The ABC’s of Biosafety Cabinet Selection




Luke Savage, Director of Ventilation Technologies

LABCONCO

Learning Objectives

- Learn when Biological Safety Cabinets are required and common applications.
- Learn about Biological Safety Standards and Regulations
- Learn how BSCs provide user and product protection
- Learn the differences between types A, B, and C cabinets

Why do we need to use a biosafety cabinet?

For handling biohazardous materials. An infectious agent (or parts thereof) that present a real or possible hazard to the health of:

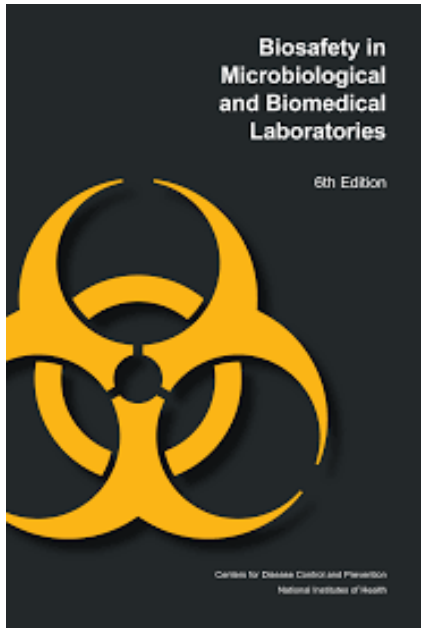
Animals

Humans

Plants

Determining when a biosafety cabinet is required

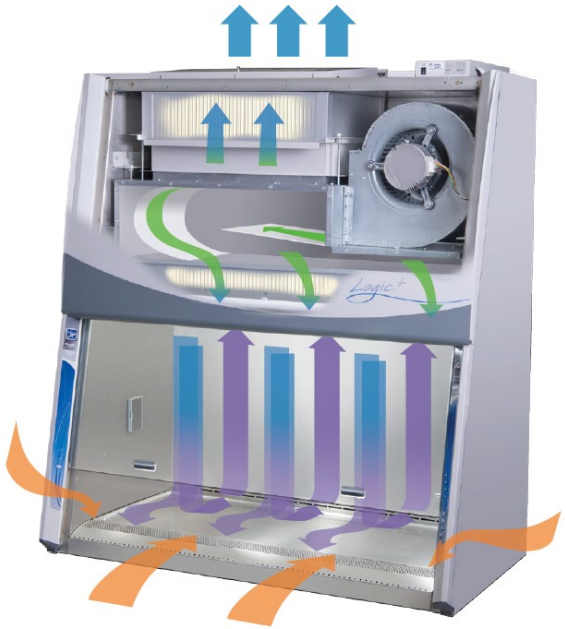
- Check for institutional guidance
  - Biosafety/EH&S Office
- Look to global biosafety standards
  - CDC BMBL
  - Canada Biosafety Standard
  - WHO Biosafety Manual
- Specific guidance provided
  - Typically by Risk Group



Canada

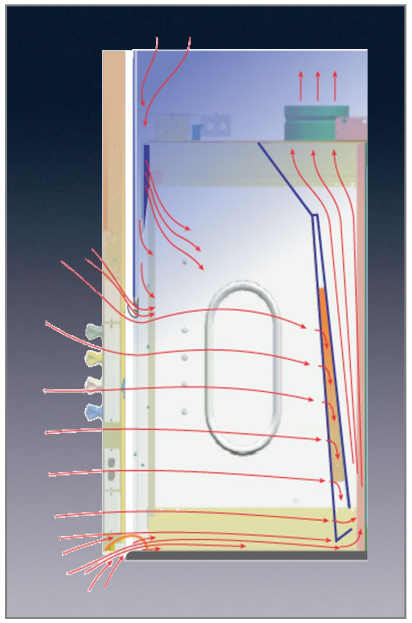
World Health Organization

BSCs vs. Fume Hoods



Biological Safety Cabinets

Enclosures that capture and contain biohazardous aerosols.



Fume Hoods

Enclosures that capture, contain and remove chemical fumes and vapors.

Class II BSC Applications

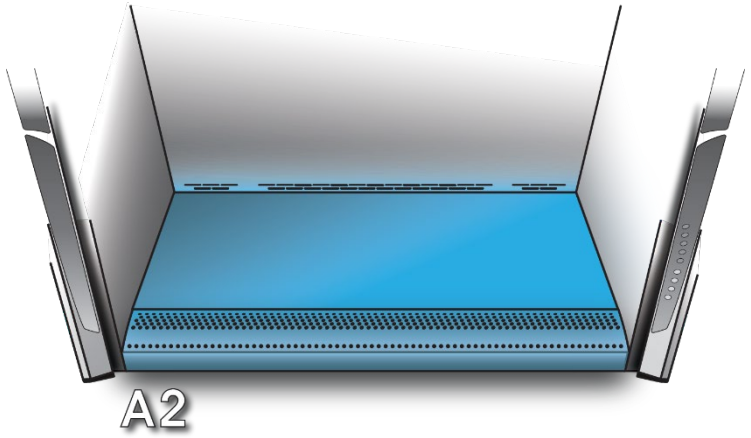
- Applications
  - Cell/Tissue Culture
  - Microbiology
  - Pathology
  - Clinical Diagnostics
  - Biopharma/Cell & Gene Therapy
  - Pharmacy Compounding

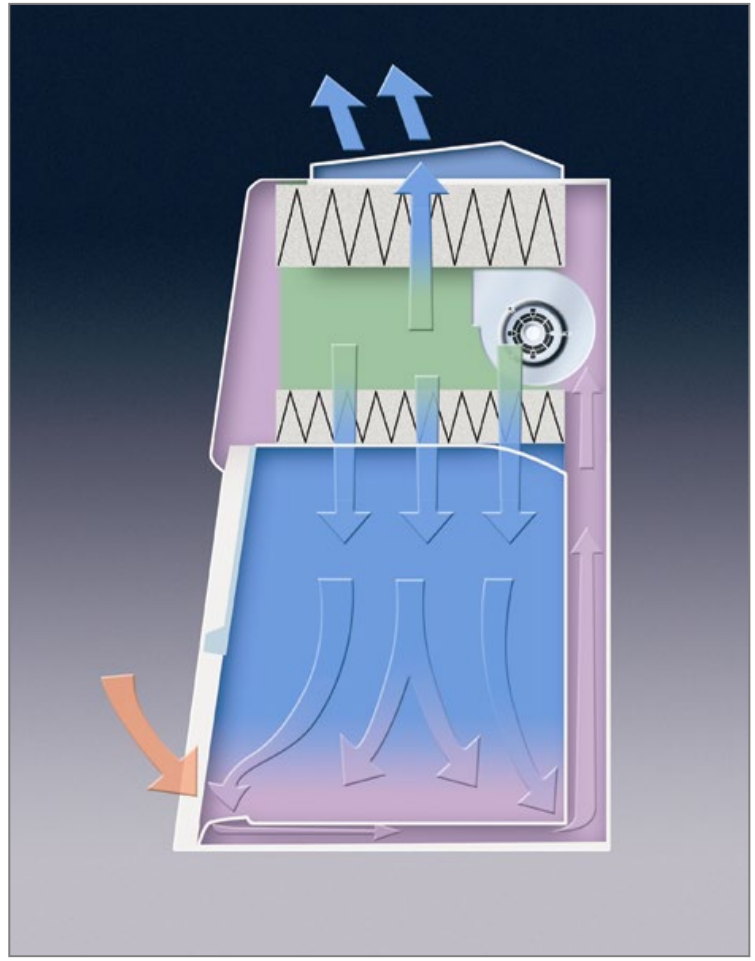
How do Class II BSCs work?

- Air is pulled through the enclosure to contain and filter pathogens and contaminants
- Air is filtered and distributed across the work area to provide aseptic working conditions
- Class II BSCs provide:
  - Personnel Protection (user safety)
  - Product Protection (contamination prevention)
  - Environmental Protection (user safety)

Class II, Type A2

- Personnel & product protection
- Airflow recirculates back into lab after filtration
  - Or thimble connection for light chemicals
- For traditional microbiological work only
  - No hazardous chemicals – recirculation
  - Light chemical usage – thimble connection





Type A summary.

PROS

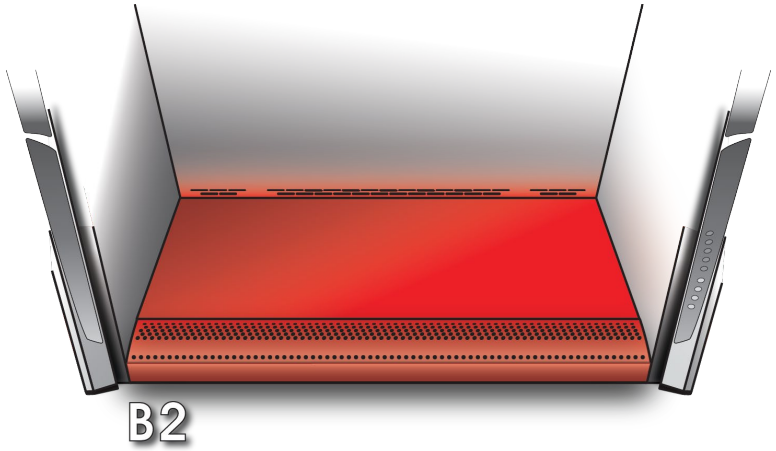
- Suitable for many BSC applications
- Can be exhausted for small volumes of chemicals
  - Easy to exhaust
  - Lower exhaust $ vs. Type B2 BSCs

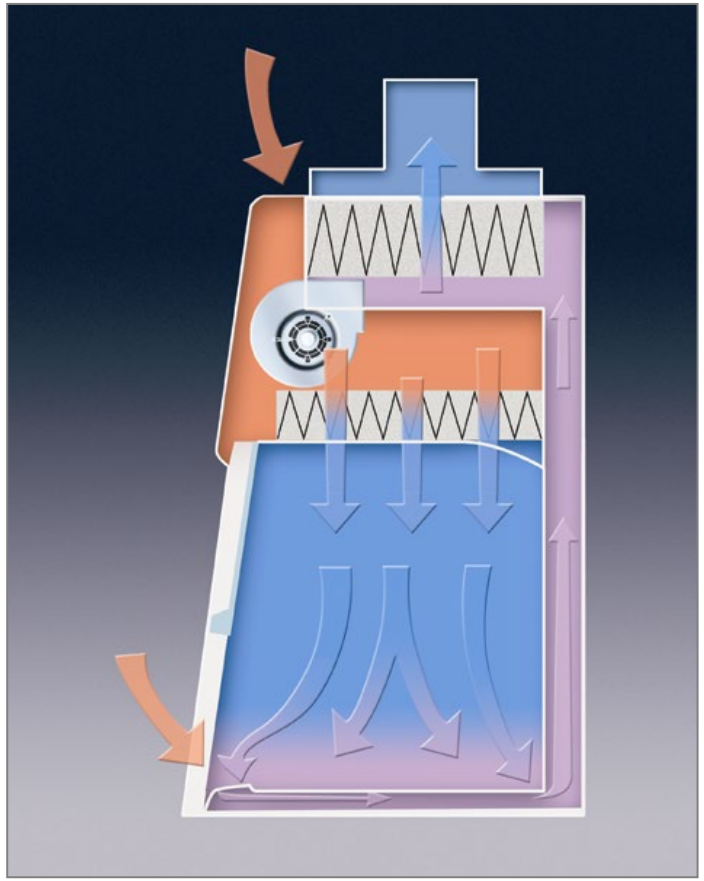
CONS

- Not suitable for medium to high volumes of volatile chemicals
- Can’t be converted into a chemical-friendly BSC

Class II, Type B2 – Total Exhaust.

- Personnel & product protection
- 100% Exhaust, no recirculation withing cabinet
- For use with non-corrosive, hazardous vapor forming chemicals
- Requires dedicated exhaust run for each cabinet
- Difficult to balance on a multi-hood exhaust setup.





Type B pros & cons.

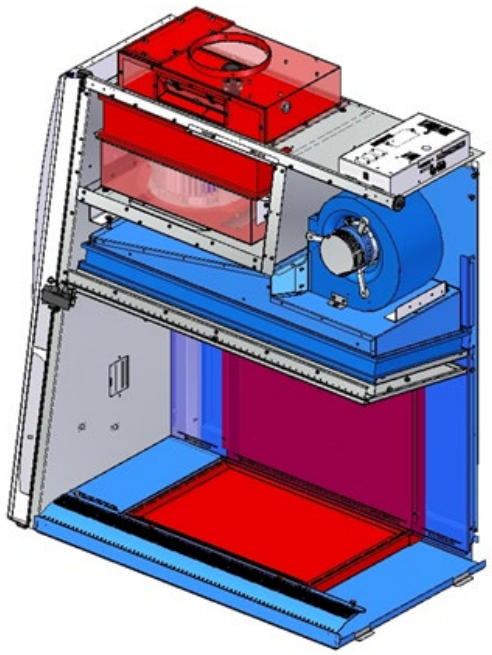
PROS

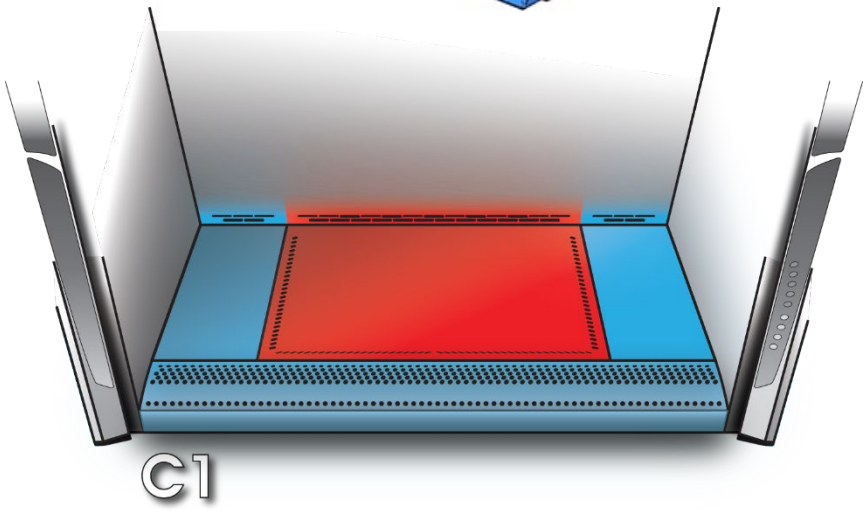
- Provide dedicated exhaust to maximize chemical safety (B2 only)

CONS

- Must always be ducted
- Must have dedicated exhaust run per BSC
  - High design costs
  - High installation costs
- Poor operational safety
  - BSC shuts down within 15 sec of exhaust failure
- High operational costs (2x CFM vs. A2)
- No flexibility – once a B, always a B

Type C1

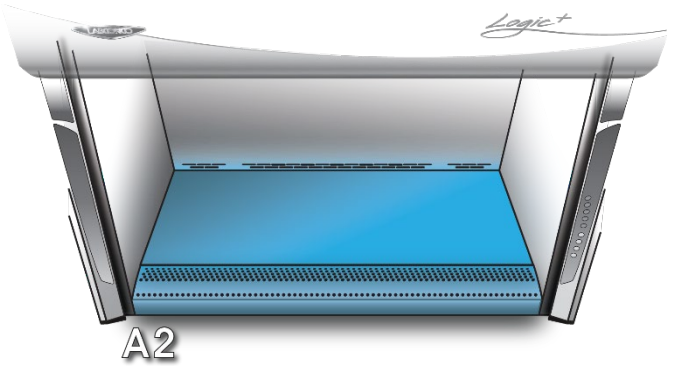


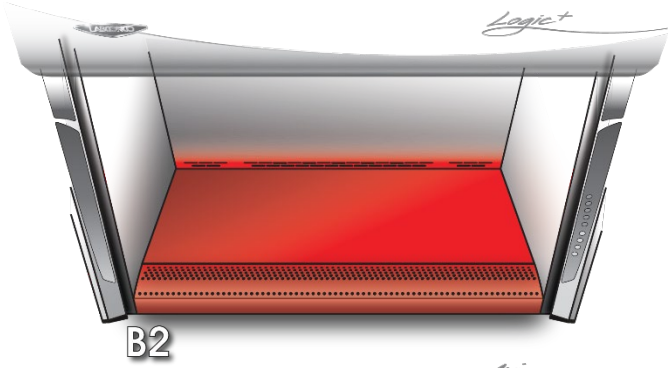


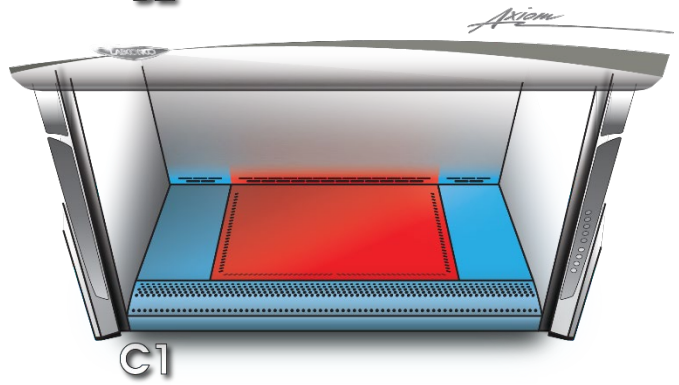
- Flexible
  - Works in Type A or Type B modes
  - Exhausted ‘Type B’ mode saves energy vs. Type B2 cabinets
  - When ducted, has minimal exhaust requirements
  - Switch from A to B mode as work changes
- Work surface divided to promote aseptic workflow
- Max operational safety
  - Runs up to 5 minutes after building exhaust failure

Biosafety Cabinet ABCs - Summary.

- Type A2
  - Most common type of BSC
  - Can be vented for odors or *small* volumes of chemicals
- Type B2
  - 100% exhaust design for *high* volumes of chemicals
  - Expensive installation and operating costs
- Type C1
  - Flexible: Type A or B (100% exhaust) modes
  - Easy installation when vented with reduced operating costs
  - Additional safety features when vented over A2 and B2 BSCs







Chemical Safety in Class II BSCs

Chemical Safety	Type A2	Type A2 w/ Canopy	Type B2	Type C1
Suitable w/ Chemicals		✓*	✓	✓
Single Pass Airflow			✓	✓
Intuitive Work Space	✓	✓	✓	✓
Easy To Vent	✓	✓		✓
Chemical Protection During Exhaust Failure		✓		✓

*Low to moderate volumes of chemicals

Exhaust Comparison – 4’ Vented BSCs

4’ Width 8” Sash	Type A2 w/ canopy	Type B2	Type C1
CFM	366 CFM	852 CFM	387 CFM
Static Pressure	0.15” w.g.	1.8” w.g. (initial) 4” w.g. (max)	0.15” w.g.

Operating Costs

Class II Type	A2	A2 with Canopy	B2	C1	
				A-mode	B-mode
Upfront cost of installation*	$600	$800	$6,150	$600	$800
15-year Lifetime maintenance Cost (Service & HEPA/ULPA filters)	$4,500	$4,500	$4,500	$4,500	$4,500
15-year Lifetime operating cost (based on $8 / CFM / year)	N/A	$40,500	$87,000	N/A	$42,000
ESTIMATED TOTAL COST (INSTALLATION & 15-yr OPERATION)	$5,100	$45,800	$97,650	$5,100	$47,300

Questions?