



# Technical Bulletin

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## Coal cargoes: self-heating and monitoring of evolved gas

*Club inspectors still come across instances where ships' crew are not familiar with, or have little knowledge of, the recommendations of the IMO Code of Safe Practice for Solid Bulk cargoes (BC Code) 2005*

This Code has now been completely reviewed with effect from January 2011 and is now called the

### **INTERNATIONAL MARITIME SOLID BULK CARGOES (IMSBC) CODE**

As with the previous publication the BC Code, the IMSBC Code 2011 gives particular reference to monitoring and measurement of gases associated with the carriage of coal. These gases include Carbon Monoxide (CO), Methane (CH<sub>4</sub>) and Oxygen (O<sub>2</sub>).

In addition a complete new section has been added relating to self unloaders entitled:-

Measurement in cargo and self-unloading spaces of gravity fed self-unloading bulk carriers

The following is the relevant Appendix to the IMSBC Code, for reference:

### **Procedures for gas monitoring of coal cargoes**

#### **1 OBSERVATIONS**

**1.1** Carbon monoxide monitoring, when conducted in accordance with the following procedures, will provide a reliable early indication of self-heating within this cargo. This allows preventive action to be considered without delay. A steady rise in the level of carbon monoxide detected within a cargo space is a conclusive indication that self-heating is taking place.

**1.2** All vessels engaged in the carriage of this cargo shall carry on board an instrument for measuring methane, oxygen and carbon monoxide gas concentrations, to enable the monitoring of the atmosphere within the cargo space. This instrument shall be regularly serviced and calibrated in accordance with the manufacturer's instructions. Care shall be exercised in interpreting methane measurements carried out in the low oxygen concentrations often found in unventilated cargo holds.

The catalytic sensors normally used for the detection of methane rely on the presence of sufficient oxygen for accurate measurement. This phenomenon does not affect the measurement of carbon monoxide, or measurement of methane by infra-red sensor.

Further guidance may be obtained from the instrument manufacturer.

#### **2 SAMPLING AND MEASUREMENT EQUIPMENT**

##### **2.1 Equipment**

**2.1.1** An instrument which is capable of measuring methane, oxygen and carbon monoxide concentrations shall be provided on board a ship carrying this cargo. The instrument shall be fitted with an aspirator, flexible connection and a length of spark-proof metal tubing to enable a representative sample to be obtained from within the square of the hatch.

**2.1.2** When recommended by the manufacturer, a suitable filter shall be used to protect the instrument against the ingress of moisture. The presence of even a

small amount of moisture will compromise the accuracy of the measurement.

## 2.2 Siting of sampling points

**2.2.1** In order to obtain meaningful information about the behaviour of this cargo in a cargo space, gas measurements shall be made via one sample point per cargo space. To ensure flexibility of measurement in adverse weather two sample points shall be provided per cargo space, one on the port side and one on the starboard side of the hatch cover or hatch coaming. (Refer to the diagram of gas sampling point.) Measurement from either of these locations is satisfactory.



**Gas sampling point**

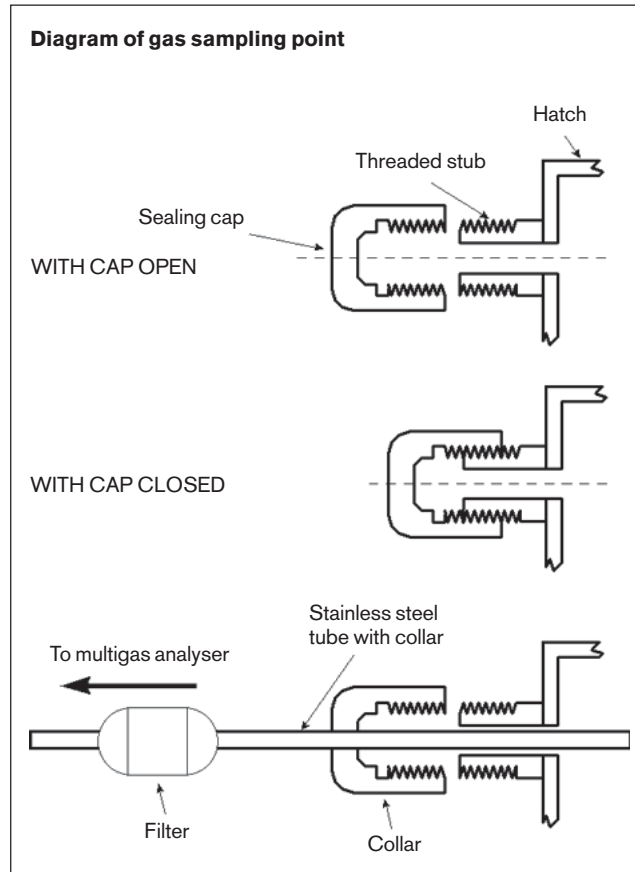
**2.2.2** Each sample point shall comprise a hole of diameter approximately 12 mm positioned as near to the top of the hatch coaming as possible. It shall be sealed with a sealing cap to prevent ingress of water and air. It is essential that this cap is securely replaced after each measurement to maintain a tight seal.

**2.2.3** The provisions of any sample point shall not compromise the seaworthiness of the vessel.

## 2.3 Measurement

The explanation on procedures for measurement is as follows:

- 1 remove the sealing cap, insert the spark-proof metal tube into the sampling point and tighten the collar to ensure an adequate seal;
- 2 connect the instrument to the sampling tube;
- 3 draw a sample of the atmosphere through the tube, using the aspirator, until steady readings are obtained;
- 4 log the results on a form which records cargo space, date and time for each measurement; and
- 5 put back the sealing cap.



## 2.4 Measurement strategy

The identification of incipient self-heating from measurement of gas concentrations is more readily achieved under unventilated conditions. This is not always desirable because of the possibility of the accumulation of methane to dangerous concentrations. This is primarily, but not exclusively, a problem in the early stages of a voyage. Therefore it is recommended that cargo spaces are initially ventilated until measured methane concentrations are at an acceptably low level.

## 2.5 Measurement in unventilated holds

Under normal conditions one measurement per day is sufficient as a precautionary measure.

However, if carbon monoxide levels are higher than 30 ppm then the frequency shall be increased to at least twice a day at suitably spaced intervals. Any additional results shall be logged.

## 2.6 Measurement in ventilated holds

**2.6.1** If the presence of methane is such that the ventilators are required to remain open, then a different procedure shall be applied to enable the onset of any incipient self-heating to be detected.

**2.6.2** To obtain meaningful data the ventilators shall be closed for a period before the measurements are taken. This period may be chosen to suit the operational requirements of the vessel, but it is recommended that it

is not less than four hours. It is vital in the interests of data interpretation that the shutdown time is constant whichever time period is selected. These measurements shall be taken on a daily basis.

## **2.7 Measurement in cargo and self-unloading spaces of gravity fed self-unloading bulk carrier**

### **2.7.1 Measurement in unventilated cargo and self-unloading spaces**

2.7.1.1 When the shipper has declared that the coal cargo has or may have self-heating characteristics, the holds shall not be ventilated unless otherwise specified in this section.

2.7.1.2 Under normal conditions one measurement per day is sufficient as a precautionary measure. If carbon monoxide levels are higher than 30 ppm then the frequency of measurements shall be increased to at least twice daily, at suitable intervals. Any additional results shall be logged.

2.7.1.3 If the carbon monoxide level in any hold indicates a steady rise or reaches 50 ppm a self-heating condition may be developing and the owners of the vessel shall be notified as outlined in the procedures. Above this level, the vessel shall operate on 'negative pressure' ventilation, in order to reduce the amount of carbon monoxide. Regular monitoring of carbon monoxide levels shall continue.

2.7.1.4 Persons entering cargo or unloading spaces with carbon monoxide levels higher than 30 ppm shall not do so without self-contained breathing apparatus.

### **2.7.2 Measurement in ventilated cargo and self-unloading spaces**

2.7.2.1 If the presence of methane is indicated by monitor, and such that ventilation is required, then a different procedure shall be applied to enable the onset of any possible self-heating to be detected. 'Positive pressure' or 'through ventilation' shall be operated to remove the methane.

2.7.2.2 To obtain meaningful data the ventilators and/or ventilation shall be closed for a period before measurements are taken. This period may be chosen to suit the operational requirements of the vessel, but it is recommended that it is not less than four hours. It is vital in the interests of data interpretation that the shutdown time is constant whichever time period is selected. These measurements shall be taken on a daily basis. If the carbon monoxide results exhibit a steady rise, or exceed 50 ppm on any day, the owner shall be notified.

2.7.2.3 In addition the following points shall be considered:

- at no time shall ventilation be shut down when crew members are in the self-unloading spaces;
- special fire-fighting equipment and/or procedures may be necessary for the vessel;
- and
- establish specific crew training for gravity fed self-unloading bulk carriers.