

Types of Class II Biosafety Cabinets

Class II biological safety cabinets are primary engineering controls typically used for microbiological studies, cell culture, pharmaceutical procedures and toxicology.

BSC classifications and standards for the United States are set by NSF International (formerly the National Sanitation Foundation). NSF defines four types of Class II cabinets (A1, A2, B1 and B2) that are distinguished by differences in airflow patterns and velocities, HEPA air filter positions, ventilation rates and exhaust methods.

The classification system has changed throughout the years, and the following overview refers to the 2011 NSF/ANSI 49 2011 manual.

Class II Biosafety Cabinet Protection:

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

Class II Biosafety Cabinets Key Features:

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

Class II Biosafety Cabinets Applications:

Type A1 and A2 cabinets are typically used for biosafety levels 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 biosafety levels 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.

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

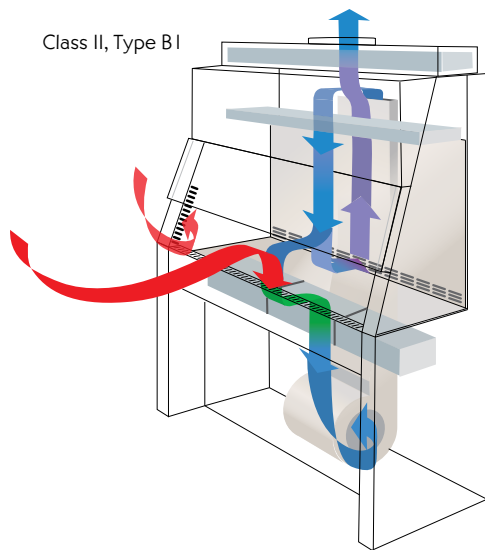
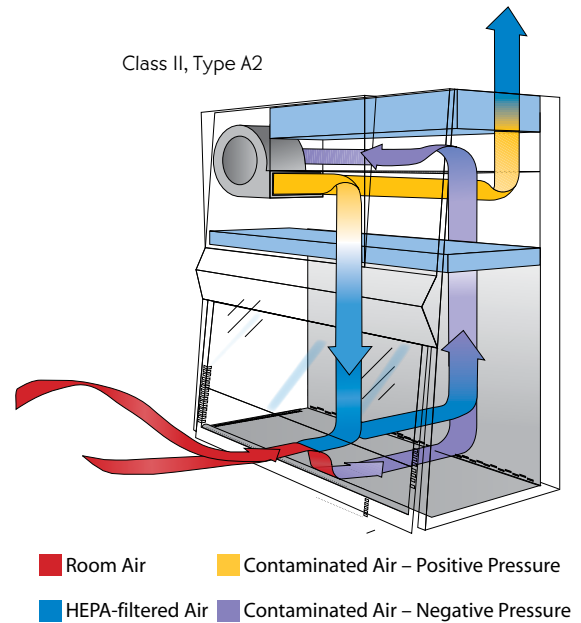
| | | | Type A1 | Type A2 | Type B1 | Type B2 |
|----------------------------|-------------------------------------------|-----------------|-------------------------------------|----------------------------------------------|--------------------|--------------------|
| Containment and Protection | Provides Protection from Particulates | Personnel | yes | yes | yes | yes |
| | | Product | yes | yes | yes | yes |
| | | Environmental | yes | yes | yes | yes |
| | Provides Protection from Vapors & Gases | Personnel | not suitable for use with chemicals | only if exhausted to facility exhaust system | reduces exposure | yes |
| | | Product | not suitable for use with chemicals | no | reduces exposure | yes |
| | | Environmental | not suitable for use with chemicals | only if exhausted to facility exhaust system | reduces exposure | yes |
| Airflow Characteristics | Cabinet Face Velocity | | minimum of 75 FPM | minimum of 100 FPM | minimum of 100 FPM | minimum of 100 FPM |
| | Nominal Percentage* | Recirculated | ~ 70% | ~ 70% | ~ 50% | 0% |
| | | Exhausted | ~ 30% | ~ 30% | ~ 50% | 100% |
| Plenum | Biologically contaminated plenum pressure | | negative to room | negative to room | negative to room | negative to room |
| Exhaust Characteristics | Cabinet exhaust source | | common plenum | common plenum | exhaust plenum | exhaust plenum |
| | Exhaust Destination | To room | yes (no, if vented outside) | yes (no, if vented outside) | no | no |
| | | Vented Outside | optional | optional | yes | yes |
| | | Connection Type | canopy | canopy | hard ducted | hard ducted |

* The percentage of air recirculated and exhausted in Type A1, A2 and B1 cabinets varies by size of cabinet and size of the access opening.

Airflow Characteristics of Class II Biological Safety Cabinets

Class II, Type A1 and Type A2 Cabinets

- » Recirculating systems
- » 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 supply filter.
- » HEPA-filtered downflow 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 A1 is a minimum of 75 FPM and 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



Class II, Type B1 Cabinet

- » Recirculating system
- » Exhausted air is pulled through a dedicated duct and through a HEPA filter (location of the filter varies by manufacturer) before entering a facility's HVAC system
- » Must be hard-connected to an exhaust system
- » Remaining air is mixed with the inflow air and recirculated to the work area through a HEPA supply filter - in some designs this recirculated air is HEPA filtered to prevent contamination of the cabinet plenums
- » Intake air velocity is a minimum of 100 FPM

Class II, Type B2

- » Provide no air recirculation within the work area
- » Must be hard-connected to a facility's exhaust system
- » HEPA filter air is immediately exhausted through a dedicated duct, into the HVAC system (HEPA-filter location varies by manufacturer)
- » Room air enters through a blower/motor located near the top of the cabinet (specific location varies by manufacturer) and pushed through a HEPA supply filter into the work area.
- » Descending air is pulled through the base of the work area through the perforated front and rear grilles
- » Simultaneously, air entering through the front opening is pulled through the perforated front grille
- » Intake air velocity is a minimum of 100 FPM

