

MSA Technical Brief: **Considerations of Oxygen Sensors used for Process Control**



MSA gas detection systems are available with oxygen sensors that can sense various oxygen levels. For some oxygen sensor types, technology used to detect oxygen in the environment employs a sacrificial lead anode that plays a part in the chemical reaction. When this type of sensor reaches its end-of-life, no reagents remain in the sensor to detect oxygen. As a result, the sensor may be unresponsive, reporting zero oxygen level. In situations where the sensor may report low or zero concentration due to its end-of-life condition, a higher oxygen concentration may be present. Careful consideration of oxygen sensor end-of-life performance is critical when considering applications such as process monitoring, where it may be desirable to maintain low oxygen concentration. Use of multiple sensors or more frequent calibration may be required to ensure an effectively monitored process.

Sensor Fundamentals

All lead-based electrochemical gas sensors employ a chemical reaction whereby inner sensor components consumed during the reaction. MSA oxygen sensor components include electrolyte solution and the lead anode that comprise the detector. The lead anode is consumed during a chemical reaction that generates electric current that can be measured by a microcontroller.

Presence of other gases within the environment can affect sensors by interfering with the intended reaction. Sensors perceive specific reaction results; any substance that interferes with the reaction may result in reduced performance. Reduced reaction may cause sensors to report erroneous target gas concentration.

Atmospheric pressure within the measuring environment may also affect sensor performance. Permeation-type sensors have very specific and controlled reactions; however increased pressure may increase response as increased pressure forces more gas through the permeation membrane.

Complete consumption of internal sensor reagents results in sensor end-of-life. For electrochemical oxygen sensors, this end-of-life-state means a zero concentration output signal from the sensor. In low or zero oxygen monitoring situations, a sensor reporting zero concentration may not be a measurement of oxygen in the environment; rather it could mean that the sensor has expired. This possibility can be verified only by calibration.

Sensor Application

Careful consideration of intended monitoring results as well as the environment in which the sensor is to operate are necessary. For example, installation of an oxygen sensor in an inerting or purging process may seem straightforward; however several factors should be considered:

- Presence of other gases or vapors within the monitoring environment may affect oxygen levels. Heavier-than-air solvent vapors will layer just above the surface of the liquid source or at the bottom of a vessel. Stratification of these gases should be considered to ensure that the sensor is monitoring the proper zone for a representative sample.
- A device calibrated at ground level will see a relative increase in pressure when taken below ground. A capillary limited sensor may be more appropriate for this application.
- Normal air has an O₂ concentration in the 20-21% by volume range. The 0-25% oxygen sensor is a general purpose oxygen sensor for use in measuring breathable levels of oxygen. If monitoring lower concentrations of O₂, the 0-10% sensor may be a better selection.
- Proper monitoring of oxygen levels within an environment may require multiple sensors to not only cover the area completely, but also to provide a comparison in the event that a sensor reaches its end-of-life. When using a single sensor, it may not be possible to distinguish between true zero gas reading or an expired sensor.

For more information, please consult your local MSA sales representative or MSA Customer Service at 1-800-MSA-INST.

Note: This Bulletin contains only a general description of the products shown. While uses and performance capabilities are described, under no circumstances shall the products be used by untrained or unqualified individuals and not until the product instructions including any warnings or cautions provided have been thoroughly read and understood. Only they contain the complete and detailed information concerning proper use and care of these products.



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