

Class II Type B2 Laminar Flow Biological Safety Cabinets at Ordering Criteria for the National Institutes of Health

Background

This document provides guidelines for the design and installation of Class II Type B2 Biological Safety Cabinets at National Institutes of Health facilities.

A Class II Biological Safety Cabinet (BSC) is commonly found in laboratories working with infectious agents or with tissue culture. By definition, a Class II BSC is a ventilated cabinet, which provides personnel, product and environmental protection. It has an open front with inward airflow for personnel protection, downward High Efficiency Particulate Air (HEPA) filtered laminar airflow over the work surface for product protection and HEPA filtered exhausted air for environmental protection.

Before purchasing any Biological Safety Cabinets for NIH please contact the Division of Occupational Health and Safety for plan reviews, work reviews, and approval at 301 496-3457.

Biological Safety Cabinets

Class II, Type B2 cabinets are total exhaust cabinets, widely used in toxicology laboratories and similar applications where chemical effluent is present and clean air is essential (see Figure 1 – Class II Type B2 Biological Safety Cabinets, page 5).

- There is no recirculation within the work area.
- Room air enters through a blower/motor in the top of the cabinet and passes through a HEPA supply filter into the work area as the vertical unidirectional airflow.
- Descending air is pulled through the base of the cabinet through the perforated front and rear grilles.
- Simultaneously, air entering through the perforated front opening is pulled through the grille and exhausted immediately.
- 100% of the air is pulled into the facility exhaust system for appropriate treatment.
- Type B2 cabinets must be hard-connected to an exhaust system and vented outside the building without recirculation.
- Facilities must be involved in the installation of the B2 Cabinet.

In order for the BSC to operate as designed and be properly maintained, the following guidelines have been developed.

Design Criteria

- Direct-duct all Class II, Type B2 BSCs to an exhaust system vented to the outside of the building without recirculation. Each biosafety cabinet shall have one duct and one exhaust fan. Class II Type B2 cabinets should be installed if routine use of volatile toxic chemicals, volatile radionuclides, or noxious specimens or cultures is expected.

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- Include a leak-tight duct, a leak proof damper in the duct above the cabinet to allow closure for gaseous decontamination of the B2, a separate damper to allow air flow control and adjustment, and an external exhaust fan as the final system component. An alarm must be installed to indicate loss of exhaust flow. Each B2 should have its own dedicated exhaust system.
- Plenums or ducts carrying contaminated air shall be maintained under negative pressure or enclosed within a directly exhausted (nonrecirculated) negative pressure zone.
- The exhaust fan shall be sized to deliver the required exhaust airflow (as specified by the cabinet manufacturer), considering pressure losses in the duct and allowing at least 1 in w.g (500 Pa) for a dirty HEPA filter.
- An alarm must be installed to indicate loss of exhaust flow. Each B2 cabinet must have its own dedicated exhaust system. This can be an exhaust volume flow or measuring device in the duct downstream of the exhaust filter, sail switch at the fan discharge, or flow measuring station in the exhaust duct.
- Provide an alternate room exhaust duct for use when the BSC is "off". A bypass damper using the BSC exhaust fan is acceptable.
- **A Bag-In/Bag-Out Unit for both the exhaust and recirculation system is required in B2 cabinets.** This protects the technician handling the filter as well as the environment. See Figure 2 – Bag-In/Bag-Out Unit.
- A voltage regulator shall be installed in-order to reduce the potential of variations in airflows. 5 amp breakers shall be utilized on the B2 cabinet.

Roof Exhaust Systems

Roof exhaust systems must have a stack that extends straight upwards at least 10 feet (3m) above the roof surface to avoid re-entrainment by the building, and should be increased in elevation when required to avoid the influence of surrounding structures.

It is recommended that roof exhaust fans be energized by direct-connected electric motors to avoid failures caused by slipping and breaking of belts.

Locating the Biological Safety Cabinet

- Locate the Class II cabinet out of the traffic pattern and away from room air currents that could disrupt the air barrier at the work access opening.
- Do not locate the cabinet where room supply air inlets blow across the front opening or onto the cabinet's exhaust filter.
- Provide a minimum of 4 inches clearance on the rear and the non-utility side, and 6 inches clearance on the utility side of all cabinets and locate the power receptacle high on the wall so that the unit may easily be unplugged for servicing.

- To help assure that the 6-inch clearance provides enough space for utility connection, use flexible gas connections.
- Seismically secure all cabinets using a connection that may easily be disconnected for servicing and relocation.

Type B2 Laminar Airflow BSC Specifications

- The BSC must be National Sanitation Foundation (NSF Standard 49) certified for Class II Biological Safety Cabinets and bear the NSF seal.
- The BSC must be a bench top / console model.
- Installation of **Ultraviolet (UV) lamps** is not permitted in biological safety cabinets at the NIH. The NIH, CDC, NSF/ANSI, and the American Biological Safety Association all agree that ultraviolet (UV) lamps are not recommended nor are they necessary. NSF Standard 49, the industry testing standard for all biohazard cabinetry, does not provide any performance criteria for UV lighting and specifically states in Section 4.24.2 “UV lighting is not recommended in Class II (laminar flow) biohazard cabinetry.” Numerous factors affect the activity of the germicidal effect of UV light, which require regular cleaning, maintenance and monitoring to ensure germicidal activity. In addition, there are safety hazards associated with UV light exposure, which include cornea burns and skin cancer.
- Maintain minimum airflow velocity of 100 ft/ min (0.5 m/s) through the work access opening
- All biologically contaminated plenums are negative to the room or surrounded by negative pressure plenums.
- Two hose cocks on each side wall (total of four hose cocks) installed and labeled for vacuum in the four and six foot models. No gas cocks can be installed. Open flames disrupt the laminar flow in BSCs and therefore NIH does not recommend the use of gas. If it is determined by Division of Occupational Health and Safety (DOHS) that gas must be used in a BSC, then a shut-off valve must be installed immediately outside of the BSC so that the gas can be shut-off in the event of a fire.
- Electrical supply should be 115 or 230 volt, 50 or 60 Hertz, AC, three prong convenience duplex receptacle for grounded plugs installed in each side wall in the four and six foot models. It should be protected with thermal circuit breakers.
- The cabinet must be listed with Underwriters Laboratories to meet requirements of UL 3101-1.
- Self contained electronic module control panel

- Hinged or sliding front window with audible and visual alarms, which indicate when the window is not at the correct position for sliding window models.
- A front access opening of eight (8) inches or ten (10) inches.
- Standard size HEPA filters with keyed, sealed gaskets that are readily available from any of the major filter manufacturers.
- HEPA filtered downflow air composed of uncontaminated recirculated inflow air.
- Designed so service can be performed (including decontamination) without disconnecting utility services and/or moving the cabinet.
- The BSC shall be ergonomically designed for maximum user comfort and adjustability.
- Noise levels are not to exceed 67 dbA with a maximum background level of 57dbA.
- As shipped, can pass through a standard doorway (6' 7"high x 2' 11" wide) or removable top mounted parts are removed before shipping and labeled with the NIH purchase order number and the manufacturer's serial number, even if parts are shipped on the same pallet.

Two copies of instruction/use booklets furnished with each cabinet and listing:

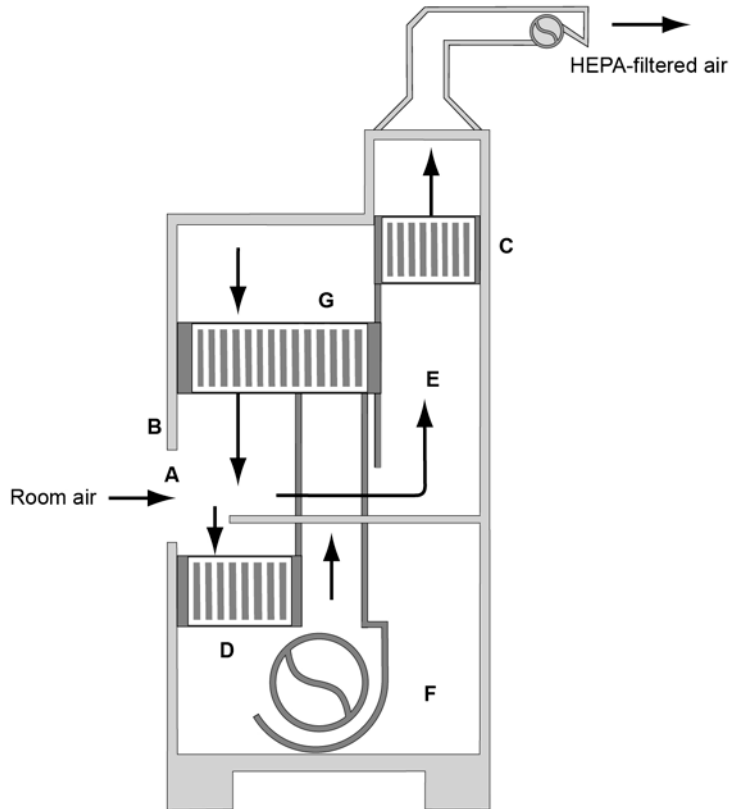
- Instructions for installing, operating and performing preventative maintenance on the cabinet.
- Identification of service parts with manufacturer's part number, and quantify required for preventative maintenance purposes.
- The fan performance curve for the integral fan(s).
- Results of the required NSF tests for each cabinet purchased.
- Results of all the production quality control tests on each cabinet.

A standard stand made by the same cabinet manufacturer which can be securely fastened to the cabinet shall be ordered for each cabinet, unless otherwise requested by the end user. The cabinet and stand combination (referred to as a console by NSF) must have passed the NSF "tip test" section A.8.3.1 of NSF/ANSI 49 2009 when mounted on the stand to be used with the cabinet, in order to be acceptable to the NIH.

Please contact the Division of Occupational Health and Safety at 301 496-3457 in Building 13 Room 3K04 or Consult the most recent edition NSF International Standard/American National Standard 49 if you have further questions.

Class II, Type B2 BSC.

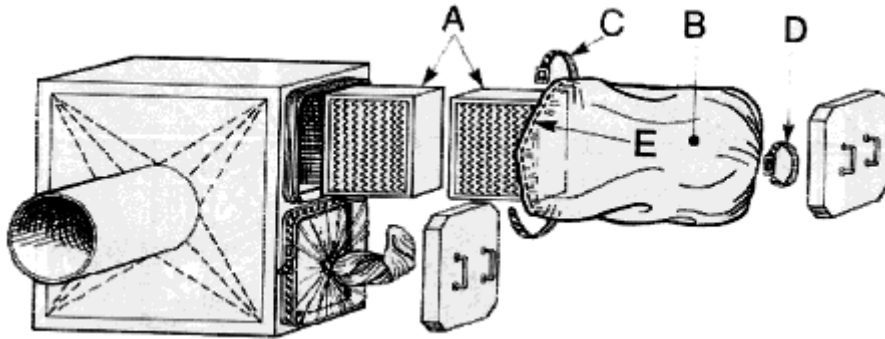
Connection to building exhaust system required.



- A. front opening
- B. sash
- C. exhaust HEPA filter
- D. supply HEPA filter
- E. negative pressure exhaust plenum
- F. supply blower
- G. filter screen

Figure 2.

BAG-IN / BAG-OUT FILTER



- A.** filters
- B.** bags
- C.** safety straps
- D.** cinching straps
- E.** shock cord located in the mouth of the PVC bag restricts the bag around the second rib of the housing