Gas detector compliance made easier

MSA
The Safety Company

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Working in confined spaces can be hazardous; therefore, there is a wide range of products and WHS rules and regulations designed to protect workers in these environments. The latest gas detector product from MSA, the Altair 2XP, is designed to do just that. It also introduces a new patented technology that uses advanced sensors to provide a simple and inexpensive approach to bump testing.

Standard industry best practice requires a bump test of gas detectors to be carried out prior to each day's use in order to maintain worker safety in hazardous environments. However, many employers are reluctant to include daily bump testing as part of their standard procedures as testing can be time-consuming and difficult to track, especially at facilities that employ large gas detector fleets or those that disperse workers over wide geographical areas. Furthermore, bump testing also requires use of calibration equipment and gases that can be costly.

Bump testing made easier

The purpose of a bump test is to firstly confirm that the gas can reach the sensor(s) and secondly, confirm that the sensor readings can trigger an alarm if exposed to gas. Additionally, bump testing and calibration record traceability, which is also the key to ensure compliance and record-keeping.

MSA has now created a simple and inexpensive approach to bump testing using its latest patented XCell Pulse Technology. The new technology provides an electronic check, or sensor interrogation, to determine if the sensor is present and operating properly by applying an active electronic pulse to the sensor. The pulse generates a similar electronic reaction to that which occurs when a sensor electrode is exposed to target gas. This electronic pulse check, combined with a check of the sensor flow path by simply exhaling breath near the sensor opening to verify that the sensor flow path is clear, allows a stand-alone bump test to be performed without the need for calibration accessories or bottled calibration gas.

MSA's patented, proprietary XCell Pulse Technology is now offered in a single-gas H_2S portable Altair 2X Gas Detector version - the Altair 2XP version.

How does it work?

When the detector is turned on, it automatically begins an electronic pulse check that activates the sensor catalyst and electrolyte interaction and makes minor corrections against prior calibration values. Next, the user completes a flow check by exhaling towards the sensor inlet. An oxygen detector embedded in the sensor, which is only active during the pulse and flow check, detects the drop in oxygen content of exhaled breath. If both of these checks pass, the detector passes the bump test.

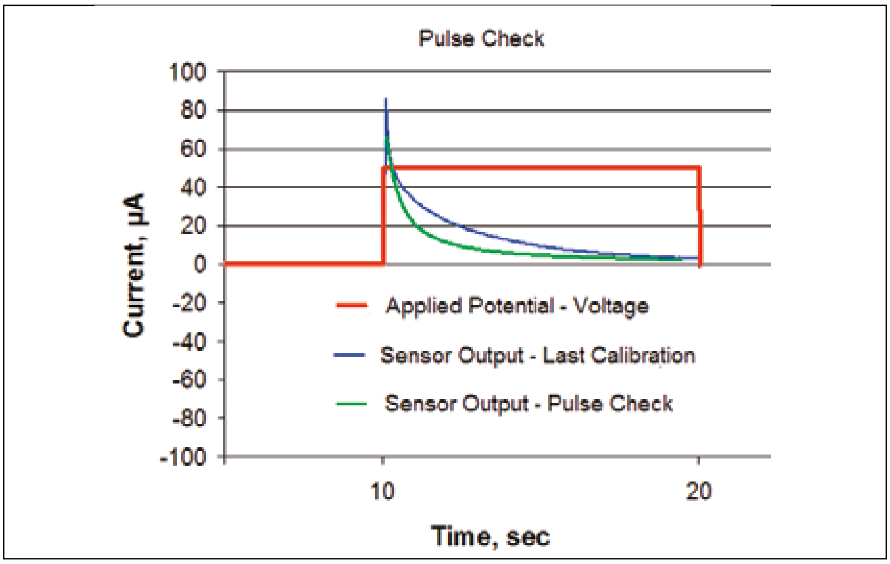

Figure1

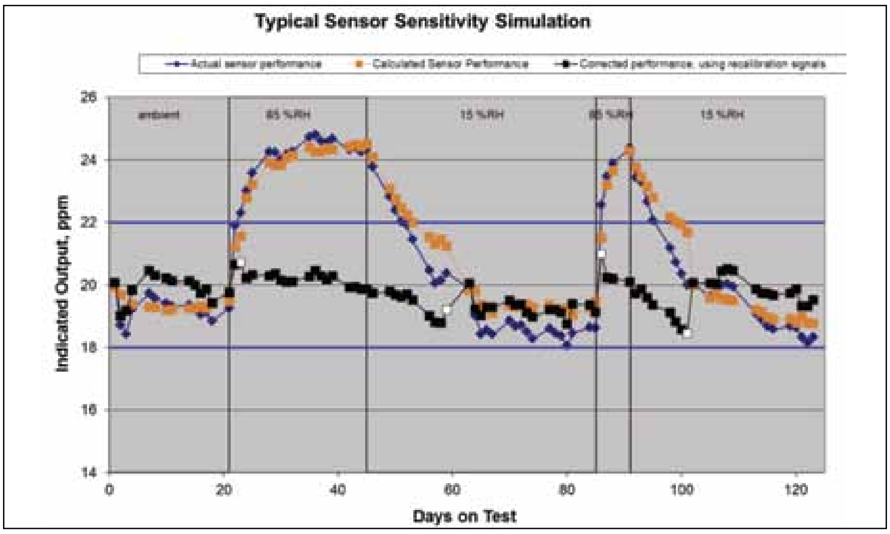

Figure 2

All electrochemical sensors operate on the following basic principle: gas enters the sensor and diffuses through the working sensor electrode and to the electrolyte/catalyst interface. This electrode's coating includes catalytic elements that react with target gas. An electrical response is generated with the convergence of the electrode, electrolyte and target gas; this convergence is known as triple point. At molecular level, each working sensor electrode has thousands of potential triple points. A particular sensor's sensitivity has a high correlation to the number of triple points able to be generated. All sensors can lose sensitivity over time due to age, environmental conditions or other exposures. By pulsing the sensor, measurements are based on the total number of triple points that can react to test gas.

Checking the pulse

The pulse check uses MSA's XCell Pulse technology to calculate gas response by applying an electronic pulse to the sensor and analysing the response curve.

The pulse check calculates changes in sensor output response electronically. A voltage pulse is applied to the sensor that activates and measures the electrode and electrolyte interaction. The response is analysed and used to indicate sensor output sensitivity to verify that internal sensor components are functioning properly and that an electrochemical reaction can take place if exposed to gas.

The electronic pulse response is analysed and used to predict sensor output sensitivity and verify that sensor internal components function properly. Predicted sensitivity is compared to stored sensitivity from the most recent gas calibration in order to determine sensor accuracy since the last calibration.

Predicted sensitivity is based on a regression model using initial sensitivity levels and change in sensor response function to electronic checks. Regression output is used to determine whether sensors should be recalibrated or if they are sufficiently close to sensitivity level from previous calibration.

If a difference is measured in sensor response within acceptable range, correction can be applied to measured output to adjust the sensor for accuracy. Adjustment is

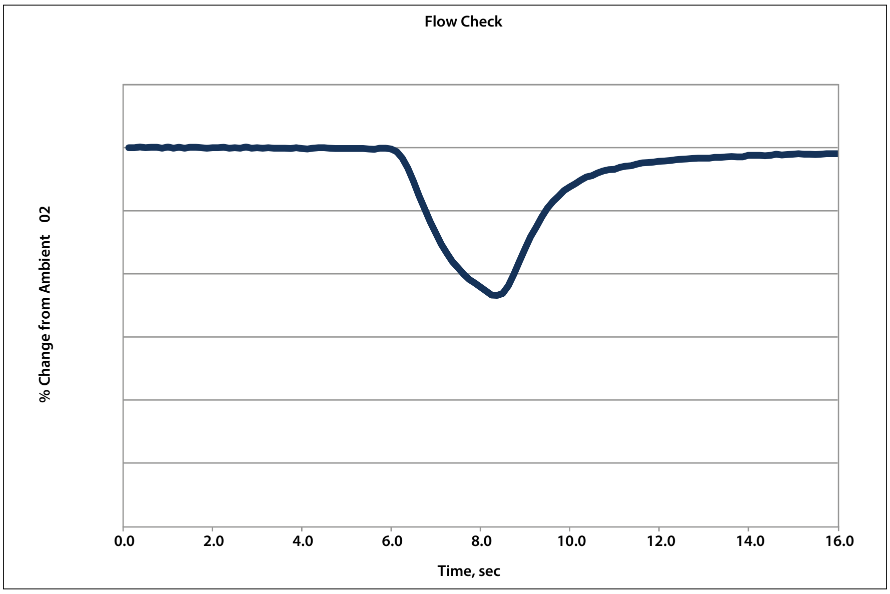

Figure 3

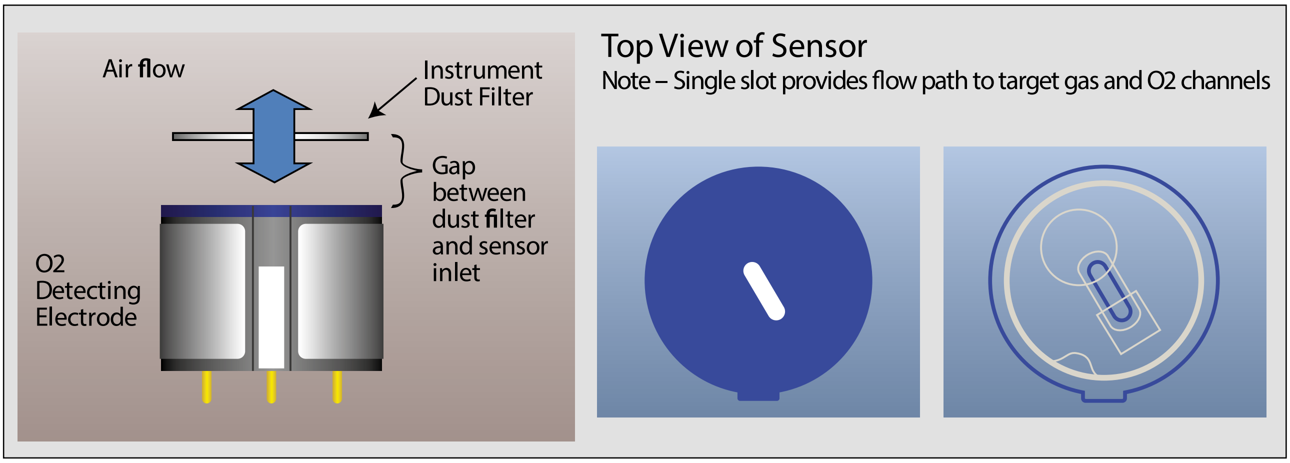

Figure 4

possible due to application-specific integrated circuits (ASICs) used in MSA's XCell Sensors. If the output signal has drifted outside acceptable range, the instrument will notify the user that calibration is necessary.

Figure 2 shows actual sensor performance during trials within ambient, 85% relative humidity and 15% relative humidity conditions over a four-month period. Actual measurement is the result of the detector observing exactly 20 ppm H_2S. Calculated performance is predicted sensor performance calculated using a regression model. Corrected performance is what the detector would actually display based on the pulse technology algorithm and the correction calculation.

Checking the flow

To complete a stand-alone bump test, confirmation that gas can reach the sensor is necessary. Once the pulse check is complete, the user exhales into the device; an O_2 channel embedded within the sensor measures for a drop in oxygen as the user exhales. The drop in O_2 content rate at which gas diffuses across the barrier is measured and is used to determine sensor functionality.

Figure 3 shows an example of flow rate in and out of the sensor face. Although individuals exhale at different rates, the rate at which gas leaks back out of the sensor following the test changes if the sensor becomes blocked. If the sensor is blocked, the rate at which breath enters and leaves the sensor face is measurably slower than that of an unobstructed sensor.

The sensor is not a combined H_2S/O_2 sensor; rather, the sensor is a single H_2S sensor that uses an O_2 electrode only for testing for filter blockage during a flow check. Although two channels are operating, the sensor includes a single flow path for gas. The oblong opening shown in Figure 4 allows gas to enter both channels, thereby ensuring that the flow path to the H_2S channel is intact.

Simple to use and comply with industry best practice

Users of the MSA portable gas detectors that include XCell Pulse technology can conduct daily bump tests without use of costly calibration accessories or bottled test gas. Users can also conduct bump tests anywhere, anytime, while not disrupting worker productivity. This process yields significant savings in terms of cost and time spent conducting bump tests prior to each day's use in accordance with best industry practices.

Visual indicators on the detector make verification of bump test easy - highly visible green light (green light, check mark) and it flashes red when not bumped. The detectors have full instrument traceability of bump and calibration records, peak readings, event logs and data logs.

Instrument records are stored and can be easily downloaded during periodic gas calibrations using the Galaxy GX2 test stand. MSA Link Pro Software provides full networking, traceability, proactive safety, compliance and reporting.

By using an electronic pulse check and exhale test, users perform a stand-alone bump test that prepares the detector for each day's use. MSA interrogation sensor electronic check capability provides users with significant cost-saving benefits resulting from reduction in required calibration gas and accessories, and easier coordination of bump testing for a user's MSA portable instrument fleet.

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