

Coal Cargoes – Measuring Methane Gas Levels in Cargo Holds

Introduction

Some coal cargoes can produce methane (CH₄). Since methane is a flammable gas, the International Maritime Solid Bulk Cargoes (IMSBC) Code requires vessels loaded with coal to monitor the concentration of methane inside the cargo holds via external sampling points. Portable gas detectors are carried for this purpose. However, in the Club's recent experience it would appear that some crewmembers may not be aware that the readings for methane may be incorrect if the amount of oxygen inside the hold is low.

Portable Gas Detectors

Portable gas detectors used at sea are typically fitted with flammable gas catalytic sensors. If the coal begins to oxidise and self-heat, the amount of oxygen within the hold will decrease. If the level of oxygen falls to 10% or less, the flammable gas readings produced by the catalytic sensor may not be accurate.

Catalytic sensors may also produce false flammable gas readings if the amount of methane in the hold atmosphere exceeds 100% of its Upper Explosive Limit (UEL).

Dilution Sampling

To obtain accurate flammable gas readings from a catalytic sensor in such circumstances, dilution sampling is required. This involves adding a controlled quantity of external air to the sample drawn from the cargo hold to ensure that there is sufficient oxygen present for the flammable gas readings to be correct.

Dilution sampling requires a special attachment to be fitted either to the sample inlet port of the gas detector or to the sampling line. The fitting has a small hole in the side to draw air from the atmosphere, diluting the sample drawn from the hold with external air at a controlled rate so that the detector can give an accurate flammable gas reading. Alternatively, a T piece equipped with a separate pipe to draw air from the atmosphere may be inserted into the sampling line.

Dilution sampling should only be carried out after the gas detector has been calibrated correctly for methane without the dilution fitting in place. Attaching the dilution fitting thereafter will draw equal quantities of cargo hold air and external air into the gas detector. This process reduces the flammable gas reading by 50%, therefore the gas detector reading must be doubled in order to determine the true figure.

Some dilution fittings may be designed to sample cargo hold air and external air in unequal amounts, meaning that the flammable gas readings will need to be increased by a factor which corresponds to the different proportions. Consequently it is essential that the design ratio of the dilution fitting is checked before it is used.

The air in the cargo hold should be at atmospheric pressure when readings are taken, otherwise the flow balance in the dilution fitting may be disturbed. If there is a vacuum inside the hold, the amount of external air drawn through the device will increase. Conversely, if the hold is pressurised, the quantity of external air will decrease. Both scenarios may result in flammable gas readings which are inaccurate. It should also be noted that variations in air temperature may give rise to a slight vacuum inside a cargo hold. Since temperature variations are more likely during the day, as far as practicable readings should be timed to avoid this possibility.

Dilution fittings should only be used to determine the concentration of flammable gas if the level of oxygen inside a cargo hold is low. At all other times the dilution fitting should be removed. It is also important to ensure that all crew members required to operate gas detectors are entirely familiar with the use of dilution fittings, in particular the dilution ratio of the fitting and how the quantity of flammable gas in the hold should be calculated once the readings have been obtained.

For further information on the type and use of dilution fittings applicable to a particular make and model of gas detector, the instrument's manufacturer should be contacted.

Infrared Gas Detectors

As an alternative to using catalytic sensors and dilution fittings, an infrared gas detector may be used to measure the amount of methane inside a cargo hold regardless of the oxygen level. Infrared gas detectors can also measure flammable gas concentrations above the UEL.

All gas detectors should be regularly serviced and calibrated in accordance with the manufacturer's instructions. Crew members required to take gas readings should be trained in, and thoroughly familiar with the use of the gas detectors onboard.

Members requiring further guidance should contact the [Loss Prevention department](#).