

Class II Biosafety Cabinets

Introduction

Class II biosafety cabinets (BSCs) are primary engineering controls typically used for microbiological studies, cell culture work, pharmaceutical procedures, and toxicology studies. BSC classifications and standards for the United States are set by NSF International (formerly the National Sanitation Foundation). On March 17, 2017, in conjunction with the American National Standards Institute (ANSI), NSF released the newest version of its standard governing Class II (zoned down flow) BSCs. Like all updates before it, NSF/ANSI Standard 49:2016—titled Biosafety Cabinetry: Design, Construction, Performance, and Field Certification—provides information relevant to certifiers, end-users, facilities managers and others in the field of biosafety. This standard defines five types of Class II cabinets (A1, A2, B1, B2 and C1) that are distinguished by differences in airflow patterns and velocities, high-efficiency particulate air (HEPA) filter/ultra-low particulate air (ULPA) filter positions, ventilation rates and exhaust methods.

When properly maintained and used in conjunction with good laboratory techniques, BSCs provide effective primary containment for work with human pathogens. In containment level 2 facilities, BSCs are used for procedures with the potential to produce infectious aerosols and for high concentrations or large volumes of infectious material. Every person working in a BSC needs to be trained in its correct use and have a good understanding of how the cabinet works.

Class II BSC types A1 and A2 are typically used for work in biosafety levels (BSL) 1 through 3. Because type A1 cabinets are not suitable for work with chemicals, use of type A2 cabinets is more prevalent. As long as vapors are not hazardous and will not interfere with the work when recirculated, it is acceptable to use an A2 cabinet with a small amount of chemicals when the cabinet is exhausted to the outdoors for removal of gases.

Type B1 and B2 cabinets are also typically used for BSL 1 through 3. As with type A2 cabinets, type B1 cabinets can be used for work generating chemical vapors as long as the vapors do not interfere with the work when recirculated or when the work is done in the directly exhausted portion of the cabinet. The type B2 total exhaust cabinets are widely used in toxicology laboratories and similar applications where chemical effluent is present and clean air is essential.

Class II, Type C1 is the first BSC that can be used in a recirculating Type A-mode for standard microbiological work, or can be connected to an exhaust system to function in Type-B mode for handling hazardous chemical vapors or radionuclides. Type C1 enclosures provide protection by filtering hazardous particulates and aerosols, such as agents that require BSL 1 through 3 containment, with the option of venting away hazardous fumes.

All types of Class II cabinets may be used in BSL 4 laboratories when workers utilize positive pressure suits.

Class II BSCs give:

- Personnel protection from harmful agents used inside the BSC
- Product protection to avoid contamination of the work, experiment or process from outside contaminants
- Environmental protection from contaminants contained within the BSC

Class II BSCs key features are:

- A front access opening with carefully maintained inward airflow
- HEPA / ULPA-filtered, vertical, unidirectional airflow within the work area
- HEPA / ULPA-filtered exhaust air to the room or exhaust to a facility exhaust system

Class II Biosafety Cabinet – Type A2

All BSCs at UTA are Class II Type A2 cabinets. Currently, as of October 2017 there are 63 BSCs used by the following departments: Bioengineering, Biology, Chemistry & Biochemistry, Electrical Engineering, Material Science & Engineering, Mechanical & Aerospace Engineering, Physics, Psychology, and the Shimadzu Institute for Research Technologies and by Biological Microsystems Division at UTARI.

When a new BSC arrives, it should be inspected carefully. The invoice should be compared with the delivered equipment. If there are any damages or missing materials, these should be reported immediately to the proper carrier and the BSC supplier regardless of how insignificant they may appear at first. Cabinet should be positioned so that there is a 6" minimum clearance behind and on each side of BSC.

[Certification of the BSC needs](#) to be arranged after it has been installed. Facilities Management personnel may be needed to connect the BSC to laboratory plumbing, electrical, and/or supply/exhaust air ventilation systems.

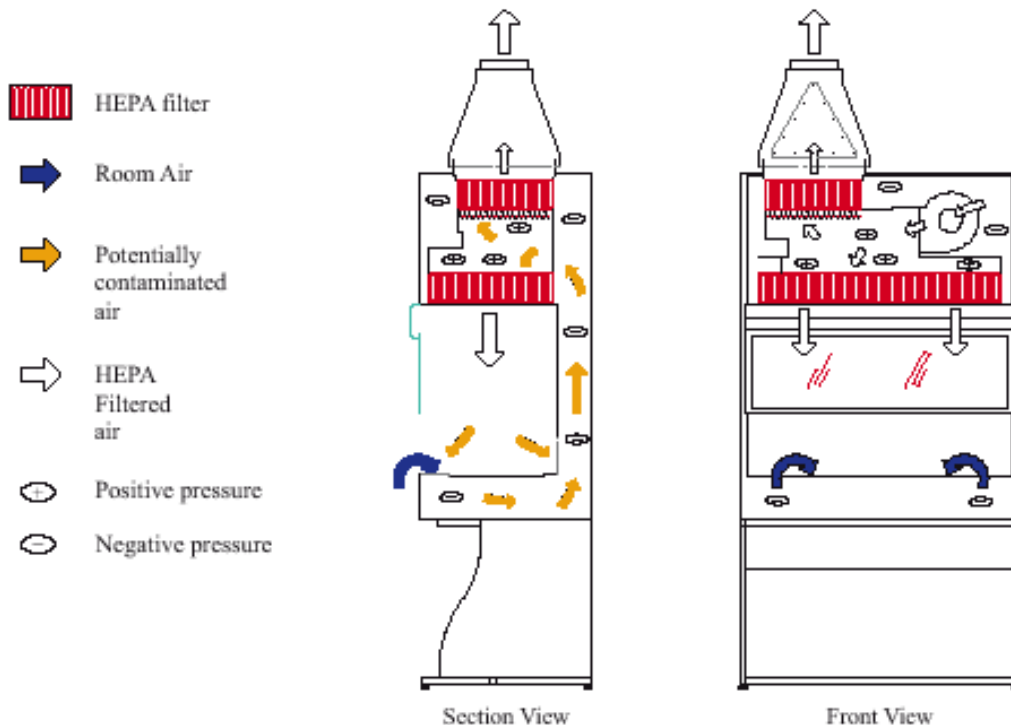
The airflow characteristics of the Class II Type A2 BSC are:

- Recirculating system
- May be vented into the room or to the facility's HVAC system through a canopy exhaust connection
- Remaining air is recirculated to the work area through a HEPA / ULPA supply filter
- HEPA / ULPA-filtered down flow air is a mixture of recirculated and inflow air from a common plenum, and will vary in total volume based on the cabinet design
- Intake air velocity for a Type A2 is a minimum of 100 FPM
- All biologically contaminated ducts and plenums are under negative pressure or surrounded by negative pressure ducts and plenums

The basic characteristics of Class II Type A2 BSC:

Class II Biosafety Cabinet			Type A2
Containment and protection	Provides protection from articulates	Personnel	Yes
		Product	Yes
		Environment	Yes
	Provides protection from vapors & gases in adjunct to microbiological work	Personnel	Only if exhausted to facility exhaust system
		Product	No
		Environment	Only if exhausted to facility exhaust system
Airflow characteristics	Cabinet face velocity		Minimum of 100 FPM
	Recirculated		App. 70 %
	Exhausted		App. 30%
Exhaust characteristics	Cabinet exhaust destination	To room	Yes
		Vented outside	Optional
		Connection type	Canopy
	Cabinet exhaust source		Common plenum
Plenum	Biologically contaminated plenum pressure		Negative to room or surrounded by negative pressure

The picture below shows the room air, contaminated air, and HEPA-filtered air movements in a Class II Type A2 BSC.



In October of 2015, NSF International issued a memorandum to field certifiers of the NSF/ANSI 49 Standard, requiring that, as of April 15, 2016, all direct-connected and canopy connected Type A BSCs need to contain auxiliary airflow alarms for personnel safety. Accredited individuals and companies may no longer certify Type A cabinets unless airflow alarms are present. This is why 14 of the Class II Type A BSCs at UTA that are connected to the building exhaust system were installed with additional alarms to be eligible for NSF field certifications.

Please Note: Any Class II Type A cabinet not connected to an exhaust system uses an air diffuser that also protects the exhaust filter. Make sure that the exhaust diffuser is not missing on top of the BSC. This filter is very fragile and easily damaged. Make sure the diffuser is installed correctly and not blocked. Keep the top of the cabinet clear.

REMEMBER:

The main purpose of a BSC is to protect the user and the environment from exposure to biohazards while working with infectious agents/materials. In addition, Class II BSCs will protect the research material(s) from airborne contaminants with the aid of HEPA / ULPA supply filters.

