Defining The Interval Between Calibration Checks

For any gas detector used in potentially hazardous locations, OSHA 1910.146 requires use of a calibrated instrument. Per OSHA CPL 2.100, the instrument must be maintained and calibrated according to manufacturer guidelines. RAE Systems strongly recommends checking the accuracy of any portable instrument by exposing it to known concentrations of test gas(es) before any daily period of use. We are frequently asked whether there are any circumstances in which the period between calibration checks may be lengthened. The International Safety Equipment Association (ISEA) provides a procedure for doing this (see Appendix).

Loss of Sensor Sensitivity

The reason we stress the need to verify accuracy on a regular basis is to guard against any loss of sensitivity due to sensor poisons or suppressors possibly present in the atmosphere being monitored; due to aging, coating or desiccation of the sensors; mechanical damage due to dropping or immersion; or other causes. In the case of combustible gas sensors, damaging effects can be caused by high concentrations of gas or exposure to sulfides, halogenated compounds, tetra-ethyl-lead, or silicone-containing lubricants (see Technical Note TN-144 for more details on LEL sensor poisons). For PIDs, exposure to heavy, oily compounds or some phosphorus compounds can coat the lamp and sensor, and water condensation can etch the salt crystal lamp window.

Other factors can also cause loss of apparent sensitivity, such as leaks in the probes, connecting tubing or pump, and improper calibration or correction factors.

Tiered Approach to Calibration Checks

Calibration checks can be done in a tiered approach:

1. **Bump Check.** The meter is shown a gas source and may alarm. The gas may be a calibration gas or an indefinite source such as a butane lighter or Magic Marker.
2. **Field Verification.** The meter is shown calibration gas and the user verifies that the readings are within a predefined amount, typically ±10% or ±15% of the calibration gas concentration
3. **Full Calibration.** The meter is shown calibration gas and readings are adjusted (automatically or manually) to the certified gas concentration.
4. **Factory Calibration.** The meter is returned to a factory-certified service center for testing and adjustment (most new meters do not have this requirement).

If a lower-level test fails, move up to the next level.

Calibration Frequency

Typically, RAE Systems instruments hold calibration for a few days to a few weeks or longer, especially when duty cycling is employed. Although weekly calibrations are a good starting point for general use, the calibration frequency should be driven by the level of threat. The higher or more frequent the risk, the more frequently calibration should take place. The safest course of action is to test the instrument with a known concentration of gas before any daily period of use. If the situation does not permit daily sensor checks, RAE Systems recommends the following procedure to establish a safe and prudent calibration schedule. This procedure is based on the ISEA recommendation, which was originally intended for combustible gas sensors. However, it is also appropriate for many other sensors, and RAE Systems recommends this approach for all sensors.

During a period of initial use of at least 10 days in the intended atmosphere, check the response daily to be sure nothing in the atmosphere is poisoning or otherwise causing a loss of sensitivity in the sensors installed in the instrument. This period must be long enough to ensure that the sensors are exposed to all conditions that might have adverse effects on them.

1. If these tests demonstrate that it is not necessary to make an adjustment, the time between checks may be lengthened. This interval should not be lengthened beyond 30 days.
2. While sensors do not need to be replaced at the end of their warranty period if they are shown to be functional, it may be wise to do so, to minimize the risk of failure during the interval between sensor checks.
3. The history of the instrument since the last verification check should be tracked or logged.

RAE Systems Inc.
3775 N. First St., San Jose, CA 95134-1708 USA
Phone: +1.888.723.8823
Email: raesales@raesystems.com
Web Site: www.raesystems.com

4. Any new conditions, incidents, experiences, or exposure to contaminants that might have an adverse effect on the calibration state of the sensors should trigger immediate verification of accuracy before further use.

If there is any doubt at any time as to the accuracy of the sensors, re-verify the accuracy by exposing the instrument to a known concentration test gas before further use. The best accuracy is obtained by calibrating on-site, at the same temperature and pressure, immediately before the measurement, and, if possible, with a similar concentration calibration gas as the test gas. If the instrument is equipped with a sampling pump, it is also important to check the pump and sample path for good flow. If the sample train leaks, the monitor may still appear to work well if test gas from a cylinder is forced through the unit. A simple way to test the pump is to block the inlet briefly with a finger and to feel for a suction.

Appendix

Statement from the International Safety Equipment Association on Verification of Calibration for Direct Reading Portable Gas Monitors Used in Confined Spaces

The Industrial Safety Equipment Association (ISEA) is the leading U.S. organization of manufacturers of safety and health equipment including environmental monitoring instruments. ISEA is dedicated to protecting the health and safety of all workers through the development of workplace standards and the education of users on safe work practices and exposure prevention. ISEA has developed the following statement to ensure consistency in all documentation and to emphasize the need to verify calibration when using portable gas monitors in confined spaces.

1. A position statement on verification of calibration is needed to:

   a. Re-emphasize to OSHA and other standards writing bodies the importance of verifying the calibration of instruments used to monitor the atmosphere in potentially hazardous locations.
   b. Clarify the differences between a full calibration and a functional (bump) test.
   c. Clarify when daily tests are needed and when less frequent tests may be appropriate.

2. Definition of two methods of verifying calibration:

   a. Functional (bump) test – A means of verifying calibration by using a known concentration of test gas to demonstrate that an instrument's response to the test gas is within acceptable limits.
   b. Full calibration – The adjustment of an instrument's response to match a desired value compared to a known concentration of test gas.

3. Recommended frequency of verification of calibration:

   a. A functional (bump) test or full calibration of direct-reading portable gas monitors should be made before each day's use in accordance with the manufacturer's instructions using an appropriate test gas.
   b. Any instrument which fails a functional (bump) test must be adjusted by means of a full calibration procedure before further use.
   c. Note: If environmental conditions which could affect instrument performance are suspected to be present, such as sensor poisons, then verification of calibration should be made on a more frequent basis.

4. If Conditions do not permit daily testing to verify calibration, less frequent verification may be appropriate if the following criteria are met:

   a. During a period of initial use of at least 10 days in the intended atmosphere, calibration is verified daily to be sure there is nothing in the atmosphere which is poisoning the sensor(s). The period of initial use must be of sufficient duration to ensure that the sensors are exposed to all conditions which might have an adverse effect on the sensors.
   b. If the tests demonstrate that it is not necessary to make adjustments, then the time interval between checks may be lengthened but should not exceed 30 days.
   c. The history of the instrument since last verification can be determined by assigning one instrument to one worker, or by establishing a user tracking system such as an equipment use log.

ISEA may be contacted at:

1901 N. Moore Street,

Suite 808, Arlington, VA 22209

Tel. 703-525-1695, Fax 703-528-2148

www.safetyequipment.org

RAE Systems Inc.
3775 N. First St., San Jose, CA 95134-1708 USA
Phone: +1.888.723.8823
Email: raesales@raesystems.com
Web Site: www.raesystems.com