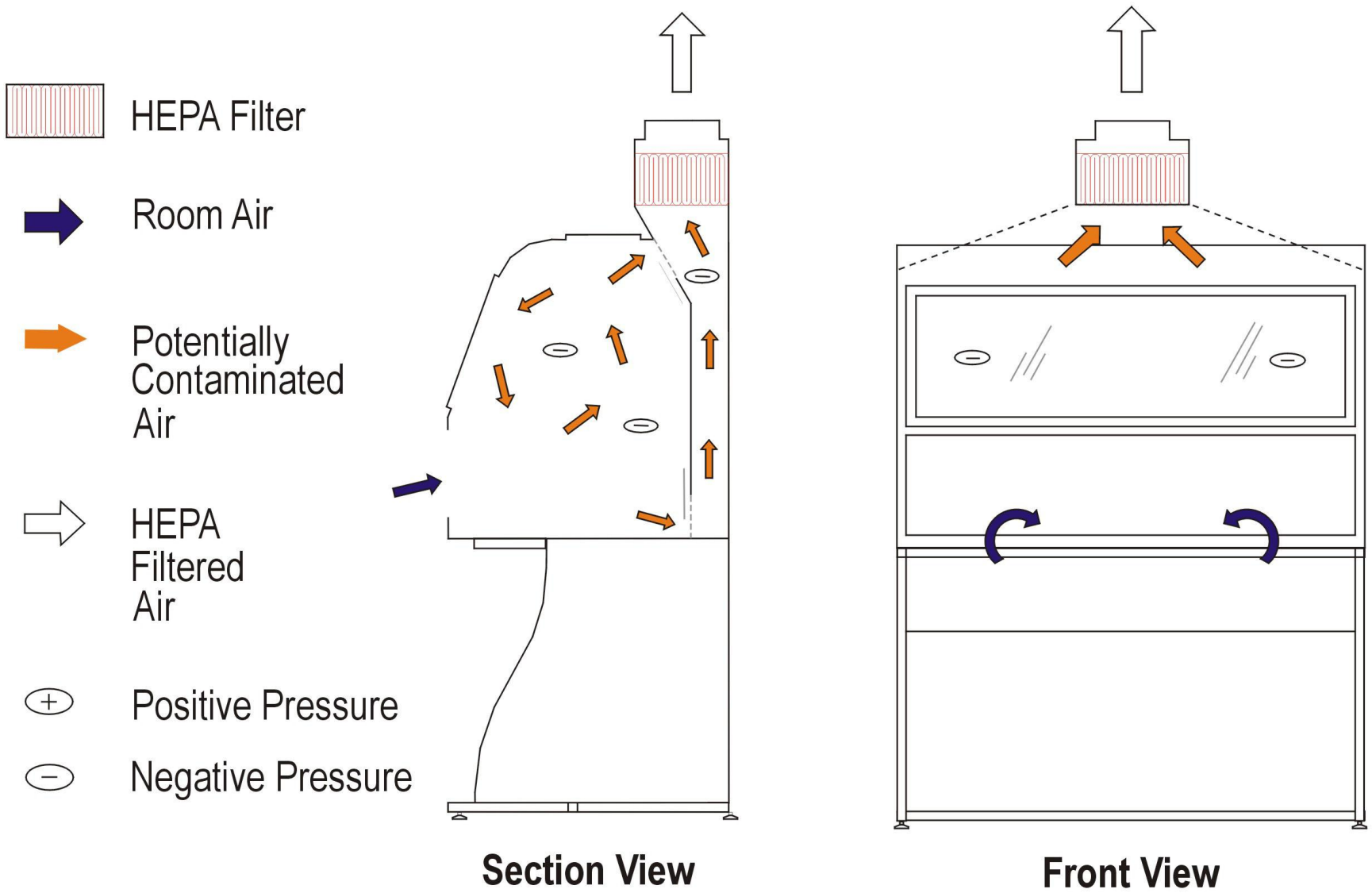
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# Class I Biological Safety Cabinet



**NUARE**  
CLASS II BIOLOGICAL SAFETY CABINET

Safety & Environmental Services  
Name: [illegible]  
Address: [illegible]  
Phone: [illegible]  
Fax: [illegible]  
E-mail: [illegible]

**NUARE**  
CLASS II BIOLOGICAL SAFETY CABINET

**CAUTION**  
THIS CLASS II BIOLOGICAL SAFETY CABINET PROVIDES PROTECTION FROM BIOHAZARD EXPOSURE WHILE THE USER OPERATES UNDER THE CABINET'S FULL SECURITY SWITCH FOR SPECIAL CHANGES.

NUARE 3000  
1/1/01

Rate Lookup Table

Rate	Area	Rate	Area	Rate	Area
1	...	1	...	1	...
2	...	2	...	2	...
3	...	3	...	3	...
4	...	4	...	4	...
5	...	5	...	5	...
6	...	6	...	6	...
7	...	7	...	7	...
8	...	8	...	8	...
9	...	9	...	9	...
10	...	10	...	10	...

At a glance

Area	Rate	Area	Rate
1	...	1	...
2	...	2	...
3	...	3	...
4	...	4	...
5	...	5	...
6	...	6	...
7	...	7	...
8	...	8	...
9	...	9	...
10	...	10	...

[illegible text]

Lead Paper  
2-4696

Case of a Bio-Hazard

Security

2005

Case of a security threat

[illegible text]

[illegible text]

NUARE 3000  
1/1/01

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# Class II BSC

**Personnel protection: YES**

- Inward air flow through sash opening

**Product protection: YES**

- HEPA-filtered air drawn down onto work surface

**Environmental protection: YES**

- HEPA filtered exhaust air to room or facility exhaust system

**Used for infectious material, biological toxins,  
human cells.**



# Class II BSC

**Divided into 4 design sub-categories:**

- Class II Type A1
- Class II Type A2
- Class II Type B1
- Class II Type B2



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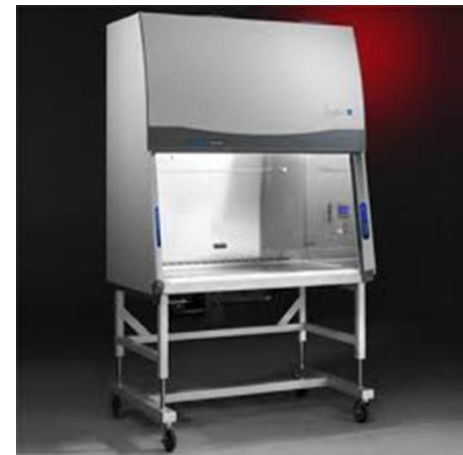


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# Class II BSC

## Class II Type A1 & A2:

- 70% air re-circulated; 30% exhausted to the room or outdoors via a canopy (thimble)
- Used for work with:
  - Infectious agents
  - Biological toxins
  - Human cells
  - Minute amounts of volatile chemicals & radionuclides (only in A2 exhausted out)



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HEPA Filter



Room Air



Potentially Contaminated Air



HEPA Filtered Air

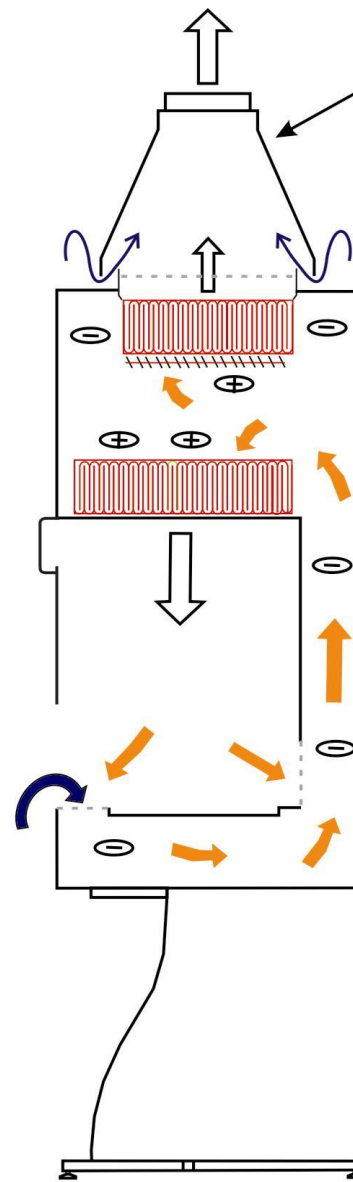


Positive Pressure

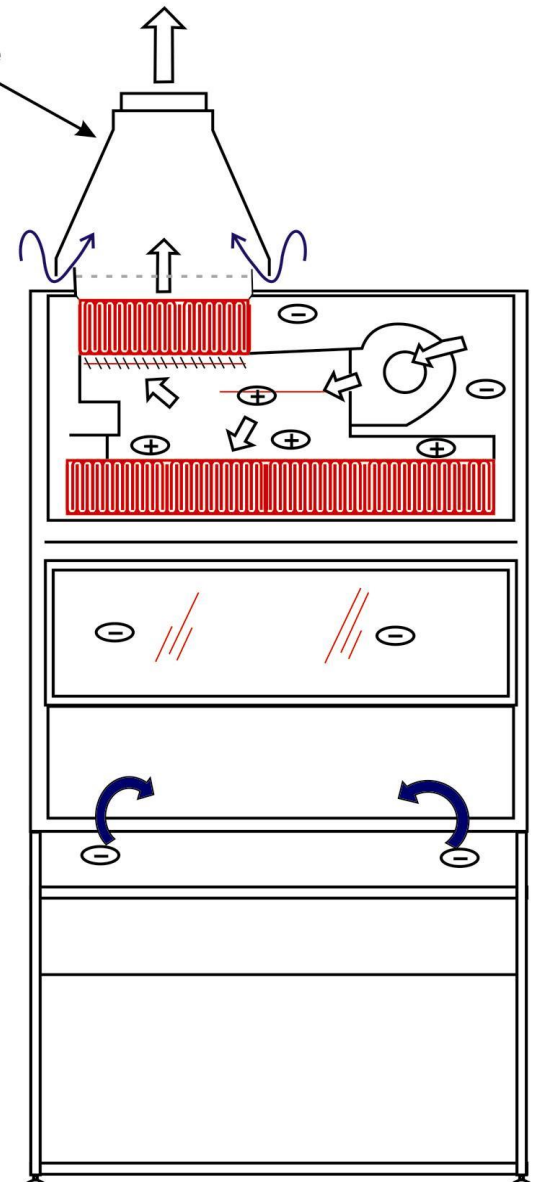


Negative Pressure

Optional Canopy or Thimble Connection



Section View



Front View

# Class II Type A2 Biological Safety Cabinet

# Class II BSC

## Class II Type B1:

- 30% air re-circulated; 70% exhausted
- Exhausted through dedicated duct into facility exhaust system
- Used for work with:
  - Infectious agents
  - Biological toxins
  - Human Cells
  - Minute amounts of volatile chemicals & radionuclides



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HEPA Filter



Room Air



Potentially Contaminated Air



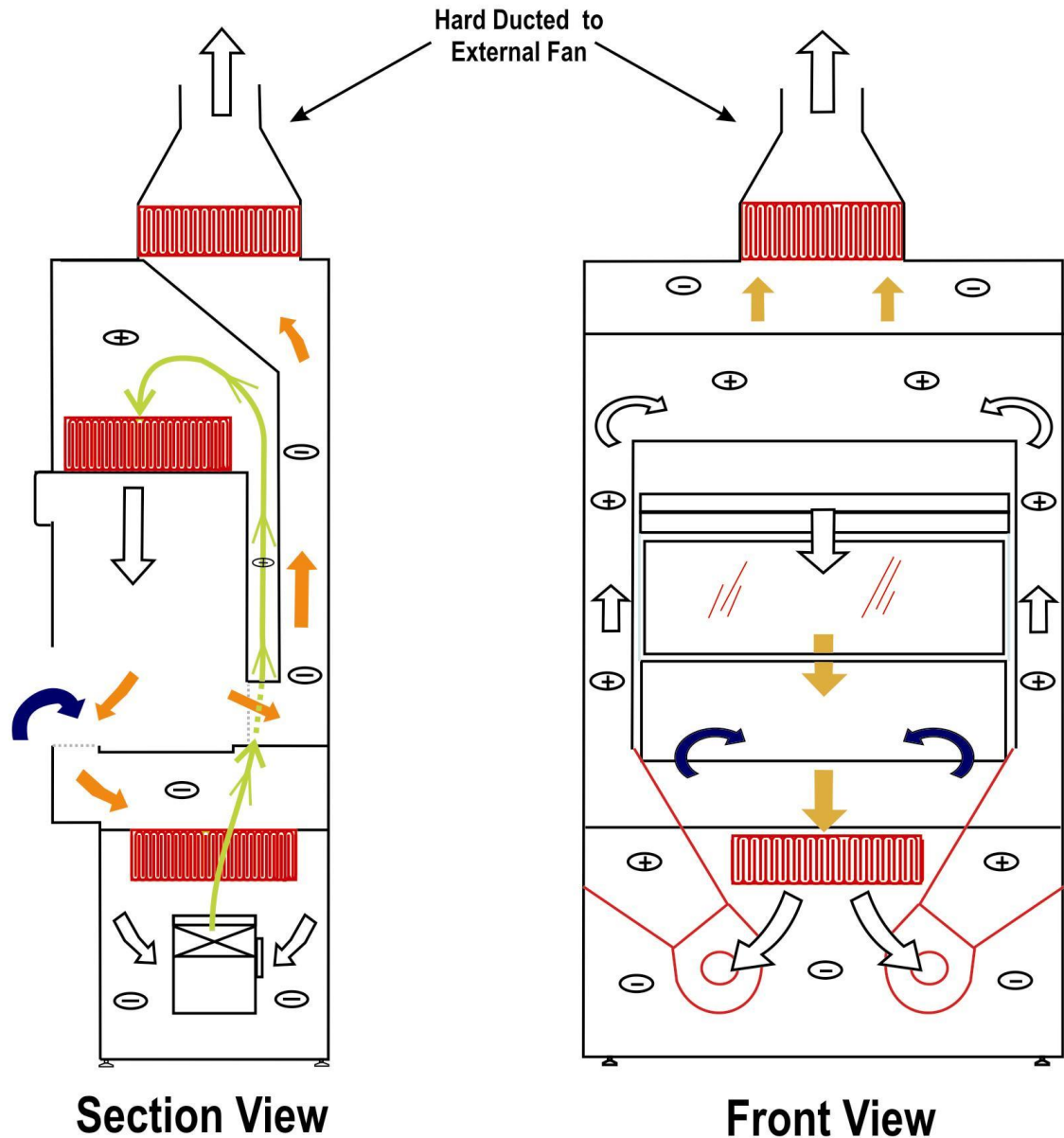
HEPA Filtered Air



Positive Pressure



Negative Pressure



**Class II Type B1 Biological Safety Cabinet**

# Class II BSC

## Class II Type B2 (total exhaust):

- 0% air re-circulated; 100% exhausted from cabinet
- Exhaust through dedicated duct into facility exhaust system
- Used for work with:
  - Infectious agents
  - Biological toxins
  - Human cells
  - Small amounts of volatile chemicals & radionuclides



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HEPA Filter



Room Air



Potentially Contaminated Air



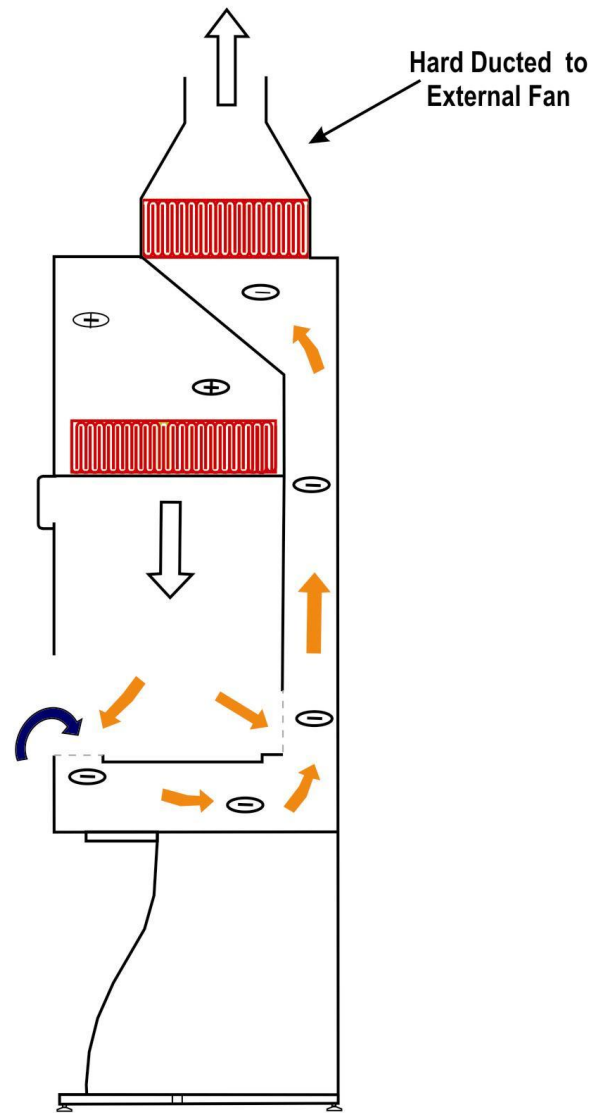
HEPA Filtered Air



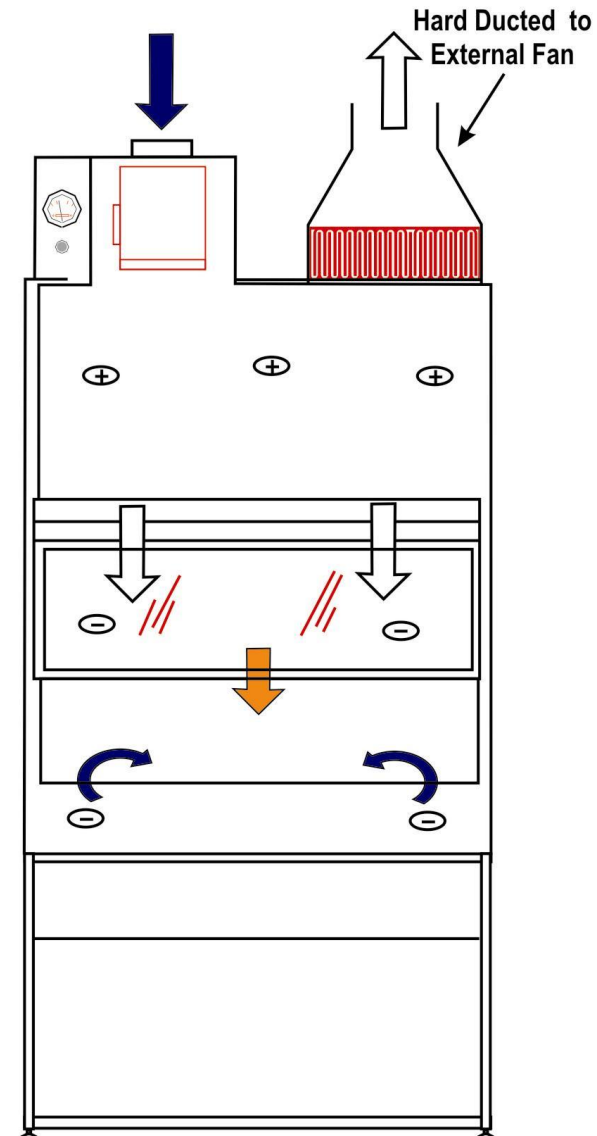
Positive Pressure



Negative Pressure



Section View



Front View

## Class II Type B2 Biological Safety Cabinet

# Class III BSC (glove box)

**Personnel protection: YES**

- Totally enclosed ventilated cabinet; gas-tight construction

**Product protection: YES**

- HEPA-filtered air drawn down onto work surface

**Environmental protection: YES**

- Double HEPA -filtered exhaust air to facility exhaust system

**BSL-4 conditions (used in a BSL-3 lab)**



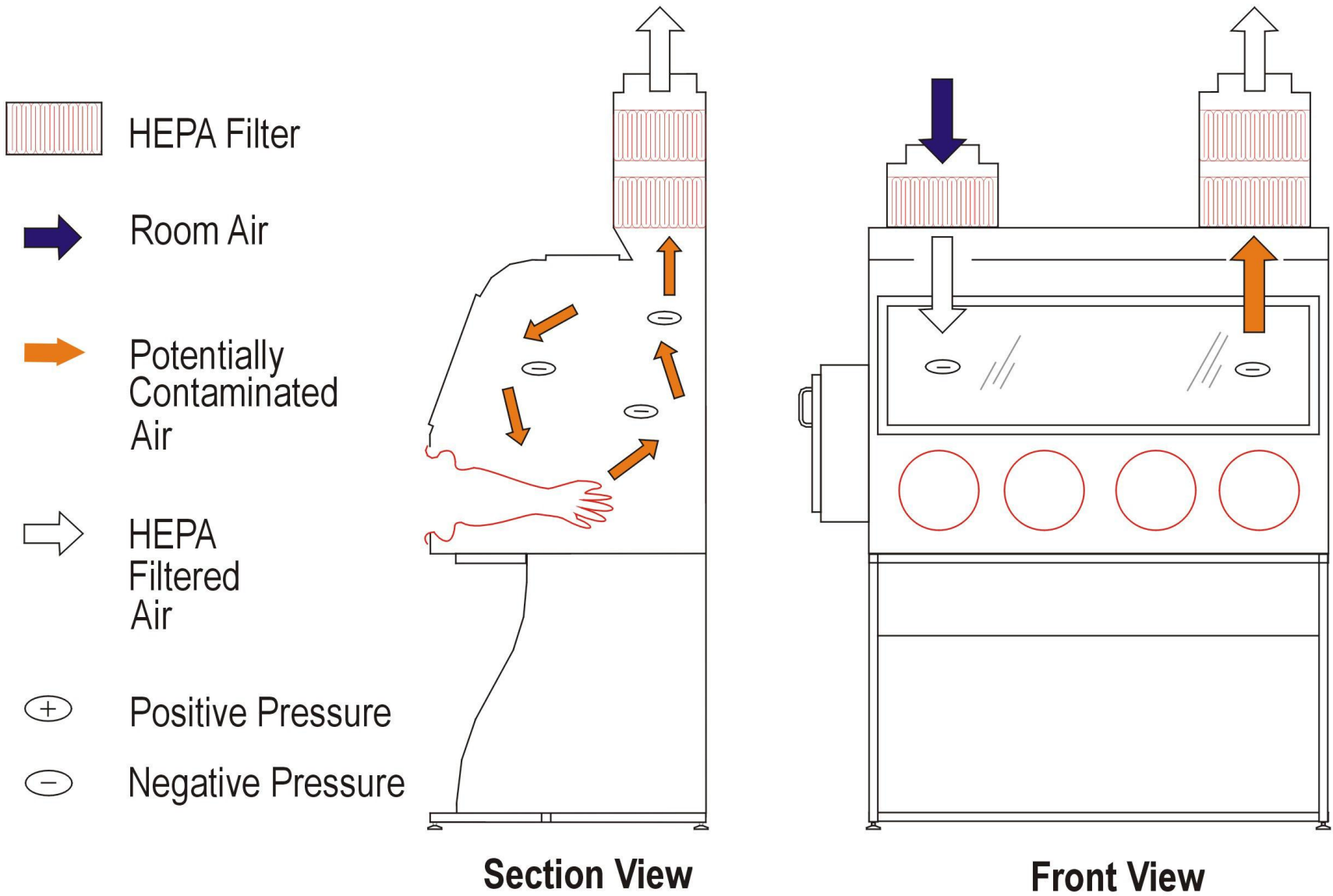
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**Class III Biological Safety Cabinet**



THE BAKER COMPANY  
IsoGARD

ALL SYSTEMS  
-6.12  
-5.89  
-6.00

**WARNING**

DO NOT USE TOOL  
OPERATOR OR A PERSON  
PROTECTED BY THIS COVER

TOPFLOW

TOPFLOW

JAMFLOW

10/11/11



# Working in the BSC

## Start-up Procedures:

- Turn off UV lights if used (use is discouraged)
- Turn on fluorescent light & blower, if off
- Check grilles for obstructions
- If BSC has an alarm, check & switch to 'on'
- Disinfect all interior surfaces with 10% bleach/70% ethanol or a suitable disinfectant



# Working in the BSC

## Start-up Procedures:

- Work surface may be lined with plastic-backed absorbent paper



# Working in the BSC

## Start-up Procedures:

- Place items required for procedure into cabinet;  
**do not obstruct grilles**



- Wait 1 minute for contaminants to purge from the work area



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# Working in the BSC

## Start-up Procedures:



**DO NOT hang spray bottles on the outside grille!**



# Working in the BSC

## Good Technique:

- Don protective clothing, gloves, respirator as appropriate
- Enter BSC straight on (avoid rapid & sweeping motions)
- Position yourself with arm pits level with top of sash



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# Working in the BSC

## Good Technique:

- Perform operations as far to the rear of work surface as possible
- Only one person should be working in a BSC at a time



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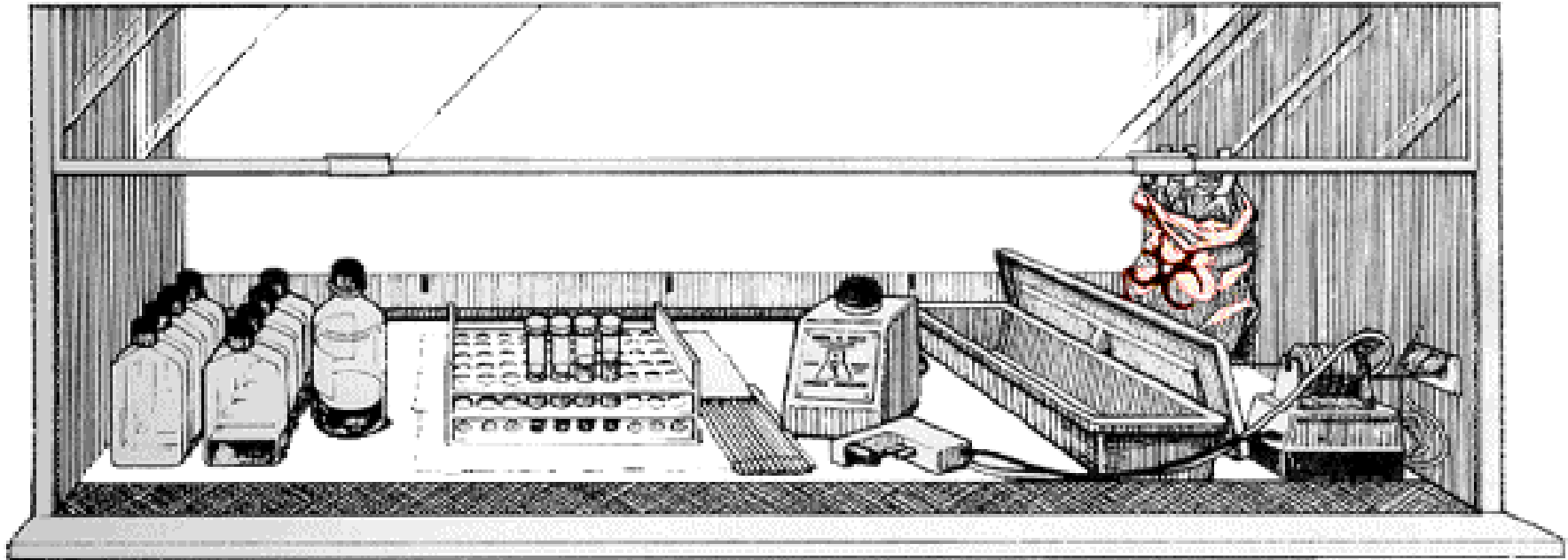


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# Working in the BSC

## Good Technique:



Work from 'clean' to 'dirty'



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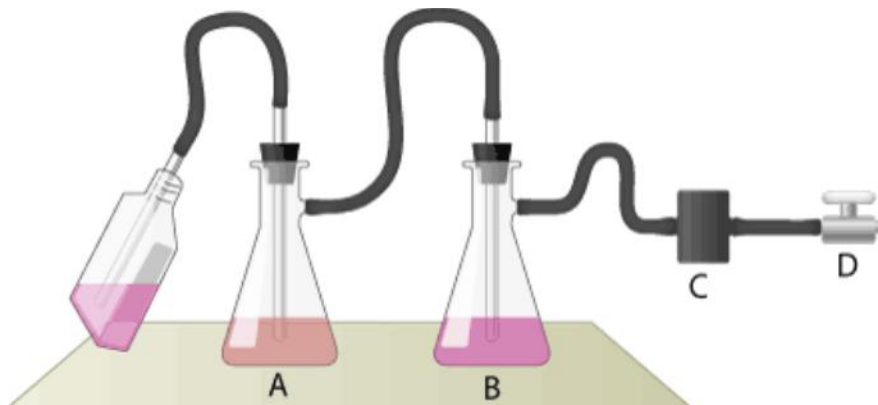


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# Working in the BSC

## Good Technique:

- Keep discarded, contaminated material to the rear of BSC; do not discard items in containers outside of BSC
- Vacuum lines must have a 0.22 $\mu$ m filter attached on the tubing *inside* the BSC



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# Working in the BSC

## Good Technique:

- Do **NOT** use large amounts **toxic** or **volatile chemicals** in the BSC (only **small** amounts permitted in Class II B1 & B2 exhausted BSCs)
- **NO OPEN FLAMES**
- If BSC alarms, stop work immediately, & secure all infectious agents
- If spill occurs, surface decon all objects; disinfect the work surface (underneath if necessary) with BSC 'on'



# Working in the BSC

## Upon completion of work:

- Close open containers
- Allow BSC to run for 1 min with no activity
- Surface disinfect all objects in BSC before removal from cabinet
- Spray off or remove first set of gloves and place into the biohazard bag within the BSC

# Working in the BSC

## Upon completion of work:

- Wipe down work surfaces with 10% bleach/70% ethanol or a suitable disinfectant
- Turn off fluorescent light & cabinet blower (ducted BSCs to be left on at all times)
- **Do not close sash (it is not a fume hood)!**
- **Do not use the BSC for storage!**



# Working in the BSC

## If a spill occurs inside a BSC:

- Leave BSC 'on'
- Don appropriate PPE
- Disinfect inside walls, work surfaces & equipment with appropriate disinfectant
- Flood work surface & catch basin with disinfectant, if necessary
- Let stand 30 minutes





# Working in the BSC

## If a spill occurs inside a BSC:

- Drain disinfectant from work surface & catch basin then autoclave or dispose down sanitary sewer
- Lift out tray & any removable exhaust grilles
- Wipe with disinfectant & replace (can autoclave any stainless steel removable parts)
- Replace tray & grilles
- Place all contaminated materials into a biohazard bag or pan & autoclave



# Working in the BSC

## UV lights:

- Time of exposure, distance, presence of dust & UV lamp intensity affect germicidal activity of UV lights
- UV light must be cleaned periodically to remove dust
- May damage eyes, skin & laboratory equipment
- Should be turned off when room is occupied

**UV lights must NOT be used for primary disinfection of BSC.**



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# Certification of the BSC

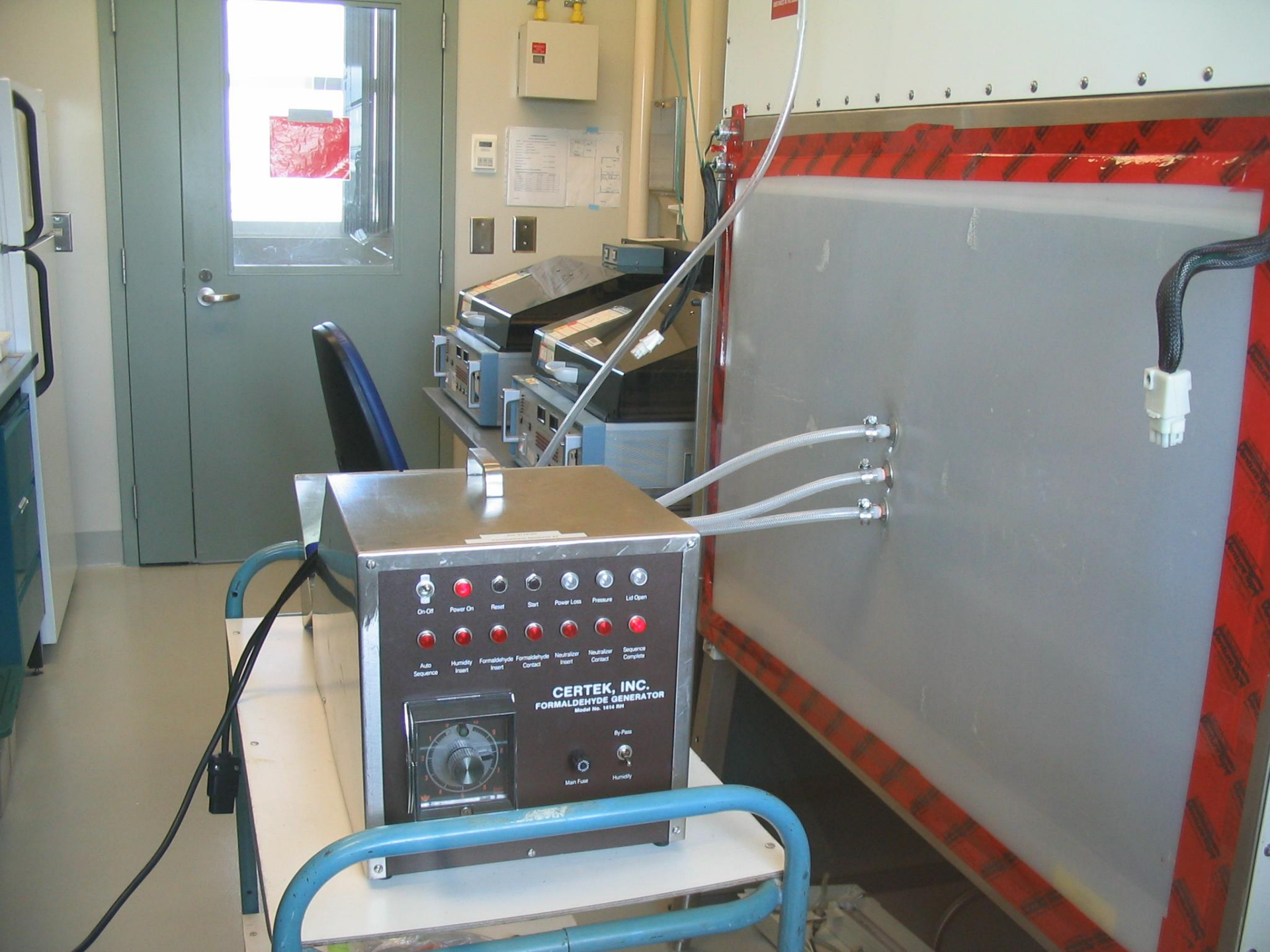
- Correct operation must be verified before use, then annually & after any repairs or relocation
- Field testing should be done by experienced, qualified persons (NSF-certified)
- A copy of the certification report must be kept by the user



# Certification of the BSC

## Preparation of the BSC for certification:

- All equipment must be wiped/sprayed with disinfectant, then removed
- BSC surface must be surface disinfected with a suitable disinfectant
- Certifier may decontaminate the BSC with formaldehyde gas or VHP



**CERTEK, INC.**  
**FORMALDEHYDE GENERATOR**  
Model No. 1414 801

On-Off    Power On    Reset    Start    Power Loss    Pressure    Lid Open

Auto Sequence    Humidity Insert    Formaldehyde Insert    Formaldehyde Contact    Neutralizer Insert    Neutralizer Contact    Sequence Complete

By-Pass  
Main Fuse    Humidity

# Certification

## Label affixed on outside of BSC with:

- Date of certification
- Date of next certification
- Standards that BSC was tested to
- Name of certifier





# Please remember.....

- **Use of a BSC is a valuable supplement to good sterile technique, not a replacement for it**
- **If you do not understand the BSC & how to operate it correctly it will not offer adequate protection for you, your product nor the environment**





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# Chemical Fume Hoods



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# Chemical Fume Hood

## Definition:

- A device with local exhaust ventilation designed to limit exposure to hazardous or noxious fumes, vapors, or dusts



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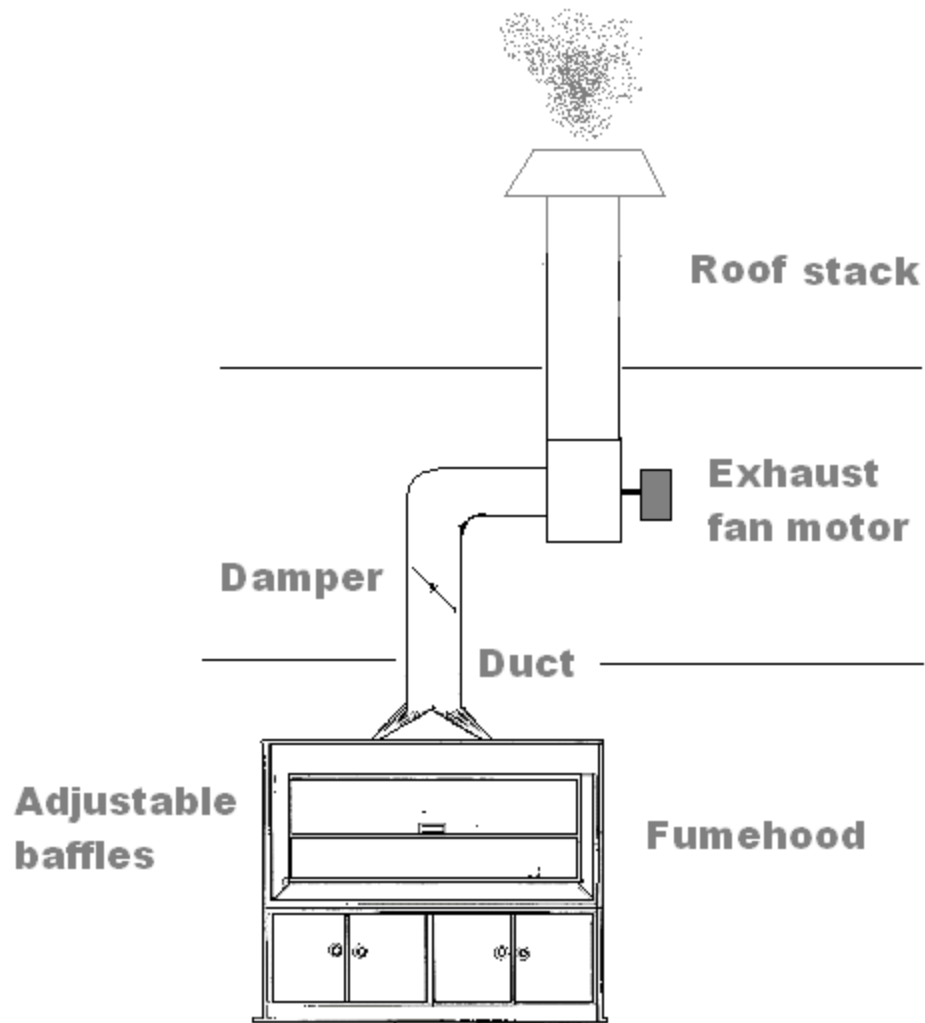


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# How chemical fume hoods work...

- Fume Hoods draw air out of the room & away from the user
- An exhaust fan pulls air and airborne contaminants from the hood through ductwork & exhausts to atmosphere
- 100% exhaust
- Shields the user with a sash (clear sliding window) that contains aerosols & prevents injury from splashes, fires, or minor explosions that may occur





- Schematic drawing of chemical fume hood and associated ductwork



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# When do we use a Fume Hood?

## When we want to:

- Contain vapors, dusts, gases, & fumes, & remove them as air flows into the hood, then out via the lab exhaust system

Fume hoods are not for use with biohazardous material  
(i.e. no HEPA filtration)



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# Proper Use of a Fume Hood

Ensure that the hood has a current inspection sticker (dated within the last year)

<b>•TESTED</b>	•UNIVERSITY OF MINNESOTA
	•Dept. of Environmental Health & Safety
•Velocity = _____	•(612) 626-6002 fpm
•Date _____ / _____	Initials _____





# Proper Use of a Fume Hood

**Verify the hood is working before using!**

- Check the flow monitor (if present)
- Use a tissue to demonstrate flow into the hood



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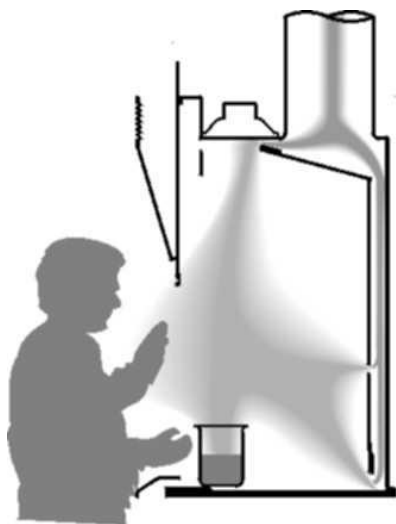
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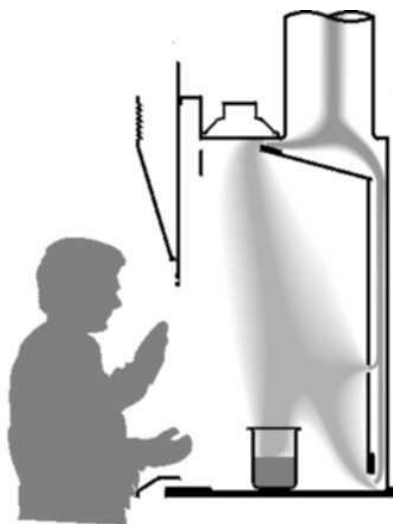
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# Proper Use of a Fume Hood

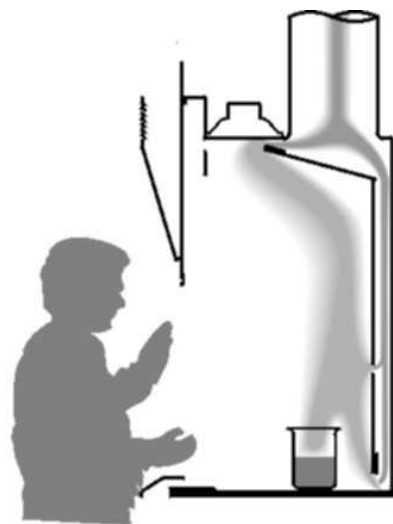
Conduct all work at least 6 inches inside the hood face



•Bad



•Better



•Best



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# Proper Use of a Fume Hood

- The plane of the sash is the barrier between contaminated and uncontaminated air



Never put your head inside an operating fume hood!



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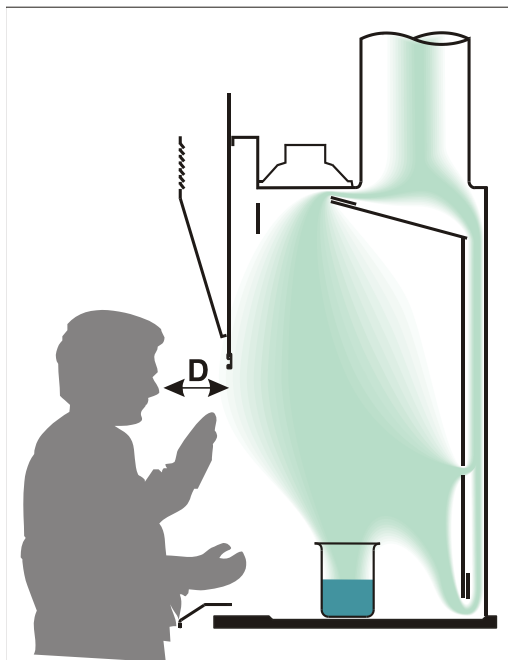
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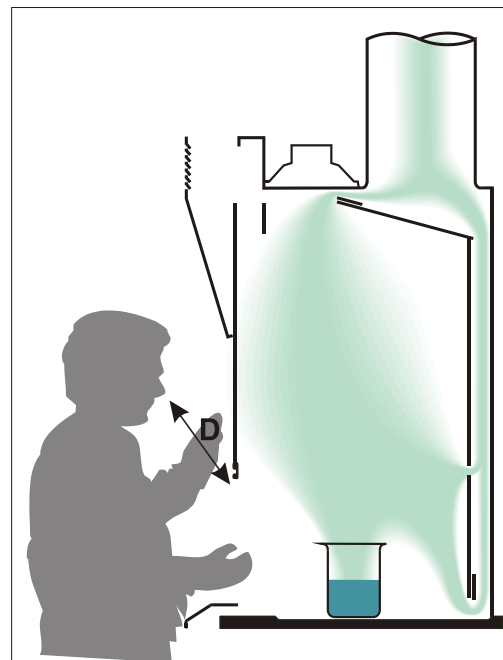
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# Proper Use of a Fume Hood

Close the sash(es) to the maximum position possible while still allowing comfortable working conditions



**Not Recommended**



**Recommended**



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# Proper Use of a Fume Hood

For hoods with horizontally-sliding sashes, keep one sash in front of your body as a safety shield



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# Proper Use of a Fume Hood

DO NOT remove sash panels or back baffles or modify the interior or exterior components of the hood



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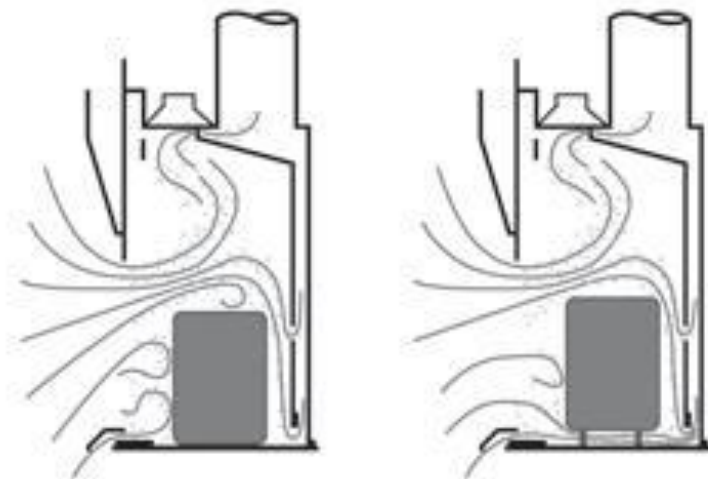
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# Proper Use of a Fume Hood

DO NOT place equipment, materials or chemicals in the hood which block the slots or otherwise interfere with smooth hood airflow



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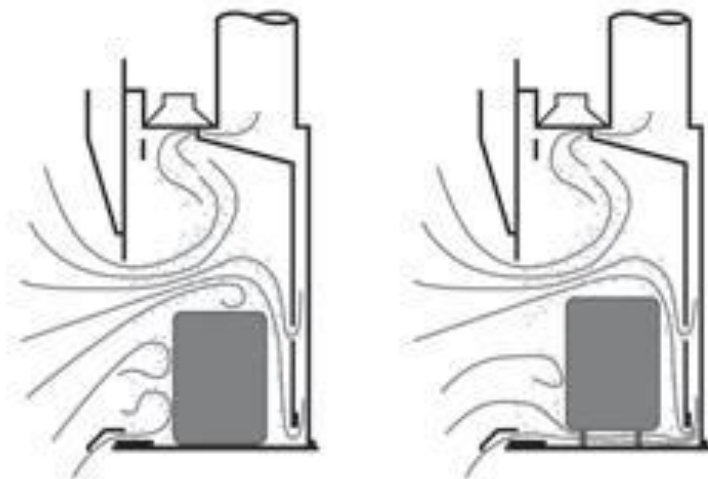


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# BSCs vs. Fume Hoods

	Biological Safety Cabinet	Chemical Fume Hood
HEPA filtered exhaust	Yes	No
Worker Protection	Yes	Yes
Product Protection	Varying degrees	No
Environmental Protection	Inf. agents – Yes; Chemicals - No	Inf. agents – No; Chemicals – Yes (indoor)
Sash closed when operational	No	Yes
Used for Biological Hazards	Yes	No
Used for Biological Toxins	Yes	No
Chemicals	Minute or small amts (ducted)	Yes



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# Thank you!



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