CARBON MONOXIDE TOXIC AND FLAMMABLE GAS DETECTION

Gas detection is designed to protect people and plant. The risk to people comes from both toxicity and any potential fire or explosion. For the plant, the physical damage of a fire or explosion is the main hazard.

Flue gas testing on a boiler

Some gases such as carbon monoxide and ammonia are both flammable and toxic. The toxic limit is generally much less than the flammable limit. Portable devices designed to protect people must be configured with an appropriate alarm setting at the toxic level. Fixed gas detection equipment installed to protect plant items may be configured with a higher alarm setting at 50% of the LEL.

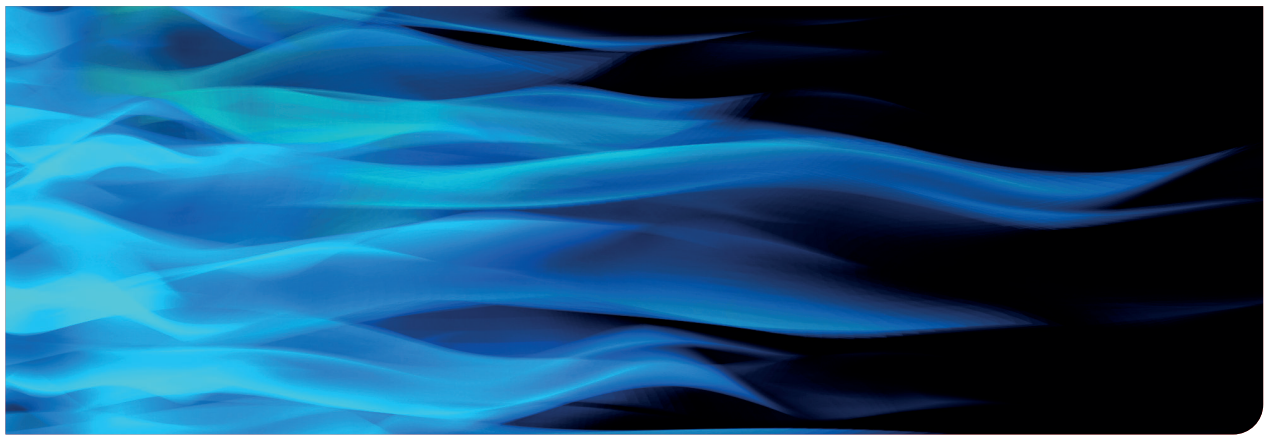
Carbon monoxide (CO) is present in syngas, which is produced when waste, biomass or coal is gasified. Syngas is also formed when natural gas is reformed to produce hydrogen for ammonia or other applications. CO can also be present in boiler flue gases, if the combustion of natural gas is incomplete.

Hong Kong Towngas production with reforming of hydrocarbons to syngas

Syngas calls for carbon monoxide gas detection

Syngas is produced from hydrocarbons when they are heated. The main constituents of syngas are CO, hydrogen, and carbon dioxide. Syngas can be upgraded to convert the CO to yield additional hydrogen. More than 95% of the hydrogen produced today worldwide is made in this way. Syngas and the toxic CO gas molecule are unavailable hazards of the hydrogen production.

Town gas was commonly used in the USA and Europe in the early to mid-20th century. It was a type of syngas derived from coal gasification. Syngas from liquid and gaseous hydrocarbon reforming is still extensively used in Hong Kong and Singapore as one of the main piped gases for heating and cooking in domestic and commercial buildings. In these grids, flammable gas detectors are the most common way to monitor for leaks. It is not common to focus on the toxic gas detection requirements.



The most widely used LEL, or flammable gas sensor is a pellistor bead that works on a catalytic oxidation principle. The sensor is integrated into a Wheatstone bridge circuit. As flammable gases flow over the sensor, it becomes hot and its resistance increases. This is identified by the electronic circuit.

Maintenance and gas testing on an industrial boiler

Pellistor sensors are low-cost, but suffer from drift, are influenced by poisons, and they are not considered to be fail safe devices. To overcome these issues, IR sensor technology has been introduced for flammable gas detection. IR sensors have been implemented in industrial applications.

An attraction of the IR sensor is that optical systems are regarded as being fail safe. However, there is still a requirement for regular calibration and cleaning of the optical surfaces. And the price tag of the sensor can be two to three times more than a pellistor.

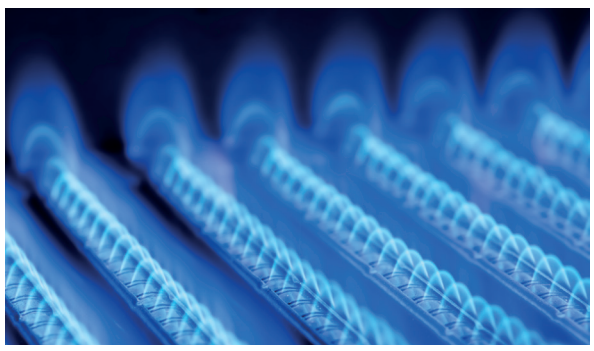
Safe operations rely on protecting plant and people with gas detection

Carbon monoxide – hidden in boiler flue gas

Gas detection of carbon monoxide (CO) has been undertaken in industrial premises and commercial buildings for decades. It is common in boiler rooms for heating and steam generation where incomplete combustion of gas can result in CO poisoning due if the flue gas leaks. Portable devices can be used to detect CO in the atmosphere and protect personnel.

Testing flue gases from a domestic boiler

The toxic risk posed to personnel for the limited time that they are present in the boiler house. However, the flammable hazard of the CO and other boiler room gases such as methane, or hydrogen in the future poses a 24 / 7 risk of explosion with the potential for collateral damage. Many heating system boilers are in the basement of high-rise buildings. An explosion in this location could result in collapse of the tower block with multiple fatalities. Therefore, the flammability risk must continuously be monitored with suitable gas detection equipment.



Incomplete combustion results in toxic CO in the flue gas

If the gas detection system is focused on identifying the toxic hazards of CO, an electrochemical sensor would be appropriate. This is a mature, low cost and reliable sensor technology. The generally accepted alarm levels for CO are 100ppm for a 15-minute exposure and 20 ppm over an 8-hour shift. These are commonly implemented as alarm levels in CO gas detection systems.

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