Osmetech ComfortSampler™
Product Information Booklet
## PRODUCT INFORMATION - REVISION LOG
(Please record any changes made to this manual)

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ATXXXX  REV A
Product Description

The innovative design and function of the ComfortSampler allows you to provide the best in patient care at an affordable price. The fast, single step procedure fills automatically with minimal arterial pressure and offers sample stability to meet your exacting standards. At the same time, reducing puncture pain and hematomas for the patient are of paramount importance. The integrated needle protector will provide the ultimate protection from therapist puncture wounds.

Compatible with most ABG analyzers.

Better sample stability than syringe samples.

Integrated needle protector for user safety.

Small gauge needle to help reduce trauma and risk of hematoma.

Balanced heparin provides accurate results.

Fills rapidly, even with minimal arterial pressure.

1. Place needle onto ComfortSampler.
2. Prepare puncture site.
4. Close needle protector by pressing against a firm surface.

See product insert for complete instructions for use.
Features and Benefits

More Comfortable for the Patient
- Small 200 uL volume allows for rapid collection
- Capillary action allows samples to be collected with minimal arterial pressure
- Low required pressure and small sample volume, allows for the use of a micro-thin needle
- Rapid filling and the micro-thin needle reduce patient trauma and discomfort

Convenient to Use
- Kit contains everything needed for the collection of arterial blood
- All in one kit can be taken to the patient
- Heparin coated capillaries eliminate the use of liquid heparin
- The unique design works with most ABG analyzers that accept capillary samples

Better Sample Stability
- Capillaries are coated with balanced heparin
- Balanced heparin preserves electrolyte values
- Only the volume of blood collected is heparinized
- Blood is automatically mixed with heparin as the sample is collected
- The sample is isolated from the transfer of body heat
- The sample is cooled rapidly to slow metabolic changes

Safety
- The 25 gauge needle has an integrated needle protector
- Micro-thin needles reduce the risk of patient hematoma
- Users are protected from capillary breakage
Product Specifications

Fill Volume: 200μL
Anticoagulant: Balanced Heparin
(6 IU Na, 9 IU Li/100 μL)
Capillary: 200 μL glass graduated 50μL increments
Needle: 26G x 7/8” (23mm) or 25G x 1” (25mm)

Available Kits:
1. BP0600 ComfortSampler with Accessories
   • ComfortSampler
   • 25G x 1”(25mm) needle with integrated needle protector
   • Alcohol prep pad
   • Gauze pad
   • Specimen bag
2. BP0610 ComfortSampler Basic Kit
   • ComfortSampler
   • 26G x 7/8”(23mm) needle
3. BP0620 ComfortSampler Bulk kit
   • 300 ComfortSamplers
   • 300 26G x 7/8”(23mm) needles
4. BP0630 ComfortSampler
   • 300 ComfortSamplers
**Blood Gas Glossary**

**Arterial Line** - A catheter threaded into artery to draw blood for analysis

**ABG Stick** - Slang for arterial puncture

**Arterial Puncture** - Puncture artery with needle for BG sample

**Skin Prep** - Sterilization of skin preparing skin for puncture.

**Blood pH** - The end result of bicarb concentration HCO₃ or (metabolic component) acting on the respiratory component $PCO_2$

**pH** - The negative log of the hydrogen ion concentration (measurement on acidity or alkalinity of a solution)

*pH Scale* - [acid 0] [↓] 7 neutral (7.40 human blood) [↑] 14 alkali

**Heparin** - Anti-coagulant to prevent clotting

**Liquid Heparin** - 1000 units per cc

**$PCO_2$** - Partial pressure of carbon dioxide CO₂

21% oxygen in O₂ 760 mmHg. = 147 psi

79% nitrogen N₂ 159.6 mmHg.

79.6 mmHg.

**$PO_2$** - Partial pressure of oxygen

$PO_2$ Arterial - partial pressure of oxygen in artery

Normal - 80-100 mm Hg.

**HCO₃⁻** - Bicarbonate ion, retained or excreted by kidney

**Normal pH** - 7.40, determined by bicarb and CO₂ being in balance with each other

**Normal $PCO_2$** - 40 mmHg

**Normal HCO₃⁻** - 24

**CO₂ Down** - pH goes up, alkaline

**CO₂ Up** - pH goes down, acidic

$PO_2$ – 90 mmHg normal (oxygen in liquid blood)

60 times more oxygen carried by the red cells than by plasma

ABG’s measure only what is in the plasma

**Hypoxia** - decreased oxygen in tissue

**Hypoxemia** - decreased oxygen in blood

Low - PO₂ - SO₂ (saturation of oxygen in red cells)

**Hypo Carbia** - $PCO_2$ below 35 mmHg 10 points in between normal

**Hyper Carbia** - $PCO_2$ above 45 mmHg
Acidemia - pH below 7.35
Alkalemia - pH above 7.45
Anaerobic - without air; this is the way ABG’s are samples are collected
Aspirate - pull on syringe plunger
Needle Bevel - cut of needle tip
Gauge – Outer diameter of a needle
Hemoglobin - molecule in red cell that carries oxygen
LUER-LOCK™ - fitting on the end of the syringe for secure needle fit
ABG Analyzer – Arterial Blood Gas Analyzer manufacturers are: Osmetech, Bayer, Radiometer, IL, Nova, i-STAT, ITC, Roche
Radial Artery - number one choice for Arterial Blood Gases (left arm wrist)
Brachial Artery - number two choice for Arterial Blood Gases (inside of left or right elbow)
Femoral Artery - third choice for Arterial Blood Gases (groin area left or right)
Artery - carries blood from the heart to the body under pressure
Systolic - blood pressure measurement out of the heart
Diastolic - blood pressure into the heart (resting)
Normal Blood Pressure - diastolic 60-90; systolic 100-140
Right Side of Heart - receives blood from body and pumps blood to the lung
Left Side of Heart - receives blood from lungs and pumps to body
Physiology of Arterial Blood Gas

General Overview

Maintaining oxygenation and/or acid-base balance is what respiratory therapy is all about. This paper explains how oxygen and carbon dioxide are transported in the blood via a series of chemical transformations. Blood gas values are measurements of the different chemical components of gas transport.

In order to understand how a certain disorder can cause altered blood gas values, you must understand what part of body functions each measurement represents, and how the body itself may try to compensate for metabolic or respiratory extremes.

Blood Gases

Blood gases are obtained in a variety of clinical situations for a variety of reasons including determination of patient oxygenation and acid base status. The acid base status is a result of the interaction of the respiratory component and the non-respiratory or metabolic component. Sometimes interest in blood gas analysis concentrates specifically on the respiratory component or the metabolic component. However, the primary interest is in obtaining both parameters.

Arterial blood gas determinations have gained great importance in diagnosing and monitoring patient care, especially for acute care patients. It always must be remembered that the information obtained cannot be considered independently of other laboratory tests. The following discussion will concentrate on the understanding and application of arterial blood gases rather than the actual techniques for obtaining these values.

Blood Samples for Blood Gas Analysis

Before discussing blood gas values, it seems appropriate to discuss what kind of blood sample is being analyzed. The preferred source for acid-base studies is arterial blood. Arterial blood is a representative mixture of blood from various parts of the body. Venous blood drawn from an extremity tells us more about the metabolism of the particular extremity the sample was collected from as opposed to the body as a whole. Arterial blood also provides information on how well the lungs are ventilating and oxygenating the blood. A venous sample, even a central venous sample, can tell us only if tissue oxygenation is low. But, it cannot separate whether or not oxygen levels are low due to lung abnormalities or perfusion abnormalities such as a low cardiac output.

Collection of ABG Samples

The most common sites for arterial sampling are the radial artery, brachial artery and femoral artery (fig. 1). The safest and most preferred site is the radial artery. It is considered a “safer” site due to the ulna artery providing a collateral blood supply to the extremity (hand) in the event the radial
Fig. 1  Arterial Blood Gas Puncture Sites

Fig. 2  Allen Test
artery becomes occluded for some reason, such as a hematoma. The test to determine adequate collateral perfusion is the Allen test which should be performed before each puncture (fig. 2). This test involves pressing on both ulnar and radial artery to occlude them, and blanching the patient’s hand either by having him make a fist and then opening the hand or by simply squeezing the blood from the hand.

After the hand has been blanched, release the pressure on the ulnar artery only and observe the hand flush from the blood being supplied by the ulnar artery. If the hand does not flush adequately within 10-15 seconds, an alternate site should be chosen.

There will be patients on which an arterial puncture is not considered reasonable. This could be due to a bleeding abnormality, sample frequency or the size of the patient such as a small child or infant. An alternative method for obtaining blood gas samples is from arterialized capillaries. This technique involves heating the site, usually a finger, heel, or ear lobe. The heating should take place to assure increased vasodilation to provide good blood flow and reduce the uptake of oxygen by the tissues. The prepared site is then punctured just deep enough to obtain a free blood flow.

**Handling and Storage of ABG Samples**

The handling and storage of blood gas samples is another important subject. The sample should be drawn in the appropriate glass or non-diffusing plastic syringe or capillary tube to which the appropriate amount of anti-coagulant (sodium or lithium heparin) has been added. If the syringe sample is not to be analyzed immediately, it should be labeled and stored in near freezing conditions such as ice water to reduce the metabolism of the blood cells. The sample should be maintained anaerobically at all times. The sample should be analyzed as soon as possible. With the Osmetech ComfortSampler no icing is required if the sample is analyzed within 30 minutes. If the time is expected to be longer than 30 minutes, the sample should be stored at 4 C.

**Oxygen Transport**

The partial pressure ($P$) of arterial blood ($PO_2$) represents the measurement of the partial pressure of dissolved oxygen in the arterial blood. The $PO_2$ is usually reported in mmHg. Oxygen is transported between the alveolus and the cell in the blood in two different forms:

1. As dissolved oxygen in plasma
2. As combined in the red blood cell hemoglobin which is a protein.

Normal $PO_2$: 80-100 mmHg

**Carbon Dioxide Transport**

The other gas in the blood that is specifically considered when ordering blood gases is carbon dioxide ($CO_2$) which is usually reported in mmHg. Carbon dioxide is a very important gas to measure when dealing with acid-base and ventilatory problems. Carbon dioxide is a by-product of normal cellular metabolism and must be transported from body tissues where it is manufactured, to the lungs where it is excreted. This is accomplished by the diffusion of carbon dioxide from the metabolizing tissue cells in the intercellular fluid to the interstitial fluid to the systemic capillary blood, and is then carried to the lungs where it diffuses into alveolar gas. Carbon dioxide is
transported by the blood in many different forms such as dissolved in plasma as carbonic acid, bicarbonate ions, carbamino hemoglobin and carbonate ion.

Normal $\text{PCO}_2$: 35-45 mmHg

**Acid-Base Balance**

Often when carbon dioxide is being discussed, the relationship between CO$_2$ and pH is thought of. pH is a measurement used to express the hydrogen ion activity. pH is mathematically defined as “the negative logarithm of the hydrogen ion activity”.

A pH value above 7.0 is considered alkaline and below 7.0 is considered acidic. Normal body pH is slightly alkaline at a normal range of 7.35-7.45.

The pH range the body maintains is very narrow and depends on the relationship between acid, bases and buffers. An acid is a substance that tends to donate free hydrogen ions. The more hydrogen ions donated, the stronger the acid becomes. Bases are substances that tend to remove hydrogen ions from solution. The more hydrogen ions capable of being removed, the stronger the base is. Buffers are weak acids or weak bases that will accept or donate hydrogen ions to prevent extreme change in hydrogen ion concentration and help to minimize extreme fluctuation of pH so that normal metabolism can continue. The most important buffer systems in the body are the bicarbonate/carbonic acid system, the hemoglobin system and the serum protein buffer system. The hemoglobin buffer system has been briefly discussed previously. The carbonic acid/bicarbonate relationship is best expressed by the “Henderson-Hasselbach equation”.

Normal pH: 7.35-7.45

**Electrolyte Analysis**

Electrolytes also affect acid base balance. Electroylytes must be electrically balanced and exchange within the kidney tubules. This means there must be the same number of anions and cations on each side of the involved membranes. The major cations involved are hydrogen, sodium and potassium ions. The major anions involved are ammonium chloride and bicarbonate ions. In order to accomplish electrical neutrality, changes in the concentration of one of the ions must be counterbalanced by a shift in the concentration of the remaining ions. For example, if a potassium ion leaves the cell it may be replaced by a hydrogen ion from plasma, allowing another free bicarbonate ion to remain in the blood thus increasing the pH. For another example, the electrolyte shift may mean that if normal amounts of chloride were reduced in excreted urine, bicarbonate ions would be excreted in its place reducing the equation; a lower pH value will result demonstrating the definite effect electrolytes have on acid base balance.

**Heparin**

Heparin is an anticoagulant which is necessary in drawing arterial blood to prevent the blood from clotting.

Initially, sodium heparin, packaged in glass ampoules was supplied for use when drawing arterial blood gases. The procedure requires the technician to break open the ampoule and drain the heparin out of the vial into a syringe, through a needle. The next step is to lubricate the barrel and
plunger of the syringe to minimize friction to allow for the plunger to respond to low arterial pressure and thus allow the syringe to fill easily. Proper technique dictates expelling excess heparin with the syringe in an upright position, leaving residual heparin in the needle, needle hub and tip of syringe. If the technician does not expel the excess heparin as proper technique calls for, the excess heparin left in the syringe will cause distortion to the blood gas values determined through analysis. Therefore, good technique is of the utmost importance to obtain accurate blood gas results. To overcome the problem of leaving excess heparin in the syringe, a new form of heparin in a dry form was introduced to the market place to satisfy the customer’s need.

The first dry heparin syringe was a sodium crystallizing heparin syringe introduced by Marquest under the brand name “Mosquito”. The heparin was “baked” onto the wall of the syringe. The major disadvantage to crystalline heparin is its solubility characteristics. Simply, it does not dissolve rapidly within the blood sample, resulting in clotting in both the syringe and the blood gas analyzer.

The next generation of dry heparin was lyophilized (freeze dried sodium), which appears in the syringe in the form of a “puff” or “flake”. The manufacturing process consists of freezing the liquid heparin and drying it in a vacuum chamber which causes the moisture to evaporate, resulting in the “puff” or “flake”. This new form of heparin has been extremely well received because it dissolves instantly upon contact with blood.

And finally, the clinical laboratory in the hospitals discovered distortions in the presence of the sodium ion in electrolyte analysis due to the use of sodium heparin. As a result, lithium heparin was introduced in both liquid and dry forms.

The Osmetech ComfortSampler glass capillary tube is coated with a mixture of dry heparin with a concentration of 6 units of Na-heparin and 9 units of Li-heparin. This special mixture of heparin dissolves instantly upon contact with blood and is the exact quantity to prevent clotting without affecting measurement values.

**Syringes**

The traditional tool used for blood collection is a syringe. The components of a syringe are the plunger and barrel. They are available in either glass or plastic. The Osmetech ComfortSampler is a plungerless device containing a glass capillary tube that fills quickly by arterial pressure.

For many years glass was the only acceptable material for blood gas syringes. The major reason for this was the concern that gases would diffuse through the syringe wall altering the blood gas values. However, with the new formulation of plastic, this fear has been reduced. The plastic syringe is now widely accepted and, in fact, outsells the glass syringe.

Blood gas syringes are available in various sizes, with hospital procedure, sample size requirements and/or personal preference determines which sizes are selected. Today, most ABG analyzers require less than 200 µL of sample, most less than 100 µl. The Osmetech ComfortSampler collects 200 µL of arterial sample—all that is necessary for an ABG sample.

A syringe with a needle attached is used for an invasive procedure (arterial puncture), whereas a syringe without a needle can be attached to a stopcock on an arterial line (A-line). An arterial line is an in-dwelling catheter inserted in the artery to draw multiple blood samples over a period of time. This eliminates the necessity and discomfort of repeated arterial puncture.
Specific needles have been designed for arterial punctures. A needle is attached to the tip of a syringe by either a twisting or pushing motion.

Needles are identified by the length and the outer diameter or the needle shaft. The unit of measure for the outer diameter is called the gauge. A variety of needle sizes are available involving 20 ga., 22 ga., 23 ga., 25 ga., and 26 ga. The larger the gauge number, the smaller the needle. The inner diameter (I.D.) or the needle (lumen) determines the rate of blood flow.

Until recently, to increase the rate of blood flow into a device a large needle was necessary. However, this resulted in increased patient trauma. With the introduction of thin wall needles, manufacturers have increased the rate of blood flow by increasing the inner diameter of the needle, without increasing the outside diameter.

The Osmetech ComfortSampler uses a 25 gauge x 1” (25mm) needle with an integrated needle protector, or a 26 gauge x 7/8” (23mm) needle without a needle protector. This is the smallest in the industry, to reduce puncture pain and hematomas but still fills within seconds by arterial pressure. Because the needle is so fine, the puncture is scarcely traumatic and bleeding is minimal.

Another important consideration in selecting arterial blood gas needles is the bevel of the needle. Put simply, the bevel is the angle at which the tip of the needle is cut. The angle of the cut is not referred to in degrees. It is commonly referred to in the industry as short or “B” bevel, long or “A” bevel and intermediate or “A/B” bevel.

The advantage of a short bevel needle is that it reduces the chance of transfixing (puncturing through) the artery. The advantage of a long bevel needle is that it is a sharp needle and will puncture the skin easily.

The Osmetech ComfortSampler 26 gauge needle has a Neolus bevel. Neolus is a trademark name for an intermediate bevel. Therefore, the Neolus bevel reduces the chance of puncturing through the artery as well as providing a sharp needle for minimal discomfort for the patient.
Significance of Arterial Blood Sampling

Clinical Significance of Arterial Blood Gases

Arterial Blood Gases consist of Oxygen (O₂) and Carbon Dioxide (CO₂) and their acid-base balance (pH).

Arterial blood carries oxygen from the lungs to the cells of the body where it is consumed to provide energy.

Carbon Dioxide is given off as a by-product of the energy that is produced and returned to the lungs in venous blood.

In the Alveoli of the lungs, the venous blood gives up the carbon dioxide molecules and takes in new oxygen molecules, thus becoming arterial blood again. This is why our blood circulates, cells are constantly being supplied with oxygen and depleted of carbon dioxide so they can perform their functions—brain cells to think, muscle cells to work, etc.

Respiratory, cardiac or renal failure can upset this process and result in death or loss of function. An analysis of the levels of oxygen, carbon dioxide and the pH (acid base) balance of arterial blood can help tell the physician what is wrong with a new patient (heart failure, shock, respiratory failure, diabetic shock, etc.), what treatment is best and how effective that treatment is.

Thus, an analysis of arterial blood is both a diagnostic and a monitoring tool.

Blood Gas Values

Many values can be identified from an ABG sample, but the most common are the blood gas values and acid balance. The symbols used to describe these values are as follows:

\[ P_{O_2} \] - The partial pressure of oxygen molecules in arterial blood, expressed in millimeters of mercury (mmHg).

\[ P_{CO_2} \] - The partial pressure of carbon dioxide molecules in arterial blood expressed in millimeters of mercury (mmHg).

\[ pH \] - The acid-base value.

These two blood gas values are the most significant because of their intrinsic informational content and because most other values are usually calculated from them. They are the base from which a complete analysis is built. If they are not accurate, then the entire blood gas analysis could be erroneous to varying degrees. Customers will be most interested in these two values, so it is important to understand their significance.
**PO$_2$ and PCO$_2$**

As indicated earlier, PO$_2$ and PCO$_2$ are the partial pressure of oxygen and carbon dioxide molecules contained in the arterial blood sample. It is a gas pressure, and gas pressures are additives. Dalton’s law describes this physical phenomenon:

“The total atmospheric pressure is the sum of the individual gas pressures and that each of these partial pressures is as though the gas alone occupies the space.”

This is best explained by the following example:

Our atmosphere is made up of 21% oxygen and 79% nitrogen. Atmospheric pressure at sea level (barometric pressure) is 760 mmHg. Therefore, partial pressure of oxygen (PO$_2$) is 21% of 760 mmHg., or 160 mmHg.

Special analyzers called Blood Gas Analyzers can process arterial blood samples, electronically, and measure partial pressures of oxygen and carbon dioxide. Normal adult PO$_2$ and PCO$_2$ values are as follows:

\[
\begin{align*}
\text{PO}_2 & = 90 \pm 10 \text{ mmHg} \\
\text{PCO}_2 & = 40 \pm 2 \text{ mmHg}
\end{align*}
\]

**Sensitivity of Blood Gas Values - PO$_2$ Error:**

Blood gas analyzers are highly accurate analyzers that precisely measure the PO$_2$ and PCO$_2$ molecules in blood plasma. The PO$_2$ value, for example, is directly proportional to the number of oxygen molecules in the blood; the more molecules, the higher the reading.

This is significant because the normal blood PO$_2$ value is 90 mm Hg. vs. a normal atmospheric PO$_2$ of 160 mm Hg. Nature will try to equalize these two different pressures. Unless the blood sample is completely isolated from the outside atmosphere, the PO$_2$ values will rise as more oxygen molecules diffuse into the blood sample, this is called PO$_2$ error.

Extra O$_2$ molecules can get into the blood sample in several ways. Sources of O$_2$ Diffusion and Subsequent PO$_2$ Error:

1. **Diffusion through plastic:** Some polypropylene syringes are permeable to O$_2$. However, with the new formulation of plastic, this fear has been overcome in a majority of syringes.

2. **Oxygen molecules within the plastic:** Some plastic itself contains O$_2$ molecules which will exchange with the blood sample, particularly if the sample is low in hemoglobin (that part of the blood which combines with oxygen).

3. **Seepage around the plunger tip:** If the plunger tip is not a tight fit, then O$_2$ can seep around it and affect the sample. Remember, atmospheric PO$_2$ is 160 mm Hg. and the PO$_2$ of the blood sample will be around 90 mmHg. Nature will seek to equilibrate the two pressures.
Some of the older plastic blood gas syringes are especially prone to this problem because of their loose filling plunger tips. In order to minimize the resistance to arterial blood flow (arterial blood should never be aspirated) the plungers are as free sliding as possible. This means a loose fit to the syringe barrel and a consequent risk of O₂ diffusion around the tip.

4. **Trapped air bubbles**: Any air bubbles inside the syringe will increase the PO₂ value.

All of these factors are time-dependent. If the sample is analyzed immediately after drawing it, the affect of oxygen diffusion from any or all of these sources is not significant. However, the PO₂ value will rise higher and higher the longer the time interval between sampling and analyzing.

These questionable plastic syringes, therefore, can be used in those situations where there is no delay between sampling and analysis. However, delays are sometimes unavoidable and can be lengthy. Also, if the sample is stored for any length of time, the risk of PO₂ error also grows.

Hospital personnel are very aware of PO₂ error and sensitive to ways of correcting it. This feeling is one of the reasons why for many years glass syringes was considered the best method of drawing and transporting a sample despite its drawbacks of high cost and fragility. Glass is virtually impermeable to O₂ diffusion. The Osmetech ComfortSampler contains a glass capillary tube to prevent any O₂ diffusion into the sample.

**Sensitivity of Blood Gas Values - PCO₂ Error:**

**Cell Metabolism.**

The potential for PCO₂ error is also high. One source is blood cell metabolism within the blood sample. The blood cells are still alive and consuming oxygen and giving off carbon dioxide. Unless the metabolic rate of these cells is slowed down by cooling, the PO₂ level will decrease and the PCO₂ level increase as the blood cells continue to metabolize oxygen. Icing syringe samples effectively slows the metabolic rate and helps stabilize the blood gas levels near their original levels. However, this cooling process is dependent on the diameter of the syringe and the volume of blood. The Osmetech ComfortSampler requires no icing if analyzed within 30 minutes. Because of the narrow diameter of the capillary, cooling occurs almost instantly stabilizing the blood gas values.

**Liquid Heparin Dilution**

The primary source of unavoidable PCO₂ error is dilution of the blood sample by liquid heparin. Heparin is an anticoagulant used to prevent blood from clotting before it reaches the analyzer. The most common source of heparin is from porcine (pig) intestinal mucosa. Without it blood will clot and cannot be inserted into the analyzer. It is also used as a lubricant in glass and plastic syringes to make the plunger slide back and forth more freely; and as a filler of syringe dead space.

The latter purpose causes the dilution problem. A syringe contains approximately ¼ cc of dead space, which is significant when drawing a 2 cc or 3 cc sample as is usually done. This ¼ cc of heparin will diffuse throughout the blood sample and lower PCO₂ value. To calculate the percent dilution error, divide the dead space by the number of cc’s of blood collected. For example, the percent reduction in PCO₂ caused by .25 cc of heparin in a 2 cc sample would be calculated as follows:
Heparin dilution = \( \frac{0.25 \text{ cc}}{2.00 \text{ cc}} \times 100 = 12.5\% \)

If the original or “body” \( PCO_2 \) value of the sample were 40 mmHg, then this value would be reduced by 12.5\% to 35 mmHg. The \( PCO_2 \) value measured by the blood gas analyzer would be 12.5\% less than the actual value of the patient’s blood.

**Dry Heparinization**

Only dry heparinization can offset this dilution problem. Any syringe that relies on liquid heparin will have some degree of sample dilution because the heparin cannot be removed from the syringe dead space.

The Osmetech ComfortSampler glass capillary tube is coated with a mixture of dry heparin with a concentration of 6 units of Na-heparin and 9 units of Li-heparin. This special mixture of heparin dissolves instantly upon contact with blood and is the exact quantity to prevent clotting without affecting measurement values.
ABG Sampling Procedure – Q&A

“Where is ABG sampling performed?”
ABG Blood Samples are taken at the patient’s bedside in the critical care areas of the hospital. The higher percentages of samples are taken in the ICU and CCU of a hospital.

“Who takes the sample?”
Respiratory Therapists do almost all blood sticks, although nurses and physicians can also draw samples. Frequently, a specialist within the Respiratory Therapy Department like a Cardiopulmonary Technician will be the designated blood sampler and do most of the sampling. Less frequently, the nursing staff will draw the samples and occasionally a doctor or lab technician may take samples. Who draws the sample will largely depend on the hospital and which department happens to be strongest.

On the average, Respiratory Therapists will take 80% of the Blood Samples with nurses and lab technicians the remainder.

“What sites are most common?”
Arterial sticks are dangerous for the patient because the artery can be destroyed by a poor puncture with a consequent loss of circulation and potential tissue death, resulting in amputation. Arteries are also surrounded by nerves which can be damaged or severed. Damage results in extreme pain—a severed nerve can result in loss of feeling or control. The arterial stick, in other words, is risky and must be done with care.

Three sites are most common:

1. **Radial Artery**: This artery is located on the inner sides of the wrist, close to the surface. Besides being readily accessible, collateral arteries are available to supply blood to one hand if the radial artery is damaged.
2. **Brachial Artery**: This is the second most common site, located on the inside of the elbow, below the biceps. This artery is larger and fills the sampling device faster; but there is a greater risk to the patient because there is little collateral circulation to the rest of the arm if the brachial artery is damaged.
3. **Femoral Artery**: This major artery supplies blood to the entire leg. Samples are usually taken from this site when the patient’s blood pressure is extremely low as in new heart attack cases or whenever cardiopulmonary resuscitation is being performed. It is rarely used for routine sticks because the entire leg is vulnerable to serious damage if the artery and/or surrounding nerves are damaged.

Several other sites are used depending on the patient and the circumstance. Neonates, for example, usually receive a heel stick or have the umbilical artery tapped. ICU patients generally have an existing arterial line tapped rather than make a new stick each time a sample is required. This latter method accounts for approximately 20% of all blood samples taken.
“What are the puncture technique objectives?”

1. To assure an arterial sample, unmixed with venous blood.
2. To assure asepsis and guard against infection.
3. To insure patient safety by guarding against arterial spasm and preventing bleeding.
4. To minimize pain, to assure patient comfort and prevent patient from hyperventilating or holding breath.
5. To avoid tissue trauma and resulting hematoma.

*Note: The Osmetech ComfortSampler is especially designed to help meet all of these objectives.*

“How is the procedure done?”

The arterial sampling procedure is risky, but quick and safe if done correctly. Listed below are the steps required for a typical stick using a conventional plastic syringe with liquid heparin.

**First**, check patient’s chart for anticoagulant medication or any bleeding tendencies.

**Second**, check to see if the patient has been recently suctioned or for any recent changes in a ventilator setting. Either procedure can cause changes in blood gases. If possible, wait at least 20 minutes before making the puncture.

**Third**, explain the procedure to the patient if he is conscious. Caution him to expect some discomfort.

Upon completion of the preliminary steps, the arterial sampling procedure is continued as follows:

**Step 1: Gather Components**

Components needed on-hand include: syringe needle(s), gauze pads, liquid sodium heparin ampoule, alcohol and/or betadine solution swab, Ziplock ice bag, syringe cap, rubber stopper, sterile field, patient identification label.

If the sample is to be drawn from an established arterial line, only the syringe and the heparin ampoule will be needed, since the sample will be drawn from a stop cock port. Needles and prepping components are not necessary except for the needle necessary to aspirate heparin from the ampoule.

*Note: Components needed for using the Osmetech ComfortSampler include:*

1 - Osmetech ComfortSampler Kit Package.

**Step 2: Preparation of Ice Bag** (Not needed with Osmetech ComfortSampler)

The blood sample must be iced to prevent cell metabolism from decreasing the PO₂ value and increasing the PCO₂ value. The Ziplock ice bag should be filled with ice prior to making the stick.

**Step 3: Opening Heparin Ampoule** (Not needed with Osmetech ComfortSampler)

On the assumption that the needle has already been attached to the syringe, the next step is to open the heparin ampoule. One of the gauze pads can be used to snap open the neck of the ampoule.
containing liquid sodium heparin. The gauze pad helps protect the user from glass fragments.

Step 3a: Heparin Aspiration (Not needed with Osmetech ComfortSampler)
The needle and syringe must be heparinized to prevent clotting and to lubricate the syringe and fill syringe dead space.

Holding the needle in an upright position, insert needle into vial and withdraw the plunger to draw heparin upward into the syringe.

Note: Sometimes the needle point can be hooked or blunted if it hits the bottom of the ampoule when withdrawing heparin. This could lead to a more painful stick and possible damage to the arterial wall.

These problems do not occur with the Osmetech ComfortSampler. The capillary tube of the Osmetech ComfortSampler is pre-coated with the exact amount of heparin to prevent the samples from clotting and, at the same time, to assure complete accuracy of results.

Step 4: Plunger Lubrication (Not needed with Osmetech ComfortSampler)
Since the heparin ampoule only contains 1.0 ml of sodium heparin, there is enough room within the syringe for lubrication. With the needle in an upward position, the plunger should be moved back and forth to insure that the syringe barrel is fully wetted and lubricated. Remember: Arterial blood should never be aspirated, so the plunger must be as free-sliding as possible to minimize resistance (plunger drag) to arterial blood pressure.

Step 5: Excess Heparin Removal (Not needed with Osmetech ComfortSampler)
Excess heparin dilutes the sample and the PCO₂ value, so it must be reduced to a minimum. All but the heparin contained in the syringe dead space must be expelled.

Note: PO₂ values may increase abnormally if patients hyperventilate as a result of anxiety which may increase as they watch the syringe and needle being prepared. The Osmetech ComfortSampler reduces patients’ apprehension. The sample size is small. The procedure is quick. And, the plungerless syringe looks as harmless as it is.

Step 6: Preparation of Puncture Site
An alcohol wipe is normally used to prep the puncture site. The site is swabbed briefly to remove contaminants from the skin’s surface. A betadine solution swab is sometimes preferred over alcohol because of its greater bactericidal properties, but it is messy and hence used less frequently.

Note: Pulse Palpitation - The individual performing the stick will feel for the pulse before making a stick to make sure that he/she has located the artery. Sometimes to determine that they are in the artery and not a vein, they will press down on the wrist above the puncture site to see if the blood flow into the syringe shows. If the needle is in a vein, blood will continue to flow and fill the syringe because the pressure is down stream of the needle. That is—blood is flowing back to the heart. This is not necessary with the Osmetech
ComfortSampler because the prompt and pulsing rise of blood level shows reliably that a vein has not been punctured by mistake.

Step 7: Performing a Stick

The technician turns the bevel of the needle “upstream” so that the back faces the direction of blood flow and makes an arterial stick.

Note: The syringe should be allowed to fill by arterial pressure only. Arterial blood should not be aspirated because possible damage to nerves and the arterial wall could result.

Step 8: Removal and Capping of Syringe

After the sample is taken (usually 2-3 cc’s) the syringe is removed from the patient. Two things now occur:

a) The needle may be removed from the syringe and the syringe capped, or

b) The syringe with needle in place may be stuck into a rubber stopper. It is important that whether a rubber stopper or syringe cap is used, the fit or seal must be tight to insure that no air bubbles are entrapped.

Step 9: Icing the Sample

The syringe is immediately placed in the Ziplock ice bag that was prepared in step 2 to prevent cell metabolism from decreasing the O₂ content and increasing the CO₂ content.

Ice bags are used if any type of delay is expected between the time that the sample was drawn and the analysis performed. If the sample is analyzed immediately, the use of the ice bag is sometimes dispensed with. But analysis should be done almost immediately to insure accurate values, even with icing. Usually 75% of all samples are analyzed within 10 minutes of drawing blood and 96% within 15 minutes.

Note: With the Osmetech ComfortSampler stability of the sample is better than with syringe samples and icing is not required for 30 minutes after collection.

Step 10: Stopping Arterial Bleeding

After the needle is withdrawn, the puncture hole in the arterial wall must be closed to prevent hematoma. Applying pressure with a gauze pad over the puncture site for 5 minutes will give the body enough time to seal the hole.

Note: With the Osmetech ComfortSampler, the puncture site is compressed for only approximately two minutes. Because the needle is so fine, the puncture is scarcely traumatic and bleeding is minimal.
In- Service

“Why the need for an in-service?”

The answer is that most successful (and lasting) conversations are accompanied by an extensive in-service program. This is a key strategy of all syringe manufacturers. If our competition is differentiating themselves through in-service programs, we must do the same to compete effectively.

A typical in-service should include all shifts of the Respiratory Therapy Department and the ICU. Others to include are Lab Technicians, Emergency Room Personnel, Nurses and Physicians, if possible.

Remember that an in-service allows you to:

- meet more users in the hospital
- establish personal contact and build rapport
- Help insure the proper use of the product
- Establish “service” as part of what you are selling

Note: Following an in-service demonstration it is important to leave an adequate number of sample kits for actual use and evaluation by personnel. Also of importance is to follow-up on the evaluation results at an agreed-upon date and time.

As stated earlier, in-services are a necessity and demonstration can be effective training aids during these sessions.

To prepare for an in-service, the following materials should be available:

1. Blood pressure cuff and gauge
2. Samples of the ABG kit being in-serviced
3. IV bag containing red food coloring

Perform the following demonstration.
Demonstration

Procedure:

Step 1 – Distribute a sample of the kit being demonstrated to each person at the in-service.

Step 2 – Lay out components. Lay out the following components of the kit on your demonstration table (components will vary depending on the kit being demonstrated):

- ComfortSampler
- Needle
- Alcohol prep pad
- Gauze pad
- Specimen bag

Step 3 – Describe the technical aspects of the ComfortSampler.

  a. Contains one preheparinized capillary tube. Total sample size is 200 uL.
  b. The amount of the heparin used will prevent the sample from clotting without distorting the results.
  c. Rapid cooling of blood in capillaries provides increased sample stability. No icing is required if the sample is analyzed within 30 minutes.
  d. Blood Gas Analysis may be preformed by holding the exposed capillary of the ComfortSampler up to the inlet port of the ABG Analyzer and aspirating the sample.
  e. 25 & 26 gauge needle allows a relatively pain free puncture and causes much less trauma to the artery.

Step 4 – Demonstrate puncture technique of the ComfortSampler.

  a. Pressurize blood pressure cuff with IV bag inside to approximately 100 mm Hg to represent patient arterial blood pressure of 60.

  Note: Pressure in bag is 60% of gauge pressure.

  b. Remove protective cap.
  c. Attach the needle.
  d. Remove the needle cover and perform the arterial puncture into the IV tube of the bag.
  e. Allow the capillary to fill completely. Terminate Puncture.
  f. Swing needle protector over needle by pressing against a firm surface or needle cap (26G needle).
  g. Label sample or attach patient label.

  Note: Explain again that because of the rapid cooling of blood in the capillary tubes, no icing is required if analyzed within 30 min. Therefore, there is no need to secure ice and no requirement to discard contaminated ice.
## Ordering Information

### ComfortSampler Configurations

<table>
<thead>
<tr>
<th>ComfortSampler with Accessories</th>
<th>BP0600</th>
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<tbody>
<tr>
<td>ComfortSampler</td>
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<td>Alcohol prep pad</td>
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<td>Gauze pad</td>
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