

application note

Working safely in confined spaces

What is a confined space?

Confined spaces pose various hazards for operators and can be found in a wide variety of industries and applications. A confined space can be defined by a number of factors; the space itself must be large enough for a worker to enter but is not suitable for continuous worker occupancy. A confined space is also defined as having limited openings for entry and exit. Examples of confined spaces found in industry include aircraft fuel tanks, underground utility vaults and wine fermentation tanks.

Due to their small size, gas hazards can quickly build up in confined space environments. Some confined spaces may require permits to enter, owing to the fact that they contain potentially hazardous atmospheres or materials that have the potential for engulfment. Inwardly sloping walls or floors can also pose dangers, because they reduce the volume of the space, and may also require a permit to enter.

Regardless of whether the area is permit required or not, all confined spaces should be treated as potential hazards.

Likely hazards encountered in confined spaces

Typically, confined spaces can contain a variety of hazards including Hydrogen Sulphide (H_2S), Carbon Monoxide (CO), Methane (CH_4) and Oxygen deficiency.

• H_2S

H_2S is a toxic gas that is produced as a bi-product of microbial activity. This gas is highly toxic and at concentrations less than 30ppm is identifiable by its strong odour of rotten eggs. At concentrations higher than 30ppm, H_2S paralyses the olfactory nerve, stopping the sense of smell. At concentrations of 500 to 700 ppm, death will occur within 30 mins to 1 hour. For further information on the dangers of H_2S please [click here](#) to read our extended feature on page 10.

• CO

CO is a toxic gas that is produced by the incomplete burning of fossil fuels such as oil, gas and coal. During normal combustion, Carbon Dioxide is produced (CO_2) but when ventilation is inadequate, CO can be produced instead. CO is absorbed by haemoglobin in the blood and prevents Oxygen being absorbed, causing the victim to die of asphyxiation. At concentrations of 400ppm, CO will start to cause nausea, dizziness, headache and sickness. At concentrations of 800ppm, death will occur half an hour after exposure.

• CH_4

CH_4 is a combustible gas that is produced by the decomposition of organic materials. CH_4 is the main constituent of Natural Gas and as a result, leaks in gas pipes can be another source of Methane.

• Oxygen Deficiency

Normally Oxygen makes up 21% of the atmosphere and an Oxygen deficient environment is described as being one where Oxygen levels are 19.5% or less. Oxygen can be displaced by toxic or inert gases and microbial action. Oxidation caused by rusting metal and combustion can also cause an Oxygen deficient environment. At 19.5% Oxygen the operator will feel drowsy. At 17% and less cognitive processes and coordination will be severely compromised. At levels of 6% or lower, death will occur quickly.

Although these are the most likely gases to be encountered in confined spaces, other gases can also be found.

[Click here](#) for more information on CO safety at home.

Dealing with confined spaces

Before an operator enters the confined space, they will need to make a pre-entry check to determine the hazards in the area.

The use of a multi-gas portable, capable of providing simultaneous monitoring of H₂S, CO, Oxygen and combustibles (%LEL) is essential for safe confined space entry (please note: The sensors used with any portable device must reflect the known hazards likely to be in the environment).

First the operator must perform a full test of the environment prior to entering. Once the area has been cleared for entry, continuous monitoring must take place to ensure the area remains safe from gas hazards.

Pre-entry check

Due to the differing nature of gases and the fact that some are heavier than air, whilst others are lighter, testing at various levels of the confined space is essential.

Until the hazards are known and evaluated, it is not safe for the operator to directly enter the area. The use of a confined space gas detector kit makes stratified testing easy and generally includes a multi-gas monitor with pump and 10 foot sampling hose for pre-testing (longer lengths available).

Continuous atmospheric monitoring

After initial testing is complete, testing of the atmosphere within the space must continue to ensure the area remains safe. If a hazardous atmosphere is detected during entry, employees should exit immediately, re-evaluate the space and take corrective measures.

What portable device?

The ideal portable device needs to offer simultaneous monitoring of 4 gases, and be rugged and suited to tough environments. A device that can provide clear readings of gas concentrations and simple one button operation is also preferable. Audible and visual alarms are also necessary to ensure that the operator is alerted to an issue, even in noisy environments, whilst an IP67 rating and concussion-proof design ensures the device can work in a wide variety of confined space environments.

Impact Pro

Easy to use with minimal training

required: 4-gas monitor with easily changeable sensors (Plug and Play / Disposable) allowing for various sensor configurations. Simple one button operation and intuitive interface

- **Reduces the ongoing cost of portable gas detection:** Cartridges can be changed in under a minute
- **Simplified pre-entry monitoring:** Automatic pump for easy remote sampling



Enforcer automatic portable calibration device

To ensure operator safety, bump testing prior to using a portable device is recommended. Enforcer, Impact's automatic calibration device allows simple, quick and cost-effective bump testing and device calibration in minutes.

- **Simple to use:** Simple one button automatic calibration
- **Reduces costs and time:** Provides full device calibration for the cost of a bump test. Calibration is carried out in two minutes
- **Ready when you are:** Fully portable, lightweight design optimised for easy use



GasAlertQuattro

Easy to use with minimal training required:

Simple operation device that can simultaneously monitor up to 4-gas hazards. Optimised for confined space entry use

- **Provides visual compliance:** IntelliFlash verifies operation and compliance to both the user and supervisors from up to 20ft / 6.1m



MicroDock II Automatic Test and Calibration Station



- **Simplifies bump testing and calibration:** Provides bump testing/calibration/datalogging within two minutes at the touch of a button
- **Universal use:** Works with all portable gas detectors from BW Technologies by Honeywell

Portable device safety

Workplace environments can be harsh and gas detectors can be subjected to all kinds of conditions that can affect their operation. The only way to guarantee an instrument will detect gas accurately and reliably is to test it with a known concentration of gas. Exposing the instrument to a known concentration of test

gas will show whether the sensors respond accurately and the instrument alarms properly.

A bump test verifies calibration by exposing the instrument to a known concentration of test gas. The instrument reading is compared to the actual quantity of gas present, as indicated on the cylinder. If the

instrument's response is within an acceptable tolerance range of the actual concentration, then its calibration is verified. Devices like Enforcer and MicroDock II can provide automatic bump testing and calibration of devices, helping to reduce the time and costs associated with this activity.