ACD Advanced Calibration Designs, Inc.

An OEM/User Guide for ACD Gas Generators

Electrochemical gas generators from Advanced Calibration Designs offer many advantages over other methods of gas sensor calibration. However, just like any technology, better understanding of these generators will make it possible to avoid many simple problems that are sometimes experienced. Below is a detailed explanation of some of the unique technological aspects of the ACD generators.

Back Pressure: Unlike a cylinder of compressed gas which has a large amount of pressure behind it, our generators rely on a pump to push the gas through the cell. If the back pressure is too large, the gas will not exit the cell properly, resulting in lowered and/or unstable results. Back pressure can be caused by long tubing lengths, tubing with a very small diameter, or calibration cups/adapters which have a restrictive disc or orifice in them. These restrictions were often installed in calibration cups/adapters to deal with the pressure from a cylinder, but need to be removed to make the adapter work with our generator. The ACDGen cell in the Model 100, 150, 300 and CAL 2000 tend to be more susceptible to this than the EC Cal or the MiniCal cell. If you think this is a problem, call the factory for more details.

Electrolyte: Since the ACD generators are electrochemical, the generating cells contain an electrolyte much as electrochemical sensors do. On the EC Cal and the MiniCal the cells are not designed to be opened. On the ACDGen cells used in the model 100, 150, 300 and the current CAL 2000, the electrolyte can be replenished or replaced. The electrolyte in these cells is hygroscopic (absorbs water), so they typically do not need to be replenished (the chlorine dioxide cell is an exception to this). However, in some dry climates the cells can begin to dry out. If the electrolyte level falls too far, the cell will go into a cell failure. Electrolyte can be added through one of the caps on the top of the cell. Since only the water portion of the electrolyte evaporates, de-ionized water can be added instead of electrolyte (except for chlorine dioxide, see below). Care must be taken not to overfill the cells, especially if the humidity will increase at a later date (i.e. in the summer).

Chlorine Dioxide Electrolyte: The electrolyte for the chlorine dioxide cell becomes unstable over time, and is not hygroscopic (it will evaporate). It must be replaced periodically (depending on use) but at least once every month if the instrument is used on a regular basis. Old electrolyte should be removed as completely as possible during this process and replaced with new electrolyte. Failure to do this will result in erroneously low readings, or eventually a lack of any gas generation at all. Since chlorine dioxide electrolyte is unstable as a liquid, replacement electrolyte is now shipped as a two part item; one vial of pre-measured de-ionized water and one vial of chlorine dioxide electrolyte in powder form . When ready to be used the water should be poured into the powder and the mixture agitated until all of the powder is dissolved. This will make enough electrolyte for one cell.

Equilibrium: ACD's electrochemical cells actually begin producing the gas when the instrument is turned on. It is then necessary for the cell's electrolyte to become saturated with the gas being generated before a constant output of gas is achieved. If the concentration of gas being generated is changed, a new equilibrium must be reached. When the unit is turned off there is still gas dissolved in the electrolyte. This gas needs to be purged from the system before the unit is fully turned off. Therefore ACD's generators have a stabilization period when the unit is turned on or when the gas concentration is changed, and a purge time when they are being shut down before the generator completely turns off.

Flow Rate: The EC Cal and CAL 2000 instruments are designed with a mass flow controller. They can adjust their flow rates from 0.2 LPM to 1.0 LPM. An external pump (such as that found in a portable gas detector) can also be used to pull the air through the EC Cal and CAL 2000 at flow rates from 0.1 to 5.0. The mass flow sensor in these two instruments can read the flow rate of the external pump and change the current accordingly to provide the requested output. As the flow rate increases, the maximum concentration of gas that can be generated decreases on these instruments (more air dilutes the sample). On the MiniCal, the flow rate is specified when the instrument is ordered and should not be changed in the field. The flow rate of the generators should be checked periodically to insure proper output. ACD calibrates the flow rates versus NIST traceable flow meters.

Gas Concentration: On the EC Cal and the CAL 2000 the gas concentration can be adjusted easily on the instrument. Note that some concentrations may not be available depending on what flow rate is being used. On the MiniCal instrument the gas concentration is controlled by the generating cell installed. To change from 5.0 ppm chlorine to 10.0 ppm chlorine would be done by removing the 5.0 ppm generating cell and replacing it with a 10.0 ppm cell. It is important to understand that the concentrations on the MiniCal cells are flow dependant. To order a MiniCal cell you must note the flow rate (of your MiniCal instrument) as well as the concentration. Using a MiniCal cell in an instrument with the wrong flow rate will result in incorrect gas concentrations being generated.

Humidity: Gas from calibration cylinders is 'bone' dry. Moisture in the cylinder would result in the gas being absorbed or reacted with the cylinder material, so it is removed. ACD instruments combine calibration gas with outside air. The CAL 2000 includes an internal charcoal filter (an optional external filter may be placed on the EC Cal) but this does not appreciably change the humidity. If our generator is used in a dry climate, it will provide dry calibration gas. If used in a moist, humid climate it will provide moist, humid calibration gas. Note that this is a much truer calibration gas as it provides the same humidity conditions that the sensor being calibrated will see during normal operation. However, some types of sensors are humidity dependant, and our generator may not match a calibration done with a cylinder of gas. This does not mean the gas detection instrument, the cylinder or our generator are incorrect. It means that humidity is a factor in the calibration, and for a truer calibration, the ACD generator should be used.

Orientation: The generating cells in the MiniCal and the EC Cal are designed to be used in any orientation, similar to a portable gas detector. However, the ACDGen cell found in the Model 100, 150, 300 and CAL 2000 works best when the unit is upright. The cell is designed not to leak in any orientation, but turning the cell upside down (or nearly so) will result in the electrolyte moving away from the electrodes resulting in low output or cell failure.

Other Questions: ACD is happy to answer questions about our products. Feel free to contact us, or to visit our website. The ACD website provides information on a variety of issues, and includes helpful items such as downloadable copies of our instrument manuals and material safety data sheets (MSDS).

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