8

Treatment Manual

Equipment

Contents

Thermal Conductivity Gas Analyzers

The thermal conductivity gas analyzer (T/C) is a portable instrument specifically designed to determine the concentration of gases under a tarpaulin or within a chamber during a fumigation. These fumigation gases include methyl bromide (MB) and sulfuryl fluoride (SF).

Instrument Description

There are two instrument brands approved for use during a PPQ-supervised fumigation:

- Fumiscope® (**Figure 8-1-1**)
- Gow-Mac® (**Figure 8-1-2**)

These instruments are lightweight, portable, and completely contained in a compact metal case. They contain a thermal conductivity cell, scale, gas pump, range switch, and gas flow meter. A gas drying tube is also included. For large enclosures, an auxiliary pump may be needed.

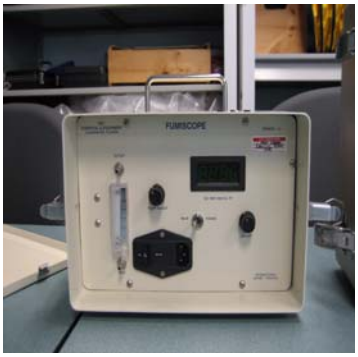


FIGURE 8-1-1: Fumiscopes®

FIGURE 8-1-2: GowMac®

Inlet

The inlet tube connector is the gas inlet for the instrument. The sampling lines are 1/4" inner diameter (I.D.) and are connected to the inlet through the drying tube.

Flow Rate Meter

The flow rate meter indicates the gas flow rate in “simulated cubic feet per hour (SCFH).” Note: The flow rate should always be read at the middle of the ball.

Flow Rate Adjustment

The flow rate adjustment dial controls the air or gas flow rate by adjusting the pump. After connecting to the gas sampling line, adjust the flow rate upward until it reads exactly 1.0 SCFH.

Scale or Digital Display

The scale or digital display indicates the concentration of the fumigant in ounces per 1,000 cubic feet (milligrams per liter or grams per cubic meter). Record the gas concentration reading only after this meter stabilizes, which may take a minute or more (depending on the length of the tubing and whether an auxiliary pump is being used). Digital Fumiscope® models can indicate a range from 0 to 2999 ounces per 1,000 cubic feet. When using the GowMac® for sulfuryl fluoride, the concentration is calculated as the reading multiplied by a specific factor.

Zero Adjustment

The zero adjustment dial is used to adjust the display to zero after the instrument has warmed up.

The instrument should be set to zero before taking concentration readings at each required time interval and reset to zero after each reading.

Line Switches

Line switches control the electrical supply to the pump and scale.

Fumigant Selector Switch

The fumigant selector switch (Fumiscope® only) changes the display to register either methyl bromide or sulfuryl fluoride (Vikane®.)

Range Switch

The range switch (GowMac® only) regulates the scale indicating the concentrations of fumigant measured, for example, 0 to 100 ounces per 1,000 cubic foot or 101 to 200 ounces per 1,000 cubic foot (some models).

Exhaust Outlet

Always connect an exhaust line to the exhaust outlet to carry gas away from the instrument and operator. When using the T/C unit in confined or poorly ventilated areas, recirculate the exhaust gas back to the fumigation space or exhaust it to the outside.

Drying Tube

Use drying tubes (filter tube) with a prepared chemical for removing certain contaminant gases or vapors that interfere with correct fumigant concentration readings. The tubes will contain a desiccant

such as Drierite® (granules of anhydrous calcium sulfate), or Ascarite® (sodium hydroxide). Both are available from scientific supply houses. **Never mix Drierite® and Ascarite® in the same tube.**

When a drying tube is used, place a thin layer of glass wool or aquarium filter wool at the bottom and top of the tube to prevent small particles from sifting into the T/C unit. Using absorbent cotton or similar materials is **not** recommended. Cotton tends to pick up moisture and to become matted, and once matted, the cotton may restrict normal air flow, thus, adversely affecting the T/C unit's operation.

Mount the drying tube *vertically* so the gas mixture moves through the drying material and does **not** pass over the top. The gas mixture will pass over the top of the drying tube when the tube is mounted horizontally (lengthwise).

Drierite®

Always use anhydrous calcium sulfate (Drierite®) to remove moisture from the gas sample. Insert the drying tubes in the gas sampling line just before the inlet connection. Drierite® should be fresh and frequently changed to ensure correct readings. Drierite®, blue in color when dry, turns pink when moisture is absorbed. Replace the Drierite® when most of it has turned pink. In extremely high moisture conditions, two Drierite® tubes can be connected in tandem. Close drying tube openings when **not** in use.

Ascarite®

T/C gas analyzers are sensitive to a number of gases other than MB. For example, CO_2 may be troublesome when fumigating fruit where kerosene heaters are placed under the tarpaulin to raise pulp temperatures, or with plant material packed in peat moss or subsoil. Correct MB gas concentration readings may be obtained if a CO_2 absorbent is used in the gas sampling line before the air-gas mixture enters the T/C unit. A CO_2 absorbent that can be used is Ascarite®. Observe the poison warning labels on the containers when using Ascarite®. **Tubes containing Ascarite® should be clearly labeled, "Warning—Avoid contact with skin, eyes, and clothing."**

During a fumigation of living plant products, such as plants, plant material, logs, wood and wood products, tubes containing Ascarite® **must** be used to remove carbon dioxide from gas samples. Used Ascarite® should be discarded per label instructions. The Ascarite® tube should be connected between the Drierite® tube and the sample inlet. **Never mix Drierite® and Ascarite® in the same tube**. Ascarite® should be replaced when the granules begin to aggregate or become moist.

Because a chemical reaction will occur, ***never*** use Ascarite® when taking readings of SF.

Instrument Standardization

Instrument standardization is the first and basic operation. In order to standardize the instrument, do the following:

1. Connect the instrument to an electrical outlet with proper voltage and set the pump and meter switches to “on”; if inoperable, check fuse (replacements—Little Fuse or Buss #3AG 1/2 Amp.—should be kept on hand).
2. Attach the drying tube to the inlet port.
   - **A.** Give the instrument a tightness test.
   - **B.** A tightness test can be accomplished by placing a finger over the inlet of the drying tube; if the tubing and connections are tight, the flow ball in the flow meter should then fall to zero.
3. Warm up the instrument for 15 to 30 minutes.

Important

The manufacturer recommends that the analyzer be kept at the same temperature as the fumigated site. It may take up to two hours for the analyzer to acclimate if moved from extreme temperatures.

4. Adjust the gas flow rate to one SCFH by adjusting the flow rate knob.
   - **A.** If the flow rate knob is turned counterclockwise too far, the pump will emit noises and cease to operate properly.
   - **B.** When properly adjusted, the flow ball should float at the center mark, or slightly below it, on the calibrated glass cylinder.
   - **C.** The pump now draws dry, fresh air through the T/C cell; the air enters via the inlet on the face of the instrument, passes through the cell, and leaves through the exhaust outlet.
5. Turn the zero adjustment knob to obtain a zero reading on the meter.
   - **A.** To obtain a stable zero reading, several additional adjustments during the first few minutes may be necessary.

Standardization is now complete and readings can be made of fumigant-air mixture drawn through the unit. At this point, it may be necessary to replace the desiccant.

The difference in the thermal conductivity of the fumigant-air mixture as compared with fresh air is measured electrically and indicated on the meter as concentration readings in ounces of gas per 1,000 cubic feet. T/C units used in PPQ must be calibrated for MB and/or SF by

the manufacturer or an approved outside contractor prior to use. When fumigations are under even a small vacuum, readings will **not** be accurate.

Operation Procedures

Because of the variety of fumigation situations, some adjustments may be necessary to meet specific needs. Nevertheless, this outline should be helpful in establishing correct operational procedures.

The proper use of the T/C unit is discussed under two headings:

- Selecting operational site
- Measuring gas concentrations

Selecting Operational Site for T/C Unit

The T/C unit should be at least 30 feet upwind from the fumigation site to allow the operator to function without the fear of accidental exposure to gas and to allow for easy exit in an emergency. It should be close enough to the fumigation site to avoid using unreasonable lengths of sampling lines, to allow for constant surveillance of the fumigation during testing, and to avoid interference with other activities in the area. Avoid excessive wiring length. When T/C unit readings in multiple locations are necessary, see that each location is the best available.

The T/C unit should be supported on a sturdy, level surface, outside the traffic pattern, and protected from wind, rain, excessive cold, and, in hot weather, sun. In some cases, temporary shelter such as a tarpaulin cover may be adequate. The gas concentration readings indicated by the T/C unit may be inaccurate unless the unit is placed in an area that is approximately the same temperature as the gas mixture in the enclosure being fumigated. If the temperature of the gas mixture within the fumigated enclosure is approximately equal to that of the ambient air outside the enclosure, the gas concentration readings indicated by the T/C unit's meter will be generally more accurate. If there are great differences between the two temperatures, water vapor may condense inside the gas sampling leads. Such condensation, if desiccant is saturated, can result in a lower than normal T/C meter reading, thus leading to the unnecessary addition of fumigant to compensate for the apparent shortage. Therefore, if vapor condensation appears inside the gas sampling leads, purge the line and move the T/C unit to a new location where the ambient temperature approximates that of the enclosure.

Most T/C units operate on 110 to 120 volts alternating current (AC). T/C units operating on 210 to 220 volts AC on direct current (DC) are available for overseas or other assignments as necessary. A converter is required to use DC. Keep extension wiring and gas sampling line length to a practical minimum and raise extension wiring above floor level when feasible.

Measuring Gas Concentrations With the Standardized Unit

As a protection for the cell and the pump of T/C units, **use a drying tube filled with Drierite® at all times.**

When taking gas concentration readings, first warm up the unit for at least 15 to 30 minutes depending on ambient temperatures. Then turn on the pump and adjust the gas flow meter to a 1.0 SCFH flow. Turn the zero adjustment knob to obtain a zero reading on the meter.

The unit is now ready to measure gas samples drawn through position tagged tubes from the area being treated. The meter will indicate gas concentrations in ounces per 1,000 cubic feet (grams per cubic meter).

Connect the gas sampling line to the Drierite tube using 1/4 inch ID polyethylene tubing. Allow sufficient time to draw a true sample. With 150 to 200 feet of 1/4 inch ID tubing and a temperature of 70 °F, a sufficient amount of time will be approximately 7 minutes. Stations equipped with small, auxiliary pumps can draw a sample through the same length of tubing in 12 to 15 seconds.

Wait until the analyzer reaches the maximum reading (at least thirty seconds) and does **not** move for thirty seconds. Ensure the flow meter still reads 1.0 SCFH. This is the gas reading. Record this reading on the PPQ Form 429.

Disconnect the sampling line and allow the pump to draw uncontaminated air through the T/C cell. The instrument should return to zero, however it may be necessary to re-zero the analyzer. Again, ensure that the flow meter reads 1.0 SCFH. **Always re-zero the analyzer before taking the next reading.**

After taking the final reading at the end of the fumigation, thoroughly purge the unit by disconnecting it from the gas sampling line and allowing the pump to draw fresh air through the instrument for several minutes.

Maintenance

If it is to function properly, the T/C unit requires the same attention as any other equipment. While the instrument is designed specifically for field use, the components, particularly the meter, may be damaged easily. To maintain an instrument capable of accurate gas concentration readings, careful handling is essential. If repairs are needed and are extensive, or the parts are **not** readily available, there will be a delay in returning the instrument. Should the need for a substitute T/C unit occur, the port should be prepared to obtain one from another source.

Repair and Calibration

Under normal service, the T/C unit will hold its calibration for a considerable length of time. To ensure all units are providing accurate gas concentration readings, recalibrate T/C units at least annually; calibrate more often if use is frequent.

Send the instrument by insured delivery service (ie. Federal Express, United Parcel Service, U.S. postal priority mail) to one of the contractors listed below. To prevent damage, the unit must be well-packed and shipped in a durable, tamper-proof box.

Prepare a memorandum to accompany each instrument explaining the need for sending the unit. Ensure all instruments are shipped with a proper return address, name of a contact person, and telephone number. The T/C unit will be calibrated for MB only, unless the PPQ office requests calibration for SF. **Notify the contractor if Ascarite® will be utilized during the readings, as the T/C must be calibrated using this type of absorbent.** All port locations will be responsible for payments to contractors.

Use one of the following contractors for repair and calibration:

Key Chemical and Equipment Co. (BPA# 45-6395-3-2872)
13195 49th St. North
Unit A
Clearwater, FL 33762
tel (727) 572-1159
fax (727) 572-4595
http://www.fumiscope.com/

Cardinal Professional Products (BPA# 45-6395-3-2871)
2641 W. Woodland Drive
Anaheim, CA 92801-2628
tel (714) 761-3292
fax (714) 761-2095
http://www.cardinalproproducts.com/

Infrared Spectroscopy Gas Monitoring Device

Infrared spectroscopy is an accurate and efficient method for measuring methyl bromide gas concentrations. There is one unit currently approved for use by PPQ. The MB-ContainIR™ is manufactured by Spectros Instruments Inc., Hopedale, MA, and will be referred to in this document as the "Spectros." The Spectros is light-weight (9 pounds; 4 kg) and battery operated.

FIGURE 8-1-3 Spectros Methyl Bromide Monitor

The Spectros uses a technology known as "non-dispersive infrared technology" (NDIR.) NDIR is based on Beer's Law (also known as Lambert-Beer Law or Beer-Lambert-Bouguer Law) that relates the absorption of light to the properties of the material through which the light is traveling. The Spectros is not affected by other volatile organic compounds such as carbon dioxide, eliminating the need for Ascarite™. Other benefits of the unit include:

- Audible and visible programmable alarm
- Battery powered and portable
- Measuring range for methyl bromide 0-240 oz./1000 ft^3 (g/m^3)
  - Sensitivity 0.16 oz./1000 ft^3 (g/m^3)
  - Accuracy 0.08 oz./1000 ft^3 (g/m^3)
- Operating temperature 32 °F - 122 °F (0 °C - 50 °C)
- Variable temperature compensation

The information and guidelines in this chapter are based on the Spectros Inc. Operation and Maintenance Guide. Contact **Spectros** for more detailed operating instructions or technical assistance.

Important points to remember:


Important

- This monitor **is not** and **should not** be used as a worker safety clearance device.
- This monitor is **not** set up to evaluate, test, or determine readings for other approved fumigants that PPQ uses, such as **phosphine** or **sulfuryl fluoride.**
- Do not operate the monitor in the presence of flammable liquids, vapors, or aerosols.
- Do not use soap and water to clean the monitor; use a dry cloth to clean the monitor.
- Maintain proper care and storage of the monitor when not in use.
- Use only batteries supplied by the factory.
- Operate the monitor at all times in a horizontal position. Operating the monitor in a vertical position may cause inaccurate measurements.
- Never operate this unit at or above 6,562 feet. (2,000 meters.)
- The monitor must be maintained free of moisture or other contaminants.
- Always place supplied filter on the gas sample line between the monitor and the sampling line.
- Always ensure that the direction of flow is correct for the supplied filter before using the monitor.
- Cap the ends of the gas sample lines to prevent the possibility of mists, aerosol, oil, water, dust, or other contaminants being drawn into the monitor.
- The maximum length of the gas sample line is 1000 feet.
- The monitor does not require Drierite if the measuring range is greater than 2 oz./1000 ft^3.
- Return the monitor to the manufacturer for calibration every 6 months.

General Operation

Prior to taking gas concentration readings, follow the guidelines in Chapter 2-4 Methyl Bromide Tarpaulin Fumigation, Conducting a Fumigation, to ensure proper installation of gas sampling lines and circulation fans.

If not using direct current, ensure that the battery for the Spectros is fully charged before the fumigation begins. When using the Spectros in battery mode, press the "test" button and observe the number of LEDs that light up.

➤ Four green LEDs on the battery indicate that the unit is fully charged and monitoring can begin. A fully charged battery pack will power the monitor for 8-10 hours.

➤ A red flashing LED on the battery indicates a low battery. Recharge the battery per manufacturer instructions before using for gas monitoring. Charging time is 3-4 hours for a fully discharged battery pack.

Gas Sample Line

Using 1/4-inch flex tubing, connect the gas sample line to the monitor by pushing the tubing onto the gas sample port on the front of the monitor. The gas sample line can be up to 50 feet in length and should be free of kinks or obstructions. If the gas sample line is longer than 300 feet, the instrument will display "FAULT" on the display screen. Ensure that the end of the line is positioned to prevent moisture or water intake, or utilize the filter element.

Purge Air Line

Connect the purge air line to the monitor by pushing the tubing onto the purge air port on the left side of the monitor. The purge line can be up to 100 feet maximum in length and should be in an area of fresh air. Ensure that the end of the line is positioned to prevent moisture or water intake, or utilize the filter element.

Exhaust Line

Connect the exhaust line to the monitor by pushing the tubing onto the exhaust port's barbed fitting. The exhaust line can be up to 50 feet in length and should terminate outside the building. Ensure that the end of the tube is positioned to prevent moisture or water intake.

Measuring Gas Concentration

To turn on the monitor lift the shield in front of the handle and press the red power ON/OFF toggle switch. Allow the monitor to warm up for 15 minutes.

The WARM UP screen is displayed and the ON light (green) will blink. After 15 minutes the ON light will stop blinking and glows steady.

The data display screen will show:

ZONETEMP - enter temperature of the area being monitored in °C. The zone is the area where the monitor is being operated, rather than the temperature of the commodity undergoing fumigation

The factory default temperature setting is 25 °C.

If the monitor is turned off at any time during operation, the monitor will run through an entire 15 minute WARM UP cycle, regardless of how long the monitor has been running.

After the warm up period, the Data Display Screen will read either MEASURE or PURGE in the upper left corner of the screen.

MEASURE indicates the monitor is actively measuring gas. The measurement is shown in the lower section of the screen. The monitor measures up to 240 g/m^3 with a sensitivity of $0.16g/m^3$.

The measurement (reading) should stabilize (stop) before recording the reading. This may take one or more purge cycles depending on the length of the gas sample line.

The measurement cycle will run for 4 minutes before the purge cycle begins. When the display shows "PURGE", the monitor is resetting it's infrared detector to baseline. The PURGE cycle runs for 10 seconds.

A zero reading indicates the concentration measured is below the lower limit of detection of 0.77g/m^3 (200ppm approximately).

NOTICE

If kinks or obstructions occur in the line, the monitor may not function properly.

Check for crimped sampling lines. Make sure nothing is restricting the flow of either the inlet sample air, purge air, or the exhaust (return sample line).

Calibration and Service

Return the Spectros to the manufacturer every 6 months for a calibration check and service. Contact Spectros to obtain a Service Request Form and Return Materials Authorization Number (RMA). Ship the unit using an insured carrier.

Contact Information

Spectros

Spectros Instruments, Inc.
4 Evergreen Lane, #12A
Hopedale, MA 01747
Phone: 508-478-1648
FAX: 508-478-1652
Website: www. spectrosinstruments.com
Email: info@spectrosinstruments.com

Treatment Quality Assurance Unit

USDA-APHIS-PPQ-CPHST
Treatment Quality Assurance Unit
1730 Varsity Drive
Suite 400
Raleigh, NC 27606
Phone: 919-855-7450
FAX: 919-855-7493
Email: cphst.tqau@aphis.usda.gov

Respiratory Protection

Fumigation or other treatments conducted under the monitored conditions stated in this manual and other program manuals, are safe operations. The Occupational Safety and Health Administration (OSHA) has ruled that employees with possible exposure to pesticides (including fumigants) shall be provided adequate respiratory protection from such exposure. This section discusses the types, capabilities, limitations, and uses of different respiratory protection available.

Responsibility

Management's Responsibilities

1. Provide respiratory protective equipment when such equipment is necessary to protect the health of the individual.
2. Provide equipment that is applicable and suitable for the purpose intended.
3. Establish a maintenance program for respiratory devices used.
4. Initiate and maintain a regular training program to inform personnel of basic and current information.

Officer's Responsibilities

1. Use and maintain respiratory equipment in accordance with instructions written in this manual and other instructions issued.
   - **A.** Adherence or nonadherence to prescribed instructions for the proper use of protective devices and equipment will be a factor in evaluating the quality of an employee's performance.
   - **B.** Gross disregard for safety measures may result in disciplinary action.
   - **C.** Proper respiratory protection unit is required at the treatment site.
2. Report any damage or malfunction of the device to management.
3. Carry out routine cleaning and care in accordance with instructions in this manual or instructions provided by the manufacturer.

TABLE 8-1-1: Threshold Limit Values of Fumigants

Toxicity	Threshold limit value
Methyl bromide (MB)	5 ppm (skin)* STEL** and ceiling
Sulfuryl fluoride (SF)	10 ppm STEL**; 5 ppm TWA***
Phosphine (PH)	1 ppm STEL**; 0.3 ppm TWA***

*Skin means the potential overall exposure includes absorption through the skin and mucous membranes.
**Short term exposure limit
***Time-weighted average

Fumigants

Every effort will be made by management and workers to prevent exposing PPQ personnel to atmospheres containing dangerous concentrations of toxic fumigants or other pesticides, or to atmospheres where there is an oxygen deficiency. However, if an emergency situation develops in which personnel may be exposed, use only respiratory protective equipment with a pressure-demand regulator. This equipment includes self-contained breathing apparatus (SCBA), air-supplied respirators, and units combining these two types. (In this manual, the term, "SCBA" may be read to include all three of these types.) Because positive air pressure is maintained in the full face mask at all times, the pressure-demand respirator affords the best protection currently available.

Pesticides Other Than Fumigants

When there is doubt selecting proper respiratory protection in either of the following categories, use the device that offers the best protection. Consulting this manual, the pesticide label, and the supervisor can help determine the most effective respiratory protection.

Air Purifying Respirators

Air purifying respirators using either a full face mask or half face mask are acceptable in areas where concentrations below maximums designated on the canisters can be expected. They may also be used during pesticide application with a pesticide toxicity or concentration known to pose little or no danger when correctly applied.

Dust Masks

Dust masks may be used when particulate matter such as dust, insect scales, aerosol, spray, or other particles are a nuisance and are of low or moderate toxicity.

Employee Acceptance

The wearer's acceptance of respiratory protection depends on facepiece comfort, clear and full vision, device weight, breathing resistance, individual physical condition, and personal preference. If more than one device with the proper facepiece seal is approved for the conditions, then the most comfortable device may be used by the individual. PPQ will use only respiratory protective equipment tested and certified by the National Institute for Occupational Safety and Health (NIOSH) and carrying an approval number prefixed by "TC."

Capabilities and Limitations

Self-Contained Breathing Apparatus (SCBA)

Breathing air is carried in a tank by the user. When properly fitted and used according to instructions, the positive pressure-demand system will prevent harmful contaminants from entering and will provide breathing air in low oxygen areas. A warning device indicates when the air supply is low and allows adequate time to leave the area. The individual must know that only 5 to 7 minutes of air remain at the alarm and that a proper evacuation route must be planned in advance. Test each unit to determine the time remaining at the sound of the alarm.

Limitations

The time that the device will provide respiratory protection is limited by the amount of air in the tank. Rapid breathing due to stress will use the air supply more quickly. There is no protection against skin irritation from toxic gases with the self-contained breathing apparatus. Because some chemicals such as HCN or pesticide groups like the organo-phosphates can be absorbed through the skin, avoid splashes of liquid fumigants or other pesticides and wear protective clothing to protect against accidental exposure.

Gas- and Vapor-Removing Respirators

Canisters and cartridges can be used as protection from most pesticides *other than fumigants*. Select the type of canister for a specific gas or vapor or combinations of gases or vapors. Canisters and cartridges have the advantage of being small, light, and simple in operation.

Limitations

Canisters and cartridges are **not** effective in oxygen-deficient atmospheres. There is no protection from skin irritations or pesticide absorption through the skin. The capacity of the cartridge or canister determines the maximum contaminant concentration against which a purifying respirator will protect. The maximum concentration for which a canister is designed is printed on the label. Cartridges do **not** have this information. Unless specified on the canister or cartridge label, no protection is provided against particulate contaminants.

The unit will **not** provide full protection unless the facepiece is carefully fitted to the wearer's face. Protection is provided dependent on the canister- or cartridge-type concentration of the contaminant and the wearer's respiratory rate.

A rise in canister or cartridge temperature indicates that a gas or vapor is being removed from the inspired air. However, do **not** rely on this characteristic as an indicator of canister performance. An uncomfortably high canister temperature usually indicates a high concentration of gas or vapor and requires an immediate return to fresh air.

Particulate-Removing Respirators

Particulate-removing respirators can be used only to protect against nonvolatile particles. Unless a special combination filter and chemical cartridge (canister) system is used, no protection is afforded against gases and vapors. When retained particles plug the filter or cartridge, breathing becomes difficult and the filter or cartridge must be replaced. Combination respirators using both chemical and mechanical filtering systems are used for dual or multiple exposures to dust and vapors. Normally, filters used for removing dust, mist, or other particulates plug up before the chemical cartridge is exhausted. Replace both filter and chemical cartridge at the same time.

Respiratory Protection Selection

Work time, including the time necessary to enter or leave a contaminated area, determines the length of time for which respiratory protection is needed. Selecting respirators must be based on all hazards to which the wearer may be exposed.

The only unit with an adequate warning device is the SCBA. The SCBA is equipped with a pressure gauge and audible alarm device. Canisters may have a window indicator that indicates only the presence of moisture. Because canister and cartridge respirators have no indication of remaining service life, replace used canisters and cartridges after each use.

The more active the wearer is, the more rapid his or her breathing. This rapid breathing shortens the usable working time of all types of respirators. High breathing resistance of air-purifying respirators under conditions of heavy work can result in distressed breathing.

Respirator Protection Use

Every effort will be made to avoid the need for respirators. The supervisor issuing respirators must be adequately trained to ensure the correct respirator is issued for each type of possible pesticide exposure. Unless more rigid standards are specified by PPQ, follow pesticide labels regarding respirator use.

If a PPQ Officer will use a respirator, the supervisor must ensure a physician or other licensed health care professional apply one or more of the following tests to determine the officer's fitness to use a respirator:

- Chest x-ray
- EKG (Echocardiogram)
- Examination of nasal passages
- Pulmonary function test

Any such examination should be requested and reported as outlined in the Animal and Plant Health Inspection Service (APHIS) Safety and Health Manual. Use APHIS Form 29 for this purpose. Only a physician or other licensed health care professional can judge whether an officer is physically able to wear a respirator.

Supervisors must ensure employees who use respirators complete a medical review every two years, or more frequently if there is a significant change in the medical or physical condition of the officer. Procedures for conducting this review are outlined in the APHIS Safety and Health Manual,

Use in Dangerous Atmospheres

For situations in which employees may be overcome by a toxic or oxygen-deficient atmosphere, at least one additional person qualified in using respirators (such as the commercial applicator) must be present. The commercial applicator and the employee should cooperate to limit the likelihood of exposure to both individuals at one time. To prevent exposure to any individual at a treatment site, all precautions must be followed. Should exposure occur and an employee be overcome by a toxic atmosphere, do **not** attempt rescue without the SCBA.

Facepiece Fitting

All respirator or SCBA wearers must receive prior fitting instructions from their supervisors, fumigation trainers, or others experienced in these procedures. By demonstrations and practice, the wearer will know how to wear the respirator, how to make adjustments, and how to determine correct fit.

The same individual fit can vary over time due to weight loss or gain, hair, and scars. Supervisors will schedule periodic fittings to ensure officers are diligent in observing these conditions. With ideal wearing conditions, leakage may be as low as one percent. The wearer must check facepiece fit according to manufacturer's facepiece fitting instructions each time respiratory protection is worn.

Inward leakage is one of the most important considerations in selecting a facepiece. Because conditions such as beard growth, sideburns, a skull cap that projects under the facepiece, temple pieces of eyeglasses, or the absence of one or both dentures can prevent obtaining an effective face seal, these conditions must be corrected so an effective seal can be obtained. Having a clean shaven area for an effective seal, removal or repositioning of a skull cap, using an eyeglass adapter kit (contact lenses cannot be worn during fumigations), or inserting dentures are some ways to correct these conditions. Long sideburns, beards, and other facial hair in the sealing area prevents an effective seal even for positive pressure masks, and is in violation of the Occupational Safety and Health

Administration (OSHA) regulations. Because the presence of facial hair in the sealing area is in direct violation of the OSHA regulations and also creates a significant safety hazard for the employees and their coworkers, cleanly shave the sealing area of the face to permit an effective seal. All supervisors and employees must be advised of this policy.


Important

The proper seal can also be attained with a hooded pressure demand SCBA designed to fit over beards and glasses, such as Survivair's Puma™, which is NIOSH-certified and OSHA-compliant.

All personnel assigned fumigation and/or pesticide duties wear SCBAs during critical portions of treatment procedures and must **not** have any condition(s) that prevent obtaining an effective face seal. Individual face masks, available in small, medium, and large sizes, will be assigned.

Facepiece Fit Tests

By following the manufacturer's facepiece-fitting instructions, examine the facepiece fit each time the respiratory protection is used. Two simple field tests are described below.

Negative Pressure Test

Close off the inlet opening of the facepiece or the canister or cartridges by covering with the palm of the hand(s). Gently inhale so the facepiece slightly collapses and hold your breath for 10 seconds. If the facepiece remains in a slightly collapsed condition and no inward air leakage is detected, the tightness of the respirator is probably satisfactory.

Also, detect leakage by crushing an ampoule of isoamyl acetate and passing it one to two inches around the seal area and exhalation valve. In this case, leakage will be noted by a "banana-like" odor in the facepiece. (See Isoamyl acetate in Appendix H, Reference Guide to Commercial Suppliers of Treatment and Related Safety Equipment.)

Positive Pressure Test

Close the exhalation valve and exhale gently into the facepiece. The face fit is considered satisfactory if a slightly positive pressure can be built up inside the facepiece without any evidence of outward air leakage along the seal. For most respirators, this method of leak testing requires that the wearer remove the exhalation valve cover, examine it, and then carefully replace it after the test. To prevent affecting the rubber valve, replace the exhalation valve cover the correct way.

Corrective Lenses With Full Facepiece

All facepieces will restrict, to some degree, the wearer's vision. This will increase accident potential. If the temple bars of eyeglasses extend through the sealing edge of the full facepiece, a proper seal cannot be

established. A prescription spectacle kit for respirators is available to correct this problem. All personnel who must wear prescription eyeglasses must use this kit when wearing equipment with a full facepiece.

It is APHIS policy to supply this adapter kit to all personnel requiring one.

Wearing of contact lenses in contaminated atmospheres with a respiratory protection device is prohibited.

Eyeglasses With Half Facepiece

If corrective eyeglasses or goggles are required, they must be worn so as **not** to affect the fit of the facepiece. Proper equipment selection will minimize or avoid this problem.

Use in Low Temperatures

The use of full facepieces at low temperatures presents problems such as poor visibility and freezing exhalation valves. All full facepieces are designed so the incoming fresh air sweeps over the inside of the lens to reduce fogging. This makes it possible to wear a full facepiece in ordinary room temperatures without severe fogging. Antifog compounds can be used to coat the inside of the lens to prevent fogging at room temperatures and down to temperatures approaching 32 °F. However, below 0 °F, antifog compounds will **not** prevent severe fogging.

Although such instances are **not** usually encountered, the employee should be aware that it is dangerous to work at temperatures near and below freezing when using respirators **not** designed for such use.

When using air supplied respirators, the high-pressure connections may leak because of metal contraction at low temperatures. Because they may break when temperatures return to normal, it is important to remember that high-pressure connections should **not** be overtightened.

Communications

The conventional respirator exhalation valve will provide a pathway for some speech transmission over short distances in relatively quiet areas. Talking can induce facepiece or component leakage and, therefore, should be limited while wearing a respirator, especially those wearing half-facepieces.

Maintenance and Care

To retain its effectiveness, properly maintain equipment. A program for maintenance and care include the following basic services:

- Cleaning and disinfecting
- Inspection for defects (including leak checks)
- Repairs
- Respirable air for self-contained breathing apparatus
- Storage

Cleaning and Disinfecting

To ensure proper protection is provided for the wearer, routinely clean and disinfect used equipment after each use and those **not** routinely used as necessary. The following is recommended for cleaning and disinfecting respiratory protection devices.

1. Remove any filters, cartridges, or canisters.
2. Wash facepiece and breathing tube with a cleaner-disinfectant or detergent solution (see following paragraphs); use a hand brush to facilitate removal of dirt.
3. Rinse completely in clean, warm water.
4. Air dry in a clean area.
5. Clean other parts as recommended by manufacturer.
6. Inspect valves, headstraps, and other parts; replace with new parts when defective.
   A. Stretching and manipulating rubber elastomer parts with a massaging action will keep them pliable and flexible and prevent them from warping or sticking during storage.
7. Insert new filter, cartridge, or canister in the unit; ensure seal is tight.

Cleaner-disinfectant solutions containing a bactericidal agent (generally a quaternary ammonium compound) are available.

To obtain the proper solution, use commercial products according to the label. However, different concentrations of the quaternary ammonium salt are required for various hardness of water to obtain a satisfactory disinfectant solution. Dermatitis can occur if the quaternary ammonium compounds are **not** completely rinsed from the facepiece and associated parts.

Strong cleaning and disinfecting can damage parts. Avoid temperatures above 120 °F and vigorous mechanical agitation. Solvents that affect elastomer or rubber parts must be used with caution.

Respiratory protective equipment can be contaminated with toxic materials such as organo-phosphates or other pesticides. If the contamination is light, normal cleaning procedures should provide satisfactory decontamination. If contamination is heavy, a separate decontamination step may be required before cleaning. For complete decontamination of phosphate pesticide residues, wash with alkaline soap, rinse with clean warm water, and then rinse with 50 percent alcohol (ethyl or isopropyl).

If commercial materials are **not** available, respiratory equipment may be washed in a liquid detergent solution, then immersed in one of the following:

- Sodium hypochlorite solution (50 parts per million of chlorine) for 2 minutes; **OR**
- Aqueous iodine solution (50 parts per million of iodine) for 2 minutes; **OR**
- Quaternary ammonium solution with 200 parts per million of quaternary ammonium compounds in water of less than 500 parts per million total hardness (see Quaternary Ammonium in Appendix H, Reference Guide to Commercial Suppliers of Treatment and Related Safety Equipment)

The sodium hypochlorite and iodine solutions are **not** stable. Prepare fresh solution for each use. These solutions age rubber parts and are corrosive to metallic parts, therefore, do **not** extend immersion times and thoroughly rinse the disinfectants from all parts with clean, warm water.

Inspection for Defects (Including Leak Checks)

The user must inspect the respiratory equipment before and after each use. Respiratory equipment that is **not** routinely used, but is kept ready for emergency use, must be inspected at least monthly to ensure it is in satisfactory working condition. SCBA air cylinders must be fully charged according to the manufacturer's instructions.

Inspection must include the following.

1. Examine the tightness of connections.
2. Examine the condition of the facepiece, headbands, valves, connecting tube, and any canisters or cartridges.
3. Examine rubber or other elastic parts for pliability and signs of deterioration.
4. Examine the regulator and the warning device to determine proper functioning before each use.
5. Examine for leaks.

Keep a record of inspection dates and findings in the unit carrying case.

Repairs

Only experienced persons should handle replacements or repairs using only those parts specifically designed for the equipment. Make no attempt to replace components or to make adjustments or repairs beyond the manufacturer's recommendations. Send reducing or inlet valves and regulators to the manufacturer or to a trained technician for adjustment or repair.

Respirable Air for Self-Contained Breathing Apparatus

Compressed air must be of high purity. Breathing air must meet the requirements for Grade D breathing air as described in Compressed Gas Association Commodity Specification G-7.1-1966. Air tanks can be refilled at most SCUBA diving stores or where local fire departments or rescue squads obtain air for their units. Test data denoting the quality of the compressed air should be available from the air supplier.

There is no need to change the air in the units, even after extended periods of time.

Never use compressed oxygen! (Compressed air may contain a low concentration of oil. When high-pressure oxygen passes through an oil or grease-coated orifice, an explosion or fire may occur.)

Have breathing air cylinders inspected and hydrostatically tested as required by the type of cylinder being used. Refer to the manufacturer's recommendations and comply with the Department of Transportation (DOT) or Interstate Commerce Commission Specifications for shipping containers.

Breathing air cylinders must be marked in accordance with American National Standard Method of Marking Portable Compressed Gas Containers to Identify the Material Contained.

Storage

After inspection, cleaning, and necessary repair, store equipment to protect against dust, sunlight, heat, extreme cold, excessive moisture, or damaging chemicals. Store respiratory equipment located at stations and work areas for emergency use in compartments built for that purpose. The compartments should be clearly marked and quickly accessible at all times. Under no circumstances shall a motor vehicle be used for respiratory protective equipment storage. The excessive and uncontrollable changes in temperature are bad for this equipment.

Routinely used respirators, such as dust respirators, may be placed in resealable plastic bags or heat-sealed plastic. Do **not** store respirators in such places as lockers or toolboxes unless they are in carrying cases or cartons and plainly marked. To prevent function impairment by the elastomer taking a permanent set in an abnormal position, pack or store respirators so the facepiece and exhalation valve will rest in a normal position. It is advisable to rotate the respirator face up, or face down at monthly inspections. Instructions for proper emergency respirators, or self-contained breathing apparatus storage are found in "use and care" instructions usually mounted inside the carrying case lid. Should the case **not** have such instructions, obtain them from the manufacturer and place in the case cover.

Detector Kits or Gas Samples

Although thermal conductivity (T/C) units such as the Gow-Mac® and the Fumiscope® are used to measure concentrations of MB and SF in ounces per 1,000 cubic feet (milligrams per liter), concentrations of phosphine and some other fumigants cannot be measured with a T/C unit. However, they may be measured with detector tubes. Residual gas concentrations during commodities or enclosures aeration can also be determined for most fumigants with detector tubes.

Principles of Operations

Special pumps are used to draw a measured sample (usually 100 milliliters) of an air-gas mixture. The sample is drawn through 1 or 2 detector tubes where a chemical reaction with the tube reagent takes place, creating a stain. The length of the stain is proportional to the concentration of the gas. Measure the length of the stain by using a calibrated chart or by simply reading the number from a scale printed on the glass tube.

Gas detector tubes are manufactured with a constant reagent weight with corrections for variations in the diameter of each tube. Detailed operational instructions accompany the equipment.

The detector tubes are specific for each fumigant and are usually available from several manufacturers. However, it is advisable to use the pump supplied by the manufacturer of the tube used. In an emergency, detector tubes available under the trade names Auer, Draeger, Gastec, Kitagawa, and Mine Safety Appliances can be used with pumps manufactured by any of these companies provided they draw 100 milliliters. Because of the different diameters of the tubes sold by each manufacturer, adapters may be necessary. The Kitagawa pump uses a removable, stainless-steel micro-orifice to reduce the rate

of air flow through many of its detector tubes. This provides greater accuracy in the chemical reaction within the tube. Remove the orifice when using tubes manufactured by other companies.

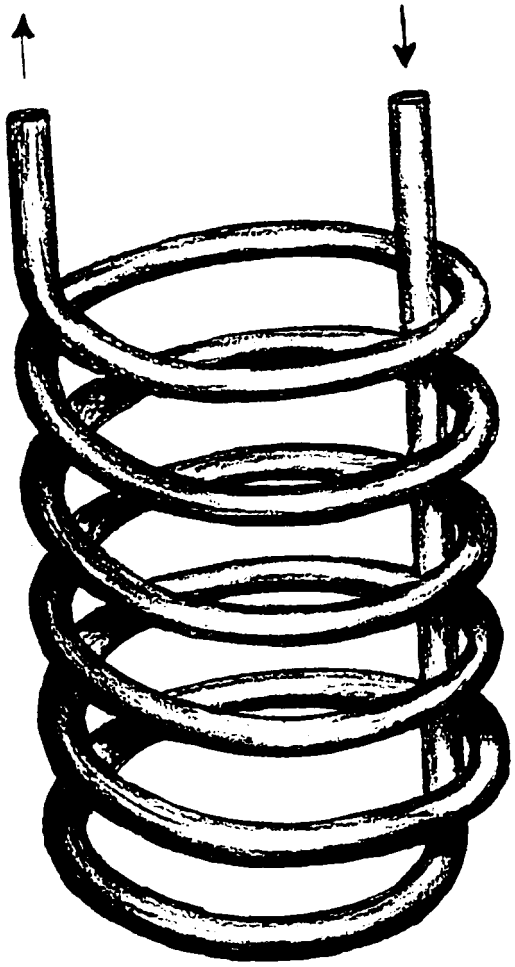
To increase shelf life, store tubes under refrigeration. Before each day's use, test pumps as provided by instructions with each kit and make repairs as necessary. Keep spare parts and operational instructions with each kit for use as needed.

When many samples must be drawn to a common point during a large fumigation, an auxiliary pump can be used. If only one sample lead is involved, it may be necessary to pull the fumigant through the line by pumping several times. A used tube can be inserted in the pump to determine when the fumigant has reached the pump.

Volatilizer

Methyl bromide must pass through a volatilizer (vaporizer) to ensure adequate conversion of liquid MB to gaseous MB. The volatilized fumigant should be introduced into or near to the air flow of the gas introduction fan. When 5 pounds or less of MB are used, a simple volatilizer can be made with a 25-foot coil of 3/8 inch O.D. (outer diameter) coiled copper tubing immersed in a container of hot water.

When amounts greater than 5 pounds are to be used, the copper tubing used in the volatilizer must consist of a minimum of 50 feet of 1/2 inch O.D. coiled copper tubing immersed in a container of hot water.



The volatilizer should be made of semihard copper tubing. It is important that gas be introduced and discharged as shown by arrows. If applied in reverse order, it may move so rapidly that some liquid will pass into the chamber.

FIGURE 8-1-4: Methyl Bromide Volatilizer Coil

The water in all sizes of volatilizers must be heated to temperatures of 200 °F or above with a minimum of 150 °F during the gas introduction process. A calibrated thermometer must be used to determine the water temperature. The thermometer must be calibrated once per year by an approved calibration company or by the fumigator under the supervision of PPQ. Written documentation of calibration must be present at the time of fumigation.

The line that runs from the from MB cylinder to the copper tubing in the volatilizer must be a 3000 PSI hydraulic high pressure hose with a 3/8 inch diameter ID (inner diameter) or larger. The line that exits the volatizer and runs into the enclosure must be a 350 PSI tubing with a 1/2 inch diameter ID or greater.

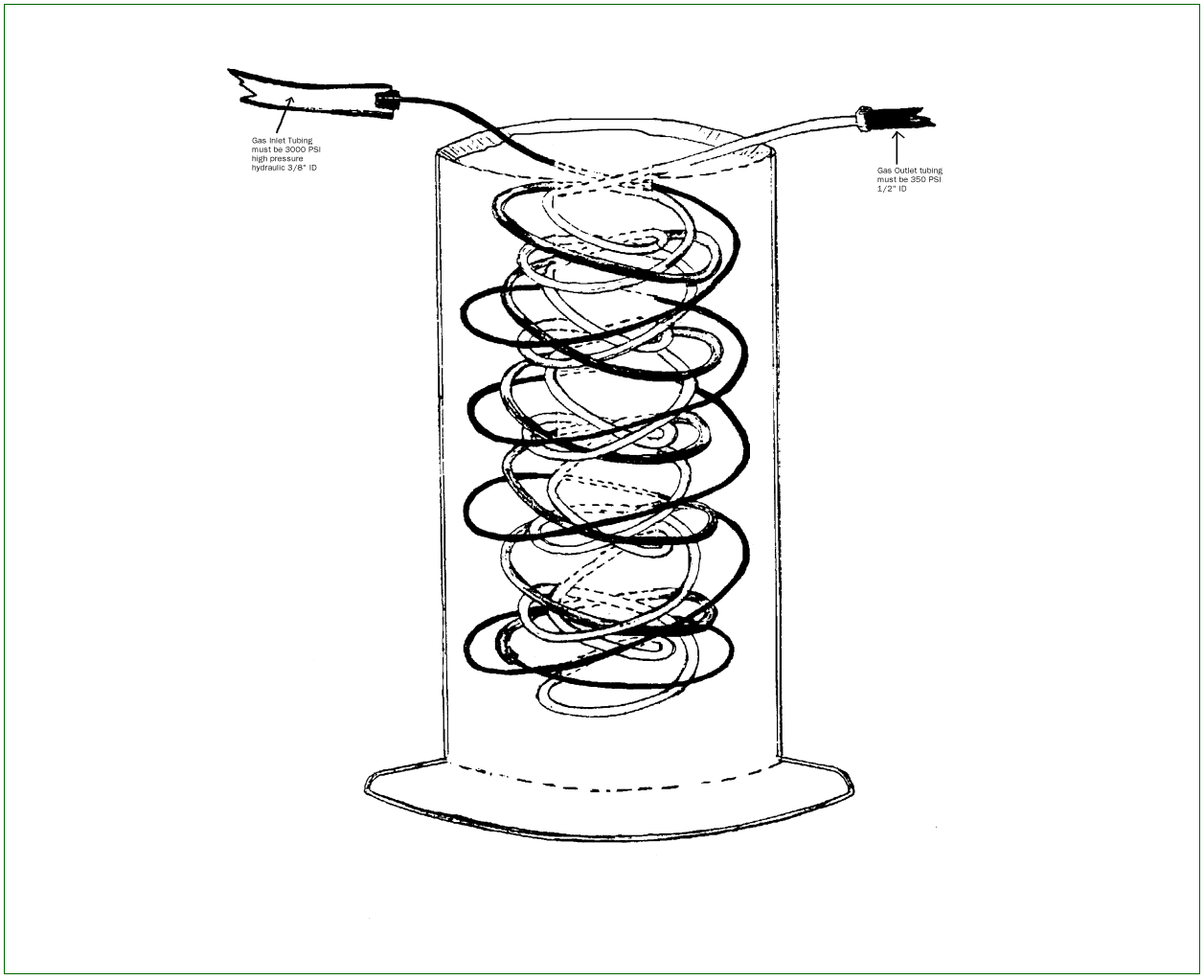


FIGURE 8-1-5: Tubing Specifications

The fumigant should be introduced through the tubing at the rate of 3 to 4 pounds of gas per minute. The gas introduction tube should feel hot to the touch as a good measure of satisfactory vaporization.

Air Velocity Measuring Instruments

Anemometer

Anemometers (wind meters) are used for measuring the air velocity of circulation fans and air curtains. Wind meters must be approved by the Treatment Quality Assurance Unit (TQAU). Submit specifications of unapproved wind meters to TQAU for approval.

Fan Velocity

The cubic feet per minute (cfm) of a fan can be measured by placing the anemometer 12 inches from the face of the fan to be tested. Take a minimum of three readings; one from the center and the others from points toward the outside of the fan. Average the readings. If an anemometer is used, each measurement should be for 1 minute, thereby giving the result in feet per minute. If a wind speed indicator is used, the reading in miles per hour should be converted to feet per minute by multiplying the miles per hour by 5,280 and dividing by 60.

Area of the fan is calculated by first measuring the radius (R)—distance from the center of the fan to the end of a blade. Formula for area is Pi* R^2 where Pi is equivalent to 3.1416 (22/7). The final answer should be given in cfm. Therefore, if the radius of the blade is given in inches and **not** feet, the factor 1/144 must be multiplied in to convert square inches to square feet. The full formula would be: Feet per minute × R^2 (in inches) × 3.14 × 1/144 = cfm.

EXAMPLE: If average air movement is 1,600 feet for 1 minute from a fan having a 7 inch radius (14 inch diameter), the calculations are as follows:

$$1{,}600 \times 7^2 \times 3.1416 \times 1/144 = 1{,}700 \text{ cfm (approximate)}$$

Velometer®

The Velometer® is one approved anemometer that can be used to measure fan velocity. It is manufactured by TSI Inc., Alnor Products. Take readings by either holding the instrument itself or jets (probes) in front of the air stream. Velocities are rapidly determined in units of feet per minute without timing or calculations.

Air Curtain Velocity

The velocity of air curtains is also measured with an anemometer. Anemometers used in this capacity must meet the following specifications:

- Hand held
- Digital
- +/- 3 percent accuracy

- Minimum operating speed of .04 m/s
- Record in at least one of the following units with the resolution in parenthesis:
  - m/s (0.1)
  - ft/min (1)
  - km/h (0.1)
  - mph (1)
  - knots (0.1)
  - Beaufort (0.1)
- CE certified with a certificate of conformity
- Tested to NIST-Traceable standards with a written certificate of tests
- Calibrated once a year to NIST calibration and certification

Kestrel® Pock Wind Meter

All Models of Kestrel® Pocket Wind Meters are approved for use by TQAU. Refer to Appendix H for ordering information.

Auxiliary Pump

During large-enclosure fumigations, it is necessary to take numerous gas concentration readings from various locations throughout the enclosure. Thus, some sample leads may be over 200 feet long. Pump the fumigant to the sampling point before making an accurate concentration reading using an auxiliary pump. If the inspector must rely on the pump provided with the gas sampler or T/C unit to pull the fumigant, a great deal of time will be needed between readings.

Because it pumps the fumigant from many areas and keeps a constant pull, the auxiliary pump will reduce sampling time to only the reading time. Constructing a unit is relatively simple. Petcocks capable of accepting sample leads are tapped and soldered to a short length of pipe. This pipe is connected to the suction side of the pump. The pipe acts as a manifold. Opening or closing the petcocks allows the gas samples to be drawn as required. Connect an exhaust line of sufficient length to the pump to ensure the fumigant is removed from the sample area.

It is important that all soldering be done in such a manner as to provide gastight construction of the petcocks. The pump should be of sufficient size to pull one cubic foot per minute through all of the leads on the manifold. Therefore, the more leads, the higher the required

capacity of the pump. Mount the whole unit on a board large enough to keep vibration to a minimum. Keep the unit weight down to allow easy transport.

Disconnect each sampling line from the auxiliary pump in turn, and close the petcock. Attach the line to the T/C unit or gas detector. Obtain a reading and reconnect the line to the auxiliary pump and open the petcock.

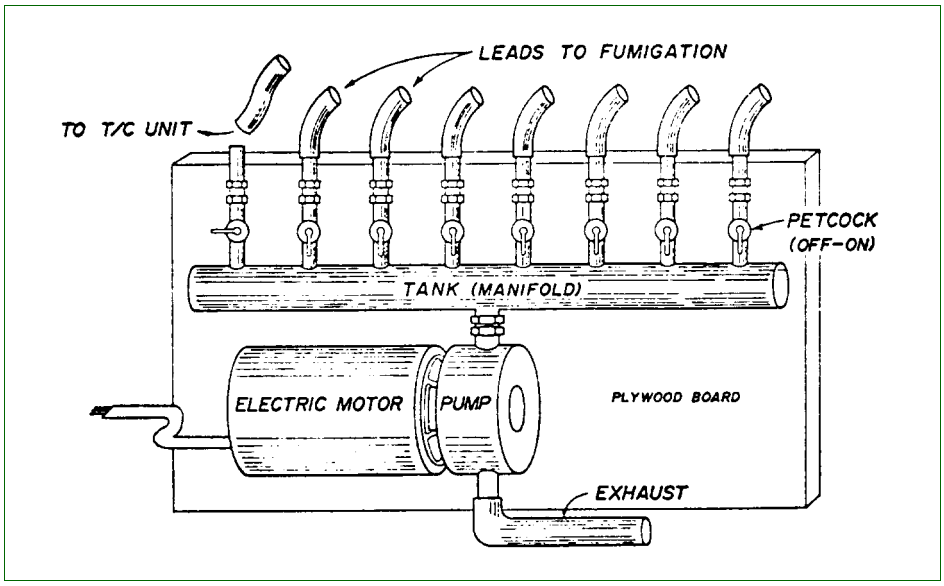


FIGURE 8-1-6: Auxiliary Pump

Open-Arm Manometer

This information has been extracted from the following web site http://www.dwyer-inst.com/htdocs/pressure/ManometerIntroduction.cfm

A manometer is used during a leakage test of a fumigation chamber and is a device used to measure pressure. Pressure is defined as a force per unit area. The most accurate way to measure low air pressure is to balance a column of liquid of known weight against it and measure the height of the liquid column so balanced. The units of measure commonly used are inches of mercury (in. Hg), using mercury as the fluid and inches of water (in. w.c.), using water or oil as the fluid.

A simple manometer is typically a U-shaped tube partially filled with liquid. The tube may be of glass or transparent plastic tubing. A ruler calibrated in millimeter (mm) divisions or carefully measured lines on a background is used to measure the difference in level of the liquid in the two arms (or the level in one arm).

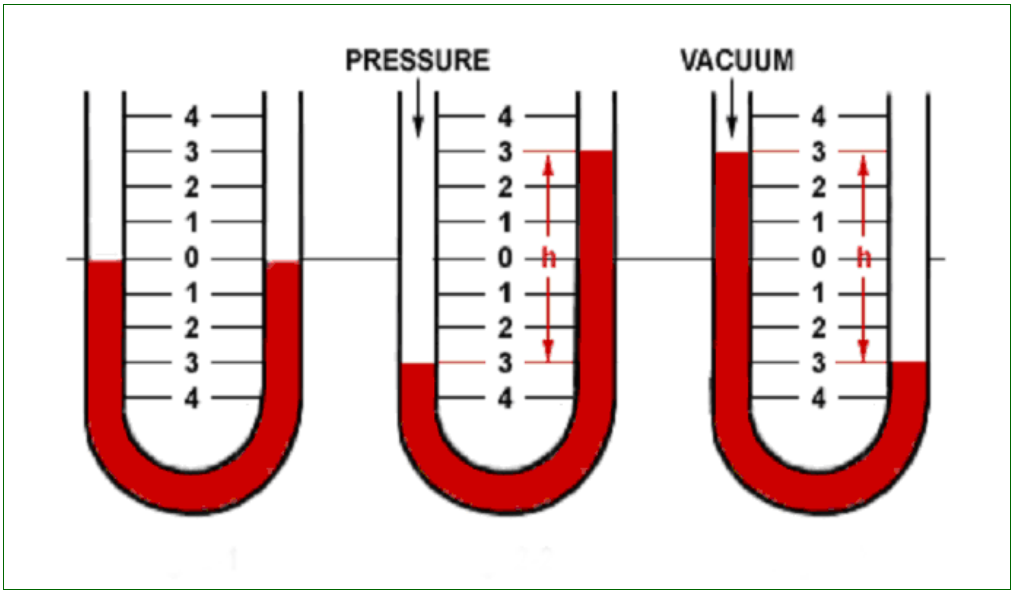


FIGURE 8-1-7: Example of Pressure Measurement in an Open-arm Manometer

As displayed by the middle picture in Figure 8-1-5, when positive pressure is applied to one arm, the liquid is forced down in that arm and up in the other. The difference in height, "h," which is the sum of the readings above and below zero, indicates the pressure.

The picture of the manometer on the right in Figure 8-1-5 shows that when a vacuum is applied to one arm, the liquid rises in that arm and falls in the other. The difference in height, "h," which is the sum of the readings above and below zero, indicates the amount of vacuum.

No manometer can be read more accurately than the accuracy with which the specific gravity of the liquid inside the manometer is known. The liquid must also have good "wetting" characteristics and be capable of forming a consistent, well shaped meniscus in the indicating tube to facilitate accurate, repeatable readings.

The liquid used also affects the operating range of the manometer. Mercury being 13.6 times the weight of water will move 1/13.6th the distance water will move in response to a given pressure. Red gage oil, having a specific gravity of .826. which is lighter than water, will move about 1.2 times farther than water in response to a given pressure. This, obviously, expands the scale for easier, more precise reading.

Red gage oil is a stable petroleum base oil with carefully controlled specific gravity which gives an excellent, consistent high visibility meniscus. Manometers for use with water are furnished with a fluorescent green concentrate which when added to water serves as a setting agent and a dye to improve the consistency and visibility of the meniscus for easier more accurate readability. Because of increased accuracy and consistency, CPHST recommends the use of red gage oil manometers.

Operating Procedures

When a fumigant is volatilized in a chamber at atmospheric pressure, a positive pressure is created, which may then be continuously reduced by leakage of the air-fumigant mixture. PPQ-approved chambers must be sufficiently tight to retain the fumigant during the exposure period. The manometer is used during the pressure leakage test for NAP chamber certification and the vacuum leakage test for vacuum chamber certification. (**See "Pressure-Leakage Test for NAP Fumigation Chambers" on page-6-3-4** and ***Certification Standards*** on **page 6-2-3** for detailed descriptions of the certification processes.)

Use the following example for the most accurate way to determine the pressure measurement from a manometer.

EXAMPLE: Referencing Figure 8-1-6, the left arm of the open-arm manometer measures 8 mm below zero. The right arm measures 7 above zero. The sum of the two measurements equals 15 mm. Therefore, in this example, 15 mm is the actual reading.

Photo by PPQ Specialist John Loyd

FIGURE 8-1-8: Example of U Tube Manometer

Mityvac Hand-held Vacuum Pump

Detect detect blocked monitoring leads by using a Mityvac hand-held vacuum pump (for supplier, see ***Vacuum Pump*** on **page H-1-70**).

Usage

1. Prior to introducing fumigant, connect the Mityvac hand-held vacuum pump to a monitoring lead.
2. Squeeze the handle on the Mityvac Unit; if the lead is blocked, a vacuum will be indicated on the vacuum gauge of the Mityvac unit (squeeze the handle 2 or 3 times for monitoring leads longer than 25 feet; the Mityvac hand-held pump has the capacity to attain and hold 25 inches of Hg vacuum and a minimum of 7 psi pressure).
3. Disconnect the Mityvac hand-held pump from the monitoring lead, and repeat this procedure for each monitoring lead (connect monitoring leads to the gas analyzer prior to fumigant introduction).

Phosphine Detector

PortaSens Phosphine Detector

Description

Historically, measuring phosphine has been done using detector tubes specific for phosphine (see ***Detector Kits or Gas Samples*** on **page 8-1-23**). The high cost associated with these tubes has been a deterrent for many ports.

A more accurate, portable unit has been recommended for use during phosphine fumigations. The Series B16 PortaSens is a portable, battery-operated instrument for measuring various gas concentrations in ambient air. The instrument can be ordered specifically for phosphine in the 0 to 1,000 ppm range. Ranges from 0 to 1 ppm are available also, along with other configurations. The PortaSens is a complete measuring instrument containing an electrochemical sensor, sampling pump, flow cell assembly, microprocessor electronics, and a two-line, backlit LCD display. The unit is powered by a rechargeable NiCad battery located in the handle, with the charger connection located at the bottom of the handle.

Operation

The PortaSens needs to be calibrated by the Center for Plant Health Science & Technology (CPHST) before use. After calibration, the instrument is ready to use directly out of the box. Simply remove the instrument from the storage case and press and release the button

(instrument switch) on the front of the handle. The LCD display on the front will immediately be activated and the internal pump will begin to pull sample into the flow cell.

The unit comes with a flexible extension wand that screws into the standard inlet fitting. Connect the extension wand and a length of flexible tubing that will reach safely from the item(s) being fumigated to the PortaSens.

Response Time

Response time will vary depending on the gas concentration and ambient temperature. The LCD readout will stabilize when maximum concentration is reached. Readings will be more timely when the monitoring leads are purged using the Mityvac hand-held vacuum pump (refer to *Mityvac Hand-held Vacuum Pump* on **page 8-1-33**).

Alarm Function

The PortaSens contains both visual and audible gas concentration alarm functions that are preset at the factory. Refer to B16 PortaSens Operation and Maintenance Manual for specific instructions. For instruments in the 0 to 1,000 ppm range, the alarm has been disabled to allow for more efficient use.

Battery Power Supply

The instrument is powered by a rechargeable NiCad battery. With a fully charged battery, the unit will continuously operate for 12 hours at 20 °C. Battery capacity will drop with decreasing temperature. Should the battery become weak during operation, the lower line of the LCD display will indicate “LOW BATT.” An audible beeper will begin to sound. At this point, there will be 1 hour of operating time left. When the voltage reaches a level where reliable measurements are no longer possible, the unit will turn itself off. If emergency use is anticipated, it is good practice to leave the instrument on charge at all times.

Flow Verification

Verify proper flow before using the PortaSens for leak detection. When the unit is turned on, a pump continuously delivers an air sample to the flow cell. In normal operation, the flow rate is approximately 300 cc/min. In order to allow quick verification of proper flow, a flowmeter is included in the PortaSens kit. Turn the instrument on and connect the sampling wand. Place the tip of the sampling wand into the tubing adapter attached to the flowmeter. Hold the flowmeter in the vertical position and verify that the flow rate is above 150 cc/min.

Power Down

In order to turn the unit off, press and hold the switch for approximately three seconds, until the “POWER DOWN” message appears on the display and then release.

Photo Ionization Detector

The Photo Ionization Detector (PID) is a portable vapor and gas detector that detects a variety of organic compounds. For methyl bromide, the PID has been used both as a leak detector to locate fumigant leakage around chambers, application equipment, temporary enclosures, and as a safety device around fumigation sites.

Principles of Operations

The PID is used to indicate the presence and approximate concentration of methyl bromide or other volatile organic compounds (VOCs) present. This is accomplished by photo ionization that occurs when an atom or molecule absorbs light of sufficient energy to cause an electron to leave and create a positive ion. Because PIDs measure all VOCs, careful attention must be paid to the presence of other VOCs in the air. Other VOCs include but are **not** limited to cigarette smoke, perfume, soap, and exhaust fumes from vehicles.

Description

All PIDs have the same basic construction, differing only in detail by the various manufacturers. Each has an ultraviolet lamp that emits photons that are absorbed by the compound in an ionization chamber. Electrodes collect the ions that are produced. The current that is generated provides a measure of the concentration.

Calibration

PIDs are typically calibrated using isobutylene, a stable gas with a slightly pungent odor. This gas is easy to handle and can be stored at high pressure, allowing calibration bottles to be used for calibrations many times. The PID manufacturer supplies a reference manual that describes calibration procedures and provides a list of correction factors.

For a partial list of manufacturers refer to ***Reference Guide to Commercial Suppliers of Treatment and Related Safety Equipment*** on **page H-1-1**.

Certified Precision Thermometers: Calibration Guidelines

Before a thermometer can be used as a calibration standard, it must meet the following requirements from an approved facilities. All calibration facilities must be approved by TQAU, 1730 Varsity Drive, Suite 400, Raleigh, NC 27606 USA.

A list of current approved facilities can be accessed in Appendix H, **Thermometers, Certified Precision, Approved Calibration Companies**.

- Accuracy must be 0.1 °C or less for Centigrade thermometer or 0.1 °F or less for Fahrenheit thermometer.
- Thermometer must be calibrated against standards that are approved by National Institute of Standards and Technology (NIST).
- The calibration certificate issued by calibration facility lists one to five calibration points, tabulated corrections for each calibration point, serial and test identification number of the NIST standard, and explanatory notes defining the conditions under which the test results were made.
- The thermometer must be calibrated annually. Thermometers with expired calibration certificates cannot be used in quarantine treatments.
- ASTM thermometers must have 5 or more calibration points. Non-ASTM (precision thermometers must have calibration points at the treatment temperature.

Charcoal Adsorber Recapture Standards

The USDA APHIS uses methyl bromide (MB) fumigant for quarantine fumigations at ports of entry and domestic facilities. The Agency also supervises quarantine fumigations conducted internationally as part of preclearance programs. Since the negotiation of the Montreal Protocol in 1987, the USDA APHIS has been actively pursuing MB alternatives and recapturing techniques.

The purpose for charcoal adsorber recapture technology is to trap most of the MB gas, preventing its release into the atmosphere and reducing impacts on the ozone layer. In order for a recapturing unit to be considered for use by USDA APHIS, it must meet the specifications outlined in this section.

The system will:

- Accommodate a variety of enclosure types (portable chamber and fixed chamber)
- Accommodate MB monitoring sensors in the air flow (number and placement of sensors will depend upon the size of the equipment)
- Accommodate the fumigant concentrations and temperature conditions listed in this (Treatment) manual
- Ensure that all untreated ventilation air is under negative pressure (in the event of a leak, ambient air will leak into the system instead of contaminated air escaping from the system)

- Leak-tight (includes valves, ducts, canisters)
- Provide a minimum adsorptive capacity of 1 pound of MB per 10 pounds of carbon (The quality of the carbon will determine the adsorptive capacity. A lower quality carbon could cause a ration of 1 pound of MB per 20-25 pounds of carbon.)
- Provide between 4 and 15 complete gas exchanges per hour
- Provide flow and pressure system monitoring
- Provide on site installation, training, and continual technical support
- Reduce emissions of MB by at least 80%
- Retain approved fumigation and aeration times as mandated by this (Treatment) manual
- Will not exceed 500 ppm (2 ounces per 1000 ft^3) MB gas released to the atmosphere and provide the ability to document MB concentration levels

Any recapturing system used in tandem with a PPQ-supervised fumigation must be approved by CPHST-TQAU. Submit equipment specifications to CPHST-TQAU for review.

List of Approved Recapturing Equipment

TIGG Corporation
1 Willow Avenue
Oakdale, PA 15071
P: 724-703-3020
F: 724-703-3026
Toll Free: 800-925-0011

For a detailed description of the Chemtura Methyl Bromide Recapture system, visit the following web site: Chemtura Recapturing System.