

# OPERATOR'S MANUAL

**BioChemGARD®** 

Class II, Type B2 Biosafety Cabinet



## MODELS:

**BCG401 / BCG601 / BCG401-AUS / BCG601-AUS / BCG401-INT / BCG601-INT**



Environments For Science™

## Welcome to Baker

Thank you for choosing to join the growing number of people who are achieving excellence in science and clinical care through clean air, containment, and incubation solutions from Baker. As a fixture in laboratories and clinical settings around the world, Baker takes special pride in helping people just like you to create optimal environments for their work, while providing a safe and comfortable user experience.

At Baker, nothing is more important to us than the trust you place in our solutions to help you achieve your goals. Whether you are involved with basic scientific research, drug discovery, or patient care, Baker has a proven record of delivering high-performing equipment through an uncompromising commitment to safety, testing, quality, and craftsmanship. Additionally, as a Maine-based family owned business in operation for more than 60 years, you can rest assured that Baker will be there for you throughout the life cycle of your new equipment.

Baker is a pioneer in the field of biological safety, and our reputation is built on taking no shortcuts and making no compromises when it comes to user safety. We are the only manufacturer to routinely subject our own equipment to extensive microbiological aerosol testing in the most challenging conditions – above and beyond what the average user would ever encounter. However, the adequacy of any equipment for user safety in a specific application should always be evaluated. This risk assessment should be performed by an industrial hygienist, safety officer, or other qualified person representing the purchasing organization. Remember that you, the owner and user, are ultimately responsible and that you use this equipment at your own risk.

I recommend that you keep a copy of this manual, along with the factory test report (if applicable), near your new equipment for convenient reference by operators and qualified maintenance personnel. If you have any questions about the use or care of your Baker equipment, please do not hesitate to contact our Technical Service Department for assistance at (800) 992-2537 +1 207 324-8773 outside the United States) or techsupport@bakerco.com.

Thank you for placing your trust in Baker.

Sincerely,

A handwritten signature in black ink, appearing to read "David Eagleson".

David Eagleson  
President  
The Baker Company, Inc.



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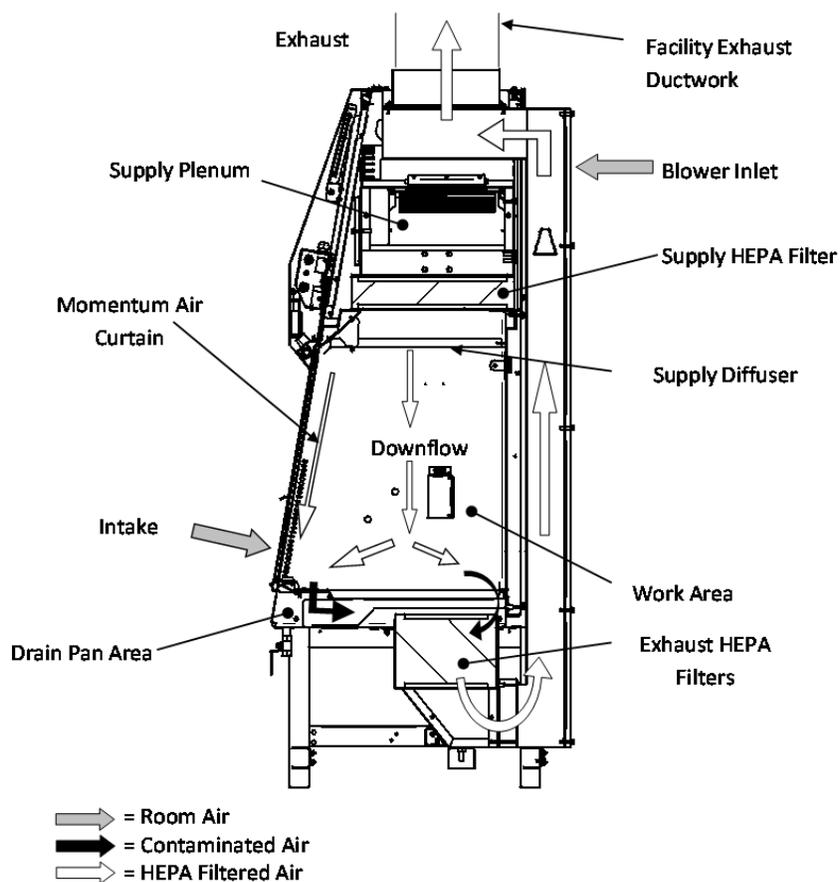
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## Function of the BioChemGARD® e3

The BioChemGARD® e3 is a Class II type B2 biosafety cabinet, BSC, (classified by NSF/ANSI Standard 49) providing personnel, product and environmental protection. Personnel protection is provided by a minimum intake air velocity entering the front access opening, product protection is provided by HEPA filtered supply air delivered to the work area and environmental protection is provided by the exhaust HEPA filter. This Class II type B2 BSC must have a hard canopy connection.

In operation, the BioChemGARD® delivers HEPA filtered, unidirectional down flow air to the work area. Most of the HEPA filtered air passes through an air diffuser; flows down into the work area and splits at the work surface level entering the front and rear perforations. Some of the HEPA filtered air is diverted down behind the viewscreen creating a downward high velocity momentum air curtain along the rear surface of the viewscreen. Concurrently intake room air is pulled inward through the front access opening at a minimum of 100 feet per minute (FPM) (0.51 meters per second (M/S)) where it merges with the down flow air entering the front work surface perforation and is pulled into the drain pan below. All of the inflow and downflow air mixes in the drain pan below the worksurface and is drawn into the exhaust HEPA filters, up the rear exhaust plenum, and exits the cabinet through the facility exhaust system. (See Figure 1)



**Figure 1 - Cabinet Airflow**

# Cabinet Design

Figure 2 below shows the standard construction and components of the cabinet.

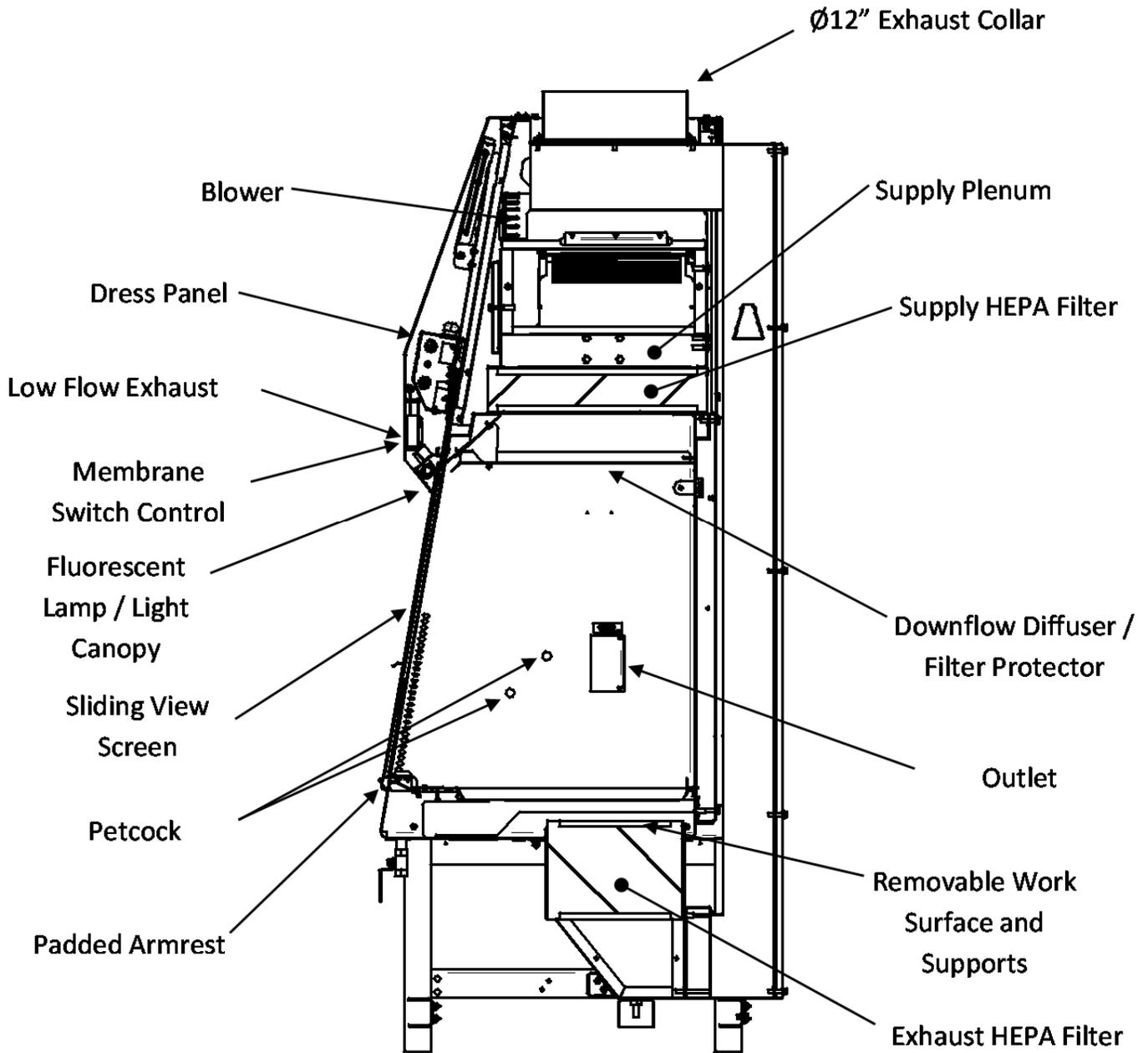


Figure 2 - Cabinet Features

# Regulatory Compliance

## Standards

This Baker product has been designed, manufactured and tested to comply with the following regulatory standards **where applicable**. Unless stated otherwise, the most recent edition of these standards has been applied.

Electrical, Mechanical, Fire and Personal Safety:

Electrical Equipment For Measurement, Control and Laboratory Use, General Requirements

US: UL 61010-1

CANADA: CAN/CSA C22.2 No. 61010-1

INTERNATIONAL: Low Voltage Directive 2006/95/EC; EN61010-1

Safety for Laboratory Hoods and Cabinets

US: UL 1805

Electromagnetic Compatibility:

Electrical Equipment For Measurement, Control and Laboratory Use, EMC Requirements

INTERNATIONAL: Electro Magnetic Compatibility Directive 2004/108/EC; EN61326-1

Hazardous Waste Abatement:

Restriction of Hazardous Substances Directive, RoHS, 2011/65/EU; EN50581

Biological Safety:

US: Biosafety Cabinetry Certification; NSF/ANSI 49

INTERNATIONAL: Biotechnology – Performance criteria for microbiological safety cabinets; EN 12469

## Cautionary Notes

Hazards may still exist, especially if the cabinet is not installed, operated and maintained according to the instructions in this manual and the service manual.

This cabinet may be affected by high levels of electromagnetic radiation from other electronic devices that are being used in close proximity or connected to the same facility power system.

This cabinet may cause radio interference or affect the operation of other equipment in close proximity. Mitigation measures such as relocation, re-orientation, or shielding may be required.

# Standard Features

## Alarms

The cabinet has audible and visual alarms to alert the operator of some unsafe conditions as defined in this manual. The standard annunciated cabinet control alarms, in order of priority, are power/processor fault alarm, viewscreen alarm, and double viewscreen position sensor fault alarm. There are also air flow alarms for both normal and ReadySAFE™ operation. See the **Alarm Conditions** section in this manual for detailed descriptions of the alarms.

## Armrest

The armrest pad is made out of EPDM sponge material which is resistant to most chemicals as well as UV exposure. The pad is held in place with an adhesive and can be easily removed for cleaning. It can also be autoclaved. When the viewscreen is fully closed, the perforated armrest provides an air bypass that allows air to continue to enter the front work surface perforations. This helps minimize noise.

## Blower Switch Status Wiring

The Blower Switch Status Wiring provides the operational status of the cabinet supply blower that can be connected to control the facility exhaust air flow.

## Cable Port

The cabinet has one cable port located in the right sidewall. Cable ports provide a safe means of introducing power and/or data cables, siphoning tubes, etc. into the work area of the cabinet without having to use the front viewscreen access opening.

## Cable Port Hooks

Stainless steel hooks are provided to suspend cables or tubing along the cabinet interior back wall when the cable port is used. The hooks should be located along the interior rear wall or work surface in the designated slots.

## Controls

The operator controls and indicators are arranged in a single, easily cleaned membrane switch assembly on the front of the cabinet. There are control pushbuttons for blower, fluorescent light, outlets, optional ultraviolet light and alarm mute. There are also pushbuttons for resetting and muting the exhaust alarms. See the **Controls** section in this manual for more detail.

## Drain Pan

The drain pan is constructed of stainless steel with smooth corners to facilitate cleaning and disinfection. Drainage is provided by a stainless steel ball valve. Cabinet exhaust filters are located in the drain pan.

## Filters

### CAUTION

**Filter media is very delicate and should never be touched.  
Only qualified technicians should replace HEPA filters.**

The High Efficiency Particulate Air (HEPA) filters consist of a continuous sheet of glass fibers pleated and mounted in a rigid frame. Both the supply and exhaust filters inside the cabinet are scan-tested HEPA filters. They are 99.99% effective on removal of the most penetrating particle size (mpps) (0.3 micron). Each filter is leak checked after installation in the cabinet and prior to shipment. HEPA filters are not intended to filter gasses or vapors. Misuse of chemicals, Bunsen burners, or a heavy dust load will shorten the filter's life.

## High Velocity Return Air Slots

High velocity return air slots are located at the front access opening on both sidewalls and horizontally along the top of the access opening behind the viewscreen. The purpose of the slots is to improve the cabinet integrity by capturing any particulates at these critical transitions.

## Lighting

The work area is illuminated to provide a typical average light intensity of 100 foot-candles [1076 lux] at the work surface. This cabinet features solid-state electronic ballasts for the visible and optional UV lighting. These ballasts increase reliability, efficiency and service life with lower heat output.

## Motor/Blower

The motor and blower are built as a single assembly and balanced to minimize vibration. The motor control automatically compensates for an increase in pressure drop across the filter without reducing the total air flow rate by more than 10%. The air flow capacity of the cabinet is measured by the ability to provide a nearly constant volume of air as the filter resistance to airflow increases.

## Motor Speed Control

The StediFLOW™ speed controller compensates for normal fluctuations in line voltage and is programmed to maintain relatively consistent air flow when the cabinet filter(s) load. This helps to maintain correct airflow in the cabinet.

## Outlets

This cabinet has outlets in both the left and right sidewalls for powering instruments inside the work area. The outlets are rated at 5 Amps total all outlets. On 115V cabinets these outlets are protected by a Ground Fault Circuit Interrupter (GFCI).

## Pressure Monitor

The cabinet has an analog pressure gauge which displays the cabinets supply plenum operating pressure.

## Pressure Plenum (UniPressure™ Preflow Plenum)

Plenum design directs air across, then through the supply filter improving downflow air uniformity, extending filter life and reducing noise. The plenum provides an evenly distributed filter clamping force assuring secure and sealed filters.

## ReadySAFE™ Mode

The ReadySAFE™ Mode is a feature that reduces the total airflow and energy consumption when the cabinet is not being used. Operation of the cabinet in ReadySAFE™ Mode maintains personnel, product and environmental protection.

## Service Connections

The cabinet is equipped with one petcock located in the right sidewall. The standard external plumbing connections are located at the bottom of the right side of the cabinet.

## Telescoping Stand

The telescoping stand has adjustable legs and leg levelers. The legs provide a minimum height (from the bottom of the drain pan to the bottom of the leg) of 26 ½" (673mm) and a maximum height of 35" (889mm).

## Timers

The cabinet has programmable off delay timers to control the operation of the fluorescent lights, accessory outlets, and UV light option. The timers can be programmed in 15-minute or 1-hour increments. See the **Operation** section in this manual for more detail.

## Viewscreen

The cabinet viewscreen is constructed of UV resistant safety glass. It is designed to move vertically to allow access to the work area and it is counterbalanced for ease of movement. The proper work access opening is clearly marked with arrows on each side of the viewscreen and the position of the viewscreen is monitored by an optical sensor activating the viewscreen alarm when not properly positioned.

## Work Surface

The work surface is constructed of stainless steel. This surface is finished to reduce light reflection. It is also recessed to retain spills. The work surface and work surface supports are removable allowing access to the drain pan. Maximum weight capacity for the work surface is 200lbs (90kg).

## Working Access Opening Height

The standard access opening is 8 inches [203 mm].

## Optional Features

### Air Tight Damper (ATD)

The air tight damper is used to seal the cabinet during decontamination.

## Anchoring Systems

### Anchors

Floor and wall restraints are available without California OSHPD pre-approval.

## Cabinet Control Monitor

The Cabinet Control Monitor option provides connections to isolated relay contacts on the control board. The control features that may be monitored are ReadySAFE™/viewscreen alarm, blower switch status, and blower operation status. Some of these connections may not be available depending on the specific configuration of the cabinet. Connection points are at the top of the cabinet.

## Cabinet Downflow Monitor

The cabinet downflow monitor option provides a digital indication of the cabinet supply pressure as well as local audible and visual alarms for unsafe air flow conditions in the cabinet. External connections to an isolated relay and analog output are provided to interface with building management systems, chart recorders, and/or other control systems or devices. Connection points are at the top of the cabinet.

## Digital Display Package (DDP)

The digital display package provides a durable touchscreen display for cabinet controls, cabinet monitoring and cabinet alarms. One airflow sensor is included in the standard offering for airflow monitoring.

## Foot Rest

An adjustable ergonomic foot rest is available for added operator comfort.

## Fume Hood Package

The fume hood package removes all electrical components and manual controls from the work area of the cabinet. Auxiliary plumbing controls are provided outside of the work area and the outlets are located beneath the work area. UV is not an option with this configuration.

## IV Bar

The cabinet can be equipped with an intravenous (IV) bar to facilitate the hanging of required materials.

## Low Exhaust Static Pressure Duct

The low exhaust static duct replaces the standard duct in the rear of the cabinet in order to lower the exhaust static air pressure requirement.

## Microscope Viewscreen

A viewscreen with an opening for microscope oculars allows a microscope inside the unit while viewing through the oculars outside the unit.

## Plastic Storage Bins

Plastic bins for storage can be purchased and are installed below the base of the cabinet.

## Service Connections

### Hardware

Stainless steel petcocks, needle valves, and stainless steel needle valves are all available as alternative plumbing hardware.

### Quantity and Exiting Direction

Additional factory installed services are available on either sidewall. Other optional configurations available from the factory are located on the rear or top of the cabinet as well as on the left side of the cabinet.

## Ultraviolet Light (UV)

**WARNING**

**UV light is hazardous, DO NOT defeat the interlock!**

**Eyes and skin should not be exposed to direct UV light.**

The cabinet may be equipped with a UV light that provides an initial minimum intensity of 40 microwatts per cm<sup>2</sup> at the work surface.

## Working Access Opening Height (Additional)

Other optional factory configurations available are 10" (254 mm) and 12" (305 mm) access openings however these openings are not NSF listed.

## Proper Cabinet Use

### CAUTIONS

**Explosive or flammable substances should never be used in this cabinet. If the operator does not operate the cabinet correctly, it may not provide an adequate protective barrier. To ensure personnel, product and environmental protection the cabinet must be operated per the manufacturer's instructions.**

Baker biosafety cabinets are designed for continuous operation. It is recommended that the blower be left on at all times to provide containment and keep the interior work area clean and free of particulates.

Reference sources are *National Sanitation Foundation Standard 49 Annex E, The Biosafety in Microbiological and Biomedical Laboratories (BMBL)*, 5<sup>th</sup> edition published by the U.S. Department of Health & Human Services as HHS Publication No. (CDC) 21-1112 and *United States Pharmacopeia* chapters <795>, <797>, and <800> as an advisory document for safe work practices.

### **The facility industrial hygienist, pharmacist or biosafety officer shall ensure that:**

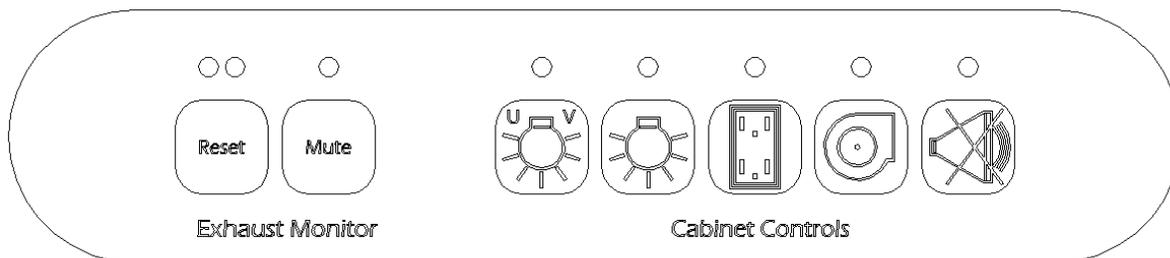
The biosafety cabinet is appropriate for all operations and procedures to be performed.

All operators are thoroughly trained and competent regarding cabinet operation and all procedures they are required to perform.

The cabinet operation, procedures, and operators are monitored at regular intervals to ensure that safety is maintained.

## Controls

The operator controls and indicators are arranged in a single, easily cleaned membrane switch assembly on the front of the cabinet. There are pushbuttons for the exhaust monitor, optional UV light, fluorescent lights, outlets, blower and alarm mute. [Reference Figure 3]



**Figure 3 Operator Controls**



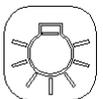
**Exhaust Monitor Reset** – This pushbutton acknowledges an exhaust air flow alarm condition. There are red and yellow indicator lights located above the pushbutton. The red indicator illuminates to indicate an alarm condition during normal operation. The yellow indicator illuminates to indicate an alarm condition during ReadySAFE™ operation.



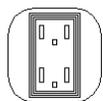
**Exhaust Monitor Mute** – This pushbutton mutes the audible alarm associated with the airflow alarm. A blue indicator light located above the pushbutton indicates the mute status.



**Ultraviolet (UV) Light On/Off** – If the UV light option is installed, this pushbutton controls its operation. A yellow indicator light located above the pushbutton will illuminate when it is on.



**Fluorescent Light On/Off** – This pushbutton controls operation of the fluorescent light. A blue indicator light located above the pushbutton will illuminate when it is on.



**Outlet Power On/Off** – This pushbutton controls the power to the outlets in the work area. A blue indicator light located above the pushbutton will illuminate when it is on.



**Blower On/Off** – This pushbutton controls the operation of the cabinet blower. A green indicator light located above the pushbutton will illuminate when it is on.



**Alarm Mute (Alarm Reset)** – This pushbutton mutes any audible, non-airflow, alarm. A red indicator light located above the pushbutton will flash when an alarm condition exists.

# Operation

## Exhaust Monitor

The Exhaust Monitor is designed to monitor the facility exhaust airflow. As required by NSF/ANSI Standard 49, a visual and audible alarm alerts the operator of a loss of exhaust airflow that potentially affects cabinet containment or personnel protection. The exhaust monitor control section is connected to an airflow monitoring device located behind the cabinet dress panel. The monitoring device measures the airflow in the exhaust air duct at the rear of the cabinet. There are two pushbuttons, reset and mute, and three indicators, red, yellow, and blue, associated with this control.

When power is applied to the AFM the red Alarm LED, yellow ReadySAFE™ Alarm LED and blue Mute LED will be ON solid for approximately 20 to 30 seconds. This is an indication that the AFM is powered but is not monitoring the airflow alarm conditions. This time is essentially the time necessary for the thermal properties of the airflow probe to stabilize and provide an accurate reading.

During normal operation, if the exhaust airflow is at a safe level, all indicators are off. If an unsafe exhaust airflow occurs the red indicator, located above the reset pushbutton, will flash. If the alarm condition clears prior to being acknowledged by an operator pressing the mute pushbutton, the red indicator will change to being on continuously. Pressing the reset pushbutton once the alarm condition has cleared will change the indicator to its normal off condition.

During ReadySAFE™ operation, if the exhaust airflow is at a safe level, all indicators are off. If an unsafe exhaust airflow occurs the yellow indicator, located above the reset pushbutton, will flash. If the alarm condition clears prior to being acknowledged by an operator pressing the mute pushbutton, the yellow indicator will change to being on continuously. Pressing the reset pushbutton once the alarm condition has cleared will change the indicator to its normal off condition.

If there is an alarm condition in either normal or ReadySAFE™ operation an audible alarm will also sound. While the alarm condition exists the audible alarm beeps once per second. If the alarm condition clears prior to being acknowledged by pressing the mute pushbutton the audible alarm changes to beep more slowly. The audible alarm can be muted for 5 minute periods by pressing the mute pushbutton. When the alarm is muted, the blue indicator located above the pushbutton flashes at the same rate as the alarm indicator. If the alarm condition is cleared when the alarm has been muted the mute period is canceled.

## UV Light (Optional)

### WARNING

- **UV light is hazardous, DO NOT defeat the safety interlock!**
- **Eyes and skin should not be exposed to direct ultraviolet light.**
- **Ultraviolet light should not be relied upon as the sole decontaminating agent and its effectiveness should be evaluated for the intended application.**
- **NSF/ANSI 49 does not recommend the use of ultraviolet lighting for decontamination purposes. Additional surface disinfection should be performed both before and after every cabinet use.**

The UV light is an optional feature that is designed to provide a minimum average intensity of 40 microwatts per cm<sup>2</sup> at the cabinet work surface. The intensity of the UV light will degrade over time so should be tested periodically to assure that its performance is adequate for the application.

A safety interlock prevents operation of the UV light unless the viewscreen is completely closed, and automatically turns the UV light off if the viewscreen is moved from the closed position. The UV light and fluorescent light are interlocked so they cannot be operated simultaneously.

## Fluorescent Light

The fluorescent lighting is designed to provide an average intensity of greater than 100 foot candles at the cabinet work surface.

The cabinet blower must be on for the fluorescent light to operate. The fluorescent light will not operate when the viewscreen is closed.

## Outlets

The circuit powering the outlets is protected by a self-resetting circuit breaker which allows a total of 7 Amps on all outlets. This helps protect the primary cabinet controls from inadvertent overloads of the cabinet outlets. The cabinet is typically equipped with outlets in the left and right sidewalls of the work area.

For 115V AC/60Hz cabinets the outlets are also protected by a Ground Fault Circuit Interrupter (GFCI). The GFCI outlet is typically installed in the right sidewall. The receptacle in the left sidewall is wired such that it is also protected by the GFCI. If the GFCI is tripped by the presence of an unsafe condition a red indicator on the GFCI will be on and the reset button on the front of the GFCI will be extended. Once the fault condition is corrected press the [RESET] button to reconnect power to the outlets. There is also a [TEST] button on the front of the device. The manufacturer recommends that the GFCI device be tested monthly to assure safe operation.

When the Fume Hood option is installed the outlets are located beneath the work area. In this application both the right and left outlets are GFCI devices.

## Blower

The motor and blower are built as a single assembly and balanced to minimize vibration.

The blower motor control is designed to automatically compensate for an increase in pressure drop across the filter without reducing total airflow rate by more than 10%. The airflow capacity of the cabinet is measured by the ability to provide a nearly constant volume of air as the filter resistance to airflow increases. The motor control also compensates for normal variations in power to the cabinet.

The blower must be turned on for the fluorescent light to operate.

## Alarm Mute (Alarm Reset)

The alarm reset pushbutton is used to mute any audible non-airflow alarm. The mute period is five minutes. The alarm indicator located above the pushbutton continues to flash while the audible alarm is muted as long as an unsafe condition exists. If the alarm condition is not corrected when the mute period is complete the audible alarm will sound.

## Cabinet Timer Functions

The cabinet fluorescent light, accessory outlets and UV light [optional] can be programmed to operate for a predetermined time period. This can be set in 15-minute or 1-hour increments. There is no time period programmed when the unit is shipped from the factory.

**NOTE - The device to be programmed should be in the off condition before programming.**

### **15-minute increment programming:**

Press and hold the pushbutton of the device to be programmed.

In about 3 seconds there will be a short 'beep'. This indicates that the timer function is turned on, is in the programming mode for the device, and is programmed to turn off in 15 minutes.

Release the pushbutton.

Each subsequent press of the device pushbutton while in the programming mode will add 15 minutes to the delay off time. (e.g. pressing the pushbutton 3 additional times would set the delay to 60 minutes, 15 minutes initially plus 3 x 15 minutes additional delay times).

The device control will remain in the programming mode for about 4 seconds if the pushbutton is not pressed.

Once the programming mode for the device has ended the device can be turned off normally, if desired, by pressing the device pushbutton.

The programmed device will turn off automatically at the end of the delay time.

Whenever a programmed device is turned off manually or automatically the programming is cleared and must be reentered.

**1-hour increment programming:**

Press and hold the pushbutton of the device to be programmed.

In about 3 seconds there will be a short 'beep'. Continue to hold the pushbutton. In about an additional 3 seconds there will be a longer 'beep'. This indicates that the timer function is on, is in the programming mode for the device, and is programmed to turn off in 1 hour.

Release the pushbutton.

Each subsequent press of the device pushbutton while in the programming mode will add 1 hour to the delay off time. (e.g. pressing the pushbutton 3 additional times would set the delay to 4 hours, 1 hour initially plus 3 x 1 hour additional delay times)

The device control will remain in the programming mode for about 4 seconds if the pushbutton is not pressed. Once the programming mode for the device has ended the device can be turned off normally, if desired, by pressing the device pushbutton.

The programmed device will turn off automatically at the end of the delay time.

Each time a programmed device is turned off manually or automatically the programming is cleared and must be reentered.

## Alarm Conditions

The cabinet has audible and visual alarms to alert the operator of some unsafe conditions as defined in this manual. The standard annunciated alarms, in order of priority, are power/processor fault alarm, viewscreen alarm, and double viewscreen position sensor fault alarm. There is a separate alarm that alerts the user to unsafe exhaust airflow conditions.

### Power/Processor Fault Alarm

The power/processor fault alarm occurs when the system is initially powered, experiences a power outage or the microprocessor/controller has a fault. The indication of this fault is a visual and audible alarm of three, one-second alarms followed by a two-second delay. This cycle is repeated until the alarm condition is cleared by pressing the alarm reset pushbutton.

### Viewscreen Position Alarm

The viewscreen position alarm occurs when the viewscreen is not at a safe operating position. There is a three-second delay before the alarm activates, to allow the operator time to move between safe operating

positions. A visual and audible alarm occurs once per second and alerts the user of an unsafe condition. There are two safe viewscreen levels defined for this cabinet, normal operating position and fully closed position. For normal operation, the bottom of the viewscreen must be placed at the safe design opening indicated by marker arrows on both the right and left viewscreen guide. Pressing the alarm reset pushbutton will mute the audible alarm for 5 minutes. The visual alarm will continue until the unsafe condition is corrected. If the unsafe condition is not corrected, the audible alarm will return.

### **Double Viewscreen Position Sensor Fault Alarm**

The double viewscreen position sensor fault alarm occurs when both viewscreen position sensors are activated simultaneously. This is a condition that should not be able to occur in normal operation. There is a three-second delay before this alarm activates. A visual and audible alarm four times per second indicates this fault condition. Pressing the alarm reset pushbutton will mute the audible alarm for 5 minutes. The visual alarm will continue until the unsafe condition is corrected. If the unsafe condition is not corrected, the audible alarm will return.

### **Exhaust Monitor Alarm**

The exhaust monitor alarm occurs when an unsafe exhaust airflow condition occurs in either normal or ReadySAFE™ operation. A visual and audible alarm once per second indicates this fault condition. Pressing the exhaust monitor mute pushbutton will mute the audible alarm for 5 minutes. The visual alarm will continue until the unsafe condition is corrected. When the unsafe condition is corrected, the visual alarm changes from blinking to continuously on and the audible alarm sounds at a slower rate. Pressing the exhaust monitor reset pushbutton will clear the alarm if the exhaust flow is at a safe level.

### **Pressure Alarm (Cabinet Downflow Monitor option)**

The cabinet pressure alarm occurs when there is a high differential pressure due to supply filter loading or a low differential pressure due to a decrease in supply air. There is a three-second delay for this alarm to prevent nuisance alarms. A visual and audible alarm, four per second for one second followed by a one-second delay, repeating, will alert users of this condition. Pressing the alarm reset pushbutton will mute the audible alarm for 5 minutes. The visual alarm will continue until the unsafe condition is corrected. If the unsafe condition is not corrected, the audible alarm will return. This alarm is only active when the cabinet blower is on.

## Alarm Summary Table

Alarm Type	Visual/Audible Annunciation	Comments	Action
Power/Processor Fault Alarm	Three one-second alarms followed by two-second delay.	Cycle will repeat until acknowledged by pushing the alarm reset pushbutton.	Check power distribution to the cabinet.
Viewscreen Alarm	Three-second delay then: *Once per second	Takes precedence over other alarms. Audible alarm can be muted for 5 minutes.	Return viewscreen to correct position.
Double Viewscreen Position Sensor Fault Alarm	Three-second delay then: *Four times per second	Audible alarm can be muted for 5 minutes.	Call a technician to determine the problem.
Cabinet Pressure Alarm (Cabinet Downflow Monitor option)	Three-second delay then: *Four times per second for one second followed by a one-second delay.	Audible alarm can be muted for 5 minutes.	Call a technician to determine the problem.
Exhaust Monitor Alarm Low Airflow <u>Note:</u> This is an independent alarm system	No programmed delay: *Once per second.	Audible alarm can be muted for 5 minutes.	Check building exhaust system.

### ReadySAFE™ Operation

The ReadySAFE™ Mode is a feature that reduces the total airflow and energy consumption of the cabinet when it is not being used. Operation of the cabinet in ReadySAFE™ Mode maintains personnel, product and environmental protection. The ReadySAFE™ Mode is activated when the viewscreen is in the fully closed position. While the ReadySAFE™ mode is active the cabinet blower speed will be reduced and the cabinet lighting automatically turns off. When the sash is returned to safe operating height the cabinet airflow will return to the original airflow set point. The fluorescent light can then be turned on. Significant additional energy savings can be realized by configuring the building exhaust system to reduce flow when the cabinet enters ReadySAFE™ mode, but this is not required for safe use of the ReadySAFE™ mode.

## Start-up Procedure

The operator should have read and understood the **Controls** and **Operation** section of this manual prior to performing this procedure. It is recommended that the cabinet blower be left on at all times.

1. With the facility exhaust operating at required airflow, turn on the cabinet blower. An indicator light

located above the pushbutton will illuminate when it is on. Listen for the sound of the cabinet blower running. The reading displayed on the analog pressure gauge should be comparable to the value recorded on the last cabinet certification report.

2. With the viewscreen placed at the safe design opening indicated by marker arrows on both the right and left viewscreen guide, check the reading on the analog pressure gauge; the displayed value should be consistent with the recorded value in the most recent certification report. A significant change in pressure should be cause for investigation. This device is not intended to be used for air flow set-point verification.
3. Turn on the fluorescent light. The indicator light below the pushbutton will illuminate along with the interior work area. The fluorescent light will not operate unless the cabinet blower is on.
4. Check to determine that the drain valve is in the closed position.
5. Lower the viewscreen to its fully closed position. This action engages the ReadySafe Mode indicated by the fluorescent light turning off and a reduction in cabinet blower speed. This will also be indicated by a lower pressure reading displayed on the analog pressure gauge.
6. If the cabinet has the optional UV light installed, turn the UV light on to make sure it is operational. An indicator light located below the pushbutton will illuminate when it is on.

**IMPORTANT**

**The UV light option features an interlock that prohibits its operation unless the viewscreen is fully closed.**

7. Raise the viewscreen just above the fully closed position. This action should return the cabinet blower to its normal speed indicated by the analog pressure gauge reading.
8. If the optional UV light is installed, verify that the UV light turns off.
9. At this viewscreen location an audible and visual alarm should activate indicating that the viewscreen is not at its safe design opening. Press the mute pushbutton to verify its operation.
10. Raise the viewscreen to the safe design opening indicated by marker arrows on both the right and left viewscreen guide.
11. Wipe down all interior surfaces of the cabinet work area with an appropriate surface disinfectant.

**IMPORTANT**

**See the Cleaning and Disinfecting Stainless Steel section of this manual**

12. Place all materials to be used for the procedure on the solid section of the work surface inside the cabinet. This may require raising the viewscreen. Blocking the front and rear perforated grilles must be avoided. **Disinfect the exterior of these materials prior to placing them on the work surface.** Everything required, and only what is required, should be placed in the cabinet before beginning work so that nothing passes in or out through the air barrier until the procedure is completed. Implements should be arranged in the cabinet's work area in logical order so that clean and dirty materials are segregated, preferably on opposite sides of the work area. If wipes or absorbent towels are used on the work surface, be sure to keep them away from the grilles.
13. After equipment is in place inside the cabinet, adjust the sliding viewscreen to the safe design opening. An alarm will signal if it is not at the proper opening. This position is important to maintain proper cabinet airflow.
14. Before using, allow a minimum of three minutes with the cabinet operating in its normal safe configuration to purge any contaminants or suspended particulates.

## Working in the Cabinet

**WARNING**

**Never work inside the cabinet when an alarm condition exists.**

This section contains some suggested basic work practices that should be observed when using a biosafety cabinet. It is not intended to be a comprehensive list for all applications. A good reference source is *The Biosafety in Microbiological and Biomedical Laboratories* (BMBL) 5<sup>th</sup> edition published by the U.S. Department of Health & Human Services as HHS Publication No. (CDC) 21-1112 advisory document for safe work practices.

The operator's hands and arms should be washed thoroughly with germicidal soap both before and after working in the cabinet. It is recommended that long-sleeved gowns or lab coats with tight-fitting cuffs and sterile gloves are worn, to minimize the shedding of skin, or related contaminants, into the work area and to protect hands, arms and clothing from contamination.

Avoid using floor-type pipette discard canisters. It is important that used pipettes be discarded into a tray or other suitable container inside the cabinet. This reduces unnecessary movement in and out of the work area. Because of the restricted access, pipetting within the cabinet will require the use of pipetting aids.

All work should be performed using the recessed area of the solid work surface. Work should be performed using slow movements, and the number of movements should be limited as much as possible. All materials required should be placed in the cabinet prior to starting a procedure to reduce the need for the operator to move arms in and out of the cabinet through the air barrier.

Room airflow can significantly affect cabinet operation. Opening and closing doors in the laboratory can cause air disturbances which might interfere with cabinet airflow. This kind of activity should be kept to a minimum while the cabinet is in use. Personnel should avoid walking by the front of the cabinet while it is in use. The location of facility air diffusers and personal fans can have an adverse effect on cabinet safety.

Use good aseptic techniques.

When a procedure has been completed, all equipment that has been in contact with the research agent should be enclosed and the entire work surface decontaminated. Trays of discarded pipettes, glassware, etc. should be covered. The cabinet should then be allowed to run for a minimum of three minutes, with no activity, so that the airborne contaminants will be purged from the work area. Once this has been done remove all equipment from the cabinet.

**WARNING**

**Never use the cabinet to store supplies or laboratory equipment.**

After removing all materials, culture apparatus, etc. from the cabinet, decontamination of the interior surfaces should be repeated. Check the work area carefully for spilled or splashed nutrient that might support bacterial growth.

It is recommended that the cabinet be left running continuously to ensure containment and cleanliness. The viewscreen alarm is not activated when the window is in the fully closed position.

## Using Ancillary Equipment

The more equipment and material that is placed in the cabinet, the greater the possibility of disrupted airflow. The resulting turbulence can alter the designed airflow and reduce the effectiveness of the cabinet. When equipment which rotates, vibrates or heats is used, be sure to place it at the rear of the work area if possible. This will help minimize the turbulence at the access opening.

## Cable Port Usage

**CAUTION!**

**Conduct a risk assessment prior to removing or introducing cables or tubing through the cable port passageway. Cabinet decontamination may be required.**

The cable port provides a safe means of introducing power, cables, vacuum aspiration tubing, etc. into the cabinet work area. These items should be installed prior to initial cabinet use. Removing or introducing items through the cable port after cabinet use shall require a risk assessment as the cable port passageway may be contaminated. Caution labels are provided on the interior and exterior of the cabinet to remind the operator of potential hazards.

## Reacting to Spills

Even when good work practices are used, occasional spills may occur. All spills should be dealt with immediately to prevent contamination and to avoid any damage to the stainless steel surfaces. It is recommended that the operator, in coordination with the facility safety professional, have a written plan available in case of an accidental exposure or spill. The safety plan should include all of the emergency procedures to be followed in the event of an accident. All employees who use the cabinet should be familiar with the safety plan.

## Cleaning and Disinfecting Stainless Steel

**IMPORTANT**

**After cleaning and disinfection, all surfaces should be rinsed with sterile water and wiped completely dry.**

## Simple Cleaning

**IMPORTANT**

**Do not use steel wool or steel pads when cleaning stainless steel.**

Dirt deposits on stainless steel (dust, dirt and finger marks) can usually be removed using warm water, with or without detergent. If this does not remove the deposits, a mild, non-abrasive household cleaner can be used with warm water and bristle brushes, sponges or clean cloths.

Iron rust discoloration can be treated by rubbing the surface with a solution of 15% to 20% by volume of nitric acid and water and letting it stand for one to two minutes to loosen the rust. The proper safety equipment should always be used when handling acids.

## Disinfection

The purpose of disinfection is to destroy any organisms that could pose a potential hazard to humans or compromise the integrity of the experiment. To ensure an organism is killed it is important to use a disinfectant in the proper concentration that is known to be effective for the specific organism. Standard disinfectants include: Iodophor-Detergent, Ethanol, Phenol and Alcohol. Hypochlorite (chlorine bleach) can also be used in dilute concentrations. Caution should be used, as Hypochlorite can cause pitting and/or cracking of stainless steel if it is either too concentrated or not completely removed from the surface in a timely manner. Allow an appropriate time to lapse for deactivation purposes (ref. *BMBL* 5<sup>th</sup> Edition) depending on the type of disinfection agent used. Follow up with a sterile water rinse and wipe completely dry to protect the stainless steel surface.

Disinfect the work area and work surface before and after every procedure.

Disinfect surfaces of all equipment used.

Remove all items from the inside of the cabinet.

Place all items that may have come in contact with the agent(s), such as used pipettes, in a plastic bag or other suitable container.

Disinfect the entire inside surface of the cabinet.

For additional information on cleaning and disinfecting stainless steel, please refer to: "Decontamination, Sterilization, Disinfection, and Antisepsis," Vesley, Donald and Lauer, James L., *Laboratory Safety Principles and Practices*, 2<sup>nd</sup> edition, 1995, Fleming, D.O., Richardson, J.H., Tulis, J.J. and Vesley, D., editors, ASM Press, Washington, D.C., pp. 219-237; and *Biosafety Reference Manual*, 2<sup>nd</sup> edition, 1995, Heinsohn, P.A., Jacobs, R.R. and Concoby, B.A., editors, AIHA Publications, pp.101-110.

## Cleaning Spills

### CAUTION

**It must be assumed that the drain pan is contaminated.**

Spills on the work surface should be first cleaned and disinfected. Spills that fall through the perforated grilles in the work surface should be cleaned up and all waste put in an appropriate disposal container inside the work area. The remainder can be removed through the drain valve in the drain pan after proper decontamination of the work area. To clean the drain pan under the work surface, lift the work surface, completely surface decontaminate the work surface including the underside and work surface supports, then remove all decontaminated items from the work area. Removing these parts provides unobstructed access to the drain pan for easy cleaning. The drain valve must be closed when cleaning of the drain pan is completed. Before reinstalling the work surface and supports, disinfect all surfaces. Be sure not to touch the exhaust HEPA filters or expose them to any disinfection agents. Before reinstalling the work surface and supports, disinfect all surfaces.

## Space Decontamination

### WARNING

**The cabinet must be decontaminated with an appropriate agent prior to conducting maintenance, service or repairs in any biologically contaminated area of the BSC. Contaminated areas of the BSC are indicated by red WARNING labels. Before selecting a decontamination agent, the user and biosafety cabinet certifier must verify compliance with local, state and federal regulations. Any specialized equipment within the cabinet work area should be evaluated for material compatibility prior to using the decontamination agent.**

The National Institute of Health, National Cancer Institute and the Centers for Disease Control recommend the use of formaldehyde gas, chlorine dioxide gas or hydrogen peroxide vapor all proven successful against most microbiological agents. All space decontamination activities shall be performed by individuals experienced in the handling and use of decontamination agents such as an accredited biosafety cabinet certifier. The selected decontamination agent should be determined effective against all of the biological agents within the cabinet. Personnel should always use the proper safety equipment (gas masks, protective

clothing, etc.) for the specific hazard. The antidote for the selected agent should be immediately available, in a visible and nearby location.

A good reference for understanding space decontamination procedures is provided in the most current version of the NSF/ANSI Standard 49 in Annex G "Recommended Microbiological Decontamination Procedures," NSF International, 789 North Dixboro Road, P.O. Box 130140, Ann Arbor, Michigan, 48113-0140.

Carcinogens and other toxins present a unique chemical deactivation problem and standard biological decontamination will not be effective against chemicals or other non-biological materials. A qualified safety professional, knowledgeable of the hazard, should be consulted to determine the proper procedure in these cases. Relocation of a BSC must involve a risk assessment to determine the need and space decontamination method.



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Patent pending – Air Bypass Armrest, Cable Port

This manual includes information for proper biosafety cabinet operation.

We recommend that the manual be kept near the cabinet for ready reference.