

## Technical Bulletin 0004

### **Subject: How Chloride Concentration in Water Environments Affects the Life and Performance of Silver-Silver Chloride Reference Electrodes**

Water chemistry, specifically the level of chloride, can adversely affect both the life expectancy and accuracy of silver-silver chloride reference electrodes (Ag-AgCl).

When silver-silver chloride reference electrodes are used in water environments with low chloride content, the potentials obtained using any silver-silver chloride reference electrode, will be affected by the difference in the concentration of chloride between the chloride reservoir inside the reference electrode and the chloride concentration in the environment outside the reference electrode.

This differential result is a chemical phenomenon called "**Liquid Junction Potential**" and may result in significant errors in your potential readings. Liquid junction potentials of as much as 60 mV may be encountered if the reference electrode is used in waters with low chloride ion content. Similarly, liquid junction potentials will be encountered when the silver-silver chloride reference electrode is used in brines with high chloride ion content.

Silver-silver chloride reference electrodes are designed for optimum performance and life expectancy when used in solutions containing 19,000 ppm (parts per million) of chloride. **This is the chloride content of undiluted seawater.** When used in waters with a chloride ion content of less than 10,000 ppm or more than 27,000 ppm, the liquid junction potential can exceed the  $\pm 10$  mV accuracy limits that the reference electrode was specifically designed and calibrated to.

When the silver-silver chloride reference electrode is used in waters with chloride ion content significantly lower than 19,000 ppm, the life of the **Stelth<sup>®</sup>** silver-silver chloride reference electrode is adversely affected through the process of **ion migration**. The design of the **Stelth<sup>®</sup>** reference electrodes incorporates a **Moisture Retention Membrane<sup>™</sup>** that mitigates against, but does not completely eliminate **ion migration** when the chloride ion concentration of the external environment is lower than 19,000 ppm.

When the silver-silver chloride reference electrode is used in waters with chloride ion content significantly higher than 19,000 ppm, the life of the **Stelth<sup>®</sup>** silver-silver chloride reference electrode **is not** adversely affected, but the accuracy of the readings may be affected.

Needless to say silver-silver chloride reference electrodes placed in **distilled or potable water will not work**. Not only will incorrect readings be obtained, but the life of the reference electrode will be reduced significantly and the reference electrode will be rendered useless, unless it is located where it can be periodically **recharged** (see technical bulletin TBE-00011 for more information on recharging Ag-AgCl reference electrodes).

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