Bump Test Frequency

Technical Bulletin

The Safety Company

Introduction

The frequency of bump testing on portable gas detection has been a subject of debate amongst safety professionals and users of gas detectors. As product durability and advancements in sensor technology continue to improve detector performance and reliability, some are using these improvements as a basis for abandoning the practice of daily bump tests that has resulted in some deviation from the best practices and could prove detrimental from both a compliance and safety perspective.

In general, most manufacturers have historically recommended a daily bump test prior to the operation of gas detectors. Not to mention, several organizations as the European Committee for Electrotechnical Standardization (CENELEC), International Electrotechnical Commission (IEC), International Safety Equipment Association (ISEA) and Occupational Safety and Health Administration (OSHA) continue to advocate a best practice of a daily bump check for portable gas meters.

MSA remains in support of a bump check before each day's use as the best practice to ensure daily readiness of detectors.

Reasons for Bump Testing

According to ISEA, the purpose of a bump test is twofold:

1) Confirm that a challenge gas can get to the sensor(s); and

2) Confirm that the sensor(s) reading can trigger an alarm if exposed to gas.

The "ISEA Statement on Validation of Operation for Direct Reading Portable Gas Monitors", March 5, 2010, clearly states, "A bump test (function check) or calibration check of portable gas monitors should be conducted before each day's use in accordance with the manufacturer's instructions." What has happened is that many users, and some manufacturers, have interpreted this to mean bump testing less frequently is now an acceptable practice.

However, performance of a daily bump test is the only method by which the entire system: instrument, sensors, flow path, power source, alarms, and all electronics can be checked to ensure that the instrument is functioning properly.

Potential Failure Modes

Over time, the accuracy of gas detection instruments can diverge from their calibration settings in several ways. According to OSHA Safety and Health Information, Bulletin 05-04-2004, the following are potential failure modes which can be exposed during a bump test.

1. Gradual chemical degradation of sensors and drift in electronic components that occur naturally, over time.

2. Chronic exposures to, and use in, extreme environmental conditions, such as high/low temperature and humidity, and high levels of airborne particulates.

3. Exposure to high (over-range) concentrations of the target gases and vapors.

4. Chronic or acute exposure of catalytic hot-bead LEL sensors to poisons and inhibitors. These include: volatile silicones, hydride gases, halogenated hydrocarbons, and sulfide gases.

5. Chronic or acute exposure of electrochemical toxic gas sensors to solvent vapors and highly corrosive gases.

6. Harsh storage and operating conditions, such as when an instrument is dropped onto a hard surface or submerged in liquid. Normal handling/jostling of the equipment can create enough vibration or shock over time to affect electronic components & circuitry.

7. In addition to these, any general component failure.

It should also be noted that paint, aerosols, mud, and other debris will frequently block sensor inlets.

Theory of Sensor Redundancy

Recent introductions of redundant sensor approach in single gas instruments has resulted in some ambiguity with regard to manufacturers bump test recommendations.

A redundant sensor approach has included data showing a mathematical reduction on potential failures based on the fact that two sensors are in place. While the math may work, this theory assumes that sensor failure is the only potential mechanism by which a detector does not respond as required. This arithmetic, however, does not consider other failure modes. For example, if acute exposure of a contaminant inherently poisons a sensor, it will, in all likelihood, poison both sensors. Similarly, filter blockages can prevent two sensors from seeing the challenge gas.

While a duplicate of a single component of a system may mitigate selected risks, it will **not provide full system redundancy**. In order to achieve full redundancy of safety equipment, it would require either a second technology or a duplicate of the entire system. A good example of redundancy can be found in Self Contained Breathing Apparatus (SCBA). At MSA, many of our SCBA are certified to National Fire Protection Association (NFPA) requirements which mandate redundant low pressure alarms. According to NFPA requirements, this redundancy must have a different mode of operation for notifications in the event that one of those modes fails. In the case of SCBA, this would include a pneumatic alarm and an electronic alarm. These are two separate technologies that provide true redundancy of the alarm.

Mitigation Strategies

There is no disputing the fact that there have been tremendous advances in detector technology and durability. For that reason, it is more important than ever before to maintain a thorough understanding of the instruments. MSA recommends that a thorough evaluation of the detectors, specifications, sensors, and warranty information be conducted prior to any purchase.

It is important to note that all detectors may be susceptible to the failure modes identified by OSHA and others. Some mitigation strategies for evaluating gas detectors and administering their programs are listed below.

	Sensor Redundancy	Bump Check	Calibration	IP ratings (independent certification)	Drop test information (independent verification)
CHEMICAL DEGRADATION OF SENSORS		■	■		
EXTREME ENVIRONMENTAL CONDITIONS		■	■		
EXPOSURE TO OVER RANGE CONDITIONS		■	■		
CHRONIC OR ACUTE EXPOSURE OF CATALYTIC HOT-BEAD LEL SENSORS TO POISONS AND INHIBITORS		■	■		
HARSH STORAGE AND OPERATING CONDITIONS	■	■	■	■	■
SENSOR FAILURE	■	■	■	■	■
ELECTRONIC COMPONENT FAILURE		■	■		
MECHANICAL COMPONENT FAILURE		■	■	■	■

Conclusion

Although some will continue to debate the need and frequency of bump testing, basing their arguments on the theory behind redundant sensor technology, CENELEC, IEC, ISEA and OSHA continue to recommend a daily bump check for portable gas meters. It is important to understand that there are multiple reasons for that. Although the assumption behind redundant sensor technology seems sound on paper, too many variables remain that can negatively impact sensor performance. So, until these variables can be eliminated, it remains clear that the current bump test recommendations should remain the industry standard. MSA stays committed to these recommendations to ensure daily readiness of detectors and will continue to **support bump checks before each day's use as the best safety practice.**

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