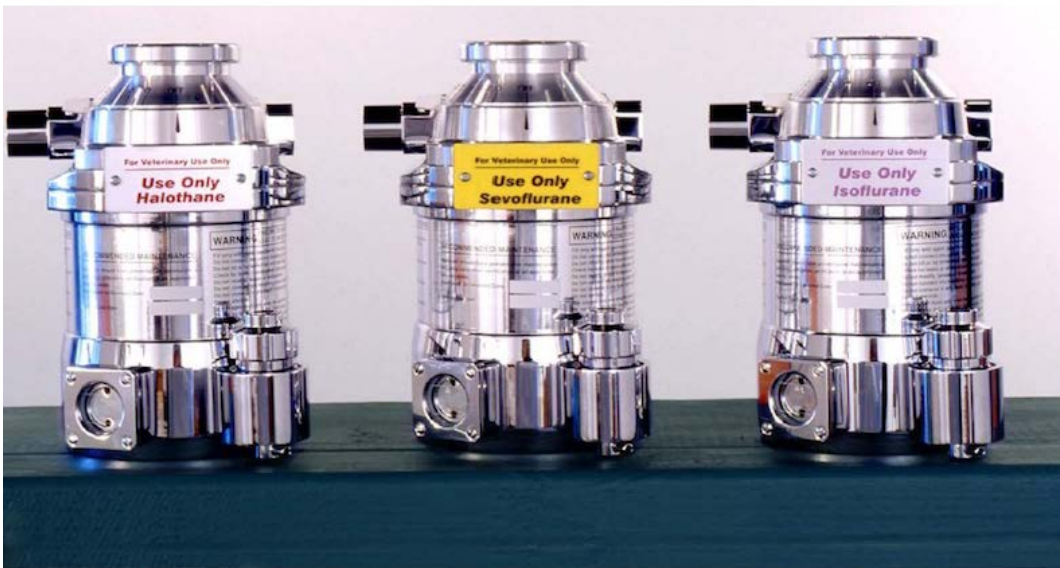




Thank you for choosing Vaporizer Sales and Service. This VSS Calibrated Vaporizer O & M Manual provides detailed instructions for the proper use, care and maintenance of our Vaporizer Units. If you should have any questions or need service please contact our sales or service department.



Sales, Service & Repair  
[vaporizerservice.com](http://vaporizerservice.com)






V.S.S. Inc  
Vaporizer Sales and Service Inc.  
457 Industrial Dr,  
Rockmart, GA 30153  
Tel: 770-684-8040  
Fax: 770-684-4453 800-788-5070 (US &  
Canada) [www.vaporizerservice.com](http://www.vaporizerservice.com)

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## 1. Introduction

### 1.1 Warnings & Cautions

1. A number of Warnings  and Cautions  are used throughout this manual. These draw attention to possible hazards and adverse conditions which may occur if the information and instructions provided are not strictly observed. Warnings are used to draw attention to a condition which can endanger either the patient or the operator. Cautions are used to draw attention to a condition which can result in damage to the equipment. Special attention must be made to each Warning and Caution as it appears in the manual.
2. This device may be sold to and used on the order of a medically qualified practitioner only.
3. This VSS calibrated vaporizer is designed for use with one anaesthetic agent only, which is that named on the vaporizer. Incorrect dosage may result if the wrong drug is used in this vaporizer. National and international standards are provided for by the keyed filler version of this vaporizer.
4. The VSS calibrated vaporizer must be secured in the upright position before it is connected to a patient. Excess dosage may be delivered if the vaporizer is moved suddenly during use.
5. When the VSS calibrated vaporizer is filled with anaesthetic agent, the dial control **MUST** be set at "OFF" when not in use and/or during transportation. The vaporizer must be secured in the upright position for a minimum of 10 minutes before it is connected to a patient or breathing system. Excess dosage may be delivered if adequate time is not allowed for the liquid agent to return to its normal level. If the vaporizer has been transported with the dial control set at any position other than "OFF", or was transported other than in an upright position, it **MUST** be flushed at 4 litres/min. for minimum of 2 minutes to prevent incorrect dosage. If the vaporizer has been dropped, it **MUST** be returned to an VSS Inc. Service Center for functional checks.
6. Anaesthetic agents are drugs; to prevent the hazard of prolonged inhalation of trace concentrations from the atmosphere, great care must be taken to avoid spilling of any agent during filling or draining. Patient exhaled anaesthetic gases should be extracted from the operating theater by an approved anaesthetic gas scavenging system.
7. The dial control **MUST** be set at "OFF" during all filling and draining operations. The delivered concentration will be incorrect if the filler port is open during use. To prevent overfilling, the vaporizer **MUST** be secured in the upright position during the process.
8. During use, frequently check that the liquid level is between the minimum and maximum marks on the sight glass level indicator. Refill the vaporizer before the liquid level reaches the minimum mark (  ) in the level indicator.
9. The VSS calibrated vaporizer may cease to function correctly if it is exposed to excessive temperature. Always store the vaporizer at temperatures between 5 F and 122 F (-20 C and 50 C).
10. The output of the VSS calibrated vaporizer is sensitive to barometric pressure. It may be necessary to use a correction factor when analysing the output, especially at high altitudes. The barometric pressure is not normally of clinical importance.
11. Anaesthetic agents must be treated as pharmaceutical products; to avoid contamination, liquid agent must **NEVER** be drained into an open container and /or re-used. The liquid must **ALWAYS** be disposed of as a hazardous chemical.
12. The VSS calibrated vaporizer must **NEVER** be modified, dismantled, calibrated or serviced by unauthorized personnel. The calibrated vaporizer **MUST** be serviced at an Vss Inc. approved Service Center.
13. The VSS calibrated vaporizer **MUST** be connected so that the flow of gas to the patient is as indicated by the arrows on the device. The delivered concentration will be incorrect if the flow is reversed.
14. The VSS calibrated vaporizer has a relatively high resistance and must not be incorporated in a breathing system downstream of the common gas outlet.
15. Before use, **ALL** connections must be checked for leaks and functional tests **MUST** be performed as described in the anaesthetic machine User Manual.

## 1.2 User Responsibility

The VSS calibrated vaporizer must be checked periodically. It must be operated and maintained in accordance with the instructions provided. A defective vaporizer must not be used. Components which are damaged, worn, distorted, broken, contaminated or missing must be replaced immediately. Should such repair or replacement be necessary, VSS inc. recommend that a verbal or written request be made only to an VSS Inc. approved agency. The vaporizer must not be altered or modified in anyway without prior written consent from VSS Inc. The user of this alteration by anyone other than VSS Inc. approved personnel, or from improper use, incorrect maintenance, improper repair or damage.

## 1.3 Servicing

The VSS calibrated vaporizer must only be serviced by qualified service personnel. The contents of this manual are not binding. If any significant difference is found between the product and this manual, please contact VSS Inc. for further information.




To ensure that the VSS calibrated vaporizer functions correctly, it must be serviced at regular intervals at an VSS Inc. approved Service Center. VSS Inc. recommend that the vaporizer should be serviced at intervals not exceeding 12 months.

Qualified service personnel and genuine spare parts must be used for all servicing and repair requirements. VSS Inc. will otherwise not assume responsibility for the materials used, the work performed, or any possible consequences of the same.

## 2 Description 2.1 General

When communicating with VSS Inc. please quote the model and serial number of the vaporizer, along with the approximate year of purchase. If the unit is being returned for repair, indicate the nature of the fault or the work required to be undertaken. VSS Inc. can be contacted by telephone by dialing 770 684 8040. Alternatively, use FAX 770 684 4453.

 **WARNING:** This manual and all its associated documentation must be studied thoroughly before any attempt is made to install, operate or maintain any part of the VSS calibrated vaporizer. Failure to do so may result in patient injury.

The VSS calibrated vaporizer is designed for "out of circuit" use in continuous flow techniques of inhalation anesthesia.

The VSS calibrated vaporizer is temperature and flow compensated so that its output remains relatively constant despite cooling due to vaporization and variations in inlet flow.

Every VSS calibrated vaporizer is labeled to show the name of the anesthetic agent for which it is designed and calibrated.

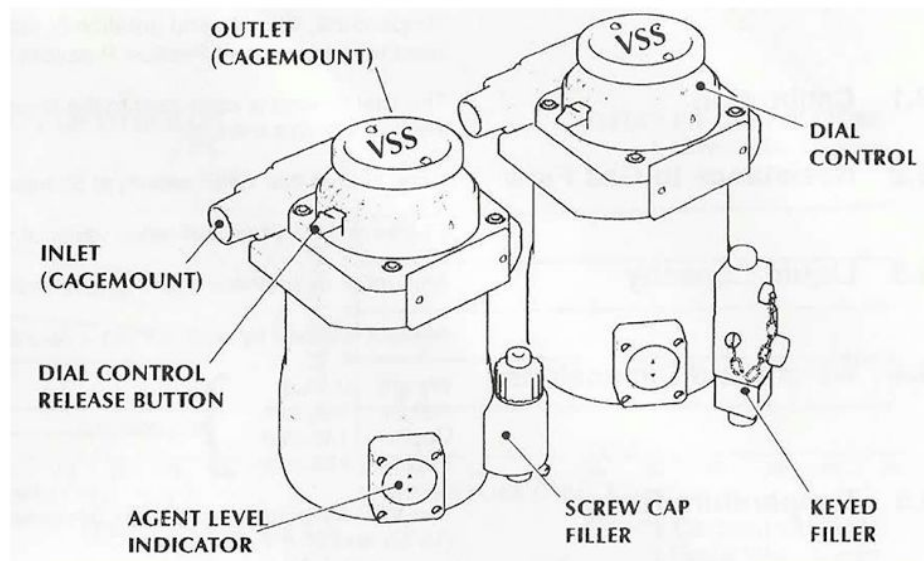


Fig. 1. VSS Calibrated Vaporizers

## 2.2 The Dial Control

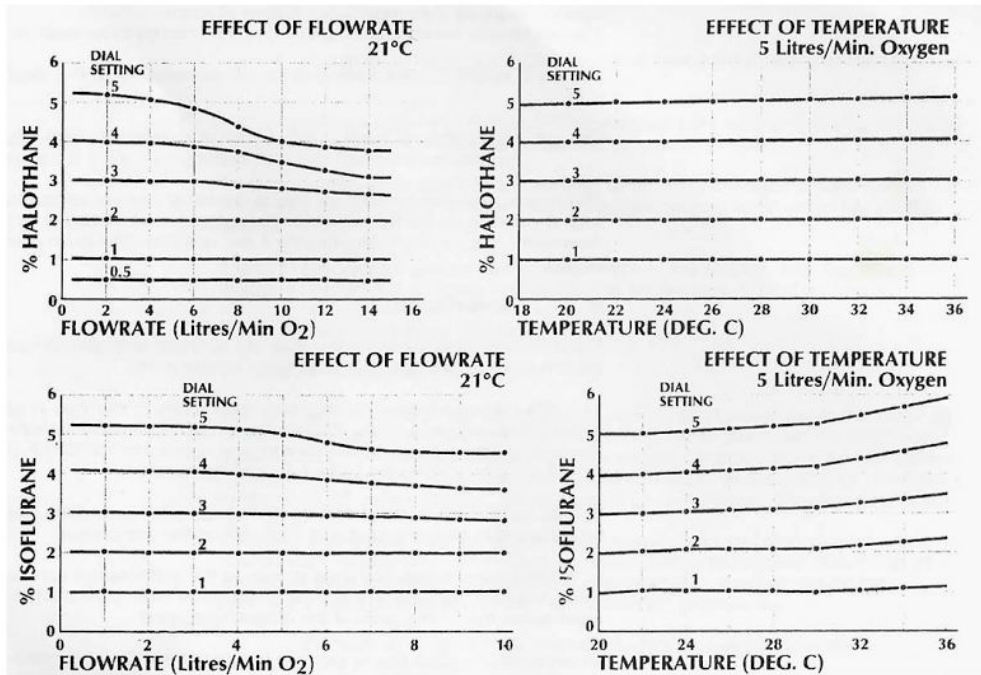
To set the desired concentration of anesthetic agent, a single Dial Control with a concentration scale calibrated in % of anesthetic agent vapor per volume(v/v) is used. This Dial Control incorporates a release button (see Fig. 1) to help prevent accidental rotation of the dial from the "OFF" to the "ON" position. A counter clockwise rotation of the dial and simultaneous depression of the release button is required to set the vaporizer to the on position.



**CAUTION:** Turn the vaporizer to "OFF" when not in use.

- 3 Specification VSS calibrated vaporizers are calibrated at 70 F (21 C). The variation in output with temperature, flowrate and duration of use is small, and the variation of output when used with Intermittent Positive Pressure Ventilation is negligible.
- 3.1 Calibration The Dial Control is calibrated to the levels shown on the performance curves in Section 4 of this manual.
- 3.2 Resistance to Gas Flow 5 cm. H<sub>2</sub>O at the "OFF" setting at 5 litres/min O<sub>2</sub>  
21.29 cm. H<sub>2</sub>O when delivering vapor at 4 litre/min O<sub>2</sub> at 70 F (21 C).
- 3.3 Liquid Capacity Amount of anaesthetic agent to fully charge the vaporizer = 125 millilitres (nominal).  
Amount retained by wick system = 35 millilitres (nominal).
- 3.4 Weight and Dimensions  
 Weight 6.9kg  
 Height 202mm  
 Depth 145mm  
 Width 135mm  
 } nominal
- 3.5 Temperature Range The VSS calibrated vaporizer is designed to operate at temperatures between 59 F (15 C) and 96.8 F (36 C).

4 Performance  
4.1 Performance Curves



4.2 Effects of Variables

A Anaesthetic Consumption

The rate of consumption of anesthetic agent depends primarily on flowrate and vapor out concentration. As an approximate working figure, 1.0 millilitre of liquid agent is required to provide 200 millilitres of vapor. The approximate hourly consumption of agents can be expressed as follows:

$$3 \times \% \times F, \text{ where } \% = \text{the setting of the output percentage, } F = \text{input flowrate in litres/min.}$$

Example: if a vaporizer is set to deliver 2% @ 6 litres/min. total input gas flowrate:  
approximate rate of agent consumption = 3 X 2 X 6 = 36 ml/hour.

The figures are intended only for clinical guidance and are approximate. They may vary depending on the type of anaesthetic agent used, accuracy of graduation of flowmeters, etc., and will vary grossly if the vaporizer filler/drain port is not fully closed.

## B Temperature

The effects of variation in temperature are normally negligible at commonly used combinations of dial setting and ambient temperature.

The VSS calibrated vaporizer responds very slowly to changes in ambient temperature and, as a safety feature, the temperature sensitive valve does not respond to temperatures below the range of approximately 53.5 F (12 C) to 59 F (15 C), thus preventing the valve from closing completely.

Should the VSS calibrated vaporizer temperature fall lower than this, the output can be expected to be lower than that indicated on the dial control.

At temperatures above the range shown on the performance curves, the VSS calibrated vaporizer output may be unpredictably high, particularly if the temperature approaches the boiling point of the anaesthetic agent.

To avoid inaccuracies due to extreme temperatures, the VSS calibrated vaporizer should be allowed to attain a temperature in the range shown on the performance curves prior to use.

## C Barometric Pressure

The dial control is graduated in v/v percentage at 760 mm Hg. If the ambient pressure changes, the v/v% changes so that at an ambient pressure P mm. Hg., the delivered percentage (D% v/v) =

$$\text{Equation 1: } \frac{D}{P} = \% \times \frac{760}{P} \text{ where \% is the nominal setting of the vaporizer.}$$

It is generally accepted that the depth of anaesthesia depends on the inspired partial pressure of agent and not the concentration by volume of agent.

To obtain a consistent depth of anaesthesia when gross changes of barometric pressure occur, the v/v% must be changed in inverse proportion to the barometric pressure.

The VSS calibrated vaporizer automatically makes this change, thus the effects of change in barometric pressure can be ignored for practical clinical purposes.

## D Back Pressure (Steady)

### 1. Low and Moderate Pressures:

The VSS calibrated vaporizer cannot distinguish between pressures at the outlet due to barometric pressure and pressures in excess of barometric pressure which are due to steady back pressure applied by downstream components. Equation 1 above therefore applies with P now being the absolute pressure at the outlet, i.e. barometric pressure PLUS back pressure. Steady back pressure reduces the v/v percentage.

Currently, it is unlikely that the steady back pressure imposed by commonly used downstream components (other than some ventilators) will exceed 30mm. Hg. at delivered v/v percentage at 760 mm. Hg. barometric pressure to :

$$\text{Equation 2: } \frac{760}{790} = 0.96 \text{ of what would otherwise be expected.}$$

Under normal clinical circumstances, effects of this magnitude can be ignored.

### 2. High Pressures:

Pressures in excess of approximately 400 mm. Hg. should not be imposed on the VSS calibrated vaporizer, since this may overcome the loads imposed by internal thrust springs.

## E Back Pressure (Fluctuating)

Fluctuating back pressure may be imposed on the VSS calibrated vaporizer by downstream components and assisted or controlled ventilation to the patient. This can affect the vaporizer and increase the concentration by intermittently altering the pressures, and hence the flow distribution within the vaporizer. The greatest effects are observed at combinations of very low flowrates and low dial settings with large and rapid pressure fluctuations. This becomes progressively unimportant as the dial setting and flowrate increase and the magnitude and rate of cycling of the pressure fluctuations decrease.

In clinical use, VSS calibrated vaporizers are considered unaffected by all fluctuating back pressures which would occur under all normal clinically encountered conditions relating to anaesthesia.

## F Carrier Gas Composition

Small effects can occur when the carrier gas composition is changed from oxygen to either air or nitrous oxide/oxygen mixture. As a general rule, variation of output with carrier gas composition can be considered of negligible clinical significance, since any effects are normally less than 10% of setting. Where changes do occur, the usual effect is that the output is slightly depressed when nitrous oxide is employed, compared to the output when oxygen is the carrier gas. The presence of nitrous oxide reduces the required inspired concentration of volatile agent and this mitigates this small depression in output.

## G Time Out of Service

If the anaesthetic machine on which the VSS calibrated vaporizer is fitted is left for a period of time with no gases flowing, a concentration of agent may be observed at the machine's outlet when the gas flow is turned "ON" and the vaporizer is set to "OFF". This concentration can be expected to fall rapidly to zero within approximately 15 seconds at a flow of 5 litres/min., for example. This phenomenon is a normal characteristic of anaesthetic vaporizers and anaesthetic machines. It is considered to be clinically insignificant because of the small volume of vapor involved.

## H Other Variables

Ambient temperature, input flowrate and duration can often affect delivered concentrations, particularly when the vaporizer is used at extremes of the usual clinical range. The valve design and temperature compensation system of the VSS calibrated vaporizer reduces the effects to levels where, under most clinical conditions, their effect on vaporizer performance is not clinically significant. The nominal performance characteristics should be consulted for further details.

### 5. Principle of Operation

When in the "OFF" position, the rotary valve (within the dial control) makes a direct link between the inlet and outlet of the vaporizer. When the dial control is turned to on, the carrier gas is split into two streams, respectively designated "bypass" and "vaporizing chamber flow".

#### 5.1 Vaporizer Sump and Valve Assembly

The vaporizer chamber is lined with two concentric wicks which enclose a nickel plated copper helix, so that the space is converted into a long spiral outlet channel. The wicks are in contact with the liquid agent, thereby ensuring that the vapor is maintained at saturation concentration in the gas leaving the vaporizing chamber.

The amount of anesthetic agent picked up in the vaporizing stream varies, due either to variation in room temperature or to the cooling which takes place as the agent is vaporized. Each variation causes changes in the effective vapor pressures of the anesthetic agent, therefore, unless some form of compensation device is used, the output of the vaporizer for any given flow and dial setting would change with changes in temperature.

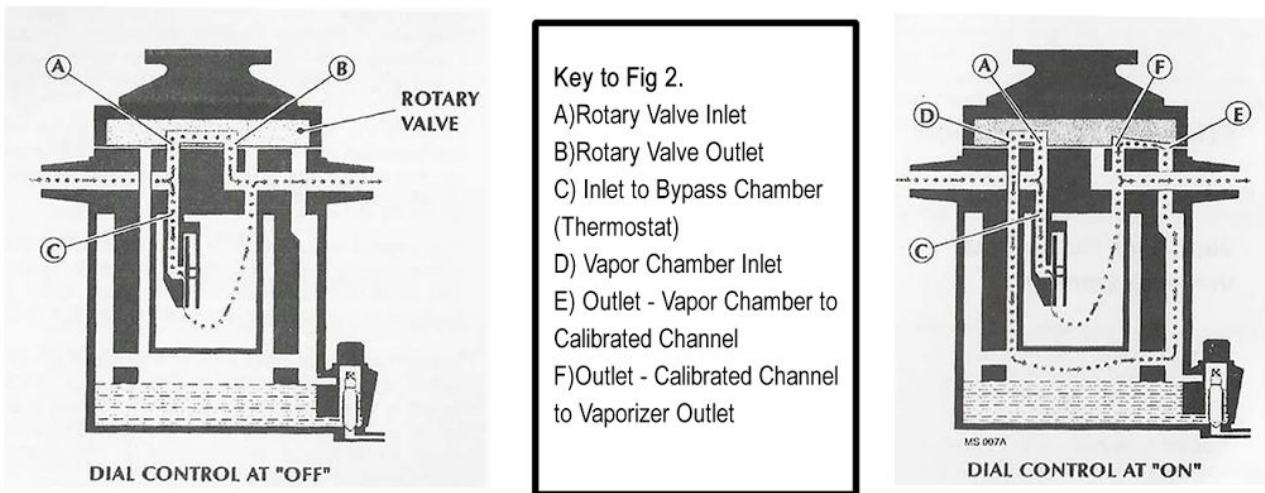


Fig. 2. Schematic - Principles of Operation

When the dial control is set at "OFF", fresh gas enters the central chamber A and leaves via outlets B and C.

When the dial control is rotated to the on position, the bypass outlet **B** is occluded. Fresh gas enters and is split to the rotary valve inlet **A** and the inlet bypass chamber **C**. Bypass gas passes through **C** to the temperature compensated bypass chamber. The other gas stream passes through the vapor chamber inlet **D** and is ducted down the inside of the inner wick support to the base of the vaporizing chamber.

From the base of the vaporizing chamber, the gas passes up the helix wick support which is sandwiched between the inner and outer wicks, thus giving a long gas pathway.


The saturated vapor leaves the chamber outlet via the outlet **E** to the outer channel. This annular channel forms a variable resistance pathway which controls the concentration of vapor. The channel is of uniform width throughout its length, but with an increase in depth from beginning to end.


The saturated vapor leaves the channel at the outlet **F** and passes to the vaporizer outlet to mix with the bypass gas to form the final outlet concentration. To increase concentration, the dial is rotated counter-clockwise so that inlet **E** and outlet **F** move relatively down to a deeper part of the calibrated channel so that the flow resistance between **E** and **F** falls. It will be seen that counter-clockwise rotation of the dial control (rotary valve) results in a lower vapor chamber resistance, thus a greater proportion of the total gas flow passes through the vaporizing chamber, which results in a rise in outlet concentration.

As the VSS calibrated vaporizer has a long inlet pathway, this, coupled with similar volumes of bypass vapor and a small volume vaporizing chamber, means that this is not readily susceptible to a pumping effect. The vaporizer's high resistance means that it can be used **ONLY BEFORE** the patient circuit.

Should the temperature fall, the thermostat closes and more gas is diverted into the vaporizing chamber

## 6. Installation

 **WARNING:** Keep the VSS calibrated vaporizer upright at all times. Do not carry the vaporizer by holding the dial control.

 **WARNING:** To help minimize cross-contamination of anaesthetic agents, only one VSS calibrated vaporizer should be fitted to an anaesthetic machine at any one time.

The VSS calibrated vaporizer must always be mounted between the flowmetering unit and the patient breathing circuit, but upstream of any absorber or humidifier.

Check the integrity of the fittings to ensure that they are leak tight. If in doubt, seek advice from the manufacturer of the equipment to which the vaporizer is attached.


Unless otherwise specified, all VSS calibrated vaporizers are supplied as standard with 23mm Cagemount fitting inlet and outlet ports.


### 6.1 Mounting the Vaporizer

Cagemount filled vaporizers normally have the standard 23mm tapered ports: male (inlet) on the left and female (outlet) on the right when viewed from the front. There are two M6 threaded holes at the rear of the vaporizer which are utilized to secure the vaporizer onto the backbar of the anaesthesia machine using appropriate M6 studs and spacers.

1. Lightly smear the tapers with an oxygen-safe grease such as Fomblin UT18 (Rocol Ltd)
2. Push the gas tubing fully onto the appropriate tapers and fully tighten the vaporizing securing nuts.


 **WARNING:** Ensure that all connections are gas tight before using the machine.

 **WARNING:** Before use, ALL connections must be checked for leaks and functional test **MUST** be performed as described in the anaesthetic machine User Manual.

 **WARNING:** To help minimize cross-contamination of anaesthetic agents, only one VSS calibrated vaporizer should be fitted to an anaesthetic machine at any one time.



7. Operating Instructions

 **WARNING:** Ensure that the VSS calibrated vaporizer is upright at all times.

7.1 Turning the Vaporizer "ON"

 **WARNING:** Do not carry the VSS calibrated vaporizer by holding the dial control.

To turn the vaporizer "ON" depress the dial control release button and turn the dial in a counter-clockwise direction.

To avoid inadvertent delivery of small concentrations of agent, the dial control must be turned to "OFF" when the vaporizer is not in use.

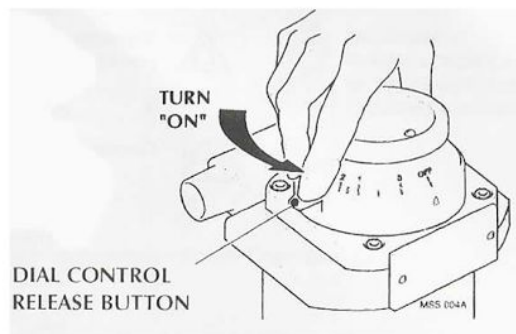





Fig. 3. Turning the Vaporizer "ON"


7.2 Filling and Draining


A General


 **WARNING:** Do not fill the vaporizer with any agent other than the one specified on the front label. The vaporizer is designed for that agent only. Any agent other than the one specified can prove to be dangerous to the patient.

 **WARNING:** Do not fill the vaporizer unless the dial control is in the "OFF" position.


 **WARNING:** Do not turn the dial "ON" during filling, or attempt to fill the vaporizer beyond the full mark.


 **WARNING:** Do not drain the agent into any container other than a properly marked container.

 **WARNING:** Periodically check the agent level. The VSS calibrated vaporizer must be filled at appropriate intervals. The vaporizer functions satisfactorily as long as the agent is above the minimum-level mark. (▼) on the agent level indicator.

 **WARNING:** The VSS calibrated vaporizer must be filled and used in an upright position.

## B Screw Cap Filler -Filling Procedure

 **CAUTION:** The vaporizer may be pressurized. Turn the screw cap slowly when filling or draining vaporizers which are fitted with screw cap fillers.

1. Ensure that the Dial is in the "OFF" position. Remove the screw cap by turning it counter-clockwise.
2. Verify that the agent to be used is the same as the specified on the front of the vaporizer. Pour the agent slowly into the filler opening, observing the agent level through the agent level indicator.  
 **NOTE:** If the vaporizer was dry before fillings, the level will decrease slightly as the wicks absorb the agent
3. When the agent level reaches the maximum-level mark ( ▼ ) on the agent level indicator, the vaporizer is full. Replace the screw cap by turning clockwise. To prevent leakage, ensure that the screw cap is fully tightened.

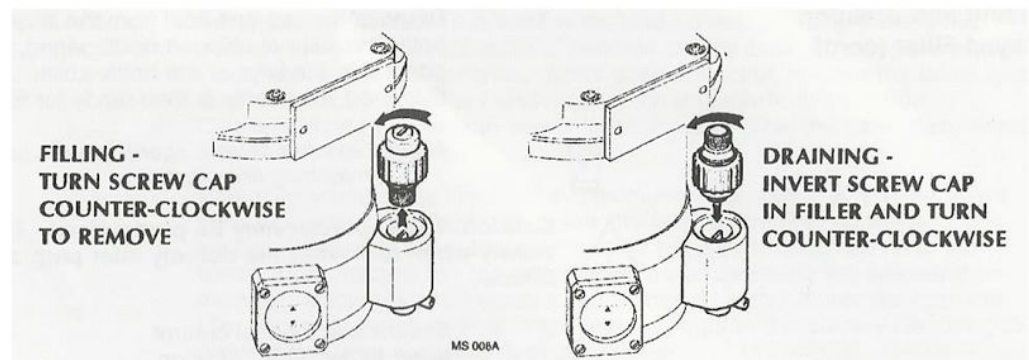



Fig. 4 Filling and Draining - Screw Cap Filler

## Screw Cap Filler - Draining Procedure

 **WARNING:** After draining the VSS calibrated vaporizer, fully tighten the drain plug before replacing the screw cap.

Remove the screw cap to reveal the drain plug. Invert the screw cap and use the slot in the top to unscrew the drain plug. DO NOT remove the drain plug. Drain the agent into a properly made container for disposal.

### C Keyed Filler - Filling procedure

This filling system consists of three keyed elements, as follows:

- the anaesthetic agent bottle collar
- the bottle adapter
- the filling/draining unit fitted to the vaporizer

1. Remove the cap and seal from the anaesthetic agent bottle. Check that the bottle neck is not chipped or damaged. Fit the keyways of the bottle adapter to the keys of the bottler collar. Screw them together until fully tightened. The bottle is then ready for filling the vaporizer.



*Note: Only the correct agent-specific adapter can be fitted into the matching filler socket.*



**CAUTION:** The vaporizer may be pressurized. Turn the top retaining screw slowly when removing the dummy filler plug on vaporizers fitted with keyed fillers.

2. Ensure that the Dial is in the "OFF" position. Turn the top retaining screw on the filler unit counter-clockwise and withdraw the dummy filler plug.
3. Hold the bottle upright below the filler socket and bend the adapter so that its end is horizontal and the two holes in the adapter are facing downwards. Insert the adapter into the filler socket.
4. After insertion, turn the top retaining screw clockwise to tighten it and seal the filler adapter in the filler socket.

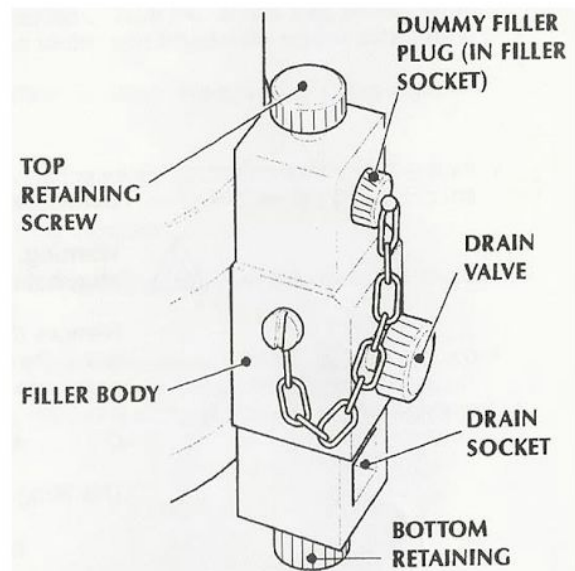


Fig. 5 Keyed Filler Components

5. Raise the bottle above the level of the filler socket, avoiding kinking the adapter tube. A steady stream of bubbles should emerge from the adapter inner tube within seconds. If this does not occur, remove the bottle and adapter from the vaporizer and remove the adapter from the bottle. Carefully shake the adapter two or three times to clear the tube, then repeat instructions from Section C.
6. When the vaporizer is filled to the maximum-level mark (▲) in the agent level indicator, lower the bottle below the level of the filler socket and wait for five seconds to allow any agent in the adapter to drain back into the bottle, then unscrew the top retaining screw and remove the adapter from the filler. If there is any excess liquid agent, allow this to escape from the filler socket completely, then insert and fully tighten the dummy filler plug to prevent gas from escaping through the filter.

The VSS calibrated vaporizer is now ready to use.



*Note: If the vaporizer was dry before filling, the level will decrease slightly as the wicks absorb the agent*

## Keyed Filler - Draining Procedure

1. Fit the bottle adapter to an empty bottle. Insert the bottle adapter with its two holes facing upwards into the drain socket. Tighten the bottom retaining screw.



*Note: Only the correct agent-specific adapter can be fitted into the matching drain socket.*



**CAUTION:** The vaporizer may be pressurized. Unscrew the top retaining screw slowly.

2. Ensure that the bottle is below the level of the drain socket and the tube is not kinked. For draining purposes (to allow air to vent) unscrew the top retaining screw and remove the dummy filler plug from the filler socket.
3. Open the drain valve by turning counter-clockwise. Allow the vaporizer to drain.
4. If it is not possible to complete the draining process, close the drain valve, loosen the bottom retaining screw, then remove the bottle and adapter from the vaporizer and remove the adapter from the bottle. Carefully shake the adapter two or three times to clear the tube, then reassemble and repeat instruction from paragraph 1.
5. When draining is complete, close the drain valve (clockwise), loosen the bottom retaining screw and remove the bottle and adapter. Replace the dummy filler plug into the filler socket and fully tighten the top retaining screw in the clockwise direction.

The performance of VSS calibrated vaporizers which are in clinical use is monitored by observing the patient signs and consumption of anesthetic agent. Some users may, however wish to employ analyzers to determine whether any abnormalities of performance have developed.

## 8. Checking the Calibration

The following points must be considered when any measurements are being carried out on VSS calibrated vaporizers to determine whether any abnormalities of performance have developed.


### 8.1 General

1. In order to predict the concentration which the VSS calibrated vaporizer can be expected to deliver, the detailed nominal performance data and preceding comments should be noted.
2. The method of testing used should be representative of normal conditions of use.
3. Any sampling techniques should be such to ensure the following:
  - a) the sample is fully representative of the vaporizer output, which may not be a homogeneous mixture at the vaporizer outlet.
  - b) absorption of agent by any connecting tubing is negligible.
4. If any number of vaporizers are being examined simultaneously, the probability of them all being consistently in error is so remote as to be negligible and the cause for any apparent error is likely to lie in the employed method of testing.
5. Consistent and reproducible analytical techniques should be used.
6. If unexpected results are obtained, it is a wise precaution to repeat the observations, since the VSS calibrated vaporizer may be more reliable than the techniques used to observe its performance.
7. If unexpected results occur, it is also worthwhile checking for sources of error, e.g. flowmeter leaks, absorption by adjacent components, etc.
8. Full account should be taken of any extraneous effects on an analyzer which may arise from changes in carrier gas composition.
9. If the anaesthetic machine on which the VSS calibrated vaporizer is fitted is left for a period of time with no gases flowing, sensitive analyzers may detect small concentrations of agent for a short time at the machine outlet after the machine is turned "ON" with vaporizer turned "OFF". This concentration can be expected to decrease rapidly to zero with approx 15 seconds at 5 litres/minute. This phenomenon is a normal characteristic of anaesthetic vaporizers and anaesthetic machines.
10. At the O-setting (where marked), it is not abnormal for small steady concentrations to be observed when using sensitive analyzers.

## 8.2 Analytical Techniques

For field checking of the state of calibration, many techniques and analyzers are available. VSS inc., does not recommend any one technique or analyzer, but account must be taken of errors of use and calibration of analyzers. The reliability of both must be realistically considered.

The following method of checking may be used where special equipment is not available and a secondary check on analyzers is desirable. The characteristics of the vaporizer are such that if the vaporizer is satisfactory at one dial setting it should be satisfactory at all graduation settings.


 **WARNING:** Appropriate measures to handle exhaust gases and spillage should be carried out during this test.


1. Ensure that the vaporizer is full and has remained at an ambient temperature of 21°C for a minimum period of 3 hours.
2. With the vaporizer securely mounted, open the drain valve until no more liquid agent runs out. Close the drain valve.
3. With the dial set at "OFF", carefully and quickly refill the vaporizer with a measured amount of agent (approximately 70 millilitres) without spilling. Close the screw cap securely.
4. Ensure that the temperature has stabilized. Allow the vaporizer to remain at 21°C for one hour.
5. Set the flowrate to 5 litres/minute O<sub>2</sub>
6. Note the time, turn the dial to 2% and check that the flowrate remains at 5 litres/min., readjusting if necessary.
7. Leave the vaporizer at this setting for 30 minutes, periodically checking and adjusting the flowrate if necessary.
8. Drain as described on page 11. Measure the amount of liquid drained from the vaporizer.
9. The amount of liquid consumed should be as follows:

Halothane	13.5 millilitres
Isoflurane	15.5 millilitres

It should be appreciated that the preceding method of checkin is designed to be quick and easy under ordinary hospital conditions and that the method is somewhat imprecise. Nevertheless, it would be unusual for measured liquid agent consumption to vary by more than approximately 25% from the amounts shown above.

## 9. Maintenance

 **WARNING:** Do not modify, tamper with, or disassemble the VSS calibrated vaporizer. If the vaporizer is modified in any way there could be possible danger of damaging the unit and altering the accuracy of output graduation.

 **WARNING:** Do not immerse the VSS calibrated vaporizer in any liquid, including water.

 **WARNING:** Do not sterilize the VSS calibrated vaporizer.

Observation of the instructions provided, regular servicing and normal professional vigilance is normally all that is required to maintain the calibrated vaporizer in a safe working condition.

## 9.1 Schedule

### A Every Two Weeks

Halothane vaporizers should be drained into an appropriately marked container when the agent is low and appropriately discarded.

### B Every Three Years

The VSS calibrated vaporizer should be serviced every three years at an VSS Inc. approved Service Center.

This service includes:

1. Complete disassembly of the vaporizer and its components.
2. Thorough cleaning.
3. Inspection for damage and wear.
4. Renewal wicks, seals and any damaged, worn or outdated components.
5. Lubrication where necessary.
6. Checking the delivered vapor concentration under closely defined conditions at different temperatures. Regraduation and adjustment where necessary.



**WARNING:** Do not carry the VSS calibrated vaporizer by holding the dial control.

Clean the exterior of the VSS calibrated vaporizer with a damp cloth.

Never allow cleaning agents to accumulate in either the filler, the gas inlet and outlet ports, or around the dial control.

If any liquid other than the correct agent is put into the VSS calibrated vaporizer.

1. Drain and discard all the liquid
2. Set the dial control to MAX and flush the vaporizer with 5 liters/minute O<sub>2</sub> until no trace of the contaminant can be detected.
3. Allow two hours for the vaporizer temperature to stabilize before proceeding with CAUTION.

If in doubt check with the manufacturer. If the contaminant is not volatile (e.g. water), drain and return to approved Service Center.

Should be carried out by trained and qualified personnel at an Authorized Service Center.

## 9.4 Service and Repairs

Vaporizer Sales and Services Inc.  
425 College Street  
Rockmart, GA 30153

Website: [vaporizerservice.com](http://vaporizerservice.com)  
Toll Free: 1-800-788-5071

## 10. Warranty

Such warranties are extended only with respect to the purchase of this product direct from the authorized dealers as new merchandise and are extended to the first buyer thereof, other than for the purpose of resale.

For a period of three (3) years (one (1) for halothane) from the date of original delivery to the first buyer or to buyer's order, this product is warranted against functional defects in materials and workmanship and to conform to the description of the product contained in the operation and Maintenance Manual and accompanying labels and inserts, provided that the same is operated under conditions for normal use, that regular periodic maintenance is performed and that replacements and repairs are made in accordance with the instructions provided.

The foregoing warranties shall not apply if the product has been repaired or serviced other than by the manufacturers authorized service facilities, or if the product has been subject to abuse, misuse, negligence or accident.

The Manufacturer's sole and exclusive obligation and the buyer's sole and exclusive remedy under the above warranties are limited to repairing or replacing, free of charge, at the manufacturer's option, a product which is confirmed as being defective by the manufacturer following the buyer's notification to the manufacturer in accordance with the instructions contained in the Servicing Section of the Operations and Maintenance Manual, not later than seven (7) days after the expiration date of the applicable warranty. The manufacturer shall not be otherwise liable for any damages including but not limited to incidental damages, consequential damages or special damages.

There is no express or implied warranties which extend beyond the warranties herein above set forth. The manufacturer makes no warranty or merchantability of fitness for a particular purpose with respect to the product or parts thereof.