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## Instrument Bump Test and Calibration Frequency

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### Introduction

ATEX, IEC, British HSE, and US OSHA standards all call for the bump test and calibration of any portable instrument used for worker health and safety protection in a potentially hazardous environment. In order to ensure safety it is necessary not only for the gas meter to read accurately but also to have functional alarms that alert the worker to a hazardous condition. Initial calibration upon receiving the instrument is necessary and, because most sensors can suffer decreased response over time, recalibration will be required. This article helps the user define appropriate time intervals between calibrations for their instrument. Although regulatory standards were written primarily for 4-gas confined space entry meters that have electrochemical sensors and pellistor-type combustible gas (LEL) sensors, this article is intended to include any Ion Science instrument used for industrial hygiene, including also PIDs, infrared sensors, and fixed instruments.

### Sensor Sensitivity Degradation

Many environmental conditions may degrade sensor response, including the following. LEL sensors are inhibited or poisoned by silicon compounds (some lubricants), sulfur compounds (e.g., H<sub>2</sub>S), lead (Pb) compounds, acids, and compounds that generate acids on combustion, like chlorinated hydrocarbons. Electrochemical sensors are affected by high levels of organic vapors and by corrosive gases. Ammonia, chlorine, and chlorine dioxide sensors lose response upon overexposure to NH<sub>3</sub>. PID lamps can lose output by a) simple aging, b) by becoming coated when exposed to excessive dust, high-boiling compounds, phosphine, organic amines or silazanes, or c) by contact with liquid water. And any sensor will lose response if sample gas does not adequately reach it because of leaks in the sample train or plugging of inlet dust filters. Thus, although most instrument will hold calibration for several days to several weeks, it is a good idea to check their accuracy regularly.

### Calibration Frequency

The ISEA (International Safety Equipment Association) and ATEX recommend the following general procedure:

1a) A daily "**Bump Test**" before the instrument is put into use. Gas is applied just long enough to make the sensor(s) alarm, to ensure that the gas is getting to the sensor and that both the sensor and alarm are working. The gas does not need to be of a well-defined concentration and could be as simple as a magic marker.

or

1b) A daily **Calibration Check** before the instrument is put into use. Calibration gas is applied to the sensor to see if it responds within predefined error limits, typically within 10-20% of the expected value, as set by manufacturer's recommendation or user's company policy.

In critical cases where a permit to work is given as a result of a gas test, ATEX recommends that a bump test or calibration check also be conducted at the end of the day's use to ensure that the instrument was functioning properly throughout the entire monitoring period.

2) **Full Calibration** if either the bump test or calibration check fail. A Full Calibration should also be conducted at regular intervals as recommended by the manufacturer, user's company policy, or regulatory agency.

During initial use in the target environment calibration should be checked frequently. The time period should cover all expected environments the instrument will be subjected to. If the instrument maintains calibration over this time, the interval between checks can be extended. In this way one can define the most suitable calibration frequency for a particular site or application.

In addition, the above test procedure should be conducted if any special circumstances occur that might affect sensor function, including, but not limited to:

- Frequent exposure to high or low temperatures, pressures, and humidity, to high particulate levels, or immersion in a liquid.
- Exposure to high (over range) concentrations of target or similar chemicals.
- Frequent exposure to sensor inhibitors and poisons, as described above.
- Exposure to harsh physical vibrations or shock.
- Upon transferring custody of the instrument to another person.

## Documentation

Note that, from a legal standpoint, it is very important to document that the instrument has passed the function test before being put in to use, in case any hazardous incident occurs and the accuracy of the monitor is later questioned.

For more information contact Ion Science:

E-mail: [info@ionscience.com](mailto:info@ionscience.com)

[www.ionscience.com](http://www.ionscience.com)