Calibration with Reactive Gases

Calibration of gas sensors with reactive or sticky gases such as CL2, CLO2, NH3, O3, NO2, HCN, HF, and HCL requires special care for the calibration system and procedures mainly because they are:

- very active or too unstable to be available in a cylinder.
- easy to be absorbed in the calibration system, such as gas delivery tubing, regulators, and gas cylinders.
- may corrode regulators and gas cylinders.

Calibration System

Because of the high reactive properties of these gases, the calibration system must be built with non-reactive materials. Regulators must be corrosion resistant, and tubing and tubing joints should be made of PTFE or Teflon. In addition, the tubing should be as short as possible. It is also important to ensure there is no condensed moisture inside the system. All of these are meant to reduce the absorption of the gas in the gas delivery system.

Calibration gases

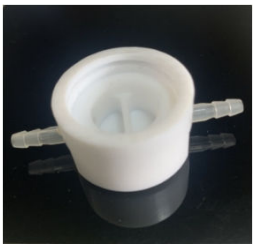
Certified calibration gases must be used, and they cannot be expired because the concentration of the reactive gas inside the cylinder will decrease over time. A reactive gas is filled in an aluminum cylinder with a stainless steel valve that has been treated to minimize reactivity with the reactive gas. A higher concentration of a reactive calibration gas usually has a longer shelf life than a reactive calibration gas with a lower concentration.

Regulators

Using the correct regulator is essential for calibration. The wrong regulator could affect the accuracy of gas monitor readings after calibration. Every gas monitor has a recommended flow rate for calibration and bump testing, but they typically fall in the 0.3 to 1.0 LPM range. Since reactive gases can corrode many materials, they require the internals of the regulators to be made with stainless steel. In addition, the reactive gases can leave residues inside the regulators, so it is highly recommended to have a dedicated regulator for each of these gases.

Calibration Cap

The calibration cap must be made of PTFE or stainless steel. The cap should have both gas inlet and outlet to maintain the gas pressure slightly higher than 1 atm during the calibration. A tight fit between the gas sensor and calibration cap is required for low concentrations of reactive gases.



Calibration Cap

Balance of Calibration System

Before calibration, the system needs to be balanced (soaked) with a higher concentration of the calibration gas; for instance, a 15 ppm or 25 ppm concentration of Cl2 should be used to balance the system prior to a 5 ppm Cl2 calibration. The required time for balancing varies with different gases and concentrations. It may take 30 minutes or longer. In general, a lower concentration needs more time to balance the system. Using pH test strips to check the reactive gas such as NH3, HCL and HF at the outlet of the calibration system is recommended if the gas sensor doesn't respond to the calibration gas.

Caution: The calibration system must be built in compliance with the safety and health regulations.