Testing and Calibrating Fixed Gas Detectors

Introduction

One of the most common questions about gas detectors is: “How do I know it’s working?”. Whether it is a brand new unit or a seasoned veteran, knowing that a gas detector will perform its job is of paramount importance. Red lights and alarms are a good indication that something is wrong, but waiting for them before taking action could have disastrous consequences. Likewise, green lights and zeros on a display does not necessarily mean the detector is good to go. Proper care and maintenance is necessary to get the most out of any gas detector, and this requires periodic tests and checks. The more frequently these are performed, the quicker any issues can be caught and resolved. This paper will cover the different types of tests and checks, why they are important, and when to perform them.

Bump Test

A bump test is a qualitative function check during which sensors are exposed to gas at both a high enough concentration and for a long enough time to activate alert and/or alarm indicators. The goal is to assess the response of a sensor and verify that the equipment is working as intended. A bump test does not check the accuracy of a sensor; it only checks that the sensor is functioning. As a result, having a known concentration of test gas is not necessary. In many cases, using a common source of unmeasured gas will be adequate. For example, carbon monoxide detectors can be tested by running a gasoline engine in the vicinity.

A detector that passes a bump test will respond quickly to the gas with all indicators and alarms activating at the appropriate time. These factors will vary depending on the make and model of the gas detector being tested, but guidelines can often be found in manufacturer documentation. A detector that fails a bump test will either not respond to gas, or respond to gas in an unreasonable amount of time. This can be the result of debris blocking the sensor from measuring the gas, or it could be that the sensor is out of calibration.

Calibration Check

A calibration check is a quantitative test with a known concentration of gas that demonstrates the sensor responds to gas within the manufacturer's specified tolerances. Every calibration check starts by evaluating the reference point in clean air. This is typically zero for most toxic and combustible gases, but some gases differ, like oxygen at 20.9%. Once this reference point is established, a known concentration of test gas is applied to the sensor. The concentration should ideally be high enough to trigger some alert or alarm state without exceeding the maximum range of the detector. The gas should also meet NIST standards. If the detector reads a value or displays an alert/alarm status within an acceptable range of the test gas concentration (usually ±10-15%), then the calibration is considered to be valid. If not, the sensor needs to be recalibrated.

Recalibration

Recalibration is the adjustment of sensor response to achieve a desired value based on a known concentration of test gas. These adjustments account for sensitivity drift, sensor degradation, and other environmental factors. The recalibration process depends heavily on the make and model of a gas detector and should only be performed by trained, qualified personnel. Consulting the manufacturer is the best way to determine the process for a specific model of detector.

Testing Frequency

Manufacturer guidelines, internal policies, and regulatory recommendations and requirements all contribute to the testing frequency. Most fixed detectors are suggested to be bump tested on a bi-yearly, quarterly, or monthly basis. The more frequent the testing, the quicker any potential issues can be addressed. Regardless of the scheduled frequency, a bump test should always be performed after exposure to any of the following:

- Change in work environment
- Extreme environmental conditions
- Highly concentrated target gas
- Solvent vapors
- Corrosive gases
- Poisons
- Inhibitors

Consult the detector's instruction manual or manufacturer for more details on abnormal operating conditions or events.

Testing for an Inspection

Outside of regularly scheduled testing, it is sometimes necessary to perform a special test to pass an inspection. The type of testing will depend on the type of inspection. Below are the three most common inspections and the associated tests required for completion.

- Visual Inspection – No Test
- Maintenance Inspection – Bump Test
- Analytical Inspection – Calibration Check

The exact requirements and pass/fail criteria will depend on regulations and the inspector, but the vast majority of inspections will fall into at least one of these categories. Being prepared and knowing what to expect will greatly increase the likelihood of passing an inspection. In some cases, an inspector may accept a certificate of calibration from the detector manufacturer in place of analytical testing.

Other Considerations

Performing any test or check requires simulating an environment. This may involve placing a calibration cup over the sensor or sealing an area around the sensor to limit the amount of gas that is needed. In either case, always clean the detector of any dirt or debris and inspect it for any signs of wear or corrosion before applying gas. If performing a bump test with an unknown or unregulated gas mixture, be careful not to damage the sensor with too high a concentration or with a mixture containing contaminants or poisons. If performing a calibration check, do not use expired gas as some gases may deteriorate over time and drift away from the indicated concentration. Regardless of the maintenance, keep a record. Tracking tests and checks over time provides a picture of the detector's overall health and can predict when service like recalibration may be needed.

Conclusion

In short, bump tests verify the functionality of a detector while calibration checks verify the accuracy. If the primary concern is knowing that the detector will respond to gas and activate some ventilation equipment, a bump test is the way to go. This method of testing requires the least time and materials to perform, and in most cases, is sufficient for demonstrating the continued operation of the detector. However, if determining the accuracy of the detector is more important, performing a calibration check will be necessary. Should any test or check fail, the detector will need to be recalibrated. Regular maintenance and evaluations are key to extending the life of a detector and ensuring that it is always ready to save lives.

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