OPERATOR'S MANUAL
Baker BioGARD
Biological Safety Cabinet

MODEL B40A/B60

THE BAKER COMPANY

NSF Classification: Class II, Type A.

This manual includes information for installation, operation, maintenance and spare parts. We recommend that it be kept near the cabinet for ready reference.

October 1999, Rev. A

THE BAKER COMPANY

INTRODUCTION AND WELCOME

It is a pleasure to welcome you to the growing number of customers who own and operate Baker biological safety cabinets. As the inventors of the laminar flow biological safety cabinet and the leaders in the field, Baker people take special pride in providing a cabinet which is designed for maximum performance.

The BioGARD Models B40A and B60 both have a number of remarkable features. Among them are the high-velocity return air slots which play an important part in maintaining both containment and a particle-free work area. Located in the areas where air turbulence is greatest, the slots draw in air at very high velocity and prevent the escape of particulates to the environment or the work area.

You will find your BioGARD cabinet suitable for use with work involving the technique of tissue culture of possibly infectious samples, and other techniques requiring a contamination-free atmosphere.

Please note that all open-front containment cabinets, including this one, are for use with low to oderate risk agents only. Open-front cabinets do not provide absolute protection for the user. The adequacy of a cabinet for user safety should be determined on-site by an industrial hygienist, safety officer or other qualified person. Remember that you, the owner and user, are ultimately responsible and that you use your cabinet at your own risk.

Built to exceed all microbiological aerosol tests specified by NSF Standard No. 49, your BioGARD has many unusual Baker features which are included for superior performance, simpler maintenance and lower life-cycle cost. Your BioGARD is designed for both safety and value.

We recommend that this manual, along with the enclosed factory test report on your unit, be kept near the cabinet for convenient reference by operators and qualified maintenance personnel. If you have any questions about the use or care of your new BioGARD cabinet, please do not hesitate to contact our Customer Service Department for assistance.

Sincerely,

Dennis Eagleson
President
The Baker Company, Inc.

TABLE OF CONTENTS

INSERT: Factory test report for this unit

I-FUNCTION AND DESCRIPTION OF THE BIOGARD CABINET

Your BioGard is a Class II, Type A biological safety cabinet of original design. It features vertical laminar airflow and a front access opening. Because of its advanced design, it protects not only the environment and the operator of the cabinet, but also shields the product within from airborne particulates.

HOW THE AIRFLOW WORKS

FIGURE 1 shows the airflow pattern of your unit and should be studied carefully by each operator of the cabinet. Clean air which has passed through HEPA (high efficiency particulate arrestance) supply filter descends through the work area in a vertical laminar flow. At the approximate center of the work area it splits, with a portion of the air exiting to the base of the cabinet by way of the front perforated grille. The remainder of the air goes to the base by way of the rear grille. Under the work area the air is re-united and pumped through the blower up the rear positive-pressure plenum to the upper part of the cabinet. From here, approximately 30 percent is eliminated through the exhaust HEPA filter and the remaining 70 percent is recirculated through the supply HEPA filter into the work area.

Because the cabinet must take in air to make up for the 30 percent which goes out through the exhaust filter, an equivalent volume of room air enters the system through the front access opening. This air, which does not enter the work area, completes the air-barrier at the front of the unit and is partially responsible for the excellent containment capability of the cabinet.

With room air entering through the intake grille at the front of the unit, it is necessary that all work be performed beyond it in the clean inner atmosphere of the work area. Any blockage of the perforated intake grille disrupts the airflow, causing turbulence and promoting contamination within the work area.

The BioGARD design incorporates unique high-velocity return air slots, which are located at the corners of the front access opening. These suction slots eliminate any “skin effects” which may permit particles to enter or leave the cabinet at these critical points. This action ensures that no unfiltered air will enter the work area.

Positive and negative pressure areas

One of the many features which set BioGARD apart from other cabinets is the interaction of positive and negative pressure areas. In the negative pressure plenum, air is drawn from the work area directly into the blower. It is then transported safely through the sealed positive pressure plenum to the HEPA supply filter. Any particle from the work area is bound to be drawn by suction into the blower, and from there swept upward into the filter.

Access to the work area

The BioGARD cabinet has a hinged view screen, parallel to the back of the unit, providing an eight inch work opening. Any work implements not easily passed into the cabinet through the front work opening may be placed inside under the raised hinged view screen. The view screen must be in a closed position and securely latched whenever the cabinet is in operation. If the view screen is not securely fastened, the speed of intake air may be reduced and the performance of the cabinet impaired.

As with other Baker cabinets, the electrical outlets inside the work area are protected by circuit breakers so that an overload by research equipment will not affect air handling or unit functioning. Overloading with electrical equipment should, of course, be avoided in any case. (See the Ancillary Equipment instructions in Chapter III on Proper Cabinet Use, and in the Appendix).

DESIGN DETAILS

Performance assurance

Meticulous care in manufacturing is followed by more than 13 separate operational and performance tests prior to shipment of your cabinet. In addition, a complete factory test report on the operation of your unit is included at the rear of the manual.

Motor/blower capacity

A motor/blower's efficiency is measured by its ability to provide a nearly constant volume of air as resistance increases because of filter loading. Having a proper motor/blower combination makes possible longer filter life. Verification by a simulated filter loading test has established that the BioGARD B40A is capable of automatically handling a 100 percent increase in pressure drop across the filter without reducing total air delivery more than 10 percent. With the manual speed controller, a 150 percent increase in the pressure drop across the filter can be handled. The BioGARD B60 is capable of automatically handling a 113 percent increase in pressure drop across the filter without reducing total air delivery m ore tan 10 percent. With the manual speed controller, a 170 percent drop across the filter can be handled. The resulting longer filter life reduces the cost of filter replacement and decontamination, and diminishes the hazard to personnel which would occur with more frequent opening of the contaminated areas of the cabinet.

One-piece interior wall construction

The interior side and rear walls of your BioGARD's work area are constructed from a single piece of 14 gauge stainless steel. The easy-to-clean 7/16 inch radiused (rounded) corners prevent the buildup of contaminants and resist corrosion.

Protective screen

Located under the drain pan, a protective screen is provided to help prevent wipes and other materials from being drawn into the blower system. This precaution eliminates costly decontamination and downtime. The screen affords easy access to waste materials and should be kept clean at all times.

Cabinet construction

BioGARD's external construction is 14 gauge cold-rolled steel, protected by white baked enamel finish. The plenums and other components of the cabinet are of gas-tight construction. Each component is welded, gasketed or assembled with hermetically-sealed joints. Each cabinet is gas tested under pressure to ensure the integrity of these seals.

Recessed stainless steel work surface

The work surface is constructed of corrosion-resistant 18 gauge type 304 stainless steel, with drain pan of, 14 gauge stainless steel. The "satin" finish of the work surface diminishes light reflection. It is recessed to retain spills, and the 3/16 inch radiused corners make for easy cleaning.

Tested HEPA filters

Supply and exhaust filters in BioGARD are zero-probed HEPA. They are 99.99 percent efficient in filtering monodisperse 0.3 micrometer Dioctylphthalate particles, and they are more efficient against particles of greater or less than 0.3 micrometer size. Each filter is scan-tested to avoid leaks.

8" access opening

BioGARD has an eight inch access opening with average ambient air intake velocity of 100-110 fpm. The access opening and viewscreen combination provide the operator with a panoramic view of the work area.

Stainless steel air diffuser/filter protector

A stainless steel air diffuser/filter protector is provided under the supply HEPA filter in the work area.

Petcocks and drainage valve

One petcock is located in the right work area side wall. One plugged penetration is located in the right side wall, and two plugged penetrations are situated in the left side wall to accommodate optional petcocks. A stainless steel ball-drainage valve provides safe and effective evacuation of the drain pan.

Work area lighting

BioGARD's lighting system provides an average of 100 foot-candles of illumination at the work surface level.

Ultraviolet germicidal light (optional)

An ultraviolet germicidal light is an option on BioGARD models. Ultraviolet lamps lose their effectiveness over a period of time and should be replaced when intensity drops below the optimum level. Eyes and skin should never be exposed to ultraviolet light. It should be used only when the lab is vacant.

Electrical specifications

BioGARD B40A:

115V - 1 Phase - 60 Hz

The standard unit is provided with two duplex receptacles at 7.5 amps, controlled by a circuit breaker switch. One 12-foot power cord is furnished, with 20-amps plug (NEMA S-20P).

* Blower motor	6.6 amps
* Fluorescent light (ballast)	0.8 amps
* Outlet amperage	7.5 amps
* Total running load	14.9 amps

BioGARD B60:

115V - 1 Phase - 60 Hz

The standard unit is provided with two duplex receptacles at 5 amps, controlled by a circuit breaker switch. One 12-foot power cord is furnished, with 20-amps plug (NEMA S-20P).

* Blower motor	9.9 amps
* Fluorescent light (ballast)	1.2 amps
* Outlet amperage	5.0 amps
* Total running load	16.1 amps

Air balance adjustments

Air balancing can be done by either of the following methods. However, it should be done only by a technician with proper training and equipment. (See Chapter IV, "On Site Checks and Maintenance," in this manual).

- A speed controller adjusts for voltage differences and filter loading.
- An adjustable damper compensates for differences in resistance of supply and exhaust filters and saves time when rebalancing the cabinet after a filter change.

Height and weight

Height of the BioGARD, Model B40A, is 79 $^{3}/_{8}$ inches. Weight is 700 pounds. Shipping weight is 1000 pounds.

Height of the BioGARD Model B60 is 79 $^{3}/_{8}$". Weight is 900 pounds. Shipping weight is 1300 pounds.

THE HEPA FILTER

The high efficiency particulate arrestance (HEPA) filter is one of the essential components of a biological safety cabinet. It is the shield which stands between the environment and the experimental agent.

Developed during the 1940's and 1950's by the U.S. Army Chemical Corps, Naval Research Laboratories and the Atomic Energy Commission, this is often called the "absolute filter."

The HEPA filter consists of a continuous sheet of glass fiber pleated over rigid corrugated separators and mounted in a wood frame. It is very delicate and the filter media should never be touched.

Proven efficiency is 99.9% for particles 0.3 microns in diameter. This size particle is used as the basis for filter definition because theoretical studies have shown that filtration efficiency should be at a minimum for particles of this diameter, with efficiency increasing for particles either larger or smaller. Experiments with various viruses and microbial agents have proven the effectiveness of the HEPA filter. (See Bibliography section in Appendix).

Chemicals and Gases:

It must be pointed out that the HEPA filter is NOT effective against chemicals in the gaseous state. Since most Baker cabinets are partially recirculating, there will be gaseous buildup to the point of equilibrium. Before any chemicals are used in the cabinet it is necessary to consider:

1. Are these chemicals, either singly or in combination, able to attack filter components, even stainless steel?

2. Are these chemicals potentially toxic to the operator? Is there any combination of two or more which could be toxic? If the cabinet is being correctly used and only the operator's hands and arms are inside the machine, then toxicity or irritation could only occur through skin penetration. A proper evaluation of toxicity must deal not only with one-time exposure, but also with the effect of many small exposures over a period of time.
3. Are these chemicals explosive or flammable? If so, they should never be used in your cabinet. With a buildup

caused by recirculation of air, an explosion can be the result of a motor spark or a burner operating in the work area.

In cases where chemical carcinogens, mutagens or teratogens are to be used, the risks should be carefully weighed in choosing a cabinet. Where the exhaust effluent contains a contaminant, it may need treatment.

Life Expectancy of a HEPA Filter:

The life of a filter is determined by how it is used and how often. Under normal laboratory conditions, you can expect at least five years of use. However, misuse or a heavy dust load within the cabinet will shorten any filter's lifetime. Bunsen burners and misuse of chemicals will also shorten the useful life.

II-PREPARING YOUR CABINET FOR USE

CHECKING THE CABINET ON ARRIVAL

Upon receipt of your new BioGARD cabinet, first inspect the exterior of the crate and skid. If there is broken glass or other visible damage, that fact should be noted on the receiving slip and immediately reported to the delivering carrier.

Now remove the crate and inspect the unit itself. The top cover of the crate should be taken off first, then the boards from front and back. Bend both ends of the crate outward, away from the sides of the unit, and remove front or rear blocking from the skid. If any concealed damage is found, it should be reported to the delivering carrier who will want an opportunity to inspect the damage. A claim for restitution should be filed within 15 days.

Because of the danger of mishandling by trucking companies, we have removed certain parts of the cabinet and have packed them separately. These items are listed on the packing slips which accompany the unit. Please check packing slips carefully to make sure that all items have been located.

The uses of a biological safety cabinet

Your BioGARD cabinet has been designed to provide a work area which protects the experiment from the environment, and the environment from the experiment. The laminar flow biological safety cabinet is designed for work with Biosafety Levels 1, 2 and 3 (low to moderate risk) agents as listed in The Center for Disease Control's "Biosafety in Microbiological and Biomedical Laboratories", U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and National Institutes of Health, U.S. Government Printing Office, Washington, D.C. 20402. HHS publication number (CDC) 93-8395.

Biosafety level 4 or extremely high risk agents should never be used in this cabinet.

CAUTIONS:

- The use of any hazardous material in the cabinet requires that it be monitored by an industrial hygienist, safety officer or other qualified individual.
- Explosive or flammable substances should never be used in the cabinet unless a qualified safety professional has evaluated the risk.
- If hazardous biological work is to be performed, apply the appropriate biohazard decal which is enclosed. This is in accord with OSHA regulations, volume 39, number 125, Part II.
- If chemical, radiological or other non-microbiological hazards are present, be sure to employ appropriate protective measures in addition to formaldehyde decontamination. Call upon a suitably trained individual to monitor the operation.

Location within the laboratory

The ideal location for any laminar flow biological safety cabinet is in a dead-end corner of the laboratory away from personnel traffic, vents, doors, windows and any other sources of disruptive air currents. Published work from The Baker Company (see Rake ASM paper, reference #34 in Appendix), and unpublished tests performed at the National Cancer Institute show that if a draft or other disruptive air current exceeds the intake velocity of the cabinet, then contamination can enter the work area or escape from it. Proper placement within the laboratory is essential.

If the cabinet exhausts its air into the laboratory instead of venting to the outside, it is important that there be adequate space between the top of the cabinet and the ceiling. A solid ceiling located too close to the exhaust filter will restrict the air and limit the intake velocity. A minimum of 12 inches of clearance on all sides and top of the cabinet is necessary to achieve ideal conditions for testing. If it is not possible to provide 12 inches above the exhaust HEPA filter, inaccuracies in measurement of exhaust flow may result. Consult with the factory for the implications of this, and for alternatives.

Installing the cabinet

Installation should be carried out in accordance with appropriate OSHA regulations, and with those of other regulatory agencies having jurisdiction.

1. First, move the cabinet from the unloading area to its intended location on dollies. The overall dimensions for the B40A are: 32" deep x 51 $^{1}/_{8}$" wide x 79 $^{3}/_{8}$" high. The overall dimensions for the B60 are: 32" deep x 75 $^{1}/_{8}$" wide x 79 $^{3}/_{8}$" high. To reduce the height to 76" for either model, remove the base leg assemblies. Another alternative is to remove the exhaust filter housing and filter, which would also reduce the height to 76".

2. Level the work surface by adjusting the legs on each of the four corners of the unit. Be sure that all four legs rest firmly on the floor when they are extended. The correct height of the working area is 34 ½" from the floor.

3. Check to make sure that the liquid drain valve is in the closed position, parallel to the floor. If something is spilled in the work area it will then remain in the drain system and not descend to the laboratory floor.

4. Make sure that service petcocks, if any, are in the closed position (perpendicular to the rear wall of the unit if installed in the sidewalls).

5. Remove the rectangular exhaust filter cover, leaving the grey gasket in place on the unit. The wrench for this job will be found on top of the cabinet. Check the HEPA filter clamp nuts for proper tightness.

6. Remove the work surface hold-down clips with a screwdriver.

7. Arrange for the exhaust. The BioGARD cabinet can operate with filtered exhaust entering directly into the room, or with filtered exhaust ducted to the outdoors. Details of these alternatives follow.

8. A drain valve is provided at the right bottom of the work area. Because the effluent from this drain may be biologically hazardous, precautions must be taken for safe disposal. When present, petcocks are piped within the cabinet. External connection is by $^{3}/_{8}$ inch FPT nipples in the sidewalls. Connection to plant utilities should be made with proper materials and technique. No flammable gas should be used. If, however, the risk is professionally evaluated and a decision is made to install a flammable gas petcock, an emergency shut-off valve will be required in an accessible location outside the cabinet.

9. A 20-amp power cord with a NEMA 5-20P plug is furnished with the BioGARD cabinet. It should be plugged into an appropriate 115-volt, 60-cycle, 20-amp dedicated utility outlet.

10. Before using the cabinet, snap the fluorescent light switch to the ON position and make sure that the bulb is lighted. These tubes are locked into place with the usual stop-lock fittings.

    If your unit is equipped with ultraviolet light, there will be a three-way switch with the center position for OFF and the other positions for ultraviolet light ON, or for fluorescent light ON.

    Turn the germicidal ultraviolet light on and make sure that the light is operational.

    CAUTION: Rays from ultraviolet lamps are injurious to human eyes. It is suggested that they be operated only after working hours, and when no one is in the room.

11. Now start the cabinet by turning the blower switch to the ON position. Allow the cabinet to run for about a half hour so the dirty air in the work area will be removed.

    Leave the blower running and wash the entire cabinet, inside and out, with a detergent — disinfectant to remove surface dust. Once started, we recommend that all cabinets be left running continuously. For additional and

subsequent start-up and use procedures, please turn to Chapter III, Proper Cabinet Use.

12. Your BioGARD cabinet has been subjected to a comprehensive series of physical tests before shipment from the factory. A physical test report is filed by serial number as a permanent record at Baker headquarters, and a copy of the report accompanies each shipment. Your copy is at the rear of this manual.

    Although all units are carefully tested at the factory, it is advisable that certain checks be made on-site by a qualified technician after installation. These include testing the filters for leaks and checking the air balance of the unit, especially, if it is connected to an exhaust system. A description of these tests can be found in Chapter IV entitled "On-site checks and maintenance."

    It is also recommended that all personnel who will be using the cabinet study this operating manual to make the most effective use of it, and that they receive proper safety training for the work they are doing.

EXHAUST INTO THE ROOM

If the cabinet exhausts its air directly into the laboratory instead of ducting it to the outside, it is important that there be adequate space between the top of the cabinet and the ceiling. At least four inches must be provided, and the shipping panel covering the exhaust filter must be removed. Attach the exhaust filter guard, supplied with the unit, with long legs to the rear. NEVER use the top of the cabinet as a storage area.

Although four inches of top clearance may be sufficient for day-to-day operation of the cabinet, it will not permit accurate airflow measurements in testing. At least 12 inches of clearance on all sides and on top is recommended for this purpose.

Never use flammable, explosive or toxic vapors or gases, or substances which generate them, unless a qualified safety professional has evaluated the risks. The filter removes only particulates, and not gases.

EXHAUST TO THE OUTSIDE

Whenever possible, the filtered exhaust should be connected to its own separate exhaust system. If it must be channeled into a multi-duct system, make sure that the system is not recirculating. You will, of course, also want to make sure that the system can handle the volume of air required to pass through it, and that there is sufficient static pressure for proper cabinet function.

The exhaust requirements of the BioGARD B40A are 268 cfm +/-5% at .02 - .04 inches water column suction directly above the exhaust filter before any dampers, elbows or other restrictions. The exhaust requirements of the BioGARD B60 are 408 cfm +/- 5% at .02 - .04 inches water column suction directly above the exhaust filter before any dampers, elbows or other restrictions.

An indicator light or some other safety device should be installed to give warning if the exhaust system fails. A properly designed duct system includes an airtight damper to balance the air, and also to shut off the duct for purposes of cabinet decontamination.

For further information, refer to National Sanitation Foundation's Standard No. 49 and other guidelines dealing with ventilation. See FIGURE 2 in the Appendix for exhaust connection details.

III-PROPER CABINET USE

A laminar flow biological safety cabinet is a valuable supplement to good sterile technique, but is not a replacement for it. If the cabinet is not understood and operated correctly, it will not provide an adequate protective barrier.

All activities that are to be performed in your cabinet should first be approved by a competent professional, such as, an industrial hygienist or safety officer, to make sure that the cabinet is appropriate for the work it will be required to do. This person should monitor the cabinet and its operating personnel at regular intervals to see that it is being used correctly.

In order to keep the interior workspace clean and free of particulates, all Baker laminar flow cabinets are designed for continuous operation. If the blowers are turned off, the unit becomes contaminated with room air. We, therefore, recommend that the blowers be left on.

Start-up procedure

1. If the unit has not been left running continuously, first turn the blower switch to ON. Make sure that you have cabinet airflow, either by listening for blower sound or feeling the airflow across your fingers. If your cabinet has a minihelic gauge, which measures positive pressure, you can look for a reading other than zero. The gauge should be consistent with the last time the unit was on.

2. Turn on the fluorescent light, at the same time making sure that the ultraviolet light (optional) is turned off. Never leave an ultraviolet light on while there is anyone in the room.
   NOTE: Because the ultraviolet light is optional equipment, your cabinet may not have one.

3. Check to determine that the drain valve is in the closed position or the drain coupling is capped.

4. As with other laboratory work space, the interior area of your cabinet should be wiped down with a surface disinfectant. NOTE: Some disinfectants may corrode or stain the steel surfaces. If this is a possibility, clean the surfaces promptly with a detergent and rinse with tap water to prevent corrosion.

5. Place all materials to be used for the next procedure inside the cabinet. It may be necessary to disinfect the exterior of these materials.

   Everything required (and nothing more) should be placed in the cabinet before you begin your work so that nothing will pass in or out through the air barrier until the procedure is completed. Within the work area, implements should be arranged in logical order so that clean and dirty materials are segregated, preferably on opposite sides.

   Blocking the front and rear perforated grilles must be avoided. If wipes are used, be sure to keep them away from the grilles.

6. After your equipment is in place inside the cabinet, close the view screen and securely clamp it in place. NEVER OPERATE THE CABINET WITH THE VIEW SCREEN IN ANY OTHER POSITION. THE EIGHT INCH OPENING IS ESSENTIAL FOR PROPER UNIT OPERATION.

7. After the cabinet has operated for three minutes, with the view screen in proper position, you are ready to begin.

The proper way to work in the cabinet

1. Hands and arms should be washed thoroughly with germicidal soap both before and after work in the cabinet. Operators are encouraged to wear long-sleeved gowns or lab coats with tight-fitting cuffs and sterile gloves. This minimizes the shedding of skin flora into the work area and protects hands and arms from contamination.

2. Perform all work on the depressed area of the solid work surface. Work with a limited number of slow movements. Since all of the equipment you need is already in the cabinet, it will not be necessary to move arms in and out through the air barrier.

3. Because opening and closing doors in the laboratory causes air disturbance which might interfere with cabinet airflow, this kind of activity should be kept to a minimum while the cabinet is in use.

4. Avoid using floor-type pipette discard canisters. It is important that your used pipettes be discarded into a surgical instrument tray or other suitable container within the cabinet. This reduces the temptation to move in and out of the work area unnecessarily.

   Because of the restricted access, pipetting within the cabinet will require the use of pipetting aids. Learning to use these aids requires only a little practice.

5. Use good aseptic technique. Procedures done with good technique and proper cabinet methods will not require the use of a flame.

   If, however, a safety officer approves the use of flame after evaluating the circumstances, then a burner with a pilot light such as the “Touch-O-Matic” should be used. Place it at the rear of the work area where the air turbulence caused by the flame will have the least possible effect. Flame disturbs the directional airstream and also contributes to the heat load. If cabinet blowers are unintentionally turned off, the flame could damage a filter.

   Tubing for a burner within the cabinet must be resistant to cracking or puncture. Material such as Tygon tubing may not be acceptable for this use.

6. NEVER OPERATE YOUR CABINET WHILE A WARNING LIGHT OR ALARM IS ON. These warning devices tell you when there has been some sort of compromise of cabinet integrity. Be sure to correct the problem before you continue your work, whether it is caused by insufficient suction in the exhaust system or some improper condition.

The operating position of the sash provides an eight inch high access opening. This restricted opening permits optimum operating conditions for the cabinet. For operating comfort it is recommended that the top of the operator’s shoulder be at the same height as the bottom of the window. Because operators will not all be the same height, it is suggested that an adjustable chair be provided.

7. After a procedure has been completed, all equipment which has been in contact with the research agent should be enclosed, and the entire surface decontaminated. Trays of discarded pipettes and glassware should be covered. The cabinet should then be allowed to run for at least three minutes with no activity so that the airborne contaminants will be purged from the work area. Next, make sure that all equipment is removed from the cabinet.

8. After you have removed all materials, culture apparatus, etc., decontamination of the interior surfaces should be repeated. Check the work area carefully for spilled or splashed nutrient which might support bacterial growth. And NEVER use the cabinet to store supplies or laboratory equipment.

   We recommend that the cabinet be left running continuously to ensure containment and cleanliness.

9. If an accident occurs during cabinet operation which causes spills and spatters around the work area, you will need to decontaminate all items and surfaces before any items are removed. If the spill was enough to create puddles or liquid in the drain pan, then an emergency spill procedure should be followed.

   It is recommended that the researchers, in coordination with their consulting 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 should be familiar with the emergency procedures.

   The emergency spill procedure may, of course, vary according to the agents being used. In the case of a biological spill, for example, the area containing the spill may be flooded with an appropriate disinfectant. The drain capacity of BioGARD B40A cabinet is 9.5 liters and the capacity of the BioGARD B60 cabinet is 13.5 liters.

   After the disinfectant has had time for a complete kill, remove or drain the residue. If

you have used a disinfectant which is harmful to stainless steel (Hypochlorite solutions, for example) be sure that none remains to corrode cabinet surfaces. Clean the surfaces with a detergent-disinfectant and rinse with water.

If you have a spill involving a hazardous Biosafety Level 2 or 3 agent, then you are advised to leave the cabinet running and close the viewscreen so as to let the aerosols settle before you start cleanup procedures. With some spills, it may be necessary to decontaminate the room with an agent such as formaldehyde gas. Biosafety Level 4 agents should NEVER be used in this type of cabinet, except in conjunction with a one-piece positive pressure personnel suit ventilated by a life support system. Please consult your safety professional for a proper risk assessment.

If the spill contains volatile liquids which generate vapors creating a danger of fire or explosion, turn off the unit and other electrical appliances and close the viewscreen. Evacuate and seal the room and call for immediate help from a safety professional.

If the agent is a hazardous chemical, it may be recommended that a Spill Kit be kept readily available. This kit should be clearly labelled, and might include such items as a respirator, chemical splash goggles, two pairs of gloves, two sheets of absorbent material, spill control pillows, a solution to clean the contaminated area, and waste disposal bags or other containers. Consult your safety professional for proper procedures and treatment of the specific agents you plan to use.

It would be helpful for operators to learn about the capabilities and limitations of the cabinet by reading some of the available literature. You will find a partial bibliography in the Appendix of this manual, including an excellent slide-cassette program called “Effective Use of the Laminar Flow Biological Safety Cabinet.”

Ultraviolet light (option)

Your BioGARD may have been ordered with the optional ultraviolet light. If so, you will have a three-way light switch, with “off’ as the middle setting, “fluorescent” on one side, and “ultraviolet” on the other.

Ultraviolet lamps lose their effectiveness over time and should be replaced when intensity drops below the optimum level.

Other important rules are:

* Eyes and skin should not be exposed to ultraviolet light. It should be turned on only when no one is in the room.

* Ultraviolet light cannot be relied upon as the sole decontaminating agent. Additional surface disinfection should be performed both before and after every cabinet use.

* A biological safety cabinet acts as a supplement to good aseptic practices, not as a replacement.

Using ancillary equipment

The rule to keep in mind is that the more equipment is in the cabinet, the greater will be the air turbulence it causes. The turbulence resulting from equipment and materials can disrupt the designed airflow and reduce the effectiveness of the cabinet. When you use equipment which rotates, vibrates or heats, be sure to place it at the rear of the work area if possible. This will minimize the turbulence in the access opening.

Another precaution is to avoid using equipment which exceeds the amperage limit of the work area duplex. The limit for the B40A is 7.5 amps and for the B60 the limit is 5 amps. A circuit breaker is provided for the outlets in the work area to protect against an overload in this area which might otherwise interrupt the continuous airflow in the cabinet.

Because certain procedures, such as those involving some types of centrifuge or blender, can generate a large volume of aerosols capable of penetrating the air safety barrier, we are including in the Appendix of this manual a special section on ‘‘Procedures for using ancillary equipment.” Please study it carefully.

PROCEDURES FOR USING ANCILLARY EQUIPMENT

This section is included because certain procedures, for example, those requiring the use of a centrifuge or blender, can release a large volume of aerosols capable of

penetrating the air safety barrier of the cabinet.

When working with any piece of ancillary equipment, it is necessary to follow correct procedures. In order to estimate how much aerosol you may create when you are using common procedures or ancillary equipment, please refer to “Potential for accidental microbial aerosol transmission in the biological laboratory”. It is listed in the Reference section of this Appendix.

Following are some special cautions relating to the use of blender or centrifuge:

USING A BLENDER

Homogenizing cultures with a blender can create an enormous aerosol load, so special precautions must be taken. It is essential to decontaminate surfaces and carry out an air purge both BEFORE and AFTER the use of the blender. DO NOT perform other research activities or leave your arms in the cabinet while the blender is in operation. And wait at least five minutes after the blender has come to a complete stop before you open its cover.

The air safety barrier could possibly be penetrated by the high concentration of contaminated particles if the blender were opened during or just after operation. In that case, the surrounding laboratory would very likely be contaminated.

USING A CENTRIFUGE

Small clinical centrifuges can also create severe turbulence because of their rotating action. They disrupt the airflow within the cabinet and also at the opening, sometimes allowing contaminated air to escape into the laboratory. DO NOT perform other research activities or leave your arms in the cabinet while the centrifuge is operating. Wait at least five minutes after the centrifuge has come to a complete stop before you open its cover. As with the blender, conduct surface decontamination and air purge both BEFORE and AFTER using the centrifuge.

If you use a centrifuge often or work with fairly hazardous agents, we recommend that you purchase a laminar flow safety cabinet which has been modified to hold various centrifuges. In these modified units, the centrifuge is placed in a well which is recessed so as to hold air turbulence to a minimum.

SOME COMMON ERRORS TO AVOID

Following is a list of suggestions to help you avoid some of the most common errors made when using biological safety cabinets.

DON'T store equipment or supplies in the cabinet.

DON'T fail to turn on the blowers.

DON'T have the viewscreen open.

DON'T fail to use pipetting aids.

DON'T use an open flame within the cabinet unless the use has been specifically approved by a safety professional.

DON'T block air intake grilles.

DON'T change cabinet or blower speed unless the change is required by a decrease in measured air velocity.

DON'T overload the work area.

DON'T use toxic, explosive or flammable substances unless a safety professional has approved them for work in your cabinet.

DON'T work in your cabinet with any high-risk agents.

DON'T forget to close the drain valve.

DON'T operate the unit while there is a warning signal.

DON'T leave an ultraviolet light on when anyone is in the room.

DON'T omit any steps in good aseptic technique.

DON'T fail to disinfect surfaces, both before and after working in the cabinet.

DON'T forget periodic maintenance checks.

If the operators are well trained and use good common sense when operating the cabinet, there should be very few problems.

IV — ON-SITE CHECKS AND MAINTENANCE PROCEDURES

We recommend that the following checks be performed before initial use, after relocation and after each filter change. They should also be carried out at regular intervals, usually six months or one year, as specified by an industrial hygienist, safety officer or other qualified person. The tests described below meet recommended minimum requirements and must be performed by an experienced technician using proper procedures and instruments. Our representatives can tell you about other tests which you may consider desirable.

As reported earlier in this manual, each individual cabinet made by The Baker Company is carefully tested before it leaves the factory. Your copy of the test report, which you will find at the back of this manual, gives the factory test results for your own BioGARD cabinet. Use it as your record of the original testing, and as your guide to testing in the future. To gain many years of satisfactory service, please be sure that your maintenance personnel come as close as possible to duplicating these original test figures.

Your test procedures should be identical to ours so that comparing test results will have meaning. Please correspond directly with us to request detailed procedures for your particular cabinet model. Alternate testing procedures can be found in the National Sanitation Foundation Standard No. 49. (See reference in Appendix).

The airflow balance

The airflow balance which is set at the factory provides your unit with air volume and velocity control to minimize leakage of airborne contamination either in or out of the work area.

In order to duplicate as closely as possible the airflow characteristics described in the original factory test report, please follow these steps:

1. Clamp the window in place.

2. Using a calibrated hot-wire anemometer mounted on a ring stand 5 ¼ inches above the exhaust filter, take readings in the positions shown in the original test report which was found at the rear of this manual.

   Average these readings and multiply the average by the open area of the filter (2.44 square feet nominal for the B40A, 3.36 square feet for the B60) to get the volume of air exhausted by the cabinet. Divide the total exhaust air volume by the area of the front access opening (which is 2.56 square feet for the Model B40A and 3.89 square feet for the Model B60) to determine the calculated intake velocity at the front access opening. This must be in the range between 100 and 110 FPM.

3. Using the same instrument and ring stand, take readings at the level of the bottom edge of the window. Starting six inches from the sidewalls, every 5 $^{11}/_{16}$ inches for the B40A and 5 $^{13}/_{16}$" for the B60 left to right, and every six inches front to back. (Refer to test report at back of this manual).

4. After you have compared your figures with those originally recorded at the factory, make whatever adjustments may be necessary.

As the HEPA (high efficiency particulate arrestance) filters load up with particulates, airflow will be maintained automatically, at least until the filter resistance increases 50 percent or more. When airflow eventually diminishes, you will have to increase the blower speed in order to maintain the original volume of recirculating air. There is a speed control located in the electrical box. Turn it clockwise until you have the desired airflow. If the airflow cannot be maintained, it will be necessary to replace the HEPA filters. (See “Procedure for HEPA filter replacement” later in this chapter).

Filter media and seal leak tests

When preparing your cabinet for use after shipment, and then at prescribed intervals throughout its working life, you will need to verify that the filters have maintained their integrity. This is done by probe-testing the filter faces and seals.

Equipment needed will be:

- An aerosol photometer. The instrument should sample air at a flow rate of one c.f.m.

- You will also need a D.O.P. generator with Laskin nozzle(s). Liquid dioctylphthalate (D.O.P.), dioctylsebacate or comparable substance aerosolized by flowing air through the nozzle(s). When generated with Laskin type nozzle(s), the mean droplet size of the aerosol is 99 percent less than 3.0 microns.

PROCEDURE FOR FILTER AND LEAK TESTS

1. Turn on the aerosol photometer and calibrate according to the manufacturer's instructions.

2. Position the D.O.P. generator so as to introduce air generated smoke into the area upstream of the filter.

3. Measure the upstream concentration of D.O.P. CAUTION: Do not do this unless the unit has been properly decontaminated.

4. Holding the photometer probe about one inch from the filter face with diffuser removed, on the downstream side, scan the entire surface area and perimeter (filter gasket frame area) in slightly overlapping strokes at a traverse rate of not more than ten feet per minute. Repeat at 90 degrees to the first scan pattern.

5. When you find leaks, repair the HEPA filter media with silicone R.T.V. sealant. Eliminate leaks in the gasket frame area by re-tightening the filter hold-down clamps.

6. A HEPA filter is considered acceptable when all significant leaks have been sealed.

Airflow smoke pattern test

To check for the direction of air movement, use a smoke generator and trace along the front access opening on the inside of the cabinet. Observe that no smoke is escaping from the work area.

In order to be sure that room air is not entering the work area, trace along the outside of the front access opening. Observe that no smoke penetrates farther into the cabinet than the front four inches of perforated metal.

Cabinet integrity test

This test will most likely be performed only after installation to verify that no damage has been done to the cabinet in shipping. It will not be necessary on later routine checks unless the cabinet has been moved or damaged. The purpose of the test is to determine that the cabinet welds and gasketed seams are free of detectable leaks.

1. Decontaminate the cabinet if it has been used.

2. Seal off the exhaust filter port. This may be done by installing a gasketed panel over the opening, using the studs on the filter box flange. An alternative is to tape a piece of cardboard or plastic over the opening.

3. Raise the window.

4. Thoroughly clean the flat surface surrounding the opening into the work area.

5. Tape a sheet of plastic or other material to the face of the cabinet, being sure to seal the suction slots above the top of the opening.

6. Attach compressed air to the drain valve and pressurize the cabinet to 2" w.g. This pressure can be maintained by flowing compressed air if there are leaks in the taped area.

7. Apply liquid leak detector along all welds, gaskets, penetrations and seals on the exterior surfaces of all cabinet plenums. A leak will be revealed by the appearance of bubbles. Do not miss large leaks which may blow the "soap solution" away without creating bubbles.

8. Repair all leaks until no further bubbles appear.

9. Remove the compressed air lines, making sure that the drain valve is closed. Remove the sealing material. Then clean up the cabinet and reassemble the window by reversing the disassembly process.

Halogen leak test

The purpose of the test is to make sure that contaminated plenums are free of leaks when under positive pressure to the room. The test is performed on all exterior welds and gaskets of contaminated positive pressure plenums.
Equipment required for the test is:

- Halogen leak detector, G.E. Ferret or equal.
- Calibrated Leak, GE-LS-20 or equal.
- Tank of Freon, R-12.

Procedure is as follows:

1. Turn on power and allow the instrument to warm up for at least 15 minutes.

2. Calibrate the instrument according to manufacturer's instructions, using the Calibrated Leak rated at 1 x 10^{-7} cc/sec. This is accomplished by first opening the gas valve and adjusting the standard leak rate to 5 x 10^{-7} cc/sec., then adjusting the sensitivity of the Ferret to indicate leakage at this setting.

3. Introduce R-12 into the cabinet, pressurize and maintain to 2 inches water gauge pressure.

4. Hold the nozzle of the probe at the surface of the cabinet in such a way as to avoid jarring the instrument, and move it at the rate of about ½ inch per second.

5. Test all seams and joints in front, rear, top and bottom. In addition, test all doors, panels, pass boxes, etc.

6. When a leak is discovered, take appropriate corrective action, such as, tightening flange bolts and screws or adjusting door hinges.

7. Repeat scanning of the area of the leak after repairs have been made.

8. Continue until all areas of possible leakage have been tested.

9. Test criteria*: Test criteria have been satisfied when all leaks greater than 5x10^{-7} cc/sec. have been sealed.

* *Do not change the instrument's sensitivity setting after calibrating. Reg. G.E. document HBK-8131, pages 806 and 807.*

Grounding continuity test

Using a volt-ohmmeter, set it to read in excess of 100 ohms. Touch the two leads together and see that the display reads "0.1 - 0.0". Touch one lead to the ground lug on the cabinet power cord while touching the other lead to bare metal on the unit where the user would be likely to touch the cabinet. If the display reads "0.1- 0.0" the unit passes the test.

ADDITIONAL SUGGESTIONS FOR GOOD MAINTENANCE

Cleaning the work area

Whatever spills fall through the perforated grilles can be removed through the drain valve after proper decontamination.

To wash the drain pan under the work surface, simply lift up the solid work surface (or the perforated grille). It is secured with clips during shipment. Remember, too, that this area must be assumed to have contamination, so use caution in the way you approach the task.

Germicidal lamp (optional)

As reported in other sections of this manual, germicidal lamps lose their effectiveness over time and should be replaced when their intensity at the work surface drops below 40 microwatts per square centimeter.
If your cabinet has a germicidal lamp, measure its intensity at the work surface with an ultraviolet light meter.

Magnehelic gauge (optional)

The magnehelic gauge should be zeroed after the unit has been leveled, but before it is initially turned on. Its purpose is to measure pressure in the filter plenum. This gauge cannot be used to measure cabinet airfiows. It gives an indication of static pressure in the filter area. If the reading is lower than normal, it may suggest improper blower operation. As filters load, the gauge indication will rise slowly to show a higher pressure required to deliver the same air volume through the filters. This is not, however, a direct reflection of air flow.

Check your HEPA filters regularly

Changes in areas surrounding the laboratory may produce unexpected dust or other conditions which affect your filters. To maintain filter integrity and good cabinet operation, be sure to take periodic exhaust and supply airflow measurements and filter leak checks.

REPLACING THE HEPA FILTER

If your periodic checks of total airflow show a drop of ten percent or more from the original settings, your filters may be loading with particulates. As explained earlier in this chapter, the blower speed can be manually increased to compensate for filter loading. However, when the airflow can no longer be maintained or when the filters are damaged or begin to deteriorate, they need to be replaced.

Before any panels are removed, the cabinet must be decontaminated (please see following section for specifics on decontamination). The filters are sure to have collected microorganisms and other potentially harmful particles generated in the work area during their lifetime, and maintenance personnel should not allow themselves to be exposed. It should also be remembered that a specific gaseous decontamination may work against microorganisms, but not against chemical agents. Where chemicals are present, consult an industrial hygienist or other qualified person.

A chemically contaminated filter must be handled with caution. Personnel should be protected by clothing or breathing apparatus as necessary to the nature of the hazard. It is advisable to seal the contaminated side of the filter by taping a plastic sheet or cardboard over the face before removal. This should minimize the number of particles shaken loose from the filter. Once removed, the filter should immediately be sealed in a chemical hazard bag and then disposed of safely in accordance with environmental regulations.

After filter replacement has been completed, the cabinet and the room should be cleaned and decontaminated in a manner consistent with the nature of the hazardous material. The cleaning materials, along with the protective gear and clothing, should be disposed of properly.

HEPA filters are very easily damaged, and you will want to use great care in handling so as to avoid injury to the filter media and gasket surfaces. When installing the new filters, it is a good idea to tape a piece of cardboard over the filter media to give protection against dropped wrenches or misdirected fingers. Of course, you'll need to make sure that the cardboard is removed before the access panels are re-installed. Inspect the filters carefully before and after installation. A broken or damaged filter is worthless.

Changing the exhaust filter

Access to the exhaust filter is through a plate on the front of the filter box on the top of the unit. After decontamination, remove the nuts and take off the plate. Loosen and remove the filter clamps. Lift the dirty filter into a heat-sealable polyethylene bag for disposal.

Prepare the new filter by putting a light coat of silicone grease on the face of the gasket. Clean the sealing flange thoroughly. Then carefully slide the new filter into place and make sure that it is properly seated on the flange. Replace the filter clamp assemblies and screw the stainless steel studs finger-tight. Tighten the studs uniformly and moderately, a few threads at a time, until the filter gasket has been compressed approximately 20 percent. DO NOT OVERTIGHTEN. Then replace the exhaust filter access panel securely and make the leak test described earlier in this chapter.

Replacing the supply filter

First remove the front access panel on the top section of the cabinet.

Loosen and remove the supply filter clamps and carefully lift the dirty filter into a heat-sealable polyethylene bag for disposal.

Put a light coat of silicone grease on the face of the replacement filter gasket. Clean the sealing flange thoroughly. Then slide the new filter into place and make sure that it's correctly seated on the flange.

Replace the filter clamp assemblies and screw the stainless studs finger-tight. As with the exhaust filter, the filter gasket should be compressed approximately 20 percent. Finally, replace the access panels securely.

When filters are replaced, the airflow must be balanced and thorough filter and cabinet leak tests made by qualified personnel.

Adjustment of the balancing damper

Filters for your BioGARD cabinet hould be selected as a pair so that their resistances will be as close as reasonably possible. Resistances of HEPA filters may vary considerably from one to another, so a damper has been installed on your cabinet's exhaust to maintain the proper balance between exhaust and recirculating air. This balance is critical because too much positive or negative pressure in the work area could mean an outflow of pathogens or an inflow of room contamination.

The balancing damper adjusts the volume of exhaust air so as to maintain the proper supply and calculated intake air velocities. The damper is preset at the factory and SHOULD NOT be changed unless the proper airflow balance cannot be achieved after new filters are installed. On those occasions when adjustment becomes necessary, access is through a pipe coupling in the center of the supply filter access panel. **CAUTION: If your cabinet has been used, it should be decontaminated before the plug is removed. The procedure is as follows:**

1. Remove the pipe plug, located in the center of the supply filter access cover, using a ¾ inch Hex wrench.

2. Loosen lock nut on the damper control, using a 1 $^{1}/_{6}$" socket, through the pipe coupling in the filter access cover.

3. Adjust the damper with a $^{3}/_{8}$" square (4 point) socket through the pipe coupling in the filter access cover.

   NOTE: Turn clockwise to close the damper or reduce the amount of exhaust and counter-clockwise to increase the amount of exhaust or open the damper. Five turns moves the damper approximately one inch.

4. After final adjustment, lock the damper by tightening the lock nut and install the pipe plug removed in Step 1.

DECONTAMINATION

Whenever maintenance, service or repair are needed in a contaminated area of your cabinet, the unit must first be decontaminated by an appropriate agent. The National Institute of Health, National Cancer Institute and the Center for Disease Control have all recommended the use of formaldehyde gas for most microbiological agents. Its application requires individuals who are experienced in the decontamination of cabinets, since
the gas itself is toxic.

A good reference for this procedure is "Formaldehyde Decontamination of Laminar Flow Biological Safety Cabinets," to be found listed in the Bibliography section of the Appendix.

An ethylene oxide gas mixture is an alternative, but it involves a more complicated procedure and should only be used by personnel who are familiar with its operation.

Whatever gas you choose, have the proper safety equipment (gas masks, protective clothing, etc.) within easy reach. In addition, you will want to be sure that the gas you are using will be effective against all of the biological agents within the cabinet. When you have decided which gas to use, post the antidote to it in a visible and nearby location. Knowing that the volume of the B40A cabinet is 49.8 cubic feet and the volume of the B60 is 72.2 cubic feet will help you provide the correct amount of decontaminating gas.

Carcinogens present a unique chemical deactivation problem and the standard biological decontamination will not, of course, be effective against chemicals or other non-biological materials. With materials of this kind, consult a qualified safety professional.

Procedure for sealing exhaust and front openings:

1. BioGARD models all have an indented view screen. You may find it easier to get a good seal in taping up the front of the unit if the view screen is raised and washed with disinfectant.

2. Place in the work area all materials which will be needed for the procedure.

3. Using polyethylene film and tape, seal off the front face of the unit, making sure to seal the suction slots.

4. Seal off the exhaust opening, and lower the window down onto the plastic. Tape it in place. Now proceed with decontamination.

5. After the appropriate contact period, the gas should be neutralized with ammonium bicarbonate, then vented where it can safely be eliminated from the laboratory.

TROUBLESHOOTING

CAUTION: Whenever the potentially contaminated areas of your cabinet must be entered, make sure that the unit is first decontaminated by use of appropriate methods.

When a smoke test indicates that there is air flowing from the interior of your cabinet into the surrounding room:

1. Make sure that the shipping cover is removed from the exhaust filter and that no other objects are blocking airflow.

2. If your cabinet is connected to an in-house exhaust, make sure that there is adequate exhaust suction and not back pressure. Also be sure the dampers are open. Re-balance the exhaust system to handle an adequate volume of air and static pressure (suction). Consult with building maintenance people.

3. The exhaust filter may be loaded with dirt if the unit has been in service for some time. Decontaminate, and replace all HEPA filters.

4. There may be high cross-drafts in the room which are causing the outflow of smoke. Check the airflow balance, following the procedure recommended in an earlier section of this chapter. Correct the causes of room drafts.

When there is low airflow within the work area through the exhaust filter:

1. Check the incoming voltage. Low voltage may cause the blower to operate at a slower-than-designed speed. Although this should be corrected in the building's electrical system, you may be able to compensate by adjusting the Triac speed control clockwise until proper velocity is reached. The control is located on the right side of the light canopy.

2. The reduced airflow may be caused by old and dirty filters. Decontaminate the unit and replace the filters.

If there is no airflow within the work area:

1. And if the lights and duplex outlet also fail to operate, make sure the unit is plugged into a dedicated grounded 20-amp, 115-volt, 60-cycle electrical outlet. Also make sure that the blower switch on the light canopy is in the ON position.

2. If the lights are working, then turn the blower switch to OFF and let the cabinet rest for ten minutes. When the time has passed, turn the blower switch to ON. If the blower starts, you know there has been overheating of the blower motor. Also check the wiring connections inside the electrical box at the top of the cabinet.

3. If these solutions do not correct the problem, or if the blower failed to start after the rest period, then either the speed control, blower motor or capacitor is defective. A qualified electrician can find out if the speed control is defective by bypassing it, using the wiring diagram in the Appendix of this manual as a guide. If there is a noise problem, it may be caused by motor bearings.

If the electrical duplex does not function:

1. Check the duplex switch/circuit breaker located on side walls of work area.

2. If the unit is equipped with a GFI (Ground Fault Interruptor) duplex, press the reset button on the duplex.

If the optional ultraviolet light does not work:

1. Check the ultraviolet bulb and lamp sockets for electrical connection.

2. Change the ultraviolet light bulb.

3. Change the ultraviolet light starter.

4. Have a qualified electrician check the wiring and ballast for shorts. Also check for any break in the ground. The wiring

can be traced to the source of a break. If none of the above is effective, the ballast may need replacing.

When there is pulsive fan operation, or noise from the motor/blower assembly:

First decontaminate the cabinet and then look for loose objects in the fan cage. Check to see if the fan wheel is contacting the blower housing. Another possible source of the problem is a speed control or potentiometer which may have been damaged by overheating.

If the fluorescent light does not work:

1. Check the multi-pin connectors at each end to be sure they are securely engaged.

2. Check to see that the lamp pins are contacting both sockets. If the lamp flickers and can be corrected by vigorous rubbing of the bulb, there is probably an improper ground. Have a qualified electrician check the electrical circuit for any break in the ground. The wiring can be traced to the source of a break.

GLOSSARY*

Absolute containment: The ability to completely retain any specified substance. Class III Safety Cabinet, for example.

Aerosol: A colloid of liquid or solid particles suspended in gas, usually air.

Air balance: To adjust the proper exhaust and supply of air volume so as to provide optimum operating conditions of cleanliness and containment.

Biological hazard: A biological entity which presents a risk or potential risk to the well being of man, either directly or indirectly through disruption of his environment. The term is often contracted to “biohazard”.

Containment: Prevention of agent transmission from one point to another. (Absolute containment can only be accomplished with an absolute physical barrier).

Contamination: Any foreign substance which makes an unwanted incursion.

Decontamination: The destruction or reduction of hazardous entities to safe levels.

Disinfectant: A chemical agent which kills or inactivates micro-organisms.

DOP (Dioctylphthalate): Oil used to generate an aerosol of particles to challenge HEPA filters. Other substances which may be less toxic (DOS) can be used as an acceptable substitute.

HEPA filter: A high efficiency particulate arrestance filter, technically capable of retaining 99.97 percent of all particles 0.3 micron diameter.

Health physicist: A professional whose duties are to protect the individual and environment from unwarranted radiation or biological exposure.

Laminar airflow: Air flow with a Reynolds number below 2000. In this context, for Class II cabinets, it is air flow in which the entire body of air within a designated space moves within a single direction along parallel flow lines.

Laminar flow biological safety cabinet (LFBSC): A Class II cabinet providing simultaneous personnel protection and a contamination-free work environment.

Micron - Micrometer: A unit of length equal to 10^{-6} meters.

Negative pressure: Pressure in a space, less than ambient, which causes an inflow of air.

Partial containment: An enclosure which is so constructed that contamination between its interior and the surroundings is minimized by the controlled movement of air. Class I and Class II safety cabinets are examples.

Plenum: An enclosed space in which the pressure of the air is greater or less than that of the atmosphere outside. In Class II cabinets, it is also a chamber for conveying or containing air.

Positive pressure: Pressure in a space, greater than ambient, which causes an outflow of air.

*Taken principally from a workshop for Certification of Biological Safety Cabinets, conducted by Dow Chemical under contract to N.C.I.

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REPLACEMENT PARTS LIST
BIOGARD HOOD VERTICAL LAMINAR FLOW CABINET
MODEL B40A AND MODEL B60

PART NAME	MODEL B40A	MODEL B60
Airflow		
Blower, supply	11429	11432
Filter, HEPA exhaust	12124	12126
Filter, HEPA supply	12127	12129
Electrical		
Ballast, fluorescent	18140	18137
Ballast, ultraviolet lamp (optional)	18135	18149
Capacitor	11557	11558
Controller, motor/blower speed	304227	304227
Lamp, fluorescent	17990	17993
Lamp, ultraviolet (optional)	18023	18025
Motor, supply	31676	31679
Socket, fixed, fluorescent lamp	35615	35615
Socket, fixed, ultraviolet lamp (optional)	18088	18123
Socket, plunger, fluorescent lamp	35614	35614
Socket, plunger, ultraviolet lamp (optional)		18124
Starter, ultraviolet lamp (optional)	20297	
Switch, blower	15826	15826
Switch, circuit breaker, duplex receptacles	186118	213299
Switch, light, fluorescent	15825	15825
Switch, light, ultraviolet (optional)	15827	15827
Mechanical Parts		
Spring, glass, viewscreen (v.s. cylinders) 8” opening	21244	21245
Spring, glass, viewscreen (v.s. cylinders) 10” opening	21242	21243
Viewscreen, glass for hinged viewscreen assembly 8” opening	17779	17780
Viewscreen, glass for hinged viewscreen assembly 10” opening	17823	17824

NOTE: When ordering replacement parts, please furnish serial number of unit as well as model number.

Purchase Specification
BioGARD Class II, Type A
Model B40A & Model B60
Biological Safety Cabinets

1. Manufacturer shall provide a certified copy of the Personnel, Product and Cross-Contamination (microbiological) tests, equivalent to, or more severe than, those specified in NSF Standard #49, performed on one unit from each production run from which cabinets purchased have been manufactured. Tests may be witnessed by a representative of the purchaser.

2. High-velocity return air slots shall be located at each end of the access opening. These slots help to prevent contaminated air from being drawn into the work area along the edges of the wall panels or escaping from the work area.

3. Radius (rounded) corners in work area. Side walls and rear wall to be one-piece construction.

4. Both exhaust and supply filters shall be front loading.

5. Complete unit shall be listed as certified by Underwriters Laboratory (UL) for electrical safety and integrity.

6. Air-balancing damper shall be located in filter housing area. To be used when filters are changed to maintain design criteria despite differences in filter resistance.

7. Hinged viewscreen shall have pneumatic lifters, with entire mechanism for lifters located outside of the work area.

8. Cabinet shall be constructed of 16 gauge CRS, with 16 gauge SS work area.

9. Unit shall have all permanent metal air plenums.

10. Unit shall have an 8” high front access opening with a calculated intake velocity of 100-110 fpm.

11. Work area shall be provided with two duplex outlets. Outlets to be provided with drip-proof covers.

12. SS air diffuser and filter protector shall be provided in the work area.

13. One petcock shall be located in the right work area side wall.

14. Overall height 79 $^{3}/_{8}$” for passage through standard doorway

15. Unit must meet minimum requirements and must be listed by NSF as meeting Standard #49.

16. Before shipment each unit shall have a complete test to assure that the cabinet meets Class II requirements.

17. Unit shall be capable of automatically handling 113% minimum increase in filter loading and not decrease total air delivery more than 10%. With use of the speed controller, a 170% increase shall be attainable. Test data available upon request.

WARRANTY

The Baker Company, Inc. expressly represents and warrants all goods (a) to be as specified (and described) in the Baker Company catalogs and literature, and (b) to be free under normal use, service and testing (all as described in the Baker Company catalogs and literature) from defects in material and workmanship for a period of thirty-six months from the invoice date.

The exclusive remedy for any breach or violation of this warranty is as follows: The Baker Company, Inc. will F.O.B. Sanford, Maine, furnish without charge repairs to or replacement of the parts or equipment which proved defective in material or workmanship. No claim may be made for any incidental or consequential damages.

THIS WARRANTY IS EXPRESSLY IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE UNLESS OTHERWISE AGREED IN WRITING SIGNED BY THE BAKER COMPANY. (THE BAKER COMPANY SHALL NOT BE RESPONSIBLE FOR ANY IMPROPER USE, INSTALLATION, SERVICE OR TESTING OF THE GOODS).

THE BAKER COMPANY

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