

**IMPORTANT: A SUMMARY OF THE SAFETY WARNINGS AND CAUTIONS TO BE OBSERVED WHEN OPERATING THIS UNIT AND/OR HANDLING THE HYDROGEN PEROXIDE CARTRIDGES CAN BE FOUND ON PAGE 1. DO NOT OPERATE THE GENERATOR OR HANDLE THE HYDROGEN PEROXIDE CARTRIDGES UNTIL YOU HAVE BECOME THOROUGHLY FAMILIAR WITH THIS INFORMATION.**

**DRAFT 10**

**ACCEPTED**  
**SEP 24 1992**  
Under the Federal Insecticide,  
Fungicide, and Rodenticide Act,  
as amended, for the pesticide  
registered under  
EPA Reg. No. **5749-7**

**EQUIPMENT MANUAL**

**VHP™ Generator  
• Series 1000**

(9/3/90)

P-129363-064

ACCEPTED

SEP 24 1992

Under the Federal Insecticide,  
Fungicide, and Rodenticide Act,  
as amended, for the pesticide  
registered under  
EPA Reg. No. 5749-7

## A WORD FROM AMSCO

Thank you for choosing this fine AMSCO product. . . you may be confident of our continued interest in your satisfaction with it.

This manual contains important information on the proper use and maintenance of the VHP Generator. **All personnel involved in the use of this equipment must carefully review and comply with the warnings, cautions and instructions contained in this manual and the Hydrogen Peroxide Material Safety Data Sheet (MSDS) supplied with the sterilant cartridges and with the unit.** These instructions are important to protect the health and safety of personnel operating the VHP Generator and should be retained in a conveniently accessible area for quick reference.

Complete instructions for uncrating and installing this unit, as well as an equipment drawing, have been furnished. If missing, contact AMSCO for replacement copies, giving the serial, equipment and model numbers of the unit.

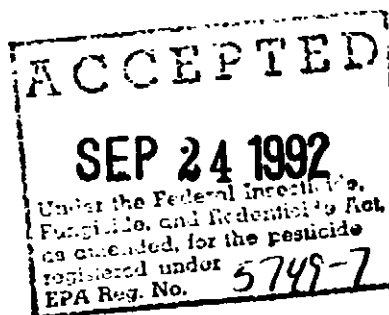
AMSCO manufactures accessories for use with the VHP Generator. An AMSCO representative will gladly review these with you.

### Service Information

A thorough preventive maintenance program is essential to safe and proper equipment operation. Comprehensive instructions for monthly, quarterly and semi-annual preventive maintenance can be found in the *Maintenance Manual, P-129363-063* (available from your AMSCO Sales or Service Representative).

Only AMSCO or AMSCO-trained personnel should attempt to perform maintenance on the VHP Generator in order to avoid personal injury.

You are encouraged to contact your AMSCO Representative concerning our Preventive Maintenance Agreement. Under terms of this agreement, preventive maintenance is provided on a scheduled basis to help assure equipment performance at peak capability and minimize untimely or costly schedule interruptions. AMSCO maintains a nationwide staff of well-equipped, factory-trained technicians to provide this service, as well as on-site installation, training and expert repair services. Please contact your local AMSCO Service Representative for service details.



### Advisory

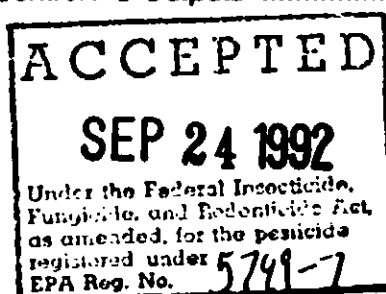
*The AMSCO VHP Generator has been designed and registered in accordance with Federal Regulations for the specific uses described in this manual. This device is to be used with enclosures that have been pre-cleaned per manufacturer's recommendations or basic instructions found in Section 6.*

*Uses other than as specified and described are not recommended, may not be effective in sterilization, and may not be safe without careful, thorough development and validation. Please contact your AMSCO Service Representative for appropriate guidance, in-service and training.*

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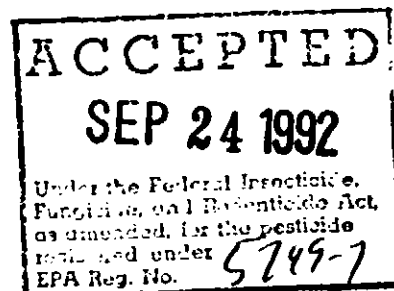
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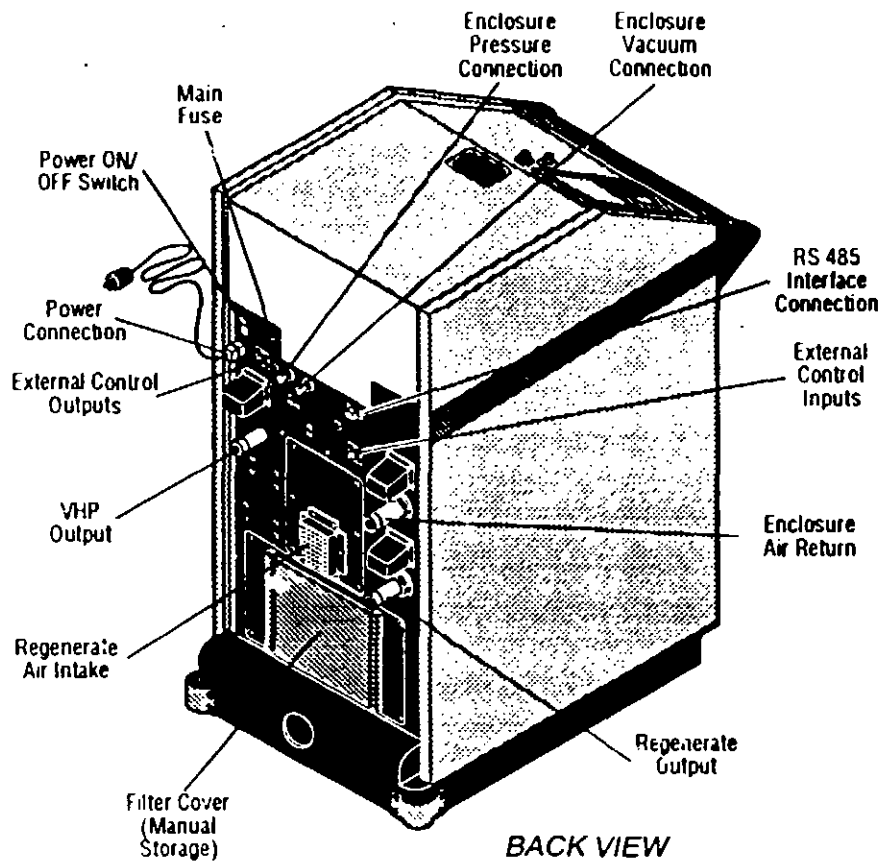
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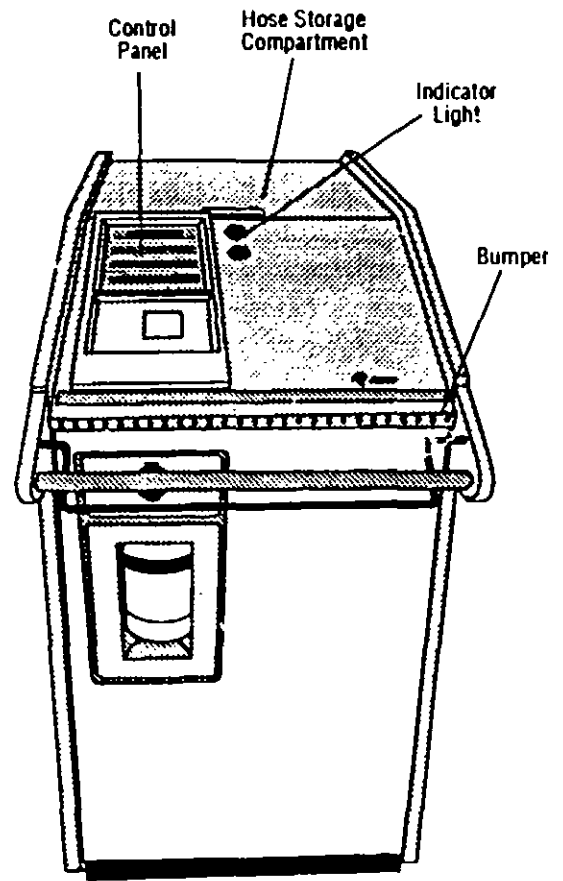
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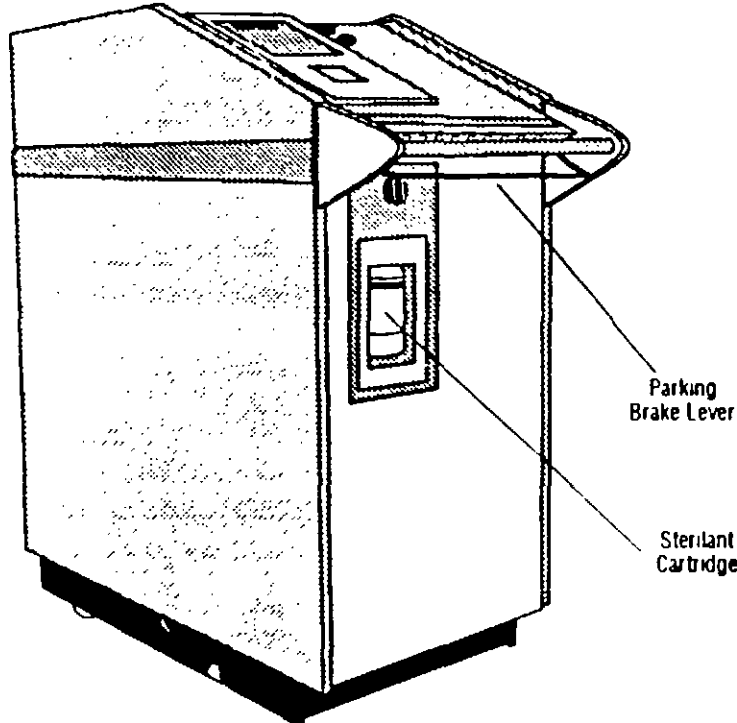




BACK VIEW



TOP/FRONT VIEW



SIDE/FRONT VIEW

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 Under the Federal Insecticide, Fungicide, and Rodenticide Act, as amended, for the pesticide registered under EPA Reg. No. 5749-7

The VHP™ 1000 Series Generator

# SUMMARY OF WARNINGS AND CAUTIONS

1

Following is a list of the safety precautions which must be observed when operating or servicing this VHP Generator and handling the hydrogen peroxide cartridges. WARNINGS indicate the potential for danger to personnel, and CAUTIONS indicate the potential for damage to equipment. These precautions are repeated (in whole or in part), where applicable, throughout the manual. It is important to review these precautions before operating the unit. Also read the Hydrogen Peroxide Material Safety Data Sheet (provided with the unit and the sterilant cartridges) for additional information on the proper use and handling of hydrogen peroxide.

## WARNING - BURN HAZARD:

- ⚠ **WHEN THE GENERATOR IS RUNNING** the VHP output connector is HOT. Do not touch the connector.

## WARNING - CHEMICAL INJURY HAZARD:

- ⚠ **WHEN HANDLING HYDROGEN PEROXIDE**, wear chemical splash goggles, vinyl or neoprene gloves and protective clothing.
- ⚠ **LIQUID HYDROGEN PEROXIDE** can cause severe, irreversible tissue damage to the eyes and blindness. In contact with the skin, hydrogen peroxide can cause burns and blistering. **HARMFUL OR FATAL IF SWALLOWED.** **HYDROGEN PEROXIDE VAPORS** can cause extreme irritation to eyes, skin, nose, throat and lungs. Exposure to the vapors can cause coughing, discomfort, shortness of breath and difficulty breathing, particularly in persons with respiratory disorders.
  - **IN CASE OF EYE CONTACT** - Immediately flush with plenty of water for at least 15 minutes, lifting upper and lower lids intermittently, and call a physician.
  - **IN CASE OF SKIN CONTACT** - Immediately flush with plenty of water. If irritation persists, obtain medical attention. If spilled on clothing, immediately remove and thoroughly wash all contaminated clothing.
  - **IF INHALED** - Immediately remove to fresh air and call a physician.
  - **IF SWALLOWED** - Immediately drink plenty of water to dilute, and call a physician. Do not attempt to induce vomiting.
- ⚠ **WHEN HANDLING THE GENERATOR HOSES**, wear chemical splash goggles, vinyl or neoprene gloves and protective clothing. Any visible liquid in the hoses must be treated as concentrated hydrogen peroxide. Observe all hydrogen peroxide handling precautions (see Section 4).
- ⚠ **A STERILANT CARTRIDGE MUST BE IN THE CARTRIDGE HOLDER AT ALL TIMES.** When no cartridge is in place, hydrogen peroxide may drip from the cartridge connector.
- ⚠ **BEFORE CONNECTING THE GENERATOR TO AN ENCLOSURE**, always perform a leak test on the enclosure (following the enclosure manufacturer's instructions). If the enclosure is not leakproof, harmful hydrogen peroxide vapors could escape from the enclosure during the cycle.
- ⚠ **BEFORE RUNNING A CYCLE**, always verify that the VHP Generator is properly connected to the sealed enclosure to ensure complete containment of the hydrogen peroxide vapors (check hose connections and make sure all enclosure vents/ports are sealed). Post warning signs on and around the enclosure to prevent accidental entry.
- ⚠ **BEFORE SETTING THE GENERATOR FOR PRESSURE OPERATION**, make sure the enclosure is completely sealed. Harmful hydrogen peroxide vapors will escape from the enclosure if all connections, vents and ports are not sealed tight.
- ⚠ **DOUBLE INLET AND OUTLET HEPA FILTERS** should be utilized in applications where the enclosure contains biologicals hazardous to humans.

## **WARNING - CHEMICAL INJURY HAZARD (cont'd):**

- ▲ WHEN EITHER OR BOTH OF THE RED WARNING LIGHTS ARE LIT**, harmful sterilant vapors are present within the enclosure. Do not access the enclosure. If it is ever necessary to access the enclosure being processed before the hydrogen peroxide is completely evacuated, wear a self-contained breathing apparatus (if concentration is greater than 10 ppm), chemical splash goggles and full-cover vinyl or neoprene protective clothing.
- ▲ AT THE END OF THE AERATION PHASE**, use a Dräger Multi Gas Detector® tube to check and periodically monitor the VHP concentration within the enclosure. The VHP concentration should be at or below the OSHA PEL (as of January 1, 1990 - 1 ppm, 8-hour TWA) before the enclosure is accessed. See Section 15 for the Dräger tube monitoring procedure.
- ▲ ANY VISIBLE LIQUIDS IN THE ENCLOSURE** must be treated as concentrated hydrogen peroxide. Always test residual liquids, using a Merckoquant® 1001 test strip as explained in Section 15, before wiping up. Observe all hydrogen peroxide handling precautions (see Section 4).
- ▲ WHEN INSTALLING A STERILANT CARTRIDGE**, keep the cartridge upright and do not squeeze. If the cartridge is turned upside down or squeezed after the cap is removed, harmful liquid hydrogen peroxide may spray or spill out.
- ▲ IN ORDER TO USE THE EXTERNAL VENT OUTPUT FEATURE**, the enclosure must be specially equipped with an outside exhaust system. The residual VHP level within the enclosure must be monitored to determine when it is appropriate to begin external ventilation. This vented exhaust may discharge low concentration VHP residuals which must be vented to an outside exhaust. Review the applicable environmental laws to determine the permissible levels. Contact your AMSCO Service Representative before using this feature.

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## **WARNING - FALL HAZARD:**

- ▲ IF WATER OR HYDROGEN PEROXIDE IS SPILLED ON THE FLOOR**, promptly clean up the spill. If in doubt whether the liquid is water or hydrogen peroxide, test the liquid using a Merckoquant® 1001 test strip as explained in Section 15, before wiping up. If the liquid is hydrogen peroxide, observe all hydrogen peroxide handling precautions (see Section 4).

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## **WARNING - FIRE AND EXPLOSION HAZARD:**

- ▲ HYDROGEN PEROXIDE IS A STRONG OXIDIZER.** Avoid excessive heat, contamination, or contact with any materials (solid, liquid or vapor) not compatible with oxidizers. Read the Material Safety Data Sheets of any other materials to be used in conjunction with this device to ensure that they are compatible with oxidizers. Clothing, shoes or other combustible materials that have come into contact with hydrogen peroxide must be immediately and thoroughly washed with water. If hydrogen peroxide is allowed to dry in the materials, spontaneous combustion may occur and a fire may result. **IN CASE OF FIRE - use water, water fog, carbon dioxide or dry chemical fire extinguishers only.**
- ▲ IF HYDROGEN PEROXIDE IS SPILLED**, dilute the spilled hydrogen peroxide with water (at least 20 parts water to 1 part hydrogen peroxide) prior to wiping up. Any materials used to wipe up hydrogen peroxide must be immediately and thoroughly washed with water. If hydrogen peroxide is allowed to dry in the materials, spontaneous combustion may occur and a fire may result. Wear chemical splash goggles, vinyl or neoprene gloves and protective clothing when wiping up hydrogen peroxide.

® Multi Gas Detector is a registered trademark of Drägerwerk Aktiengesellschaft, Postfach 1339, Moiskinger Allee 53/55, D-2400 Lübeck 1, Federal Republic of Germany.

® Merckoquant is a registered trademark of E. Merck, Postfach 41 19, D-6100 Darmstadt, Federal Republic of Germany.



## **WARNING - PERSONAL INJURY AND/OR EQUIPMENT DAMAGE HAZARD:**

- ▲ MOVING THE VHP GENERATOR** requires more than one person. The unit weighs approximately 500 pounds.
  - ▲ MOVE THE VHP GENERATOR ONLY ON FLAT SURFACES.** Although it is mounted on casters, it is not intended to be moved on inclined surfaces and the parking brake is not designed to stop or hold the unit on an inclined surface. Use an elevator to move the unit from one floor to another.
  - ▲ PARK THE VHP GENERATOR ONLY ON FLAT SURFACES.** The parking brake is not designed to maintain the unit stationary on inclined surfaces.
  - ▲ REPAIRS AND ADJUSTMENTS TO THIS EQUIPMENT SHOULD BE MADE ONLY BY AMSCO or AMSCO TRAINED SERVICE PERSONNEL.** Nonroutine maintenance performed by unqualified personnel or installation of unauthorized parts could cause personal injury, invalidate the warranty, or result in costly damage. Contact your AMSCO Service Representative regarding service options.
  - ▲ REGULARLY SCHEDULED PREVENTIVE MAINTENANCE IS REQUIRED FOR SAFE AND RELIABLE OPERATION OF THIS EQUIPMENT.** Contact your AMSCO Service Representative to schedule preventive maintenance.
- 

## **WARNING - PERSONAL INJURY, UNSTERILE ENCLOSURE AND/OR EQUIPMENT DAMAGE HAZARD:**

- ▲ USE ONLY AMSCO STERILANT CARTRIDGES,** containing AMSCO-registered 30% hydrogen peroxide, which has been specially formulated, tested and approved for use in this VHP Generator. Federal law requires that the sterilant be registered with the United States EPA. Use of unregistered sterilant is a violation of the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA), could impair equipment operation and result in costly repairs, could lead to an unsterile enclosure and could void the equipment warranty (see Section 4).
  - ▲ BEFORE INSTALLING A STERILANT CARTRIDGE,** check the expiration date. Do not use a sterilant cartridge if it is beyond its expiration date, or if it will not be fully used before its expiration date.
- 

## **CAUTION - POSSIBLE EQUIPMENT DAMAGE:**

- ▲ Keep connecting hoses off the floor.** If supply hoses rest on cool floors, hydrogen peroxide may condense in the hoses. Place a support under the hoses to prevent kinks and undue strain on the hose connections.
- ▲ Before setting pressure (vacuum) differentials for the enclosure,** test the enclosure (according to the enclosure manufacturer's recommendations) to verify that it can withstand the pressure (vacuum) being programmed. Failure to do so could cause the enclosure to rupture during the DEHUMIDIFICATION phase.
- ▲ The VHP 1000 Generator is capable of pressurizing (or evacuating) a sealed enclosure to 2 psig (or 55" W.C.).** If your enclosure is not rated for operation at a pressure (or vacuum) in excess of 2 psig, you must use an AMSCO overpressure/underpressure alarm unit in conjunction with the generator. This will prevent damage to the enclosure.
- ▲ Do not attempt to turn the cartridge control knob counterclockwise.** It does NOT turn counterclockwise and attempts to turn it counterclockwise may damage the cartridge connection mechanism.
- ▲ When the new cartridge is in place,** turn the cartridge control knob only as far as the ENGAGE position. Do not turn it past this position. Turning it past this position will make the sterilant cartridge unusable.

## **CAUTION - POSSIBLE EQUIPMENT DAMAGE (cont'd):**

- ⚠ Use nonabrasive cleaners when cleaning the unit. Follow directions on the container and rub in a back-and-forth motion (in the same direction as the surface grain). Abrasive cleaners will damage stainless steel. Cleaner rubbed in a circular motion or applied with a wire brush or steel wool can be harmful to stainless steel. Do not use these cleaners on painted surfaces.**
- ⚠ Avoid touching or moving the generator once a cycle has been initiated. The electronic balance is extremely sensitive and any sudden movement may cause alarm/abort conditions.**

An Equipment Drawing, showing all utility and space requirements, was supplied when the VHP Generator was ordered. The clearance space specified on the Equipment Drawing is necessary for proper operation, maintenance and repair of unit. Uncrating/Installation instructions were furnished with the Generator. If any of these documents is missing or misplaced, contact AMSCO giving the serial, equipment and model numbers of the unit. Replacement copies will be sent to you promptly.

After setting up the VHP Generator according to the Uncrating/Installation Instructions, contact your AMSCO Service Representative to review your installation and demonstrate proper equipment operation.

## **Pre-operation Checklist**

Read all of the WARNINGS and CAUTIONS in Section 1 before operating the equipment. Then complete the following checklist to be sure the VHP Generator is ready to operate.

Check that:

- The electrical supply for VHP Generator is as specified on the Equipment Drawing (120V, 20A, 3-wire connection)
- The hoses are in place in the storage compartment



**WARNING - PERSONAL INJURY AND/OR EQUIPMENT DAMAGE HAZARD:** Moving the Generator requires more than one person. Move/position it only on flat surfaces. Refer to Section 1 for expanded WARNINGS.

- The VHP Generator is properly positioned in relation to the enclosure being processed, see Section 6.



**WARNING - CHEMICAL INJURY HAZARD:** A leak test must be performed on the enclosure, to assure that it is leakproof, before running a cycle. Harmful hydrogen peroxide vapors could escape from the enclosure during a cycle if enclosure is not leakproof. Refer to Section for expanded WARNING.

- A leak test has been performed on the precleaned, sealed enclosure following the enclosure manufacturer's instructions (a properly cleaned and sealed enclosure is essential for the effectiveness and safety of the VHP process).



**WARNING - CHEMICAL INJURY HAZARD:** When handling hydrogen peroxide, wear chemical splash goggles, vinyl or neoprene gloves and protective clothing, and observe all safety precautions. Refer to Section 1 for expanded WARNINGS.

- A sterilant cartridge is in place; if a cartridge is not in place or is empty, install a new cartridge as described in Section 4

- The printer has an adequate paper supply; if a paper roll is not installed or if the paper supply is low, install a new roll as described in Section 13

## The VHP (Vaporized Hydrogen Peroxide) Process

The AMSCO VHP Generator provides a simple and reliable method for sterilizing sealable enclosures.

Effective VHP sterilization requires adequate VHP concentration and exposure time.

The AMSCO VHP Generator uses air as a carrier to deliver vaporized hydrogen peroxide (VHP) to the exposed surfaces inside a pre-cleaned sealed enclosure. This allows the sterilization process to take place at, or near, atmospheric pressure. The VHP concentration depends on the temperature and humidity of the sealed enclosure. Because sterilization relies only on the contact of VHP with exposed surfaces, the transfer of heat and moisture required by steam or chemical processes is not necessary with VHP.

VHP is continuously injected for the required exposure time to assure sterilization. Once the VHP sterilant leaves the enclosure, it is converted into water vapor and oxygen.

## The VHP Sterilization Cycle

The VHP sterilization cycle consists of four phases: DEHUMIDIFICATION, CONDITION, STERILIZATION and AERATION.

- DEHUMIDIFICATION — Dry, HEPA-filtered air is circulated to reduce humidity to a predetermined level in the 10-40% relative humidity range. This permits the necessary VHP concentration to be maintained below saturation levels during the CONDITION and STERILIZATION phases. Time to reach the targeted humidity increases with the volume of the enclosure.
- CONDITION — The flow of dry, HEPA-filtered air continues while VHP is injected into the air stream just before it leaves the Generator. The injection rate is controllable in the 2 to 10 grams per minute range. The CONDITION phase facilitates reaching the desired sterilization concentration more quickly in larger sealed enclosures. CONDITION time is affected by sterilant injection rate and enclosure volume.

The CONDITION phase is optional and can be selected for the purpose of reducing total cycle time, especially for larger applications. Use of the CONDITION phase does not reduce the time of exposure to the constant VHP concentration during the STERILIZATION phase.

- STERILIZATION — A constant flow of the VHP/HEPA-filtered air mixture is maintained at the selected hydrogen peroxide injection rate, within the controllable range.
- AERATION — VHP injection is stopped and the flow of dry, fresh, HEPA-filtered air continues to reduce the VHP concentration within the enclosure.

**⚠ WARNING - CHEMICAL INJURY HAZARD:**  
At the end of the AERATION phase, use a Dräger tube to check and monitor the VHP concentration within the enclosure. The VHP concentration should be at or below the OSHA PEL (as of January 1, 1990 - 1 ppm, 8-hour TWA) before the enclosure is accessed. Refer to Section 15 for the monitoring procedure.

## **The Catalytic Converter**

Outflow from the enclosure circulates, during all phases, through a catalytic converter which converts hydrogen peroxide into water vapor and oxygen. The catalytic converter reduces the peroxide concentration to a level well below 1 ppm.

## **The Regeneration Cycle**

After the VHP Generator has been operated for a period of time, the drying agent's capacity to absorb moisture becomes depleted. The regeneration cycle restores this drying capacity.

- HEAT-UP — Band heaters supply thermal energy to the drying agent and air-flow preheater for a specified time period.
- REGENERATION — Air is heated by the preheater and passed (in the reverse direction) through the drying agent to remove the water vapor collected during prior sterilization cycles. This air is exhausted from the unit after it has passed through the catalytic converter, which converts any residual hydrogen peroxide into water vapor and oxygen.
- COOL-DOWN — The drying agent is allowed to cool.

## **Hydrogen Peroxide Handling Precautions**

Certain precautions must be observed when handling hydrogen peroxide. Review the WARNINGS and CAUTIONS in Section 1 before handling the hydrogen peroxide sterilant cartridges. Also, read, comply with, and save the hydrogen peroxide Material Safety Data Sheet (MSDS) included with each carton of sterilant cartridges.

**⚠ WARNING - CHEMICAL INJURY HAZARD:** Wear chemical splash goggles, vinyl or neoprene gloves and protective clothing, and observe all hydrogen peroxide safety precautions when handling the hydrogen peroxide sterilant. Refer to Section 1 for expanded WARNINGS.

**⚠ WARNING - FIRE AND EXPLOSION HAZARD:** Hydrogen peroxide is a strong oxidizer. Avoid excessive heat, contamination or contact with any materials not compatible with oxidizers. Dilute any spilled hydrogen peroxide with water before wiping up. Immediately rinse with water any materials used to wipe up hydrogen peroxide spills. If hydrogen peroxide is allowed to dry in the materials, spontaneous combustion may occur and a fire may result. Refer to Section 1 for expanded WARNINGS.

**⚠ WARNING - PERSONAL INJURY, UNSTERILE ENCLOSURE AND/OR EQUIPMENT DAMAGE HAZARD:** Use only AMSCO sterilant cartridges, containing AMSCO-registered hydrogen peroxide in this equipment. Refer to Section 1 for expanded WARNINGS.

## Installing the Sterilant Cartridge

The control prints a message when the sterilant cartridge needs replacement. Also, the windowed door on the sterilant cartridge compartment allows you to easily check the cartridge to see when it is empty (see Figure 4-1).

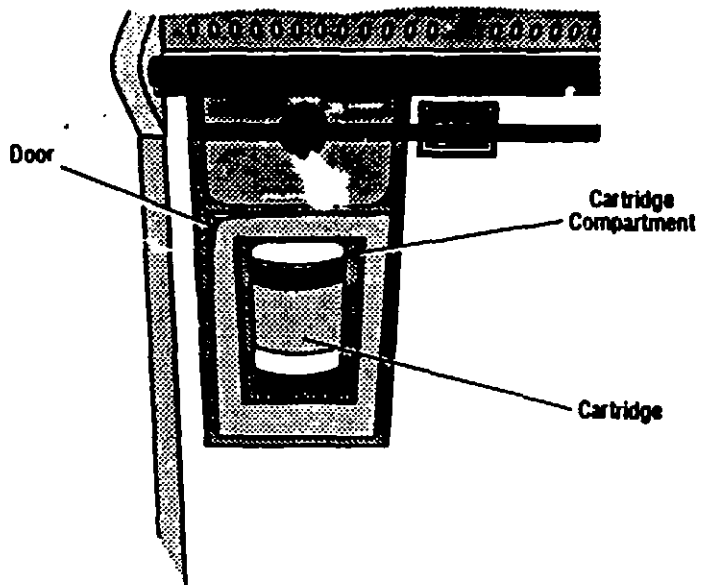


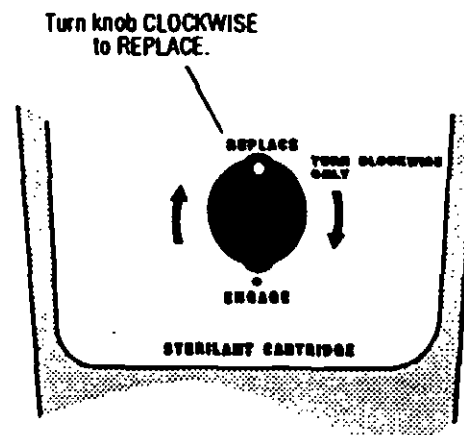
Figure 4-1. Sterilant Cartridge Compartment

**WARNING - CHEMICAL INJURY HAZARD:** Wear chemical splash goggles, vinyl or neoprene gloves and protective clothing, and observe all hydrogen peroxide safety precautions when handling sterilant cartridges. Refer to Section 1 for expanded WARNINGS.

**CAUTION:** Turn the cartridge control knob **CLOCKWISE ONLY**. Turning it counter-clockwise may damage the cartridge connection mechanism.

1. Put on chemical splash goggles, vinyl or neoprene gloves and protective clothing.

2. Turn the cartridge control knob clockwise 1°0' to the REPLACE position.





**WARNING - CHEMICAL INJURY HAZARD:** Keep cartridge upright and do not squeeze. If cartridge is turned upside down or squeezed after the cap is removed, liquid hydrogen peroxide may spray or spill out.

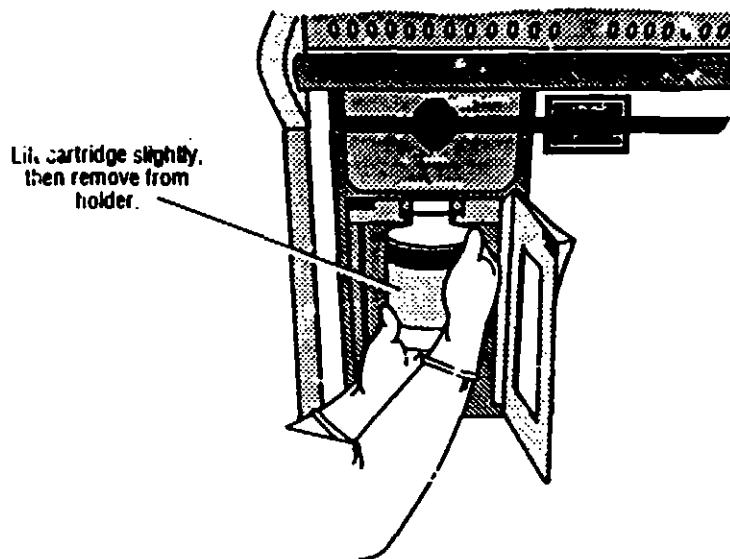
**WARNING - PERSONAL INJURY, UNSTERILE ENCLOSURE AND/OR EQUIPMENT DAMAGE HAZARD:** Use only AMSCO sterilant cartridges, containing AMSCO-registered hydrogen peroxide in this equipment. Do not use a sterilant cartridge if it is beyond its expiration date, or if it will not be fully used before its expiration date. Refer to Section 1 for expanded WARNINGS.

**NOTE:** AMSCO sterilant cartridges contain high purity 30% hydrogen peroxide and are filled under controlled conditions to assure effectiveness through the expiration date stamped on the label.

**NOTE:** Cartridge is not properly installed if it does not rest in the recess.

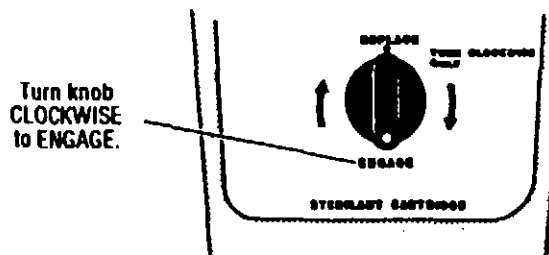
**CAUTION:** Turn the cartridge control knob **CLOCKWISE** only as far as the **ENGAGE** position. Turning it past this position will make the sterilant cartridge unusable.

3. Open the cartridge compartment door.
4. Gently grasp the spent cartridge with both hands. Carefully lift it up slightly (about 1/16 of an inch) and then remove cartridge from the holder (see Figure 4-2).



**Figure 4-2. Remove Spent Cartridge**

5. With water running in a sink, empty all remaining cartridge contents into the sink. When the cartridge is empty, carefully and thoroughly rinse the cartridge with tap water before disposal.
6. Remove a new cartridge from the carton. Check the expiration date on the new cartridge.
7. Remove the vented shipping cap from the new cartridge.
8. Gently grasp the new cartridge with both hands, align it with the groove in the cartridge holder, and carefully slide it all the way into the holder. Lower the cartridge into the 1/16" recess in the holder.
9. Turn the cartridge control knob **clockwise** 180° to the **ENGAGE** position. **DO NOT TURN THE KNOB PAST THIS POSITION.**



The cartridge is now locked in place and cannot be removed until the cartridge control knob is turned to the REPLACE position.

10. Close the cartridge compartment door. The VHP Generator will now automatically fill the reservoir from the sterilant cartridge as needed.

---

## **Sterilant Cartridge Storage**

---

AMSCO sterilant cartridges are warranted through the expiration date when the following storage practices are followed:

- Store cartridges in an upright (vertical) position.
- Store cartridges in the original polyethylene bag at a temperature not to exceed 77°F (25°C) or, if cartridge has been removed from bag, store refrigerated at or about 40°F (4.4°C). DO NOT FREEZE, i.e., temperatures below -15°F (-26°C).

Stability has been assured for cartridges stored in the bag at temperatures up to 77°F (25°C) and, out of the bag, refrigerated at 40°F (4.4°C).

## Power ON/OFF Switch

The ON/OFF switch (Figure 5-1) supplies power to the VHP Generator and its controls.

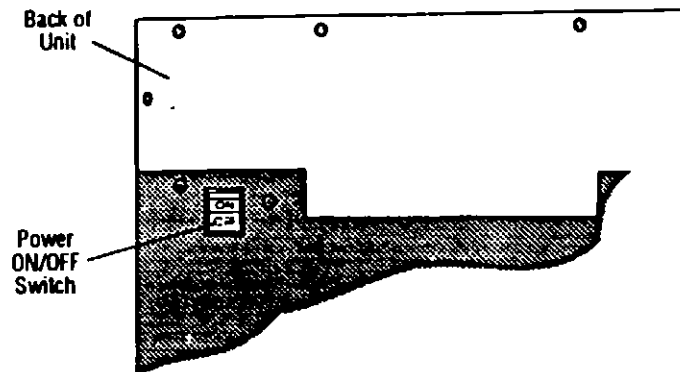


Figure 5-1. Power ON/OFF Switch

## Control Panel

*NOTE: Although Cycle 1 has been preset by AMSCO, the cycle parameters can be changed if the preset defaults do not fit the application. See Section 8 for information on changing cycle parameters. The preset parameters for Cycle 4 cannot be changed.*

The control panel directs all VHP Generator functions. Once the appropriate access code has been entered, cycles can be run as described in this manual.

Cycles 1 and 4 have been preset by AMSCO. Cycle 1 is the sterilization cycle. Parameters controlling this cycle have been established and validated by AMSCO for sterilization of empty, pre-cleaned, sealed enclosures up to 40 ft<sup>3</sup> in volume. Cycle 4 is the preset regeneration cycle to be used for periodic regeneration of the drying agent, as needed.

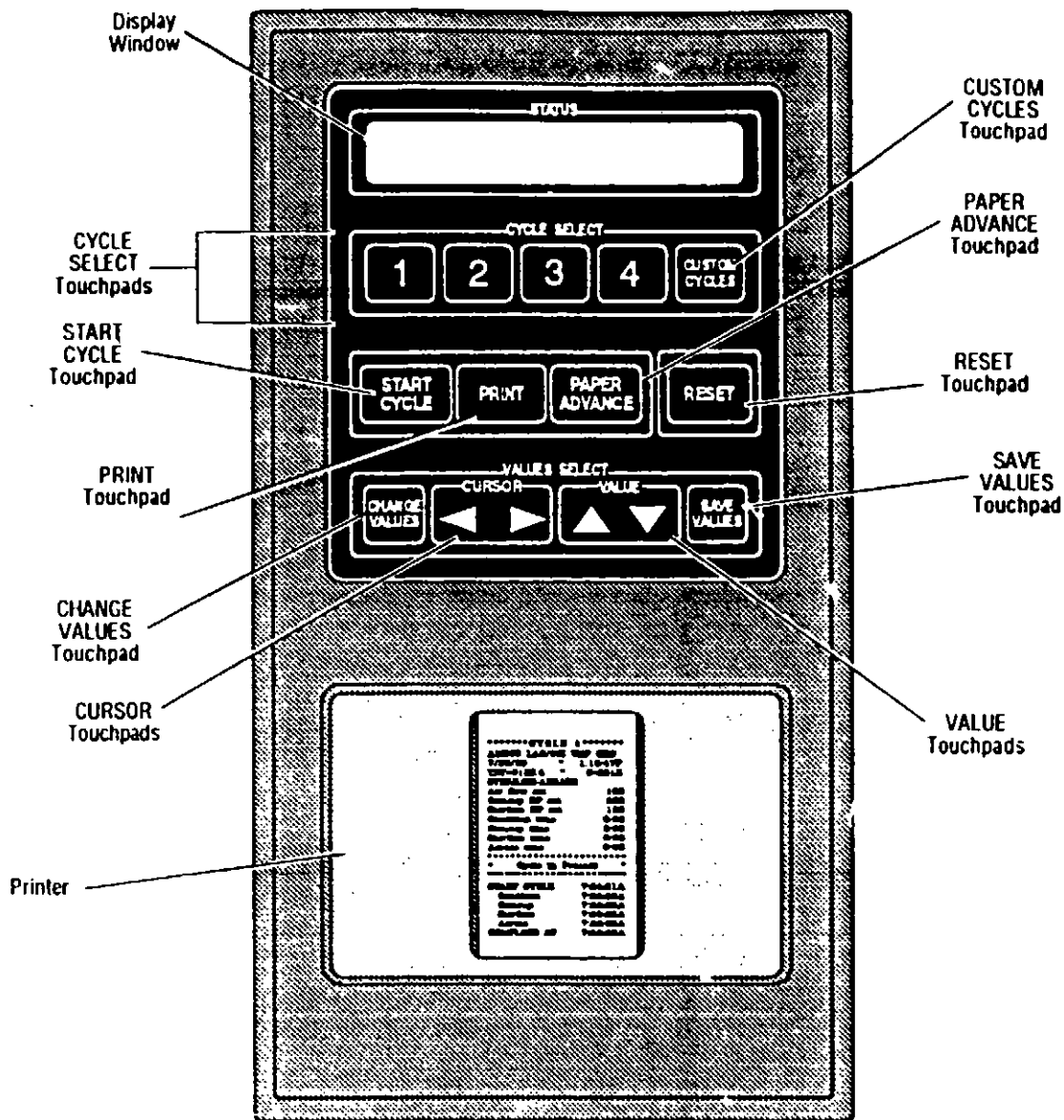
Cycles 2 and 3 (CYCLE SELECT touchpads #2 and #3) and Cycles 5 and 6 (accessed through the CUSTOM CYCLES touchpad) are reserved for special purpose operations that are developed, programmed and validated by the user.

Custom cycle parameters can be entered only by operators who are assigned programmer or supervisor access codes which should only be assigned when special training has been conducted and stringent qualifications have been met. Use of restricted, discrete access codes to perform certain functions is intended to prevent unauthorized entry and use of parameters that have not been properly developed and validated. See Section 8 for Custom Cycle information.

## Advisory

*The AMSCO VHP Generator has been designed and registered in accordance with Federal Regulations for the specific uses described in this manual. This device is to be used with enclosures that have been pre-cleaned per manufacturer's recommendations or basic instructions found in Section 6.*

*Uses other than as specified and described are not recommended, may not be effective in sterilization, and may not be safe without careful, thorough development and validation. Please contact your AMSCO Service Representative for appropriate guidance, in-service and training.*



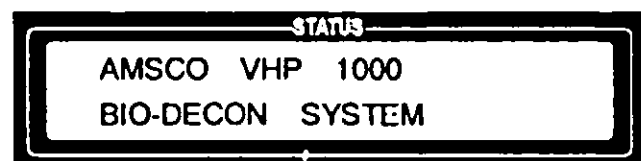
**Figure 5-2. Control Panel**

The control also indicates cycle information both on the display and on the printout.

It is important to become familiar with the control panel and its functions before attempting to run a cycle (see Figure 5-2). Following is an explanation of each of the control panel components and their functions:

**Display Window**

- The display window provides cycle information, as well as prompts to facilitate operation. When the VHP Generator power switch is turned ON, the display momentarily shows the name of the unit . . .



and then goes to STANDBY.

STATUS  
STANDBY 1:12:46P  
SR= 1023.4g DC=20:00

- When in the STANDBY mode, the display shows the time, the grams of hydrogen peroxide solution remaining in the reservoir (SR=), and the remaining capacity of the drying agent (DC=) in hours:minutes.

*NOTE: In order to operate the equipment properly, it is essential that you read the Equipment Manual before running a cycle.*

When a CYCLE SELECT or CUSTOM CYCLE touchpad is pressed with the STANDBY screen displayed, the control asks if the operator has read the Equipment Manual. The operator must use the VALUE (up) arrow to change NO to YES and then press CHANGE VALUES in order to proceed with the cycle.

STATUS  
HAVE YOU READ THE  
EQUIPMENT MANUAL NO

- After YES is entered, the display shows that the selected cycle is active.

STATUS  
CYCLE 1 ACTIVE  
CHG VAL OR START CYC

- When the START CYCLE touchpad is pressed with the display showing the active cycle, the display asks that a four-digit access code be entered.

STATUS  
CYCLE 1 START  
ACCESS CODE 0 0 0 0

Pressing the VALUE (up and down) and the CURSOR (right and left) arrows allow selection of the four-digit access code. Pressing the START CYCLE touchpad enters the access code and initiates the cycle.

STATUS  
CODE ACCEPTED !!

If the access code is incorrect, access is denied.

STATUS  
ACCESS DENIED !!

When the VHP Generator is in cycle, the display shows the applicable parameters for the phase in process. The following display windows appear, in sequence, after Cycle 1 is started:

The DEHUMIDIFICATION phase display shows the recirculating air flow in standard cubic feet per minute (SCFM), the time remaining in the DEHUMIDIFICATION phase, and the relative humidity of the recirculating air as it returns to the VHP Generator.

| STATUS  |         |           |
|---------|---------|-----------|
| C 1     | DEHUMID | A=12 SCFM |
| 0:45:00 |         | RH= 10 %  |

The CONDITION phase display shows the recirculating air flow in SCFM, the time remaining in the CONDITION phase, and the liquid hydrogen peroxide injection rate in grams per minute.

| STATUS  |      |             |
|---------|------|-------------|
| C 1     | COND | A=12 SCFM   |
| 0:00:00 |      | IR= 00.0g/m |

The STERILIZATION phase display shows the recirculating air flow in SCFM, the time remaining in the STERILIZATION phase, and the liquid hydrogen peroxide injection rate in grams per minute.

| STATUS  |      |             |
|---------|------|-------------|
| C 1     | STER | A=12 SCFM   |
| 1:30:00 |      | IR= 02.2g/m |

The AERATION phase display shows the time remaining in the AERATION phase and the recirculating air flow in SCFM.

| STATUS  |        |           |
|---------|--------|-----------|
| C 1     | AERATE | A=12 SCFM |
| 1:00:00 |        |           |

At the end of the cycle, the display shows time and date cycle was completed. The display continues to show CYCLE COMPLETE information until RESET is pressed. . .

| STATUS           |  |          |
|------------------|--|----------|
| CYCLE 1 COMPLETE |  |          |
| 07-31-90         |  | 4:27:46P |

then the display returns to STANDBY.

| STATUS      |  |          |
|-------------|--|----------|
| STANDBY     |  | 4:30:48P |
| SR= 0825.2g |  | DC=16:45 |

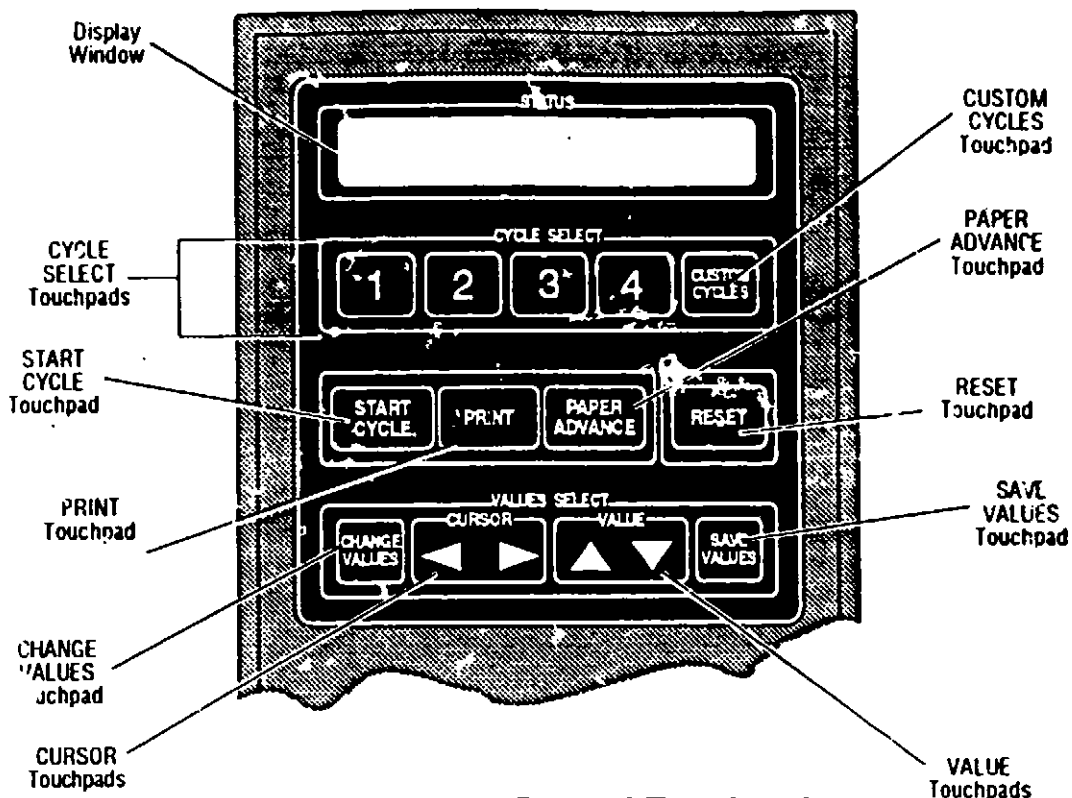


Figure 5-3. Control Touchpads



**Touchpads (Figure 5-3)**

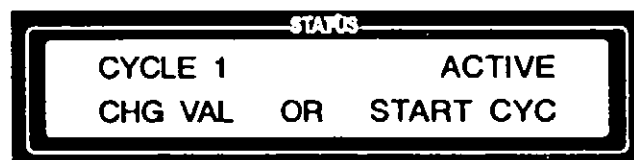
• **CYCLE SELECT Touchpads (1, 2, 3, 4 and CUSTOM CYCLES)**

Pressing one of these touchpads selects the desired cycle. Up to six cycles can be selected, 1 through 4 on the numbered touchpads, 5 and 6 on the CUSTOM CYCLES touchpad.



• **START CYCLE Touchpad**

Pressing START CYCLE when a cycle is active on the display begins the cycle sequence.



The display advances to the cycle start access code screen.



Pressing the VALUE (up and down) and the CURSOR (right and left) arrows allows selection of the four-digit access code. Pressing START CYCLE enters the access code, which either starts the cycle or, if access code is incorrect, denies operator access.

The START CYCLE touchpad is used to enter responses throughout the cycle start-up routine.



- **PRINT Touchpad**

Pressing PRINT when a cycle is active on the display, generates a printout of the parameters for the selected cycle.



- **PAPER ADVANCE Touchpad**

Pressing this touchpad once advances the printer paper one line.

Pressing and holding down this touchpad advances the printer paper multiple lines.



- **RESET Touchpad**

When no cycle is running, pressing RESET causes the control to immediately revert to STANDBY.

When a cycle is in progress, pressing RESET aborts the cycle and then returns the control to STANDBY.

*NOTE: If sterilant injection had begun before RESET was pressed, an AERATION phase runs to completion before the control reverts to STANDBY.*



- **CHANGE VALUES Touchpad**

Pressing CHANGE VALUES cycles through the various screens involved when making changes in the ACCESS CODE menu, the CUSTOM PRINTOUT menu, and the various CUSTOM CYCLE menus.

*NOTE: Only operators with programmer or supervisor access codes can change cycle parameters. Refer to Section 8 for Custom Cycle programming instructions.*



- **CURSOR Touchpads (left and right arrows)**

Pressing these touchpads moves the cursor highlight left or right when entering access codes or selecting cycle settings.



- **VALUE Touchpads (up and down arrows)**

Pressing these touchpads increases/decreases numbers when entering access codes or selecting cycle settings. The VALUE touchpads are also used to cycle through the possible selections when answering questions asked by the display, i.e. YES/NO, PRESS/VACUUM, etc.



- **SAVE VALUES Touchpad**

Pressing SAVE VALUES completes the CHANGE VALUES process and saves the new cycle settings. After SAVE VALUES is pressed the control returns to the active state for the cycle selected.



The SAVE VALUES touchpad can be pressed at any time while in any of the menus accessed by the CHANGE VALUES touchpad. When SAVE VALUES is pressed, the control updates all parameters, permanently overwriting the previous cycle settings.

If RESET is pressed instead of SAVE VALUES, then the previous cycle settings are retained and the control reverts to the STANDBY mode.

### Printer

The printer records the status of VHP Generator, e.g., power-up, cycle parameters, actual cycle data and operator responses to prompts.

#### • Power-up

Prints the time the unit was turned on and software version number (by date and time).

*NOTE: If power was interrupted or shut off during the previous cycle and VHP had been delivered to enclosure, the VHP Generator goes through an AERATION cycle and the printout shows AERATION cycle information.*

```
.....  
• AMSCO VHP 1000 •  
• BIO-DECON SYSTEM •  
• MADE IN THE USA •  
• UNIT SERIAL # 0218391011 •  
• VERS 071791 •  
• 7/28/91 • 2:18:07 •  
.....  
• Read Instructions •  
• Before Operating •  
.....  
PREVIOUS CYCLE ABORTED  
ABORT AERATION  
Start: 12:02:33P  
Complete: 1:02:36P
```

• **Cycle Start**

When START CYCLE is pressed, the printout shows the total run time in hours (TRT=), i.e., the total number of hours the unit has been powered up, and the number of cycles run (C=).

Then the printer generates a printout of all cycle settings for the current cycle, as well as the print interval setting.

```

*****
CYCLE 2 PARAMETERS
OP#9 SET 7/26/91
CYCLE TIME= 0002:06
***** CYCLE 2 *****
OPERATOR # 9
      AMSCO VHP 1000
      BIO-DECON SYSTEM
UNIT SERIAL # 0216391011
7/26/91      2:18:07P
TRT=0123.4   C= 2
Enclosure vol. (l) 0030
Dehum. air set (CFM) 20
Cond. air set (CFM) 00
Ster. air set (CFM) 12
Aerate air set (CFM) 20
Dehumid to (%R.H.) 10
Cond inj rate (g/m) 00.0
Ster inj rate (g/m) 02.1
Dehum time 0:08
Cond time 0:00
Ster time 1:00
Aerate time 1:00
Vaporizer temp set 212 f
Preheater temp set 11 f
Print interval set 0:10
*****
  
```

• **During a Cycle**

When a cycle is running the printout shows the start time and end time of each phase, the cycle parameters (as selected during printer setup, see Section 1C), and the time of each cycle parameter printout (at the print interval selected during printer setup).

```

*****
DEHUMID START      2:18:07P
Reached RH Setpoint
Continuing till Time Out
Cham Ret. R.H.(%) = 23.8
Dryer In R.H.(%) = 02
Dehumidified to RH Set
And Time Out
Cham Ret. R.H.(%) = 14.1
VHP Return Temp = 95.3f
Dryer In R.H.(%) = 00
Dryer In Temp = 94.8f
*****
DEHUMIDIFY COMP 2:23:16P
*****
  
```



• **Aborts and Failures**

Whenever a cycle is aborted (automatically or manually) the printer indicates the type and time of the abort. If VHP had been delivered before the cycle was aborted, the VHP Generator proceeds to the AERATION phase and prints AERATION information.

```
.....  
SLOW BLOWER  
ABORTED AT      11:23:48A  
.....  
.....  
HEATER FAILURE  
ABORTED AT      11:23:48A  
.....  
.....  
PUMP FAILED  
ABORTED AT      11:23:48A  
.....  
.....  
ABORTED CYCLE AERATE  
Aerate start    11:23:48A  
11:33:48A  
Air flow (SCFM) =      18.0  
VHP Conc. (mg/D) =     1.2  
.....  
Aerate end      3:23:48P  
.....
```

---

## Warning Lights

---

Whenever VHP is present in the pre-cleaned, sealed enclosure being processed, the red lights alongside the control panel are energized. These lights come on at the beginning of CONDITION and remain on until AERATION is complete and the operator has verified that the VHP concentration within the enclosure is at or below the OSHA PEL (as of January 1, 1990 - 1 ppm, 8-hour TWA). There are two lights in case one fails. VHP is present in the chamber whenever one or both of these lights are lit.

A low-power connector, located on the back of the VHP Generator, can be connected to interlock the enclosure's access ports whenever the warning lights are on.

# CONNECTING THE UNIT TO THE ENCLOSURE

6

## Cleaning the Enclosure

Prior to running a sterilization cycle, the enclosure must be thoroughly cleaned per manufacturer's recommendations. This includes wiping down the enclosure with a acceptable cleaning solution and allowing enclosure to dry properly. Surfaces in the enclosure may air dry or be towel dried; surfaces should not be dried using dry heat.

Carefully review the WARNINGS and CAUTIONS in Section 1 before connecting the VHP Generator to the enclosure.

## Performing a Leak Test on the Enclosure

1. Perform a leak test, or verify that a leak test has been performed, on the enclosure following the enclosure manufacturer's recommendations.

**WARNING - CHEMICAL INJURY HAZARD:** Always perform a leak test on the enclosure, to assure that it is leakproof, before running a cycle. Refer to Section 1 for expanded WARNING.

## Positioning the VHP Generator

Position the VHP Generator near the pre-cleaned, sealed enclosure to be sterilized (no more than 10 feet away) as follows:

**WARNING - PERSONAL INJURY AND/OR EQUIPMENT DAMAGE HAZARD:** Moving the Generator requires more than one person. Move/position it only on flat surfaces. Refer to Section 1 for expanded WARNINGS.

1. Release the parking brake, using both hands to draw the parking brake release lever up toward the handle (see Figure 6-1).
2. Holding the brake release lever and with more than one person helping, push (or pull) the unit to the desired location.
3. Once the unit is in the proper location, release the parking brake lever. The parking brake automatically re-engages when the release lever returns to its original position.

**CAUTION:** Avoid touching or moving the generator once a cycle has been initiated. The electronic balance is extremely sensitive and any sudden movement may cause alarm/abort conditions.

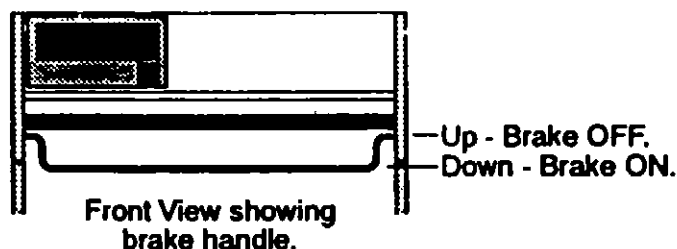


Figure 6-1. Release the Parking Brake

## Connecting the VHP Generator to the Enclosure

**WARNING - CHEMICAL INJURY HAZARD:** Wear chemical splash goggles, vinyl or neoprene gloves, and protective clothing, and observe all hydrogen peroxide safety precautions when handling hoses. Refer to Section 1 for expanded WARNINGS.

**WARNING - BURN HAZARD:** The VHP output port will be hot if the unit was run recently. Be careful when connecting hoses.

**WARNING - BIOHAZARD:** Double inlet and outlet HEPA filters should be utilized in applications where the enclosure contains biologicals hazardous to humans

1. Connect inlet and outlet hoses to pre-cleaned, sealed enclosure ports as follows (see Figure 6-2):

- Remove the hoses from the hose storage compartment.
- Uncap (unplug) one end of a hose and connect it to the VHP output port on the back of the VHP Generator. Uncap (unplug) the other end of the hose and connect it to the inlet to the enclosure. The inlet should have a HEPA filter to prevent biologicals from escaping (or entering) the sealed enclosure.
- Repeat the above procedure for the other hose, connecting one end to the enclosure air return port on the back of the Generator and the other end to the exit of the enclosure. The exit should have a HEPA filter to prevent biologicals from escaping (or entering) the sealed enclosure. Make sure all connections are tight.

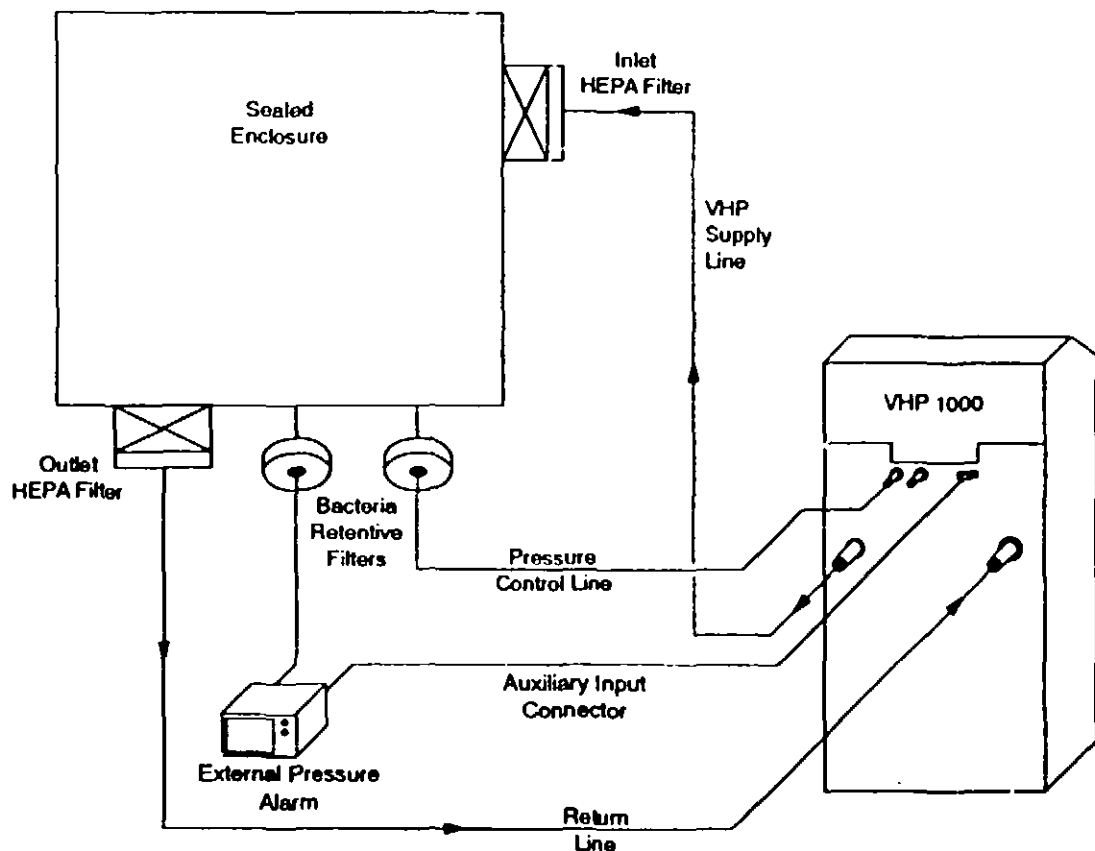


Figure 6-2. VHP Generator/Enclosure Pressure Connection

**CAUTION:** Keep connecting hoses off the floor. A cool floor may cause condensation in the hoses. Support the hoses to prevent kinks and undue strain on the hose connections.

**WARNING - CHEMICAL INJURY HAZARD:** The unit generates harmful hydrogen peroxide vapors and discharges them from the VHP output port. Always make sure that all connections are tight and that all enclosure vents/ports are sealed. See Section 1 for expanded WARNINGS.

**CAUTION -** The VHP Generator is capable of pressurizing (or evacuating) a sealed enclosure to 2 psig (or 55" W.C.). If your enclosure is not rated for operation at a pressure (or vacuum) in excess of 2 psig, you must use an AMSCO overpressure/underpressure alarm unit in conjunction with the generator. This will prevent damage to the enclosure.

d. Place a support under the hoses to keep them from touching the floor and to prevent kinks and strain on the connections. If the supply hoses rest on a cool floor, hydrogen peroxide may condense in the hoses.

2. Check that all enclosure vents/ports are closed and sealed so that there can be no VHP leakage. Check hose connections to make sure they are tight.

3. If pressure (or vacuum) inside the enclosure is to be controlled by the VHP Generator during the cycle, an External Pressure alarm must be used. To install this sensor, connect the sensor line assembly (short tube, long tube and bacteria-retentive filter) to the enclosure and the Generator as follows (see Figures 6-2 or 6-3):

- a. Connect the short tube to the enclosure.
- b. Connect the bacteria-retentive filter to the short tube.

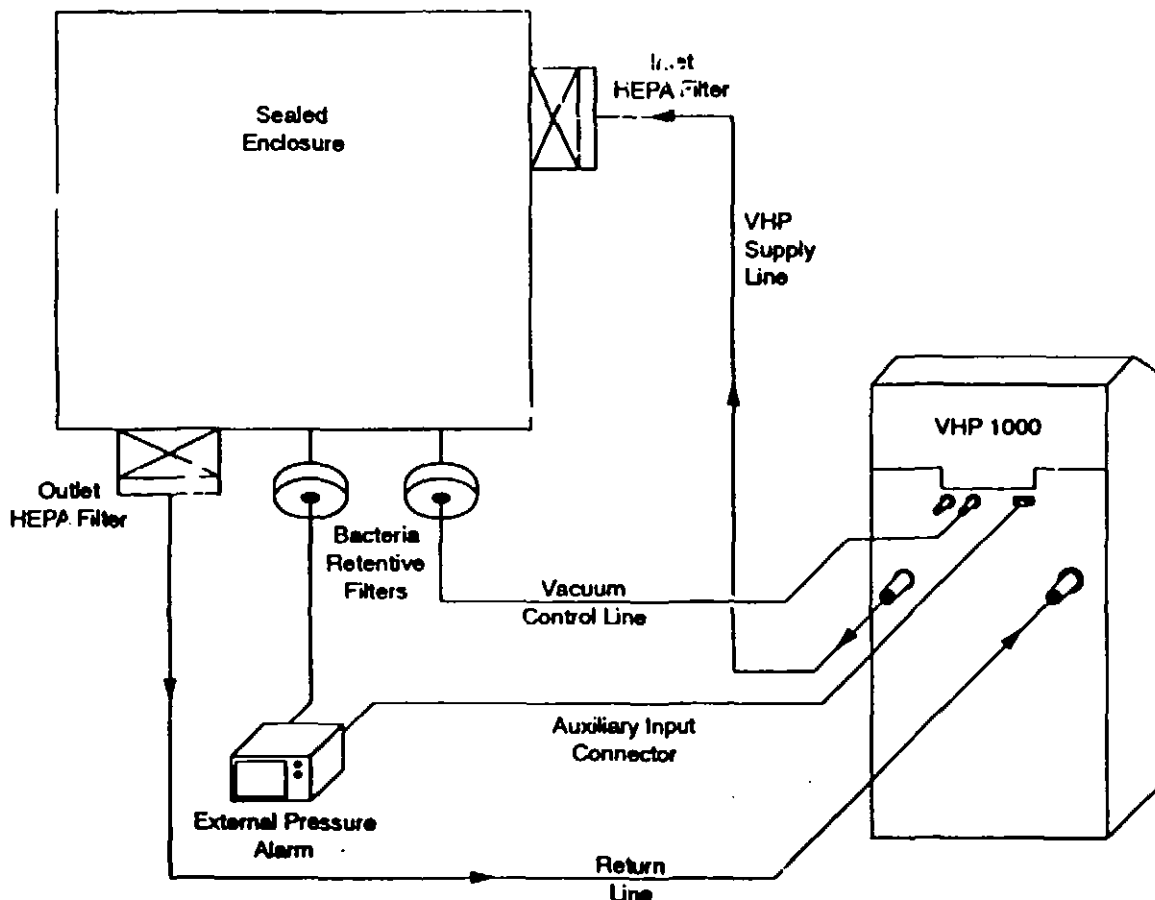
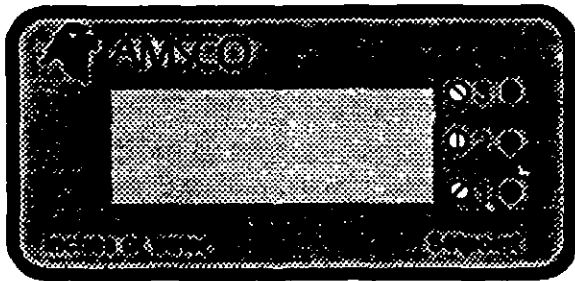


Figure 6-3. VHP Generator/Enclosure Vacuum Connection

- c. Connect the long tube to the bacteria retentive filter and then to the port on the back of the External Pressure alarm.
  - d. Connect the Auxiliary Input Cable (P-136808-127) to the VHP Generator's DC Input port on the rear of the generator and the other end to the External Pressure Alarm's port.
  - e. Connect the AC Power cord (included with the External Pressure Alarm kit) to the rear of the alarm and the other end to a receptacle
4. Post appropriate warning signs on and around the enclosure.
  5. If not running an AUTO-REGENERATE at the end of the cycle, check to make sure the regeneration exhaust port (see Figure 6-3) is capped.
  6. If running an AUTO-REGENERATE at the end of the cycle, uncap the regeneration exhaust port. Connect a hose from this port to an outside exhaust. This connection assures that the moist regeneration air stream is discharged to an area remote from the regeneration air intake.

**NOTE:** Approximately one gallon of water is released into the air during the regeneration cycle. The moist air released during regeneration should be discharged to an outside exhaust to prevent it from being drawn back into the generator through the regeneration air intake, which could adversely affect regeneration.

## Setting External Pressure Alarm Limits



**Figure 6-4. External Pressure Alarm - Front Panel**

**NOTE:** When performing cycles requiring either a pressure condition or vacuum condition in the enclosure, it is necessary to verify that the alarm setpoints for both the VHP 1000 control and the External Pressure alarm are equal. If not, unnecessary alarm/abort conditions will occur.

After successfully connecting the External Pressure Alarm, the HI and LO alarm limits must be set to prevent any unnecessary alarm/abort conditions from occurring. These alarm limits must be equal to those set in Section 7 (only the 'OVERPRESSURE SETPOINT' can be set through the VHP 1000's control program; the external alarm can monitor both over-and-underpressure conditions).

To set the HI and LO alarm limits, perform the following steps (see Figure 6-4) ...

1. Press and hold button #1; use a screwdriver to turn the screw and set the underpressure setpoint. It is up to the user to establish what value is acceptable for underpressure. Release the button when value displayed on the External Pressure alarm is acceptable.
2. Press and hold button #2; use a screwdriver to turn the screw and set the overpressure setpoint. This value must be the same as set in Section 7, specifically, the 'OVER PRESS ALARM SETPOINT'. Release the button when the value displayed on the External Pressure alarm is acceptable.



## Preset Cycle Factory Settings

*NOTE: Although Cycle 1 has been preset by AMSCO, the cycle parameters can be changed if the preset defaults do not fit the application. See Section 8 for information on changing cycle parameters. The preset parameters for Cycle 4 cannot be changed.*

Cycles 1 and 4 have been preset by AMSCO at the factory. Cycle 1 is the established sterilization cycle that was developed and validated for both 2 ft<sup>3</sup> and 40 ft<sup>3</sup> pre-cleaned, sealed enclosures. AOAC (Association of Official Analytical Chemists) sporicidal test protocols were used to validate the cycle.

The preset cycle parameters for Cycle 1 are as follows:

STATUS  
C 1 DEHUMID A=12 SCFM  
T= 0:45:00 RH= 10 %

STATUS  
C 1 COND A=12 SCFM  
T= 0:00:00 IR= 00.0g

STATUS  
C 1 STER A=12 SCFM  
T= 1:30:00 IR= 02.2g

STATUS  
C 1 AERATE A=12 SCFM  
T= 1:00:00

Cycle 4 is the regeneration cycle which has been programmed to regenerate the drying agent. Settings are as follows:

STATUS  
REGENERATE HEAT UP  
2:00:00 TEMP=392.0F

STATUS  
REGENERATE A=04 SCFM  
8:00:00 TEMP=230.0F

STATUS  
REGENERATE COOL DOWN  
8:00:00

## Running the Preset Sterilization Cycle

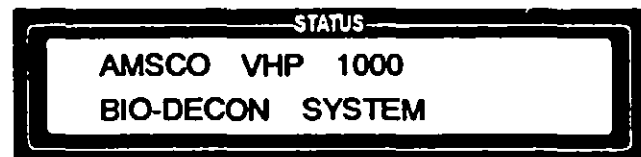
**WARNING - CHEMICAL INJURY HAZARD:** Observe all safety precautions when handling hydrogen peroxide. Refer to Section 1 for expanded WARNINGS.

**CAUTION:** Avoid touching or moving the generator once a cycle has been initiated. The electronic balance is extremely sensitive and any sudden movement may cause alarm/abort conditions.

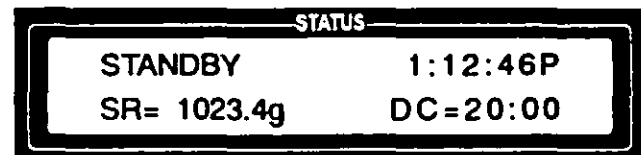
Carefully review the WARNINGS and CAUTIONS in Section 1 before attempting to run the preset STERILIZATION cycle.

1. Verify that the VHP Generator is properly connected to the pre-cleaned, sealed enclosure and that a leak test has been performed.
2. Verify that a sterilant cartridge is in place.
3. Verify that the printer has an adequate paper supply.
4. Position the power switch to ON.

The display momentarily shows the unit's name. . .



and then advances to STANDBY.



The STANDBY display shows the sterilant reservoir contents (in grams) and the remaining dryer capacity (in hours:minutes).



*NOTE: In order to operate the equipment properly, it is essential that you read the Equipment Manual before running a cycle.*

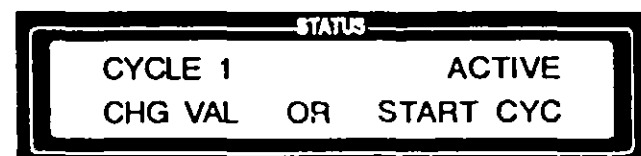
5. Press CYCLE SELECT touchpad #1 to activate the AMSCO validated cycle.

The display asks if you have read the Equipment Manual.



6. Use the VALUE (up) arrow to change NO to YES, then press CHANGE VALUES.

The selected cycle is shown in display window:



7. Press the PRINT touchpad to obtain a printout of the cycle settings for the selected cycle. Compare the printout to the desired preset cycle parameters.



8. Press START CYCLE.



The display shows the cycle selected and asks that an access code be entered.



9. Enter your access code, using the VALUE (up and down) and CURSOR (right and left) arrows, then press START CYCLE to initiate the cycle start-up sequence.

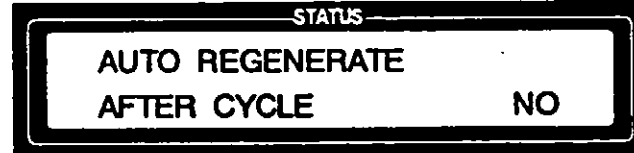
If the wrong access code is entered, the display indicates that access is denied.



When the correct access code is entered, the display first shows that the code is accepted. . .



and then asks if you want to run an automatic regeneration cycle at the end of the sterilization cycle.



10. Use the VALUE (up and down) arrows to change NO to YES if desired, then press START CYCLE.

- If YES is entered, the display asks you to verify that the regeneration connections have been made.



Check your connections, then use the VALUE (up) arrow to change NO to YES. Press START CYCLE.

The display then indicates that the control is checking the remaining drying agent capacity.



- If the cycle time exceeds the dryer capacity by more than one hour, the display momentarily shows that dryer

**WARNING - CHEMICAL INJURY HAZARD:** Wear chemical splash goggles, vinyl or neoprene gloves and protective clothing, and observe all hydrogen peroxide safety precautions when handling hoses. Refer to Section 1 for expanded WARNINGS.

regeneration is necessary, and then the control aborts the cycle. If this happens, disconnect the unit from the enclosure and run the regeneration cycle (see *Running the Preset Regeneration Cycle* later in this section).

STATUS  
REGENERATION OF  
DRIER REQUIRED

- If the cycle time exceeds the dryer capacity by less than one hour, the display momentarily indicates that the cycle time exceeds the drying capacity. . .

STATUS  
TIME TO RUN CYCLE  
EXCEEDS DRYER TIMER

RESET

and then allows you to either abort the cycle (press RESET) or continue the cycle (press START CYCLE).

STATUS  
PRESS RESET TO ABORT  
OR START CYCLE TO CONTINUE

START  
CYCLE

If you know that the remaining dryer capacity is sufficient to run your cycle, press START CYCLE. If you want to regenerate the drying agent, press RESET to abort, then run the regeneration cycle.

*NOTE: The reservoir must contain enough hydrogen peroxide to complete the selected cycle before the control will advance.*

Once it is determined that the dryer capacity is sufficient to run the selected cycle, the display advances to show that the control is checking the amount of hydrogen peroxide in the reservoir.

STATUS  
CHECKING H2O2 WEIGHT

- If there is not enough hydrogen peroxide in the reservoir to complete the selected cycle, the control fills the reservoir from the cartridge.

STATUS  
FILLING RESERVOIR  
SCALE= 0587.5

- If the cartridge is not in place or if it is empty, the display alerts the operator. If the display gives this message, install a new cartridge as explained in Section 4.

STATUS  
REPLACE EMPTY OR  
MISSING CARTRIDGE

**WARNING - CHEMICAL INJURY HAZARD:** Wear chemical splash goggles, vinyl or neoprene gloves and protective clothing, and observe all hydrogen peroxide handling precautions when installing a new cartridge. Refer to Section 1 for expanded WARNINGS.

When the reservoir is at the required level, the display indicates that the sterilant weight is sufficient.



**NOTE:** In order to use this feature, the enclosure volume must be larger than 10 cubic feet and a sensing line must be connected from the enclosure to the appropriate sensing port on the back of the Generator (see Section 6, step 3).

The display then advances to ask if you want the VHP Generator to control the pressure in the enclosure.



11. Use the VALUE (up and down) arrows to select YES or NO, then press START CYCLE to enter your response.
  - a. If the response is NO, the display advances to indicate that the control is opening the air supply and return valves (skip to step 12).
  - b. If the response is YES, the display asks that your access code be entered.

**Programmer or Supervisor Access Code Required** →



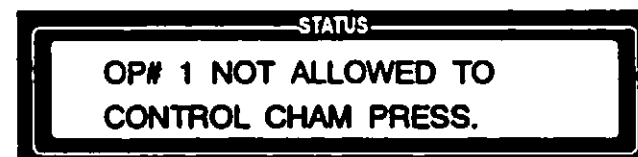
Enter your access code, using the VALUE (up and down) and CURSOR (right and left) arrows, and press START CYCLE.

- If an invalid access code is entered, the display indicates that access is denied. . .



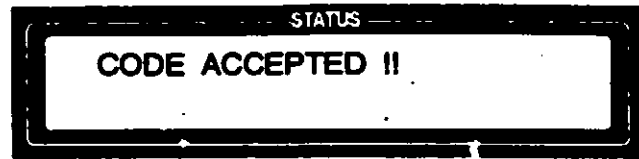
and then reverts to the PRESSURE CONTROL screen.

- If the access code entered is valid **but not a programmer or supervisor access code**, the display shows the operator number for the access code entered, and denies access. . .



and then reverts to the PRESSURE CONTROL screen.

When the correct access code is entered, the display first shows that the code is accepted. . .



and then asks you to verify that the enclosure is larger than 10 cubic feet.

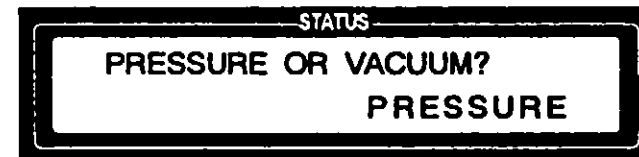


If you are sure your enclosure is larger than 10 cubic feet, use the VALUE (up) arrow to change NO to YES and press START CYCLE. If your enclosure is not larger than 10 cubic feet, press START CYCLE with NO displayed. The screen momentarily shows. . .



and then reverts to the PRESSURE CONTROL screen.

Once you have verified that the enclosure is larger than 10 cubic feet, the display asks that you specify whether you want the generator to maintain pressure or vacuum within the enclosure.



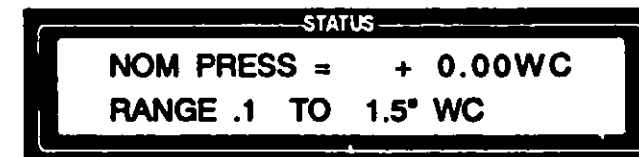
Use the VALUE (up and down) arrows to select PRESSURE or VACUUM, then press START CYCLE.



**CAUTION:** Test the enclosure to verify that it can withstand the desired pressure (or vacuum) before setting pressure (or vacuum) differentials. Refer to Section 1 for expanded CAUTION.

**NOTE:** It is the operator's responsibility to make sure the operating pressure (or vacuum) selected does not exceed the enclosure manufacturer's recommendations.

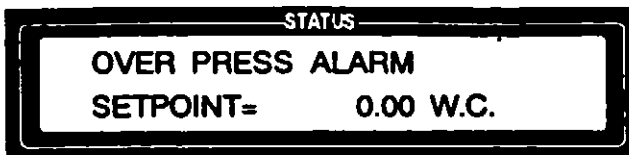
The display then verifies your selection (PRESSURE or VACUUM) and asks that you enter the value, in inches of water column (WC) of the nominal pressure differential that is to be maintained. The setting must be in the range shown at the bottom of the display (.1 to 1.5" WC).



Use the VALUE (up and down) and CURSOR (left and right) arrows to enter the desired differential, then press START CYCLE.



The display then asks you to enter the minimum value, in inches of water column, above the nominal pressure differential, that the cycle will alarm/abort.



**NOTE:** It is the operator's responsibility to verify that the sensing line is connected to the correct port (PRESSURE or VACUUM) on the back of the Generator (see Section 6, step 3).

Use the VALUE (up and down) and CURSOR (left and right) arrows to enter the desired differential, then press START CYCLE.

The enclosure will be maintained at a pressure (or vacuum) that is equal to this differential above (or below) atmospheric.

The display then asks you to check that the sensing line is connected to the proper port, PRESSURE or VACUUM, match your selection.



**NOTE:** It is the operator's responsibility to verify that the pressure alarm is connected (see Section 6, step 3).

Check that the sensing line connection is to the correct port on the back of the generator (see Section 6, step 3 if in doubt). If the display shows PRESSURE, then the line must be connected to the pressure port; if it shows VACUUM, then the connection must be to the vacuum port. After you have verified the connection, use the VALUE (up) arrow to change NO to YES and press START CYCLE.

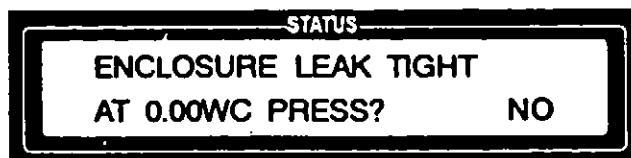
The display advances to ask if the external pressure alarm is connected.



**⚠ WARNING: CHEMICAL INJURY HAZARD:** Harmful hydrogen peroxide vapors will escape from the enclosure if it is not sealed completely when the Generator is set for pressure operation. Refer to Section 1 for expanded WARNINGS.

Make sure the alarm is connected, then use the VALUE (up) arrow to change NO to YES and press START CYCLE.

The display then asks you to verify that the enclosure is leak tight at the pressure (or vacuum) setting that has been made.



Make sure the the enclosure has been leak-tested for the pressure or vacuum setting made, then use the VALUE (up) arrow to change NO to YES and press START CYCLE.

12. The display then asks that you press START CYCLE again to confirm that you are ready to run the cycle.



Press **START CYCLE**.

The display advances to indicate that the control is opening the air supply and return valves.

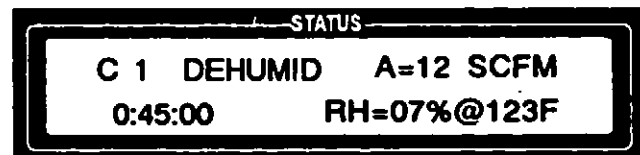


then . . .

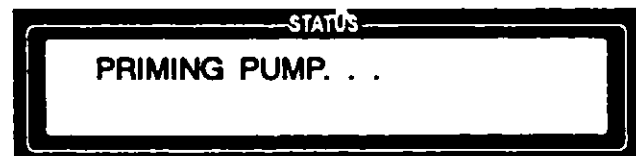


13. The cycle then proceeds, with the display showing the applicable parameters for the phase in process. The following display windows appear, in sequence, when Cycle 1 is run:

- The DEHUMIDIFICATION phase display window shows the recirculating air flow, in standard cubic feet per minute (SCFM), the time remaining in the DEHUMIDIFICATION phase, and the relative humidity and temperature of the air stream after it leaves the enclosure, returns to the Generator and passes through the catalytic converter.



At the end of the DEHUMIDIFICATION phase, the display indicates that the hydrogen peroxide injection pump is being primed. . .



then the cycle advances to the **CONDITION** phase.

- The **CONDITION** phase display window shows the recirculating air flow in SCFM, the time remaining in the **CONDITION** phase, and the liquid hydrogen peroxide injection rate in grams per minute.

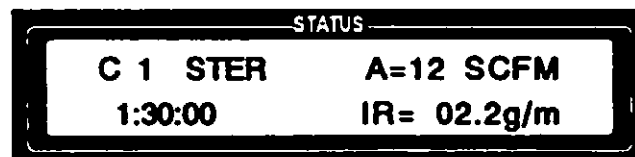
**NOTE:** The **CONDITION** phase is optional. If **CONDITION** time is set to zero, the control automatically advances to the **STERILIZATION** phase.





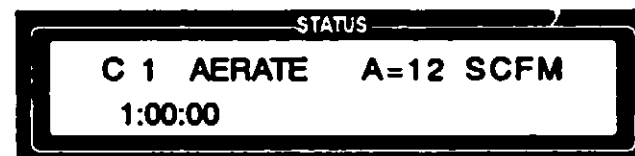
When the timer counts down to zero, the control automatically advances to the STERILIZATION phase.

- The STERILIZATION phase display window shows the recirculating air flow in SCFM, the time remaining in the STERILIZATION phase, and the liquid hydrogen peroxide injection rate in grams per minute.

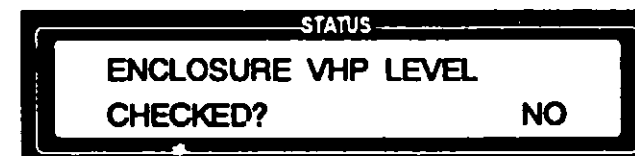


When the timer counts down to zero, the control automatically advances to the AERATION phase.

- The AERATION phase display window shows the recirculating air flow in SCFM and the time remaining in the AERATION phase.



When the AERATION timer counts down to zero, the control asks if you have checked the VHP residual level in the enclosure.



14. Use a Dräger Multi Gas Detector® tube to test the enclosure for residual VHP as explained in Section 15.

After verifying that the enclosure is at an acceptable VHP level, use the VALUE (up) arrow to change NO to YES on the display, then press CHANGE VALUES.

- The AIR SUPPLY and AIR RETURN VALVES close. The display indicates that valves are closing. . .



**WARNING - CHEMICAL INJURY HAZARD:**  
At the end of the AERATION phase, use a Dräger tube to check and monitor the VHP concentration within the enclosure. The VHP concentration should be at or below the OSHA PEL (as of January 1, 1990 - 1 ppm, 8-hour TWA) before the enclosure is accessed. Refer to Section 15 for monitoring procedure.

**NOTE:** The blower continues to run and the red warning lights remain lit until the VHP concentration is checked and YES is entered on the control.

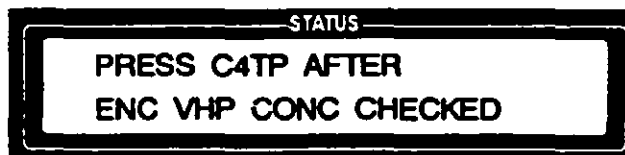


and then . . .



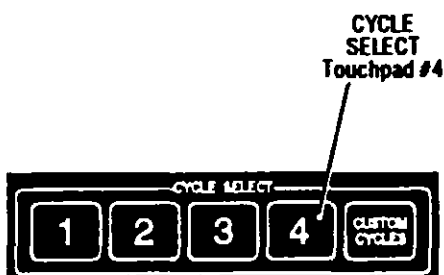
**NOTE:** During auto-regeneration, the red warning lights remain lit for up to 12 hours or until the VHP concentration is checked and CYCLE SELECT touchpad #4 is pressed.

- If AUTO-REGENERATE was selected, the control automatically advances to the regeneration cycle. The cycle proceeds as described in *Running the Preset Regeneration Cycle* later in this section, except that, during the first 12 hours of the regeneration, the display flashes a message alerting the operator to check the enclosure hydrogen peroxide concentration before disconnecting the unit.

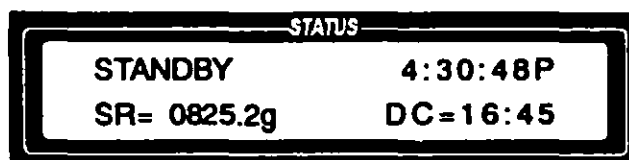


If it is necessary to access the enclosure before the auto-regeneration is complete, first check the enclosure for residual VHP as explained in Section 15, then press CYCLE SELECT touchpad #4. The red warning lights go out and the auto-regeneration continues.

- At the end of the cycle, the display shows the time and date the cycle was completed. The display continues to show CYCLE COMPLETE information until RESET is pressed.



When RESET is pressed the display returns to STANDBY.



**WARNING - BURN HAZARD:** The VHP output port is hot after the unit has been run. Be careful when disconnecting the hoses.

15. To disconnect the Generator from the enclosure, carefully remove and store the hoses as follows:
  - a. Keeping the end of the hose elevated so that no residual hydrogen peroxide can drip out, disconnect and cap one end of a hose at a time.
  - b. Once hoses are disconnected and capped, inspect each hose for any visible liquid that may have collected inside. Any liquid inside the hoses should be treated as concentrated hydrogen peroxide and handled accordingly. If the hoses contain any residual liquid . . .
    - Place them, one at a time, in a sink that is piped to an enclosed drain.



**WARNING - CHEMICAL INJURY, FIRE AND EXPLOSION HAZARD:** Wear chemical splash goggles, vinyl or neoprene gloves and protective clothing, and observe all hydrogen peroxide safety precautions when handling hoses. Any residual liquid in the hoses and/or the enclosure should be treated as concentrated hydrogen peroxide. Refer to Section 1 for expanded WARNINGS.

*NOTE: Filtered, oil-free air can be used to speed up drying.*

## Read before Running the Regeneration Cycle

- Turn on the water and uncap one end of the hose.
  - Elevate the capped end of the hose and allow all the liquid to drain from the hose.
  - Remove the cap from the other end of the hose and run deionized or distilled water through the hose.
  - Repeat the procedure for the second hose.
  - Allow hoses to air dry, then recap them.
- c. Place hoses in the storage compartment.

16. Inspect the enclosure for any visible residual liquids. Any liquid inside the enclosure must be treated as concentrated hydrogen peroxide and handled accordingly. Test any liquid residue in the chamber using a Merckquant® 1001 test strip as explained in Section 15.

A regeneration cycle is required whenever the moisture absorption capacity of the drying agent is depleted to the point that the desired cycle cannot be run to completion. The remaining drying agent capacity (DC) is always displayed when the unit is in the STANDBY mode. This capacity is displayed in hours:minutes.

| STATUS      |          |
|-------------|----------|
| STANDBY     | 3:12:24P |
| SR= 0920.5g | DC=00:42 |

The time required to run a sterilization cycle must be less than the remaining drying agent capacity in order for a cycle to be run to completion.

The regeneration cycle has three phases:

- **HEAT-UP** — Band heaters supply thermal energy to the drying agent and the air-flow preheater for a specified time period.
- **REGENERATE** — Ambient air is drawn into the Generator and passed through a preheater, then (in a reverse-flow direction) through the drying agent. This hot flowing air stream removes water vapor from the drying agent. The moist air stream then passes through a catalytic converter before being discharged from the unit. The discharge line should be connected to an outside exhaust.
- **COOL-DOWN** — The drying agent is allowed to cool for a specified time period. When cool-down is complete, the unit is ready to run a sterilization cycle.

## Setting Up the Generator for the Regeneration Cycle

*NOTE: Approximately one gallon of water is released into the air during the regeneration cycle. The moist air released during regeneration should be discharged to an outside exhaust to prevent it from being drawn back into the generator through the regeneration air intake, which would adversely affect regeneration.*

1. Uncap the regeneration exhaust port, located on the back of the unit (see Figure 7-2).
2. Connect a hose from the regeneration exhaust port to an outside exhaust line. This connection assures that the moist regeneration air stream is discharged to an area remote from the regeneration air intake.

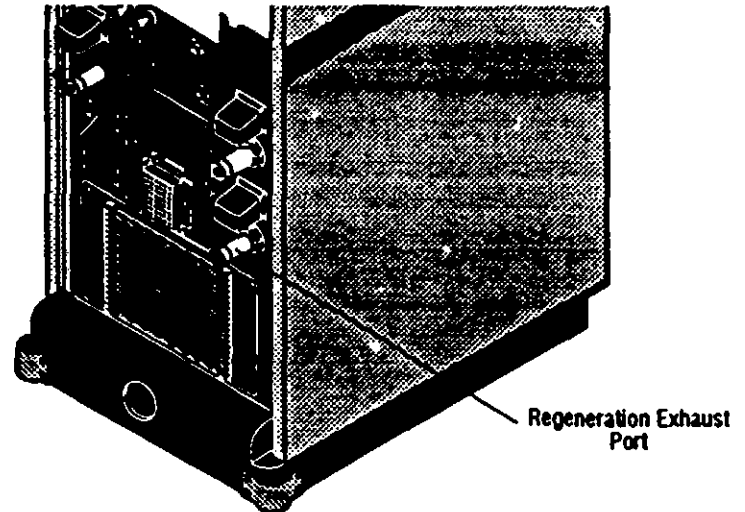
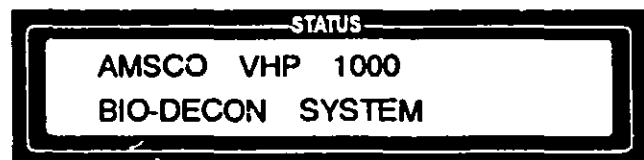


Figure 7-2. Regeneration Exhaust Port

## Running the Regeneration Cycle

1. Verify that the regeneration exhaust line is connected to an outside exhaust.
2. Verify that the printer has an adequate paper supply.
3. Position power switch to ON.

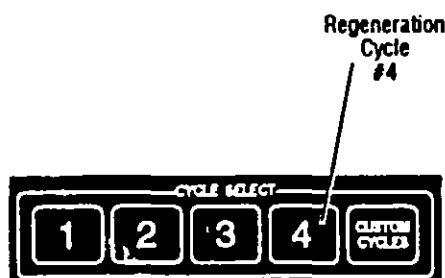
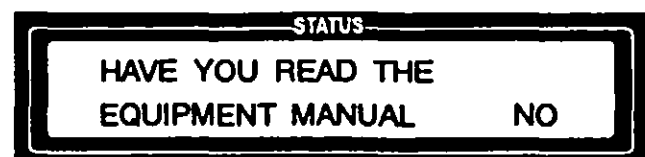
The display momentarily displays the unit's name. . .



and then advances to STANDBY.



4. Press CYCLE SELECT touchpad #4 to activate the regeneration cycle. Display asks if you have read the Equipment Manual.



*NOTE: In order to operate this equipment properly, it is essential that you read the Equipment Manual before running a cycle.*



- Use the VALUE (up) arrow to change NO to YES, then press CHANGE VALUES.

The selected cycle is shown in display window:



- Press START CYCLE.

The display shows that CYCLE 4 is selected and asks that an access code be entered.



- Enter your access code, using the VALUE (up and down) and CURSOR (right and left) arrows, then press START CYCLE to initiate the cycle start-up sequence.

If the wrong access code is entered, the display indicates that access is denied.



When the correct access code is entered, the display momentarily shows that the code is accepted. . .



then asks you to verify that the REGENERATION connections have been made.

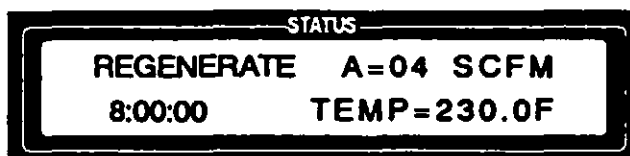


Check your connections, then use the VALUE (up) arrow to change NO to YES. Press START CYCLE.

The display then indicates that the HEAT-UP phase is in process and shows the time remaining in the HEAT-UP phase.



When the HEAT-UP timer counts down to zero, the REGENERATION phase begins. The display shows the temperature of the air stream as it leaves the air drier and the time remaining in the phase.



The cycle advances to the COOL-DOWN phase when the REGENERATION timer counts down to zero and the temperature of the air stream is greater than or equal to 230°F (110°C).



When the COOL-DOWN timer counts down to zero, the REGENERATION cycle is complete. The display shows CYCLE COMPLETE information until RESET is pressed.



When RESET is pressed, the display returns to STANDBY.



**Advisory**

The AMSCO VHP Generator has been designed and registered in accordance with Federal Regulations for the specific uses described in this manual. This device is used with enclosures that have been pre-cleaned per manufacturer's recommendations or basic instructions found in Section 6.

Uses other than as specified and described are not recommended, may not be effective in sterilization, and may not be safe without careful, thorough development and validation. The instructions that follow explain how to program the parameters that make up a custom cycle. For appropriate guidance, in-service and training on how to develop and validate custom cycles for your special needs, please contact your AMSCO Service Representative.

**Read before Programming Custom Cycles**

Parameters controlling preset Cycle 1 have been established and validated by AMSCO for sterilization of empty, pre-cleaned, sealed enclosures up to 40 ft<sup>3</sup> in volume. Cycle 4 has been preset by AMSCO for periodic regeneration of the drying agent as needed.

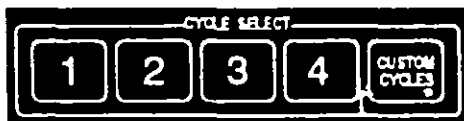
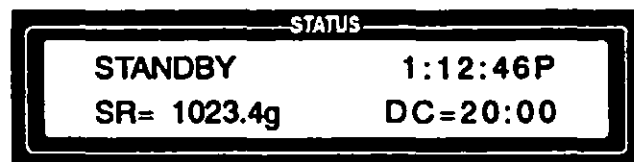
Cycles 2 and 3 (CYCLE SELECT touchpads #2 and #3) and Cycles 5 and 6 (accessed through the CUSTOM CYCLES touchpad) are reserved for special purpose operations that are developed, programmed and validated by the user.

Custom cycle parameters can be entered and/or changed only by operators who are assigned programmer or supervisor access codes, which should only be assigned when special training has been conducted and stringent qualifications have been met. Use of restricted, discrete access codes to perform certain functions is intended to prevent unauthorized entry and use of parameters that have not been properly developed and validated.

Parameters can be changed for all cycles except Cycle 4, the Regeneration cycle.

**Programming Custom Cycles**

1. With the unit in the STANDBY mode . . .



press any one of the custom cycle touchpads, i.e., #2, #3, or CUSTOM CYCLES (to access cycles #5 and #6).

The display asks if you have read the Equipment Manual.

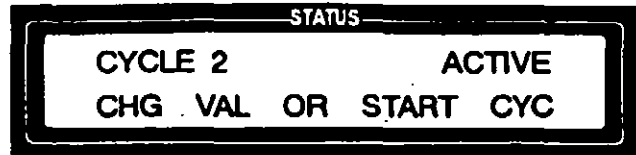


**NOTE:** In order to operate the equipment properly, it is essential that you read the Equipment Manual.



2. Use the VALUE (up) arrow to change NO to YES, then press CHANGE VALUES.

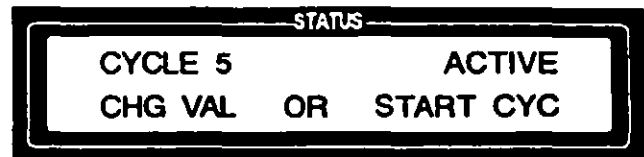
- If Cycle #2 is made active, the following is shown on the display:



- If the CUSTOM CYCLES touchpad is pressed, the CUSTOM CYCLE selection screen is displayed:



Press the CURSOR (right and left) and VALUE (up and down) arrows to select a custom cycle number, 5 or 6, then press CHANGE VALUES to lock in the custom cycle number. The display then shows that the selected cycle is active:



**NOTE:** Pressing the PRINT touchpad generates a printout of the current cycle settings for the active cycle. It is recommended that this printed record be generated before changing any cycle parameters. Whenever cycle parameters are changed, the previous cycle parameters (stored in RAM) are permanently overwritten.



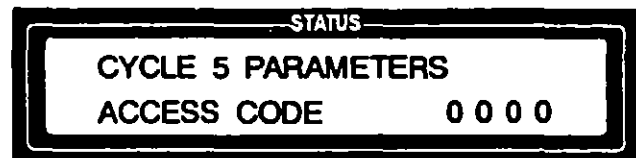
3. Press the PRINT touchpad to obtain a printout of the current cycle settings.



4. With a cycle active on the display (e.g., Cycle 5), press CHANGE VALUES.

The display asks that a programmer or supervisor access code be entered.

**Programmer or Supervisor Access Code Required** →



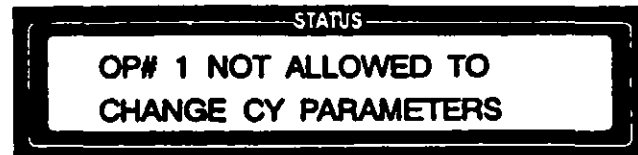
5. Enter your access code, using the CURSOR (right and left) and VALUE (up and down) arrows, then press SAVE VALUES to initiate the custom cycle sequence.

- If an invalid access code is entered, the display indicates that access is denied.

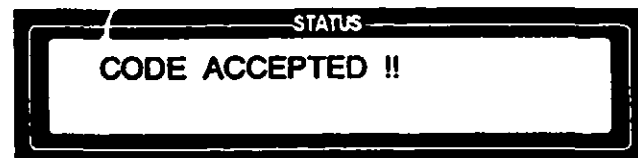




- If the access code entered is valid but not a programmer or supervisor access code, the display shows the operator number for the access code entered, and denies access.



When the correct access code is entered, the display momentarily shows that the code is accepted. . .



then asks that you enter the volume (in cubic feet) of the enclosure to be processed.



Use the CURSOR (right and left) and VALUE (up and down) arrows to enter the enclosure volume.

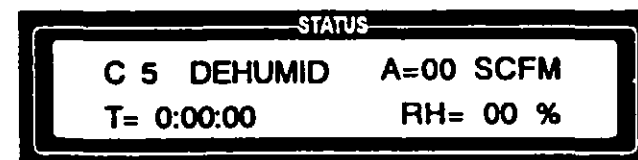


Then press CHANGE VALUES.

**NOTE:** Pressing SAVE VALUES after a parameter has been changed immediately updates the parameters for the active cycle, permanently overwriting the previous cycle settings, and returns the display to the CYCLE ACTIVE screen. More than one cycle phase parameter screen can be updated before the SAVE VALUES touchpad is pressed. If changing parameters for more than one phase, press CHANGE VALUES to access the displays for each phase, then press SAVE VALUES, after all changes have been made, to save the new settings.



6. The display advances to the first CYCLE PARAMETERS screen which shows the current settings for the DEHUMIDIFICATION phase of the active cycle.



Use the CURSOR (right and left) and VALUE (up and down) arrows to make the desired changes to the parameter settings for the DEHUMIDIFICATION phase. The parameters that can be changed are: the recirculating air flow (A) in standard cubic feet per minute (SCFM), the phase countdown timer setting (T) in hours:minutes:seconds (seconds cannot be set), and the enclosure relative humidity (RH) - relative humidity choices are 10, 20 or 30.



The relative humidity settings determine the amount of water (measured in gns/ft<sup>3</sup> or mg/liter) in the enclosure's air at a specific temperature.

The relative humidity is measured in the air stream returning from the enclosure. The probe is located in the inlet to the air dryer. The printout includes the relative humidity and the corresponding temperature. They are printed as "Dryer in Temp = 91.8F" and "Dryer in RH% = 12".

The following table contains the RH equivalents (10%, 20%, or 30%) for dryer inlet temperatures ranging from below 77°F to over 122°F.

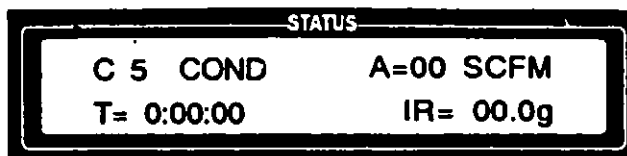
| DRYER IN TEMP | DRYER IN R.H. (user selectable setpoints) |     |     |
|---------------|---|-----|-----|
|               | 10%                                       | 20% | 30% |
| ≤ 77 F        | 10%                                       | 20% | 30% |
| 78 to 80 F    | 9%  | 18% | 27% |
| 81 to 84 F    | 8%  | 16% | 24% |
| 85 to 88 F    | 7%  | 14% | 21% |
| 89 to 93 F    | 6%  | 12% | 18% |
| 94 to 100 F   | 5%  | 10% | 15% |
| 101 to 108 F  | 4%  | 8%  | 12% |
| 109 to 119 F  | 3%  | 6%  | 9%  |
| ≥ 120 F       | 2%  | 4%  | 6%  |

 Denotes actual R.H. in the enclosure

The cycle will only advance to the condition phase when the setpoint has been achieved and the dehumidify countdown timer has reached zero.



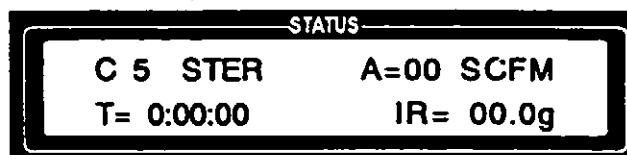
7. Press CHANGE VALUES to advance display to the settings for the CONDITION phase.



Use the CURSOR (right and left) and VALUE (up and down) arrows to make the desired changes to the parameter settings for the CONDITION phase. The parameters that can be changed are: the recirculating air flow, the phase countdown timer setting, and the liquid hydrogen peroxide injection rate (IR) in grams per minute (g).



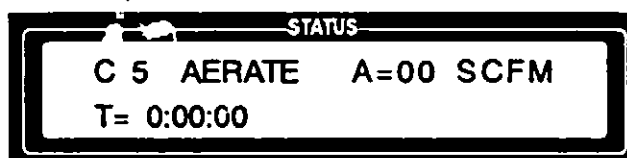
8. Press CHANGE VALUES to advance display to the settings for the STERILIZATION phase.



Use the CURSOR (right and left) and VALUE (up and down) arrows to make the desired changes to the parameter settings for the STERILIZATION phase. The parameters that can be changed are: the recirculating air flow, the phase countdown timer setting, and the liquid hydrogen peroxide injection rate.



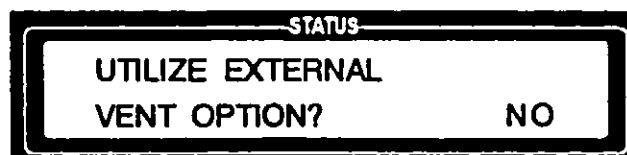
9. Press CHANGE VALUES to advance display to the settings for the AERATION phase.



Use the CURSOR (right and left) and VALUE (up and down) arrows to make the desired changes to the parameter settings for the AERATION phase. The parameters that can be changed are: the phase countdown timer setting and the recirculating air flow.



Press CHANGE VALUES. The display asks if you want to use the external vent output option during AERATION.



If you want the cycle to include an exhaust to an external vent during the AERATION phase, use the VALUE (up) arrow to change NO to YES, then press CHANGE VALUES. If you do not want an external exhaust during AERATION, press CHANGE VALUES when NO is displayed and proceed to step 10.

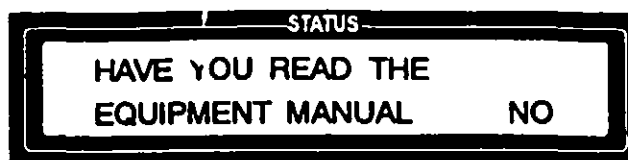
**WARNING - CHEMICAL INJURY HAZARD:**  
Enclosure must be specially equipped with an external exhaust system in order to use the External Vent Output feature. Check environmental laws and contact your AMSCO Service Representative before using this feature. See Section 1 for expanded WARNING.



**NOTE:** In order to operate the equipment properly, it is essential that you read the Equipment Manual.

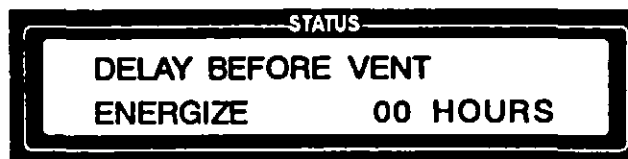


If you chose to use the external vent option, the display advances to ask if you have read the Equipment Manual.



Use the VALUE (up) to change NO to YES and press CHANGE VALUES.

The display then asks that you enter how long (in hours) the AERATION phase should run before the vent blower comes on. The minimum delay is one hour to assure that the hydrogen peroxide level in the enclosure is sufficiently reduced before being vented to the outside.



Use the CURSOR (right and left) and VALUE (up and down) arrows to set a time, then press CHANGE VALUES.

If you attempted to set a time delay less than one hour, the display momentarily displays . . .

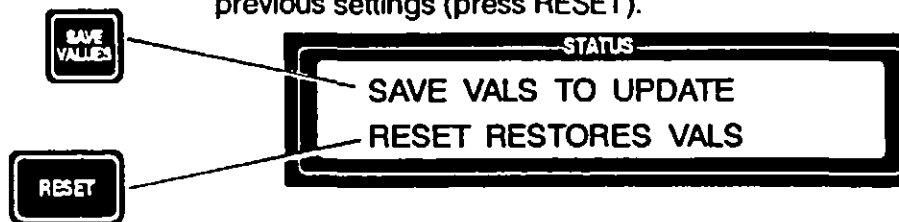


and then reverts back to the vent option screen.

Once an acceptable time delay is entered, the display advances to the SAVE VALUES screen.

**NOTE:** Pressing SAVE VALUES causes the control to update all parameters, permanently overwriting the previous cycle settings. Pressing RESET returns the display to STANDBY without saving the changes.

10. The display screen prompts the programmer to save all parameter changes made (press SAVE VALUES) or restore previous settings (press RESET).



11. Press SAVE VALUES to save the new settings, or RESET to restore the previous settings. The display screen shows which action is taken, either updating the parameters. . .



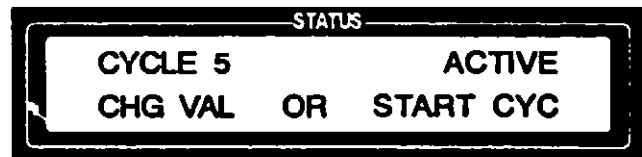
or restoring the previous values.



The display then momentarily shows the number of the operator who changed the cycle parameters and the current date. . .



and then reverts to the CYCLE ACTIVE screen.



12. If the cycle parameters were changed, press the PRINT touchpad to obtain a printout of the new cycle settings. Review the printout in detail to insure that the correct changes were made. Initial and date the printout, and keep it in a permanent file.

## **Read before Running a Custom Cycle**

Parameters programmed into any of the Custom Cycle registers have not been preset, and may not have been developed or validated, by AMSCO. It is the operator's responsibility to verify that a Custom Cycle is appropriate for an application before the Custom Cycle is initiated.

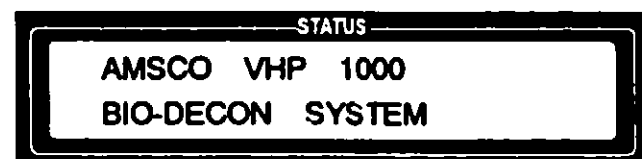
## **Running a Custom Cycle**

**⚠ WARNING - CHEMICAL INJURY HAZARD:**  
Observe all safety precautions when handling hydrogen peroxide. Refer to Section 1 for expanded WARNINGS.

Carefully review the WARNINGS and CAUTIONS in Section 1 before attempting to run a Custom Cycle.

1. Verify that the VHP Generator is properly connected to the pre-cleaned, sealed enclosure and that a leak test has been performed on the enclosure.
2. Verify that a sterilant cartridge is in place.
3. Verify that the printer has an adequate paper supply.
4. Position the power switch to ON.

The display momentarily shows the unit's name. . .



and then advances to **STANDBY**.



The **STANDBY** display shows the sterilant reservoir contents (in grams) and the remaining dryer capacity (in hours:minutes).



5. Press the desired custom cycle touchpad, i.e., #2, #3, or **CUSTOM CYCLES** (to access cycles #5 or #6).

The display asks if you have read the Equipment Manual.

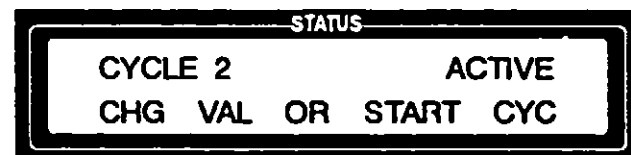


*NOTE: In order to operate the equipment properly, it is essential that you read the Equipment Manual before running a cycle.*



6. Use the **VALUE** (up) arrow to change **NO** to **YES**, then press **CHANGE VALUES**.

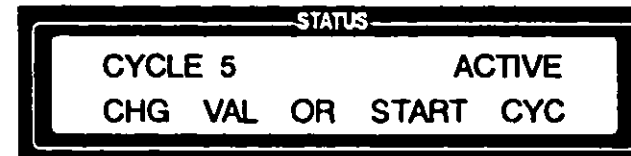
• If Cycle #2 is selected, the following is shown on the display:



• if the **CUSTOM CYCLES** touchpad is pressed, the **CUSTOM CYCLE** selection screen is displayed:



Press the **VALUE** (up/down) arrows to select the desired custom cycle (5 or 6), then press **CHANGE VALUES** to lock in the custom cycle number. The display shows that the cycle is active.



*NOTE: If the cycle parameter settings are not appropriate for the cycle being run, then press **RESET** to abort the cycle.*



7. Press the **PRINT** touchpad to obtain a printout of the cycle settings for the selected cycle. Compare the printout to the desired custom cycle parameters.



8. Once you have verified that the cycle parameter settings are correct, press **START CYCLE**.

The display shows the cycle selected and asks that an access code be entered.



9. Enter your access code, using the VALUE (up and down) and CURSOR (right and left) arrows, then press START CYCLE to initiate the cycle start-up sequence.

If the wrong access code is entered, the display indicates that access is denied.



When the correct access code is entered, the display first shows that the code is accepted. . .



and then asks if you want to run an automatic regeneration cycle at the end of the sterilization cycle.



Use the VALUE (up and down) arrows to make your selection, then press START CYCLE.

- If YES is entered, the display asks you to verify that the regeneration connections have been made.



Check your connections, then use the VALUE (up) arrow to change NO to YES. Press START CYCLE.

10. The cycle then proceeds as described in Section 7, *Running a Preset Sterilization Cycle*.





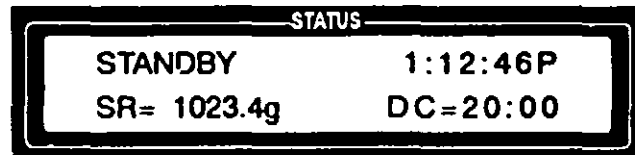
## Access Codes

A four-digit access code is required to operate the VHP Generator. There are three levels of access codes associated with operating the unit. These access codes are assigned based on the degree to which the operator has been trained. The codes are assigned by AMSCO at the initial installation and training session, then the supervisor assumes responsibility for future access code level assignments:

- OPERATOR ACCESS CODE — Allows an operator to run PRESET and CUSTOM Cycles and to change PRINT PARAMETERS. The operator can also change his/her own access code.
- PROGRAMMER ACCESS CODE — Allows an operator to run PRESET and CUSTOM Cycles, to change PRINT PARAMETERS, to program CUSTOM cycles, to set OPERATING PARAMETERS, and to make in-cycle parameter changes. The programmer can also change his/her own access code.
- SUPERVISOR ACCESS CODE — Unrestricted. Allows all the privileges of the programmer access code plus the ability to change and/or assign other operator's access codes.

## Changing Access Codes

1. With the unit in the STANDBY mode. . .



press the CHANGE VALUES touchpad. The display asks if you have read the Equipment Manual.



*NOTE: In order to operate the equipment properly, it is essential that you read the Equipment Manual.*



2. Use the VALUE (up) arrow to change NO to YES, then press CHANGE VALUES.

The CHANGE ACCESS CODE screen is displayed:





3. Use the VALUE (up and down) arrows to select YES. Press CHANGE VALUES when YES is displayed. The display then asks you to enter your current access code and the desired new access code.

| STATUS       |      |
|--------------|------|
| CURRENT CODE | 0000 |
| NEW CODE     | 0000 |



4. Enter your current access code and the desired new access code, using the VALUE (up and down) and CURSOR (right and left) arrows, then press CHANGE VALUES.

- If you enter your CURRENT CODE incorrectly, the display briefly shows...

| STATUS               |  |
|----------------------|--|
| * INVALID PASSWORD * |  |

and then reverts to the CHANGE ACCESS CODE screen.

- If you enter your current access code correctly, but an invalid or duplicate NEW CODE, the display briefly shows...

| STATUS               |  |
|----------------------|--|
| INVALID NEW PASSWORD |  |

and then reverts to the CHANGE ACCESS CODE screen.

When both the CURRENT access code and the NEW access code are entered correctly, the display verifies that the new code was accepted, and shows the new access code.

| STATUS   |      |
|----------|------|
| ACCEPTED |      |
| NEW CODE | 3156 |



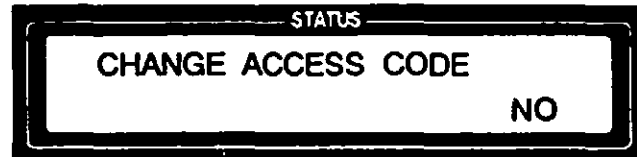
5. Press SAVE VALUES to return to the STANDBY mode or CHANGE VALUES to access the VHP Generator OPERATING PARAMETERS menu (refer to Section 10).

## Custom Printouts

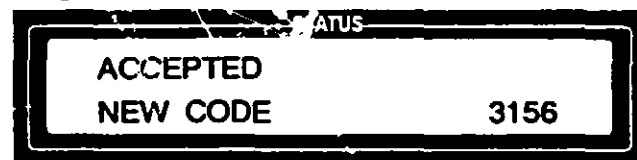
The CUSTOM PRINTOUT menu follows the CHANGE ACCESS CODE menu (refer to Section 9). It can be accessed either of two ways:



- When CHANGE VALUES is pressed with NO indicated on the CHANGE ACCESS CODE screen. . .



- When CHANGE VALUES is pressed after the access code has been changed.



1. Access the CUSTOM PRINTOUT menu by either of the above methods. The first screen allows setting of the print interval in hours:minutes.



Use the VALUE (up and down) and CURSOR (right and left) arrows to make the desired changes to the print interval setting.

*NOTE: Pressing SAVE VALUES at any time brings up the SAVE SELECTIONS display.*



*Press CHANGE VALUES when YES is displayed to save your changes and advance to the Operating Parameters menu. Change YES to NO and press CHANGE VALUES to advance to the Operating Parameters menu without saving your changes.*



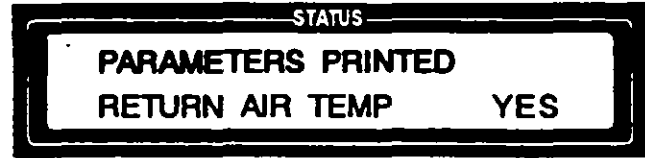
2. Press CHANGE VALUES to advance to the PARAMETERS PRINTED screens. The first screen asks if you want the printout to show air flow.



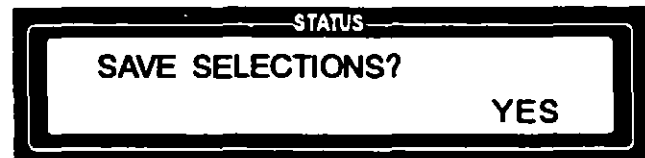
Use the VALUE (up and down) arrows to select YES or NO. Press CHANGE VALUES to advance the display to the next screen.

The following screens are displayed in sequential order. Select YES or NO as desired, pressing CHANGE VALUES to advance to each new screen.

**NOTE:** When YES is initiated on this screen the printout will also include the vaporizer temperature.



The display then asks if you want to save your settings:



3. Press CHANGE VALUES to save your settings. If you do not want to save your settings, use the VALUE (up) arrow to change YES to NO, then press CHANGE VALUES. The control returns to the default settings.
4. The display then advances to ask if you want to change the VHP Generator OPERATING PARAMETERS.



If you have a programmer or supervisor access code and want to make operating parameter changes, use the VALUE (up) arrow to change NO to YES and press CHANGE VALUES. The control advances to the Operating Parameters menu (see following section).



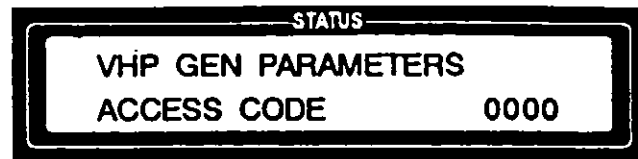
To return to STANDBY without making operating parameter changes, press CHANGE VALUES when NO is displayed.

# Operating Parameters

**Programmer or  
Supervisor Access  
Code Required** ➔



1. The first screen of the OPERATING PARAMETERS menu asks you to enter your access code.



Enter your access code, using the VALUE (up and down) and CURSOR (right and left) arrows, and press CHANGE VALUES.

- If an invalid access code is entered, the display indicates that access is denied. . .



and then reverts to the CHANGE GEN PARAMETERS screen.

- If the access code entered is valid but not a programmer or supervisor access code, the display shows the operator number of the access code entered, and denies access. . .

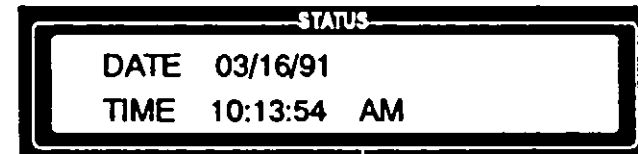


and then reverts to the CHANGE GEN PARAMETERS screen.

Once the correct access code is entered, the display shows the code is accepted. . .

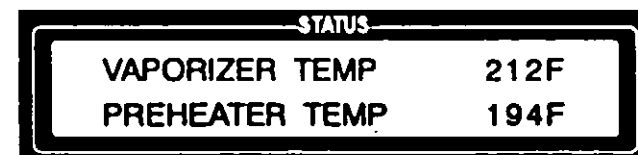


and then advances to the DATE and TIME display.



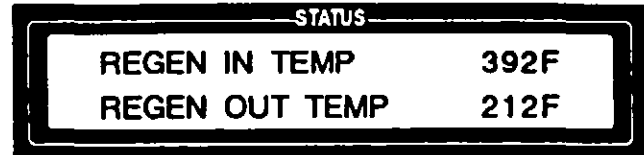
*NOTE: AMSCO has set the VAPORIZER TEMPERATURE at 100°C (212°F) and the PREHEATER TEMPERATURE at 90°C (194°F).*

2. Use the VALUE (up and down) and CURSOR (right and left) arrows to select the correct date and time. Press CHANGE VALUES to advance the display to the temperature settings screens.





Use the VALUE (up and down) and CURSOR (right and left) arrows to make settings, then press CHANGE VALUES. The display shows:



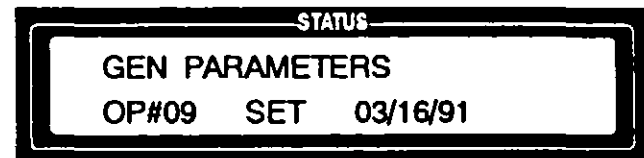
Use the VALUE (up and down) and CURSOR (right and left) arrows to set the regenerate temperatures as desired. Recommended setting is 200°C (392°F) for REGEN IN, and 100°C (212°F) for REGEN OUT.



3. Press SAVE VALUES to update the parameters or RESET to cancel the update and retain the previous parameters.

**NOTE:** Pressing SAVE VALUES causes the control to update all parameters, permanently overwriting the previous cycle settings.

If you press SAVE VALUES, the display momentarily shows your operator number and the date. . .



and then returns to STANDBY.



If you press RESET, the display returns to STANDBY and any changes you made to parameter settings will not be saved.

## Control AC Outputs

The microprocessor control provides two 120 VAC output signals (see Figure 11-1). They can be used to drive relays that draw less than or equal to 1/2 amp each. A four-wire connector, that mates with a connector on the back of the VHP generator, is supplied with the unit. The two output signals are described below.

### • Interlock Output

One output signal is energized whenever VHP is present within the enclosure, i.e., throughout the entire CONDITION, STERILIZATION and AERATION phases. This output signal can be used to interlock enclosure access ports whenever sterilant vapors are present. It can also provide power to a warning light or alarm if desired.

The interlock feature requires that an electrically actuated locking device be installed on the enclosure at all operator-accessible ports, and that the device(s) be properly connected to the VHP Generator. Improper hookup will render the interlock feature inoperable.

### • External Vent Output

The second output signal is energized during the AERATION phase at the appropriate selected time. It allows the enclosure's ventilation system to assist in aerating the enclosure. This system can be used to allow the VHP Generator to provide an increased non-recirculating (or vented) air flow that passes out through an external exhaust when the output is energized.

The output signal can also be used to open dampers on an enclosure's ventilation system (as well as turn on the ventilation system itself) so that a more rapid aeration is possible.

**⚠ WARNING - CHEMICAL INJURY HAZARD:** Enclosure must be specially equipped with an outside exhaust system in order to use the External Vent Output feature. Check environmental laws and contact your AMSCO Service Representative before using this feature. See Section 1 for expanded WARNING.

*NOTE: AMSCO can provide information regarding the potential installation of a catalytic converter integral to the enclosure's ventilation system in addition to providing guidance on how to use the external vent feature. Instructions are not included in this manual.*

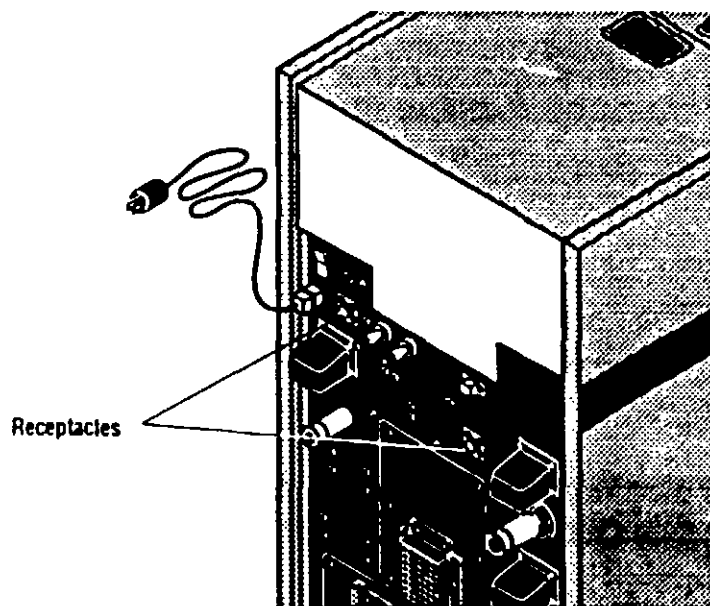
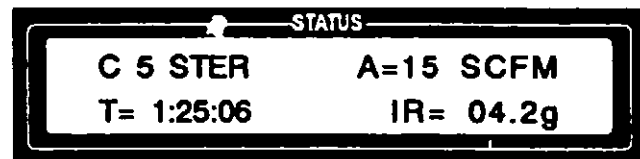


Figure 11-1. AC Outputs

## In-cycle Parameter Changes

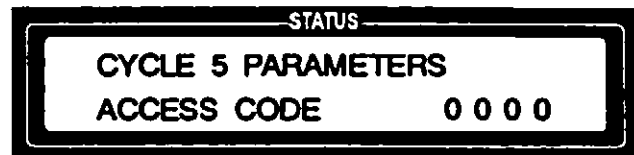
The control permits limited parameter changes during a cycle. This feature is meant to be used during the development and validation of a custom cycle. A programmer or supervisor access code is required to use this feature.

The two parameters that can be changed during a cycle are the hydrogen peroxide INJECTION RATE and the recirculating AIR FLOW rate. The appropriate menus can be accessed from the STATUS screen of any cycle phase. The following explanation assumes that you access the menu from in the STERILIZATION phase:



1. Press CHANGE VALUES. The display asks that your access code be entered.

Programmer or  
Supervisor Access  
Code Required



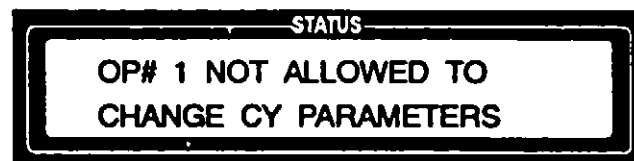
2. Enter your access code, using the VALUE (up and down) and CURSOR (right and left) arrows, and press CHANGE VALUES.

- If an invalid access code is entered, the display indicates that access is denied. . .



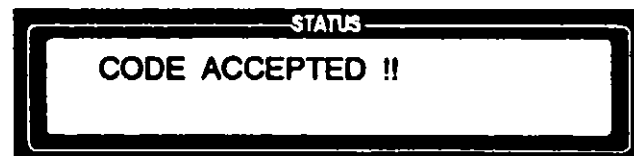
and then reverts to the CYCLE ACTIVE screen.

- If the access code entered is valid but not a programmer or supervisor access code, the display shows the operator number of the access code entered, and denies access. . .



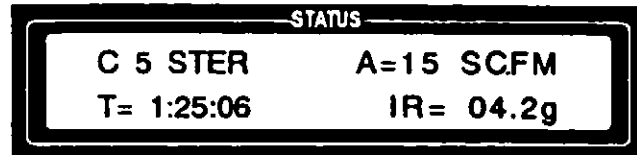
and then reverts to the CYCLE ACTIVE screen.

Once the correct access code is entered, the display shows the code is accepted. . .



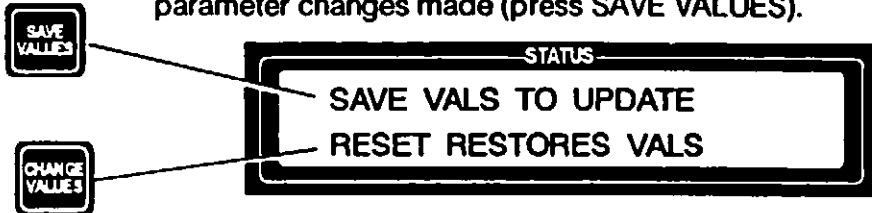


and then advances to show the current settings for the STERILIZATION phase of the active cycle.



Use the VALUE (up and down) and CURSOR (right and left) arrows to make the desired changes to the recirculating air flow (A) in SCFM, and/or the injection rate (IR) in grams per minute (to the nearest 1/10 of a gram). The time setting cannot be changed. Make your settings, then press CHANGE VALUES.

- The display screen then prompts the programmer to save all parameter changes made (press SAVE VALUES).



**NOTE:** Pressing SAVE VALUES causes control to update the parameters, permanently overwriting the previous settings. Pressing RESET returns the display to the active cycle's status screen without saving the changes.

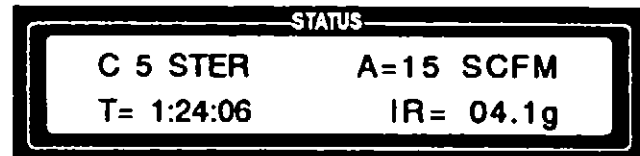
- Press SAVE VALUES to save the new settings, or RESET to restore the previous settings. The display screen shows which action is taken, either updating the parameters. . .



or restoring the previous values.



The display then reverts to the active cycle's STATUS screen.



The cycle continues during this process. At the time of the change, the printer shows the new cycle parameters on the printout along with a record of which operator made the changes.



## Alarms that Abort Cycles

A number of parameters are monitored by the control. If any of these parameters vary from the nominal preset value by more than the applicable allowance, an alarm occurs. Examples include:

STATUS  
CYC ABORTED 12:34:56  
980 GRAM H2O2 LIMIT

STATUS  
CYC ABORTED 12:34:56  
VHP OUT HOSE OFF

STATUS  
CYC ABORTED 12:34:56  
VHP IN HOSE OFF

STATUS  
CYC ABORTED 12:34:56  
REGEN OUT HOSE OFF

STATUS  
CYC ABORTED 12:34:56  
REGEN OUT PLUG OFF

STATUS  
CYC ABORTED 12:34:56  
V4 DIDNT OPEN

STATUS  
CYC ABORTED 12:34:56  
V4 DIDNT CLOSE

The preceding alarms all result in the cycle being aborted. An AERATION cycle is automatically run after each of these alarms if VHP was injected into the enclosure before the cycle was aborted. A complete description of all the alarms, as well as the possible causes and appropriate corrective actions, are included in Section 14, *Troubleshooting*.

## **Alarms that Inform**

Following are some of the unit's alarms that do not necessarily result in the cycle being aborted:

STATUS  
CARTRIDGE EMPTY

STATUS  
ACCESS DENIED !!

STATUS  
DRIER CAPACITY LOW

## Read before Performing Routine Maintenance

**⚠ WARNING - PERSONAL INJURY AND/OR EQUIPMENT DAMAGE HAZARD:** Only AMSCO or AMSCO-trained service personnel should make repairs and adjustments to this equipment. Nonroutine maintenance done by unqualified personnel or installation of unauthorized parts could cause personal injury, invalidate the warranty, or result in costly damage.

The following procedures are routine maintenance and should be performed as necessary. Any maintenance procedures not included in this section should be done only by qualified service personnel fully acquainted with the equipment.

In addition to the routine maintenance described in this section, regularly scheduled preventive maintenance is essential for safe and reliable operation of the equipment. A Preventive Maintenance Agreement is available where maintenance, adjustments and replacement of worn parts are performed by a qualified technician on a scheduled basis to assure peak equipment performance and avoid unscheduled downtime. Contact your AMSCO Service Representative for details.

## Cleaning the Generator

**⚠ CAUTION:** Use only nonabrasive cleaners and rub in same direction as surface grain. Abrasive cleaners will damage the stainless steel. Do not use these cleaners on painted surfaces. Refer to Section 1 for expanded CAUTION.

To keep your VHP Generator looking like new, AMSCO recommends cleaning painted and stainless-steel surfaces with a mild detergent solution or a mild window-cleaning solution as follows:

*NOTE: Avoid getting water into the controls. Wring out cloth before wiping the control panel.*

*NOTE: AMSCO recommends an occasional application of AMSCO Pry<sup>®</sup> Cream (which is mildly acidic) to stainless-steel surfaces. However, it contains a very fine abrasive and should NOT be used on painted surfaces. See Section 16 for ordering information.*

1. Unplug the unit.
2. Apply cleaning solution with a damp cloth, rubbing in a back and forth motion (parallel to surface grain on stainless-steel).
3. Rinse cloth and wipe off any detergent residue, then dry surfaces with a clean, lint-free cloth.

## Cleaning the Hoses

**⚠ WARNING - CHEMICAL INJURY HAZARD:** Wear chemical splash goggles, vinyl or neoprene gloves and protective clothing, and observe all hydrogen peroxide safety precautions when handling hoses. Refer to Section 1 for expanded WARNINGS.

*NOTE: Sterilant delivery hoses should not be left lying around where they can be contaminated with dust or other catalytic particles. They should be returned to the storage compartment when not connected to an enclosure.*

**⚠ WARNING - FALL HAZARD:** To prevent falls, promptly wipe up any water or hydrogen peroxide drippage. Before wiping up hydrogen peroxide, dilute it by flooding with water. Refer to Section 1 for expanded WARNINGS.

The sterilant delivery hoses need to be cleaned periodically to remove dust and other debris from the interior surfaces. This should be done annually, or whenever the interior of the hoses becomes soiled or dusty.

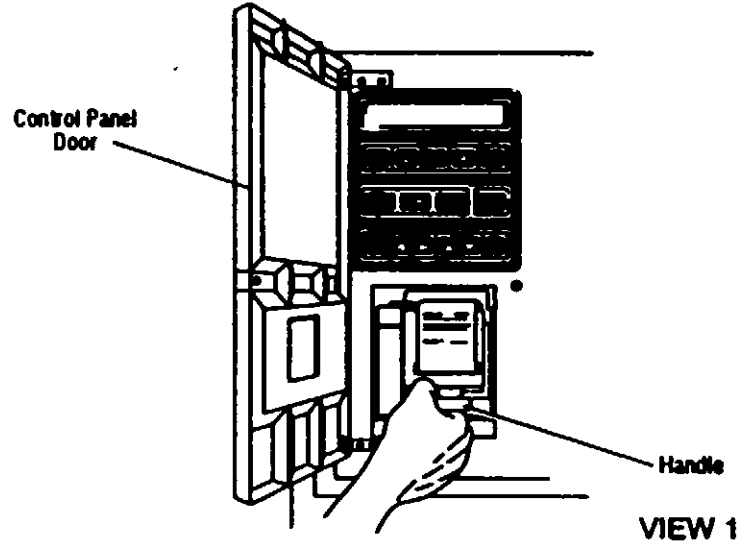
Clean hose interiors as follows:

1. Put on chemical splash goggles, vinyl or neoprene gloves and protective clothing.
2. Remove the hoses from the storage compartment, or disconnect them from the enclosure and/or generator.
3. Submerge the hoses in a **clean** sink or tub filled with water containing a mild detergent.
4. Soak hoses for 30 minutes, then drain.
5. Run deionized water through the hoses to rinse them. Rinse thoroughly.
6. Dry the hoses by blowing oil-free, filtered, compressed air through them, or allow hoses to air dry.
7. Return the hoses to their storage compartment when dry.

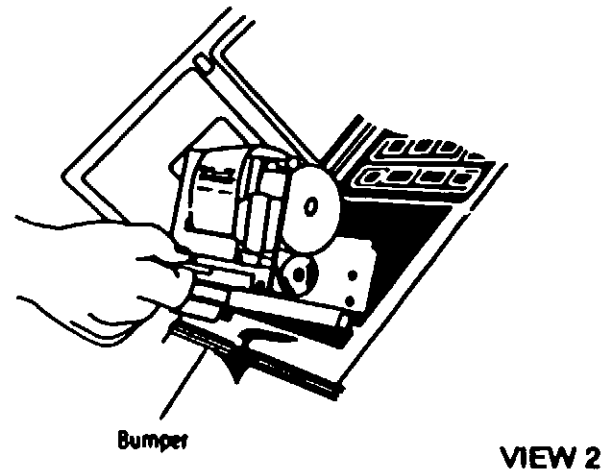
## Replacing the Printer Paper Supply

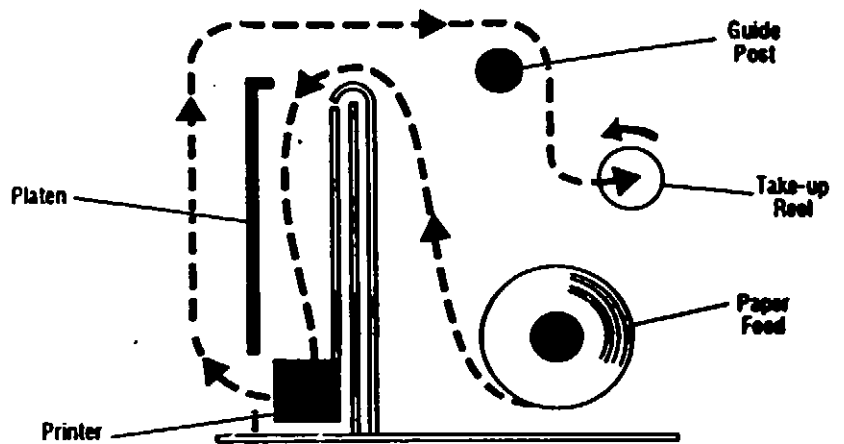
When a red line appears on the printer paper roll, install a new roll of paper as follows:

1. Position power switch to OFF.
2. Open the control panel door and firmly grasp the handle on the lower front of the printer assembly (View 1).



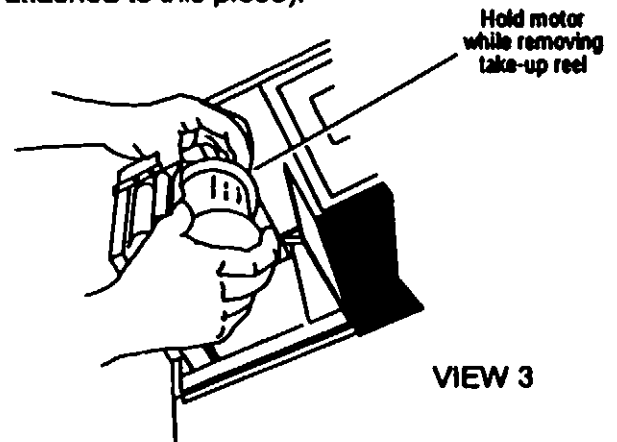
3. Pull the printer assembly straight out until it stops, and then carefully lower the assembly forward until it rests on the bumper (stop) at the lower edge of the control panel (View 2).





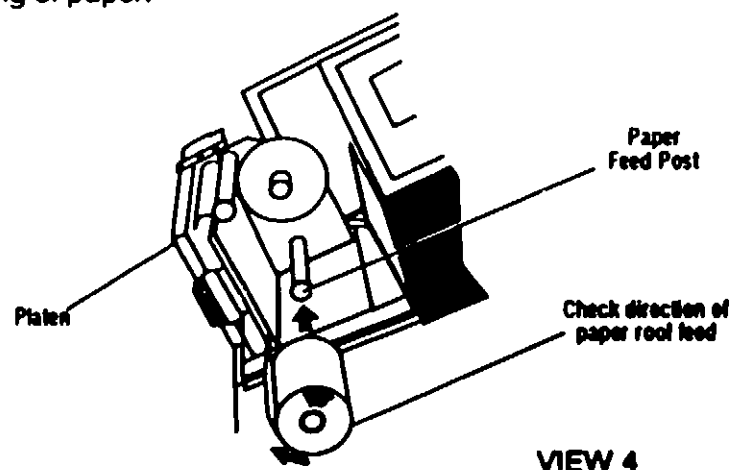
**Figure 13-1. Paper Threading Diagram**

4. Holding the take-up spool by the motor and/or the left side of the spool (View 3), pull off the right side of the take-up spool (take-up spindle is attached to this piece).



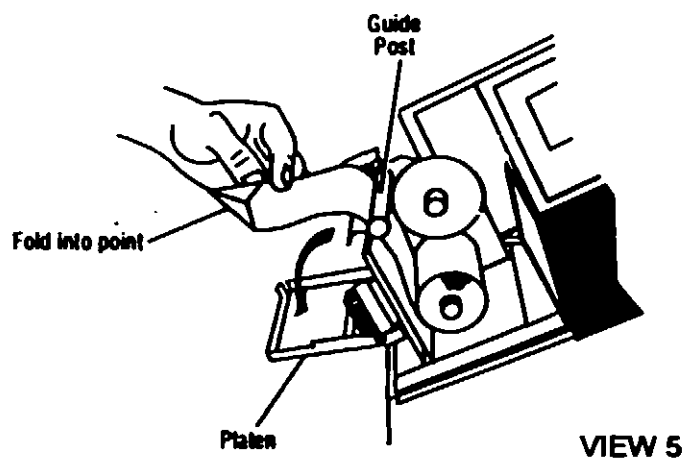
5. Remove the used paper from the take-up spool. File this paper roll in an appropriate place so that you have a permanent record of the cycles that have been run.
6. Place a new roll of paper on the plastic paper-feed post (View 4). Make sure that the paper is coming off the spool in the correct direction, from the bottom of the roll, toward the platen. See the paper threading diagram (Figure 13-1) for proper routing of paper.

**NOTE:** The thermal paper will not print if the paper roll is installed backwards.

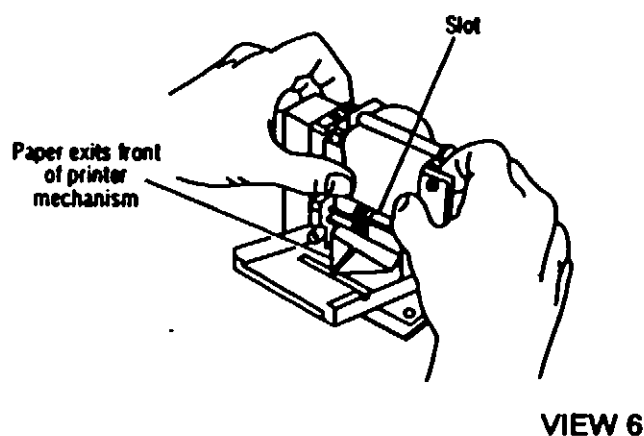




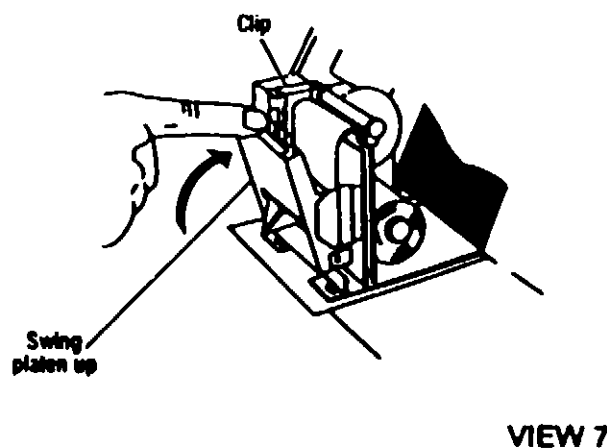
7. Lower the platen. Pull out approximately eight inches of paper and feed it under the guide post. Fold and crease the end of the paper into a point. (View 5.)



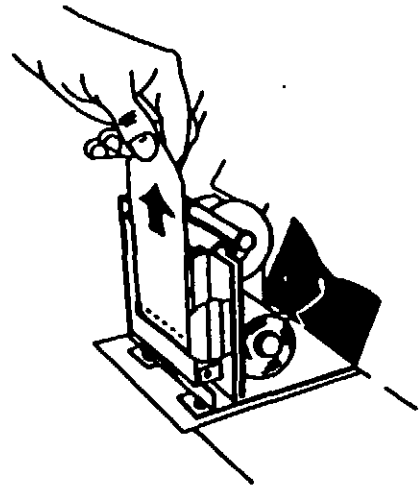
8. Slide the pointed end of the paper into the slot at the top of the printer mechanism until it comes out the bottom (View 6). Feed paper through the printer mechanism until approximately one inch of paper extends from the bottom.



9. Raise the platen (View 7), making sure the printer paper comes through the slot in the front of the platen (paper should feed itself). Snap platen in place under clip.



10. Pull up (to prevent damage to printer head) on pointed end of paper until the piece is 10 to 12 inches long (View 8).



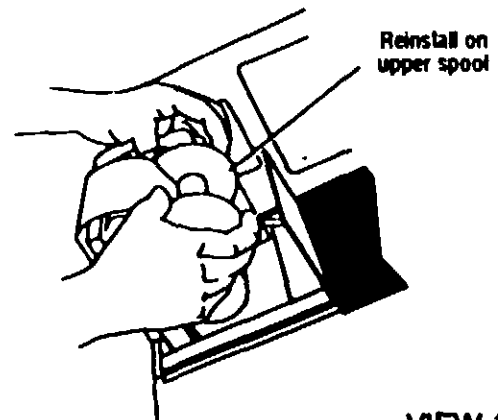
VIEW 8

11. Insert pointed end of paper into the slot on the take-up spindle removed previously (View 9). Turn the spindle as shown so that paper is drawn onto the spool from the underside. Refer to Figure 13-2 if in doubt about proper paper threading.



VIEW 9

12. Replace the take-up spindle on the upper spool (View 10).



VIEW 10

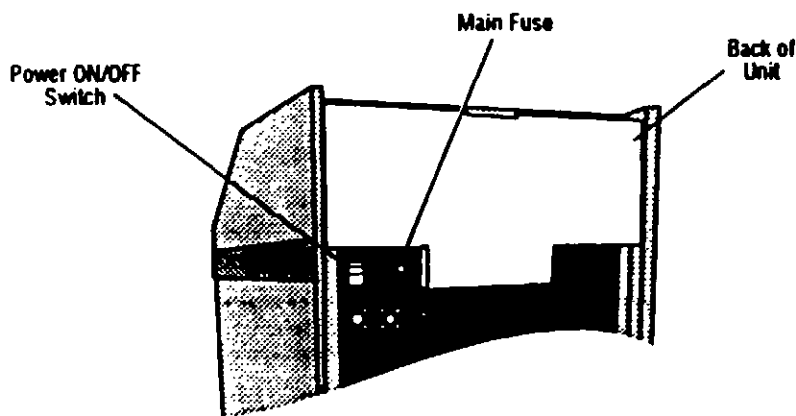
13. Grasp handle on lower front of printer assembly. Lift the printer assembly and gently slide it into place in the control panel.
14. Close the control panel door. The printer is now ready to operate.

## Replacing the Fuses

The VHP Generator has five fuses:

- The main fuse that protects the entire generator, and
- Four auxiliary fuses that protect the microprocessor control and other components.

The main fuse is located next to the power ON/OFF switch on the back of the unit (see Figure 13-2). Replace this fuse, when necessary, as follows:



**Figure 13-2. Main Fuse**

**NOTE:** If the fuse blows repeatedly, call your AMSCO Service Representative.

1. Unplug the VHP Generator.
2. Turn the fuse holder counterclockwise and then pull it straight out.
3. Remove the blown fuse and place a new 20A Slo-Blo® fuse in the fuse holder.
4. Insert the fuse holder back into the unit and turn it clockwise to lock in place.
5. Plug unit into a wall outlet and position power switch to ON.

The auxiliary fuses are not accessible to the operator. Only fully trained service personnel can replace these fuses. If one of these fuses blows, contact your AMSCO Service Representative.

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## **Replacing the Warning Light Bulbs**

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There are two warning lights on the top of the VHP Generator that illuminate whenever VHP is being generated. If either bulb burns out, replace it as follows:

1. Unplug the unit.
2. Unscrew (turn counterclockwise) and remove the red plastic lens covering the bulb.
3. Grasp the light bulb and pull it up and out of the bulb holder.
4. Gently push the new bulb into the holder.
5. Replace the red plastic lens and screw (turn clockwise) it in place.

| ABORT DISPLAY  | DESCRIPTION/CAUSE/TIME<br>D=Description C=Cause T=Time  | OPERATOR ACTION  |
|--|---|--|
| <p style="text-align: center;">VAP</p> <p>CYC ABORTED 12:34:58<br/>VAP RTD PROBLEM LOW</p>     | <p>D - Vaporizer RTD reading less than 60°F.<br/>C - Probably an open circuit.<br/>T - Anytime power switch is ON, except in Regenerate phase.</p>        | <p>1. Allow unit to Aerate, then retry cycle.<br/>2. If problem does not clear, call an AMSCO Service Representative.</p>  |
| <p style="text-align: center;">VAP</p> <p>CYC ABORTED 12:34:58<br/>VAP RTD PROBLEM HIGH</p>    | <p>D - Vaporizer RTD reading more than 300°F.<br/>C - Vaporizer RTD probably shorted.<br/>T - Anytime power switch is ON, except in Regenerate phase.</p> | <p>1. Allow unit to Aerate, then retry cycle.<br/>2. If problem does not clear, call an AMSCO Service Representative.</p>  |
| <p style="text-align: center;">PREHTR</p> <p>CYC ABORTED 12:34:58<br/>PREHTR RTD PROB LOW</p>  | <p>D - Preheater RTD reading less than 60°F.<br/>C - Probably an open circuit.<br/>T - Anytime power switch is ON.</p>                                    | <p>1. Allow unit to Aerate, then retry cycle.<br/>2. If problem does not clear, call an AMSCO Service Representative.</p>  |
| <p style="text-align: center;">PREHTR</p> <p>CYC ABORTED 12:34:58<br/>PREHTR RTD PROB HIGH</p> | <p>D - Preheater RTD reading more than 461°F.<br/>C - Preheater RTD probably shorted.<br/>T - Anytime power switch is ON.</p>                             | <p>1. Allow unit to Aerate, then retry cycle.<br/>2. If problem does not clear, call an AMSCO Service Representative.</p>  |
| <p style="text-align: center;">DESIC</p> <p>CYC ABORTED 12:34:58<br/>DESIC RTD PROB LOW</p>    | <p>D - Desiccant RTD reading less than 60°F.<br/>C - Probably open circuit.<br/>T - In Regenerate phase only.</p>   | <p>1. Allow unit to Aerate, then retry cycle.<br/>2. If problem does not clear, call an AMSCO Service Representative.</p>  |
| <p style="text-align: center;">DESIC</p> <p>CYC ABORTED 12:34:58<br/>DESIC RTD PROB HIGH</p>   | <p>D - Desiccant RTD reading more than 300°F.<br/>C - Probably shorted.<br/>T - In Regenerate only.</p>   | <p>1. Allow unit to Aerate, then retry cycle.<br/>2. If problem does not clear, call an AMSCO Service Representative.</p>  |
| <p style="text-align: center;">VHPRET</p> <p>CYC ABORTED 12:34:58<br/>VHPRET RTD PROB LOW</p>  | <p>D - VHP Return RTD reading less than 60°F.<br/>C - Probably open circuit.<br/>T - In any cycle phase except Regenerate.</p>                            | <p>1. Allow unit to Aerate, then retry cycle.<br/>2. If problem does not clear, call an AMSCO Service Representative.</p>  |
| <p style="text-align: center;">VHPRET</p> <p>CYC ABORTED 12:34:58<br/>VHPRET RTD PROB HIGH</p> | <p>D - VHP Return RTD reading more than 300°F.<br/>C - Probably shorted.<br/>T - In any cycle phase except Regenerate.</p>                                | <p>1. Allow unit to Aerate, then retry cycle.<br/>2. If problem does not clear, call an AMSCO Service Representative.</p>  |
| <p style="text-align: center;">VAP</p> <p>CYC ABORTED 12:34:58<br/>VAP TEMP 30 BELOW SP</p>    | <p>D - Vaporizer temperature dropped 30°F below its set point.<br/>T - In Condition and Sterilize.</p>  | <p>1. Allow unit to Aerate, then retry cycle.<br/>2. Check vaporizer set point; it should be approximately 212° F.<br/>3. If problem does not clear, call an AMSCO Service Representative.</p> |

| ABORT DISPLAY   | DESCRIPTION/CAUSE/TIME<br>D=Description C=Cause T=Time  | OPERATOR ACTION  |
|---|---|--|
| <p style="text-align: center;">ERROR</p> <p>CYC ABORTED 12:34:56<br/>VAP TEM 30 ABOVE SP</p>  | <p>D - Vaporizer temperature increased 30°F above its set point.<br/>T - In Condition and Sterilize.</p>                                  | <p>1. Allow unit to Aerate, then retry cycle.<br/>2. If problem does not clear, call an AMSCO Service Representative.</p>  |
| <p style="text-align: center;">ERROR</p> <p>CYC ABORTED 12:34:56<br/>980 GRAM H2O2 LIMIT</p>  | <p>D - Cycle requires more than 980 grams of peroxide.<br/>T - Prior to cycle when checking weight.</p>                                   | <p>1. Allow unit to Aerate, then retry cycle.<br/>2. Maximum H<sub>2</sub>O<sub>2</sub> use for a cycle cannot exceed 980 grams.<br/>3. If problem does not clear, call an AMSCO Service Representative.</p>                             |
| <p style="text-align: center;">ERROR</p> <p>CYC ABORTED 12:34:56<br/>VHP OUT HOSE OFF</p>     | <p>D - VHP output hose came off in cycle.<br/>T - Any cycle except Regenerate.</p>  | <p>1. Reattach the hose (see WARNINGS in Section 1).<br/>2. Allow unit to Aerate, then retry cycle.</p>  |
| <p style="text-align: center;">ERROR</p> <p>CYC ABORTED 12:34:56<br/>VHP IN HOSE OFF</p>      | <p>D - VHP input hose came off in cycle.<br/>T - Any cycle except Regenerate.</p>   | <p>1. Reattach the hose (see WARNINGS in Section 1).<br/>2. Allow unit to Aerate, then retry cycle.</p>  |
| <p style="text-align: center;">ERROR</p> <p>CYC ABORTED 12:34:56<br/>REGEN OUT HOSE OFF</p>   | <p>D - Regenerate output hose off.<br/>T - In Regenerate or in standard cycle with Auto-Regenerate programmed.</p>                        | <p>1. Reattach the hose (see WARNINGS in Section 1).<br/>2. Allow unit to Aerate, then retry cycle.</p>  |
| <p style="text-align: center;">ERROR</p> <p>CYC ABORTED 12:34:56<br/>REGEN OUT PLUG OFF</p>   | <p>D - Regenerate output plug off.<br/>T - In standard cycle with no Auto-Regenerate programmed.</p>                                      | <p>1. Reattach the hose (see WARNINGS in Section 1).<br/>2. Allow unit to Aerate, then retry cycle.</p>  |
| <p style="text-align: center;">ERROR</p> <p>CYC ABORTED 12:34:56<br/>V4 DIDNT OPEN</p>        | <p>D - Output ball valve (V4 - air supply) took longer than 10 seconds to open.<br/>T - Prior to standard cycle and in service test.</p>  | <p>1. Allow unit to Aerate, then retry cycle.<br/>2. If problem does not clear, call an AMSCO Service Representative.</p>  |
| <p style="text-align: center;">ERROR</p> <p>CYC ABORTED 12:34:56<br/>V4 DIDNT CLOSE</p>       | <p>D - Output ball valve (V4 - air supply) took longer than 10 seconds to close.<br/>T - Prior to standard cycle and in service test.</p> | <p>1. Allow unit to Aerate, then retry cycle.<br/>2. If problem does not clear, call an AMSCO Service Representative.</p>  |
| <p style="text-align: center;">ERROR</p> <p>CYC ABORTED 12:34:56<br/>V5 DIDNT OPEN</p>        | <p>D - Input ball valve (V5 - air return) took longer than 10 seconds to open.<br/>T - Prior to standard cycle and in service test.</p>   | <p>1. Allow unit to Aerate, then retry cycle.<br/>2. If problem does not clear, call an AMSCO Service Representative.</p>  |
| <p style="text-align: center;">ERROR</p> <p>CYC ABORTED 12:34:56<br/>V5 DIDNT CLOSE</p>       | <p>D - Input ball valve (V5 - air return) took longer than 10 seconds to close.<br/>T - Prior to standard cycle and in service test.</p>  | <p>1. Allow unit to Aerate, then retry cycle.<br/>2. If problem does not clear, call an AMSCO Service Representative.</p>  |
| <p style="text-align: center;">ERROR</p> <p>CYC ABORTED 12:34:56<br/>CHAMBER UNDER PRESS.</p> | <p>D - Chamber pressure went below user selectable vacuum setting.<br/>T - In standard cycle with chamber vacuum control requested.</p>   | <p>1. Check that enclosure is properly sealed; pressing on enclosure during a cycle may cause this situation.<br/>2. Allow unit to Aerate, then retry cycle.<br/>3. If problem does not clear, call an AMSCO Service Representative.</p> |

| ABORT DISPLAY  | DESCRIPTION/CAUSE/TIME<br>D=Description C=Cause T=Time  | OPERATOR ACTION   |
|--|---|---|
| <p style="text-align: center;">7201</p> <p>CYC ABORTED 12:34:56<br/>CHAMBER OVER PRESS.</p>  | <p>D - Chamber pressure went above user selectable vacuum setting.<br/>T - In standard cycle with chamber pressure control requested.</p>   | <ol style="list-style-type: none"> <li>1. Check that enclosure is properly sealed; pressing on enclosure during a cycle may cause this situation.</li> <li>2. Allow unit to Aerate, then retry cycle.</li> <li>3. If problem does not clear, call an AMSCO Service Representative.</li> </ol> |
| <p style="text-align: center;">7202</p> <p>CYC ABORTED 12:34:56<br/>EXT LOW PRESS ALARM</p>  | <p>D - Chamber pressure went below user set external pressure device setting.<br/>T - In standard cycle with chamber vacuum control requested.</p>  | <ol style="list-style-type: none"> <li>1. Check that enclosure is properly sealed; pressing on enclosure during a cycle may cause this situation.</li> <li>2. Allow unit to Aerate, then retry cycle.</li> <li>3. If problem does not clear, call an AMSCO Service Representative.</li> </ol> |
| <p style="text-align: center;">7203</p> <p>CYC ABORTED 12:34:56<br/>EXT HIGH PRESS ALARM</p> | <p>D - Chamber pressure went above user set external pressure device setting.<br/>T - In standard cycle with chamber pressure control requested.</p>  | <ol style="list-style-type: none"> <li>1. Check that enclosure is properly sealed; pressing on enclosure during a cycle may cause this situation.</li> <li>2. Allow unit to Aerate, then retry cycle.</li> <li>3. If problem does not clear, call an AMSCO Service Representative.</li> </ol> |
| <p style="text-align: center;">7204</p> <p>CYC ABORTED 12:34:56<br/>SLOW REGEN BLOWER</p>    | <p>D - Regenerate blower cannot run fast enough to maintain 4 SCFM.<br/>T - In Regenerate only.</p>   | <ol style="list-style-type: none"> <li>1. Check for a restriction in the flow loop.</li> <li>2. Allow unit to Aerate, then retry cycle.</li> <li>3. If problem does not clear, call an AMSCO Service Representative.</li> </ol>   |
| <p style="text-align: center;">7205</p> <p>CYC ABORTED 12:34:56<br/>FAST REGEN BLOWER</p>    | <p>D - Regenerate blower cannot run slow enough to maintain 4 SCFM.<br/>T - In Regenerate only.</p>   | <ol style="list-style-type: none"> <li>1. Check for a restriction in the flow loop.</li> <li>2. Allow unit to Aerate, then retry cycle.</li> <li>3. If problem does not clear, call an AMSCO Service Representative.</li> </ol>   |
| <p style="text-align: center;">7206</p> <p>CYC ABORTED 12:34:56<br/>SLOW FLOW BLOWER</p>     | <p>D - Cycle flow blower cannot run fast enough to maintain selected air flow.<br/>T - In standard cycle. Also, the warning lamps flash and the buzzer sounds.</p>  | <ol style="list-style-type: none"> <li>1. Check for a restriction in the flow loop.</li> <li>2. Allow unit to Aerate, then retry cycle.</li> <li>3. If problem does not clear, call an AMSCO Service Representative.</li> </ol>   |
| <p>Followed By ... (If the blower is not functioning at a normal capacity)</p>               |   |   |
| <p style="text-align: center;">7207</p> <p>LOW AIR FLOW ABORT<br/>CANT AERATE</p>            |   |   |
| <p style="text-align: center;">7208</p> <p>CYC ABORTED 12:34:56<br/>FAST FLOW BLOWER</p>     | <p>D - Cycle flow blower cannot run slow enough to maintain selected air flow.<br/>T - In standard cycle.</p>   | <ol style="list-style-type: none"> <li>1. Check for a restriction in the flow loop.</li> <li>2. Allow unit to Aerate, then retry cycle.</li> <li>3. If problem does not clear, call an AMSCO Service Representative.</li> </ol>   |
| <p style="text-align: center;">7209</p> <p>CYC ABORTED 12:34:56<br/>NO PEROXIDE INJECTED</p> | <p>D - First scale reading less than or equal to second reading over a one-minute period.<br/>C - No peroxide removed from scale, or control board not reading scale.<br/>T - In Condition and Sterilize.</p> | <ol style="list-style-type: none"> <li>1. Check that electronic balance has been zeroed with reservoir and tubing included (see Section X).</li> <li>2. Allow unit to Aerate, then retry cycle.</li> <li>2. If problem does not clear, call an AMSCO Service Representative.</li> </ol>       |

| ABORT DISPLAY | DESCRIPTION/CAUSE/TIME<br>D=Description C=Cause T=Time | OPERATOR ACTION |
|---------------|--|-----------------|
|---------------|--|-----------------|

(7/21)

CYC ABORTED      12:34:58  
 INJ SYS PROB HI RPM

D - Peristaltic pump can't run fast enough to maintain selected inject rate.  
 C - Probably plugged needles or open anti-siphon valve.  
 T - In Condition and Sterilize.

1. Allow unit to Aerate, then retry cycle.  
 2. If problem does not clear, call an AMSCO Service Representative.

(7/21)

CYC ABORTED      12:34:58  
 INJ SYS PROB LOW RPM

D - Peristaltic pump can't run slow enough to maintain selected inject rate.  
 C - Probably line off after pump or scale/reservoir interference problem.  
 T - In Condition and Sterilize.

1. Allow unit to Aerate, then retry cycle.  
 2. If problem does not clear, call an AMSCO Service Representative.

(7/21)

CYC ABORTED      12:34:58  
 INJ SYS OVER PRESS.

D - Pressure on needles greater than 2 PSI.  
 C - Probably plugged needles.  
 T - In Condition and Sterilize.

1. Allow unit to Aerate, then retry cycle.  
 2. If problem does not clear, call an AMSCO Service Representative.



## **Measuring VHP Residuals Within an Enclosure**

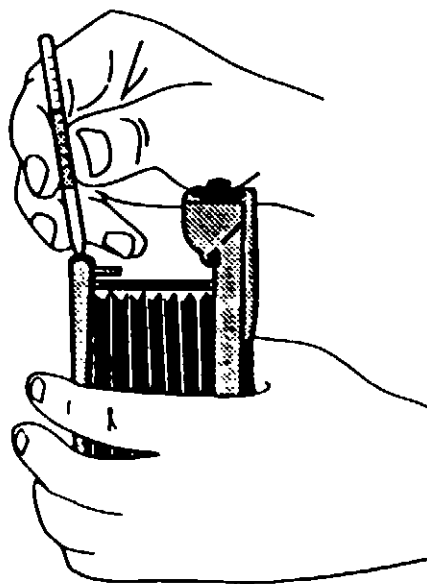
The hydrogen peroxide concentration within a pre-cleaned, sealed enclosure must be checked at the end of the Aeration phase to assure that the concentration of hydrogen peroxide is at an acceptable level. This is important to the validation process, as well as in determining that the enclosure can be safely accessed. It is important that the method used to measure the hydrogen peroxide concentration within the pre-cleaned, sealed enclosure not compromise the decontamination which has been achieved.

## **Measuring VHP Residuals in Glove Boxes and Isolators**

Glove boxes and isolators have gloved arms and/or half suits which allow the operator to work within the sealed enclosure without breaking the microbial barrier.

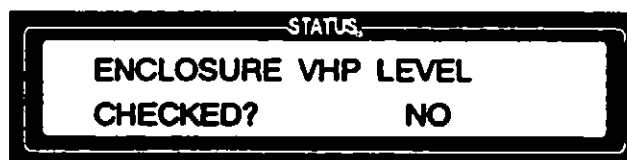
When processing glove boxes or isolators with the VHP 1000 generator, use the following procedure to measure hydrogen peroxide concentration.

1. Obtain a hand operated Multi Gas Detector, bellows pump, and hydrogen peroxide detector tubes.
2. Perform a leak test on the bellows pump per manufacturer's recommendations.
3. Obtain several screw cap test tubes that are large enough to hold a single Dräger tube.
4. Place one end of the tube in the break-off eyelet of the bellows pump (see Figure 1). Hold pump over a trash can and carefully break off the tip. Do this to both ends of the tube.



**Figure 15-1. Break tips off Dräger Tubes**

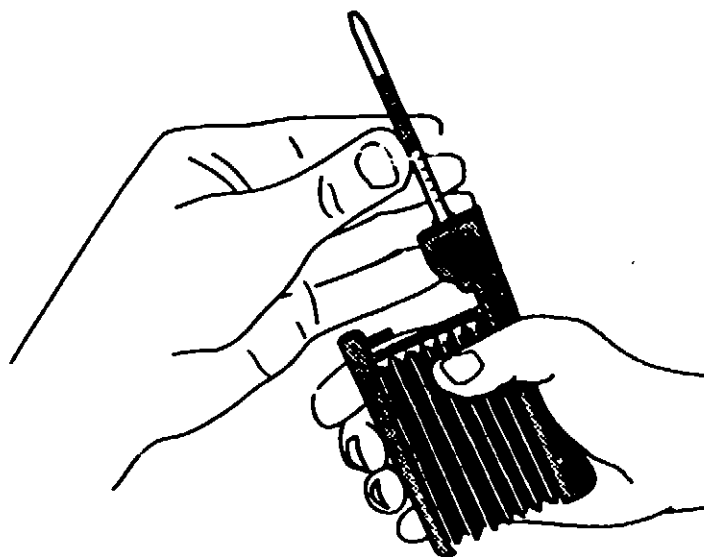
5. Remove the screw cap from from a test tube and insert the Dräger® tube. Replace the screw cap.
6. Place the bellows pump and the test tubes inside the glove box or isolator prior to running a bio-decontamination cycle.
7. Seal the glove box or isolator.
8. Connect the VHP 1000 to the glove box or isolator as outlined in Section 6 and run a validated sterilization cycle per instructions in Section 7 or 8.
9. When the AERATION timer counts down to zero, the control prompts the operator with the following display:



**⚠ WARNING - PERSONAL INJURY HAZARD:**  
Do not access a hot suit until a Dräger has been used to verify that the VHP residual level in the enclosure is within an acceptable range.

**⚠ WARNING - PERSONAL INJURY HAZARD:**  
Dräger tubes must be used with Dräger pumps to produce reliable indications.

10. Using the gloved arms in the glove box or isolator, remove the Dräger tube from the test tube.
11. Tightly insert the Dräger tube into the pump head with the arrow pointing toward the pump (see Figure 2).



**Figure 15-2. Placing Dräger Tube into Pump**

12. Compress the bellows completely. Release the bellows to allow a constant sample volume to automatically flow through the Dräger tube (see Figures 15-3, 15-4, and 15-5).
13. Repeat Step 12 two more times. If after three pumps the tube indicates between .1 and .7 ppm, multiply the value by 30 (deviation  $\pm$  35%) to get an approximate VHP residual level in the enclosure. See AMSCO VHP Validation Manual (P-129363-317) for more information.
14. Evaluate the indicator after three pumps as described in the AMSCO VHP Validation Manual (P-129363-317). If more pumps are needed, continue pumping, repeat step 12 for a total of 20 compressions.

**WARNING - CHEMICAL INJURY HAZARD:**  
 At the end of the AERATION phase, use a Dräger tube to check and monitor the VHP concentration within the enclosure. The VHP concentration should be at or below the OSHA PEL (as of January 1, 1990 - 1 ppm, 8-hour TWA) before the enclosure is accessed.

15. Evaluate the indicator after 20 compressions as described in the Dräger Tube Operating Procedures. If the indicator is at, or below, an acceptable VHP level, press the VALUE (UP) touch pad to change the display from NO to YES, then press the CHANGE VALUES touch pad.
16. If the indicator is above an acceptable VHP level, allow the VHP 1000 to continue aerating the enclosure
17. After an appropriate extension of the AERATION phase, repeat Steps 10 - 15
18. Repeat Step 17 (if necessary) until the residual VHP is at an acceptable level.

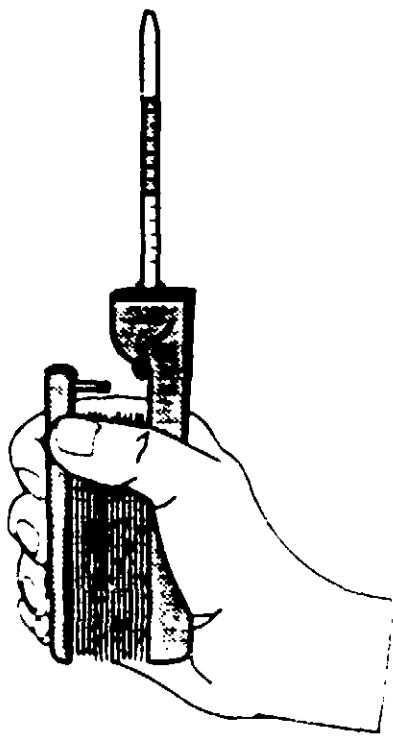


Figure 15-4

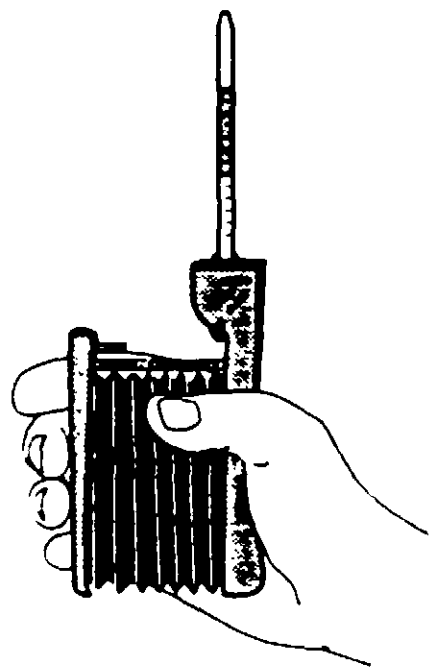


Figure 15-3

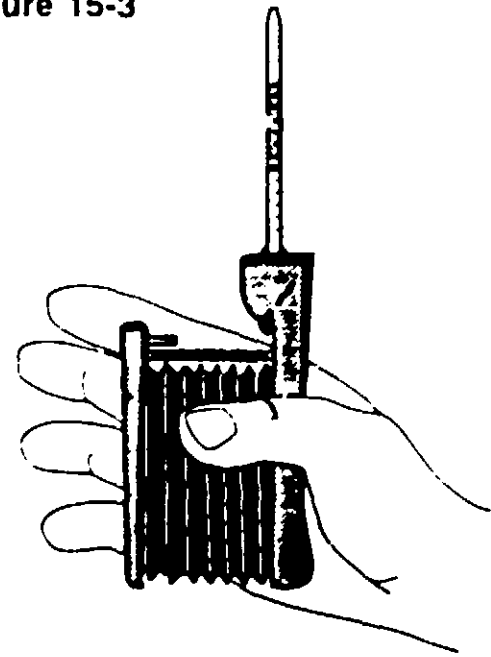
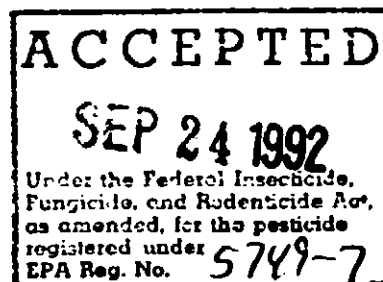


Figure 15-5

**ACCEPTED**  
**SEP 24 1992**  
 Under the Federal Insecticide, Fungicide, and Rodenticide Act, as amended, for the pesticide registered under EPA Reg. No. 5749-7

## Measuring VHP Residuals in Other Enclosures

Enclosures that do not have gloved arms or half-suits will need to have an access port for VHP sampling. This access port must be designed such that there is no compromise to the level of bio-decontamination within the enclosure. HEPA filters and valving can be used to provide an access port. It is also possible to install an access port in the return line of the VHP generator. Consult the AMSCO Service Department for appropriate guidance and training on how to install VHP access ports.



## Ordering Information

**⚠ WARNING - PERSONAL INJURY AND/OR EQUIPMENT DAMAGE HAZARD:** Only AMSCO or AMSCO-trained service personnel should make repairs and adjustments to this equipment. Maintenance done by unqualified personnel or installation of unauthorized parts could cause personal injury, invalidate the warranty, or result in costly damage.

Use only AMSCO authorized parts on this equipment. Use of unauthorized parts will void the warranty. To order replacement parts and/or supply products, proceed as follows:

1. Include the part number and description as listed below.
2. Include the model and serial numbers of your equipment on your order.
3. Send your order directly to the AMSCO Sales and Service Center serving your area.

Contact your AMSCO representative if you need parts that are not listed below.

## Recommended Spare Parts

The parts listed in this section are those that would be necessary to do minor maintenance on the VHP Generator.

| RECOMMENDED SPARE PARTS        |              |      |
|--------------------------------|--------------|------|
| Description                    | Part Number  | Qty  |
| FUSE, 20A, Slo-Blo®            | P-129363-088 | 2    |
| FITTING, Cam-lok Quick Connect | P-136808-071 | 2    |
| FITTING, Tri-clover            | P-129363-180 | 2    |
| HOSE                           | R-3500-045   | 25ft |
| ASSEMBLY, Pressure Sensor Line | R-3500-030   | 1    |
| BULB, Warning Light            | P-129363-089 | 2    |
| LENS, Red, Warning Light       | P-129363-085 | 1    |
| CORD, Power                    | P-93912-130  | 1    |
| *FILTER, Inlet, HEPA           | P-93912-001  | 1    |
| *FILTER, Outlet, HEPA          | P-146656-053 | 1    |
| *GASKET, HEPA Filter           | P-136808-007 | 3    |
| *CONNECTOR, Auxiliary Output   | P-93912-404  | 1    |
| *CONNECTOR, Auxiliary Input    | P-93912-402  | 1    |
| *FUSE, 2A (Pump)               | P-129363-160 | 2    |
| *FUSE, 1/2A (AC Outputs)       | P129361-141  | 4    |
| *FUSE, 5A (Filter) Slo-Blo®    | P-118142-091 | 1    |

**ACCEPTED**  
**SEP 24 1992**  
 Under the Federal Insecticide, Fungicide, and Rodenticide Act, on 09/24/92, for the pesticide registration under EPA Reg. No. 5749-7

*These parts to be installed by AMSCO or AMSCO-trained personnel only.*

Ⓢ Slo-Blo is a registered trademark of Littelfuse, a subsidiary of Tracor

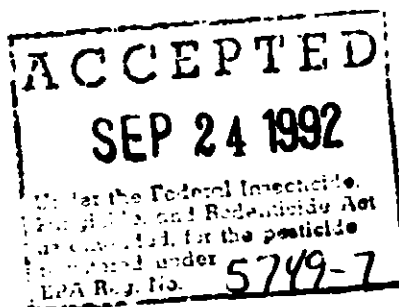
## Supply Products

**NOTE:** Use only AMSCO-registered sterilant in AMSCO cartridges in the VHP Generator. AMSCO sterilant cartridges contain high purity 30% hydrogen peroxide and are filled under controlled conditions to assure effectiveness through the expiration date stamped on the label. Federal law requires that the sterilant be registered with the U.S. EPA. Use of unregistered sterilant is a violation of the FIFRA laws and will void the warranty.

**⚠ WARNING - PERSONAL INJURY AND UNSTERILE ENCLOSURE HAZARD:** Use only AMSCO brand hydrogen peroxide sterilant in AMSCO cartridges. See Section 1 for expanded WARNINGS.

| SELECTED SUPPLY PRODUCTS             |              |
|--------------------------------------|--------------|
| Description                          | Part Number  |
| PAPER, Printer (Pkg. of 5 Rolls)     | P-129359-008 |
| CARTRIDGE, Sterilant (Carton of 6)*  | P-93912-362  |
| CHEMICAL INDICATORS (Pkg. of 100)    | NB302        |
| BIOLOGICAL INDICATORS (Pkg. of 100)  | NA301        |
| BIOLOGICAL INDICATORS (Pkg. of 500)  | NA302        |
| AMSCO PRY® STAIN REMOVER CREAM       | NM430        |
| Dräger Multi Gas Detector® Tubes     | N/A          |
| Dräger Gas Detection Pump - Model 31 | N/A          |
| Merckoquant® 1001 Test Strips        | N/A          |

\*Allow a week to 10 days for delivery of sterilant cartridges.



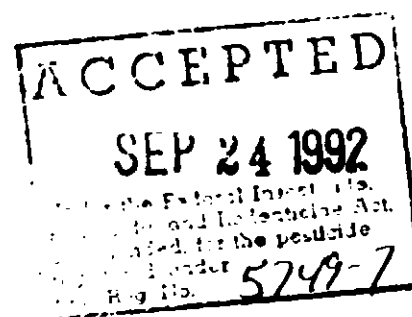
- Pry is a registered trademark of AMSCO
- Multi Gas Detector is a registered trademark of Dräger
- Merckoquant is a registered trademark of E. Merck

## VHP Generator Publications

Publications listed in this section are those associated with the use and maintenance of this VHP Generator.

When ordering, please include the part number (if applicable), description and quantity of each publication requested. Order directly from your AMSCO representative.

| PUBLICATION                              | PART NUMBER  |
|--|--------------|
| Tech Data Sheet                          | SD-500       |
| Product Brochure                         | SI-3100      |
| Concept Wrap                             | SI-3000      |
| Biological & Chemical Indicator Brochure | SI-3800      |
| Uncrating/Installation Instructions      | P-129363-062 |
| Equipment/Operating Manual               | P-129363-064 |
| Maintenance Manual                       | P-764324-608 |
| Equipment Drawing                        | 93912-050    |



# NOTES

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**ACCEPTED**  
**SEP 24 1992**  
Under the Federal Insecticide,  
Fungicide, and Rodenticide Act,  
as amended, for the pesticide  
registered under  
EPA Reg. No. 5749-7