Sampling in acute care testing
simpler, faster, better
Radiometer’s vision is to make acute care testing simpler and better. For us, simpler and better testing means short turnaround time, less workload and reduced risk of errors. To help you achieve that, our solutions simplify and automate key processes in acute care testing, leaving you with the time and confidence to focus on what matters most: patient care.

Safer, more accurate sampling
Radiometer samplers play an integral role in making acute care testing simpler and better. Easy to use, they help to reduce the likelihood of preanalytical errors and, where possible, increase operator and patient safety.

In this brochure, we detail some of the most common errors associated with blood gas testing and explain our approach to safe sampling. We also show how Radiometer’s dry electrolyte-balanced heparin helps to optimize accurate results, and outline the benefits of automated testing over manual testing.
Avoiding preanalytical errors

With as many as 68 % [1] of all blood gas testing errors occurring in the preanalytical phase, it is important to invest in samplers that can help reduce these errors while increasing operator and patient safety. To receive our comprehensive guide to preventing preanalytical errors, contact your local Radiometer provider.

Prebarcoding ensures correct patient identification

The challenge
Incorrect or missing patient IDs are some of the most frequent - and critical – errors in laboratory testing, leading to resampling, misdiagnosis and incorrect treatment.

Radiometer solution
Our safePICO samplers are prebarcoded and ready for use, making it easier to correctly identify each sample. With the FLEXLINK software, sample and patient IDs are scanned and linked together at the bedside and connected to the correct result.

References

Avoid air bubbles and minimize risk of contact with blood

The challenge
Air bubbles can seriously affect arterial samples. \( \rho O_2 \) and related parameters are particularly prone to bias.

Radiometer solution
Different tip caps for minimizing the risk of air bubbles and blood contact:

safePICO samplers are available with our unique safeTIPCAP’s. The safeTIPCAP’s self-sealing function minimizes the risk of contact with patient blood, while its special ventilated construction simplifies the removal of air bubbles. The sample is sealed after air bubbles have been removed. The contact with patient blood is limited as the safeTIPCAP stays on during transport and analysis.

PICO50 and PICO70 samplers are available with our standard TIPCAP. The TIPCAP attaches securely to reduce the risk of blood spillage, while its air channels prevent air from entering the syringe as it is being sealed.
### Needle shield device for maximum safety

**The challenge**
Operator safety is crucial in all phases of acute care testing.

**Radiometer solution**
All safePICO and safePICO70 samplers come with an onboard needle shield device that allows the needle syringe to be easily removed with one hand without the risk of needle-stick injury.

Needle cubes are also available, helping to ensure operator safety. Simply insert the needle into the cube placed on a plane surface and, using forceps, remove it and place it in the waste container.

### Built-in mixing ball ensures homogeneous mixing

**The challenge**
To avoid clots, disperse the heparin immediately after blood sampling.

Sedimentation of red blood cells occurs when blood samples are stored, leading to separation of the sample. The sample must be mixed thoroughly to ensure homogeneity and with care to avoid hemolysis.

**Radiometer solution**
All safePICO samplers have a built-in metal mixing ball. This feature ensures a fast and homogeneous mixing of the sample, while avoiding clots, as heparin is dispersed throughout the sample.

In addition, the metal ball allows automated mixing without leading to hemolysis when the safePICO sampler is placed in the FLEXQ or the safePICO Mixer.
safePICO70 sampler with needle shield device
High analytical quality with dry electrolyte-balanced heparin

Radiometer’s samplers reduce the risk of clotting, electrolyte biases and reduce the risk of dilution errors.

Reducing risk of clotting
All PICO samplers are preheparinized with dry electrolyte-balanced heparin, significantly reducing the risk of clotting and securing the reliability of the result.

Electrolyte-balanced heparin
Adding heparin is vital to ensuring that blood samples do not coagulate. However, using non-balanced heparin can lead to electrolyte biases, as heparin binds all positive ions in the blood – especially calcium ions. To compensate for biases on electrolytes, Radiometer uses electrolyte-balanced heparin.

**Example:**
Non-compensated heparin may cause an error on $cCa^{2+}$ of as much as 6%. This means that a sample with a true $cCa^{2+}$ of 1.15 mmol/L will report a value that is 0.07 mmol/L too low - that corresponds to 50% of the reference range (1.15-1.29 mmol/L) [1].

Whole blood tests of blood gas, oximetry, electrolytes and metabolites are sensitive to dilution errors and electrolyte bias if incorrect type of heparin is used.

The binding of electrolyte ions to common types of heparin may cause significant errors in the electrolyte results, especially for $cCa^{2+}$.
Eliminating sample dilution errors
Using liquid heparin as an anticoagulant dilutes the arterial blood samples. Even a small dilution causes significant changes to blood gas results [2,3,4], potentially leading to misdiagnosis and incorrect treatment. Therefore, Radiometer offers samplers that are pre-heparinized with dry electrolyte-balanced heparin.

Example:
An addition of 0.05 mL liquid heparin to 1 mL whole-blood sample (Hct 45 %) will dilute the plasma phase by 10 %. Since the electrolyte parameters are determined in plasma, the concentrations of these parameters will decrease accordingly [5].

References

Radiometers electrolyte balanced heparin has been formulated to compensate for the addition and binding effects that normal heparin has on the measurement of $cCa^{2+}$.
Fully automated blood gas analysis system

At Radiometer, we believe that automating acute care testing helps to eliminate human error. 1st automatic – the world’s first fully automatic blood gas analysis system – not only helps to reduce error, but also simplifies testing.

**Simpler, more accurate testing**

1st automatic means no more precious time wasted waiting at the analyzer. The user simply places up to three samplers in the analyzer and 1st automatic handles the rest. Patient identification, sample mixing and aspiration, and analysis and result delivery are all fully automated.

**1st automatic’s key components**

1st automatic consists of three key components: FLEXQ, safePICO mixer and FLEXLINK.

**FLEXQ**

Optional on ABL800 analyzers, the FLEXQ module automatically identifies, mixes and aspirates up to three prebarcoded safePICO samplers. Automating these processes cuts the risk of operator error and frees up more time for patient care.

**safePICO mixer**

When time is of the essence, the safePICO mixer comes into its own. Capable of mixing a sample in just seven seconds, it delivers thorough and uniform mixing to ensure sample integrity and reduce the risk of preanalytical errors.

**FLEXLINK**

FLEXLINK from Radiometer links sampler, patient and operator IDs at the bedside, making data readily available to users and eliminating the risk of incorrect patient identification.
Fully automated blood gas analysis system

ABL800 FLEX analyzer with the FLEXQ module
The end of manual mixing?

A study carried out by the University of North Carolina, comparing manual mixing with automatic mixing using Radiometer’s ABL800 FLEX analyzer found the latter superior in terms of producing homogenous samples [1].

Background

In order to produce accurate blood gas analysis results, whole blood specimens must be thoroughly mixed in advance. This is particularly relevant for the determination of total hemoglobin (tHb), because specimens in which red blood cells have settled produce inaccurate results.

Bland-Altman plots reveal that manual mixing of specimens produces significantly more variation in tHb measurements compared to automatic mixing after specimen storage for 10, 20, and 30 minutes (p<0.0001). The dotted lines define the 95% confidence interval.
Producing a homogenous blood gas specimen presents a unique challenge, because the syringe barrel must be free of any dead space in order to prevent contamination of the specimen with atmospheric air. But the absence of a dead space can impair the efficient mixing of the specimen.

Although it is recommended that syringe specimens be mixed by gentle rotation for a minimum of two minutes prior to analysis, this is rarely done properly and may be insufficient.

**Conclusions**

Manual mixing produces significantly more variation in the measurements after specimen storage for 10, 20 and 30 minutes. This led the research team to conclude that manual mixing of a syringe using non-standardized techniques is insufficient to guarantee a homogenous specimen.

**References**

Simpler, faster, better

Radiometer's products and services simplify and automate all phases of acute care testing, providing you with the speed and ease of use you want and the accuracy you need.

This is acute care testing truly made simpler, faster and better.

Sales companies:
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