

CO detection on boats

BSS Examiner Training Course

Thursday 7th December 2017

GES, Welwyn Garden City

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Today's Agenda

- **Carbon monoxide – the silent killer** (*introduction, basic science, where it comes from, symptoms*)
- **Boats and CO** (*case studies, particular sources and problems, recreation vs live-aboard, owned vs rented*)
- **BSS Examiner CO project** (*why we are doing this, research aspects and protecting the 3rd party risk*)
- **GMI PS500 gas detection instrument** (*how to use it, what it can and can't do, PC software*)
- **When to report data** (*action levels, incidents*)
- **Practical experience from a BSS Examiner** (*Mark Paris using an instrument this summer*)
- **CO alarms on boats**
- **Questions and discussion**

CoGDEM

Council of Gas Detection & Environmental Monitoring

Founded in 1974, now around 60 member companies

**Members are manufacturers and service providers
in the field of gas detection (inc. BSI & HSL as guests)**

**Protecting everything from the smallest bedsit, caravan,
boat or tent to the largest offshore oil & gas platform or
refinery**

Key role in writing standards

CO helpline 0800 1694 457

Carbon monoxide – the silent killer

- can't be smelt, seen, tasted, heard, felt
- medics call it the perfect poison

**CO molecules stick to blood haemoglobin
200 times more readily than oxygen molecules**

Detectable only by blood test, breath test or pulse CO-oximetry, but its half-life in the body is 4-5 hours



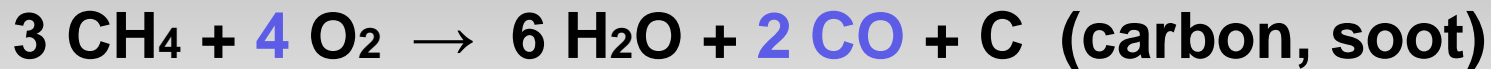
Carbon monoxide – symptoms

- headache
- nausea, vomiting
- dizziness, confusion
- tiredness, lethargy
- increased heartrate
- breathing difficulties
- collapse
- loss of consciousness
- death

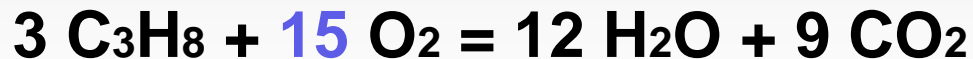


Carbon monoxide – incomplete combustion

- hydrocarbon fossil fuels C_xH_y
- gas, oil, petrol, wood, coal
- insufficient air
- consider methane CH_4 , a clean fuel gas:



But propane is C_3H_8 so 2.5 times more oxygen is needed for complete combustion than for methane

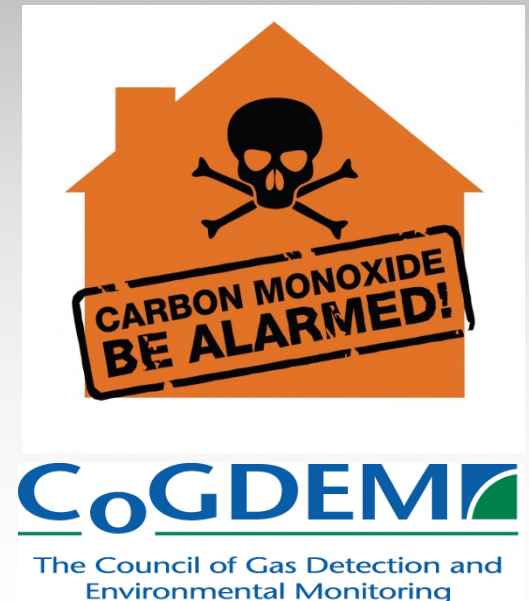


Carbon monoxide – the silent killer

- 30 – 40 domestic fatalities per year
- 4000 A&E admissions
- perhaps 20 times more diagnosis without A&E referral
- no blood test at post-mortem
- elderly and very young most at risk

Typical domestic sources:

- poorly maintained gas appliances
- solid-fuel installations
- inadequately ventilated kitchens
- barbecues & generators



Carbon monoxide on boats

- 30 boater CO deaths in 20 years
- most on inland waters
- boat population on inland waters – around 80,000
- 2016, 3 boat CO fatalities = 10% of UK's total CO fatalities

Typical sources:

- engine exhausts
- bottled-gas cabin appliances
- portable petrol generators
- solid fuel or oil-fired stoves
- barbecues/embers/ash buckets

Carbon monoxide fatalities on boats



- **Drunken Duck (2)**
2007, Staffs canal
- **Arniston (2)**
2013, Lake Windermere
- **Samara (1)**
2014, Banbury canal
- **Love for Lydia (2)**
2016, Norfolk Broads
- **Vasquez (1)**
2016, Cardiff Marina
- **Mais Oui (1)**
2017, Jersey

BSS Examiner CO project

- **Graham Watts will explain why the BSS have embarked on this project:**

Research aspects

Third Party Risks

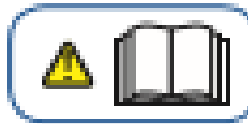


GMI PS500 multi gas detector

- **Training led by Leigh and John Turnbull**
- **Quick-start guide**
- **Charging**
- **Turning on, turning off**
- **Displays**
- **Datalogging**
- **Retrieving saved data**
- **Set-up menu**

PS500

Quick Operation Guide



Switch On

The diagram shows a hand turning a rotary switch to the 'ON' position. Below this, a sequence of three LCD screens is shown: the first displays the 'GMI PS500' logo, the second shows 'OFF 3', and the third shows 'OFF 2'. A double-headed arrow with a battery icon indicates the power is on.



Switch Off

The diagram shows a hand turning the rotary switch to the 'OFF' position. Below this, a sequence of three LCD screens is shown, each displaying 'OFF' followed by a number (3, 2, 1). A double-headed arrow with a battery icon indicates the power is off.

Backlight On

Mar Min

The diagram shows a sequence of LCD screens. The first screen shows 'Mar' and 'Min' values. A hand turns the rotary switch to 'ON'. The second screen shows 'OFF 3'. A hand turns the rotary switch to 'OFF'. The third screen shows 'OFF 2'. A hand turns the rotary switch to 'ON'. The fourth screen shows 'OFF 1'. A hand turns the rotary switch to 'OFF'. A double-headed arrow with a battery icon indicates the backlight is on.

Confidence Signal

Every 10s

The diagram shows the PS500 device with a green signal light on top. A hand turns the rotary switch to 'ON'. A double-headed arrow with a battery icon indicates the confidence signal is on.

Manual/Default

The diagram shows a hand turning the rotary switch to the 'Manual/Default' position. Below this, an LCD screen is shown displaying 'OFF 3'.

Pump

The diagram shows a hand turning the rotary switch to the 'Pump' position. Below this, an LCD screen is shown displaying 'OFF 3'. A hand turns the rotary switch to 'OFF'. A double-headed arrow with a battery icon indicates the pump is on.

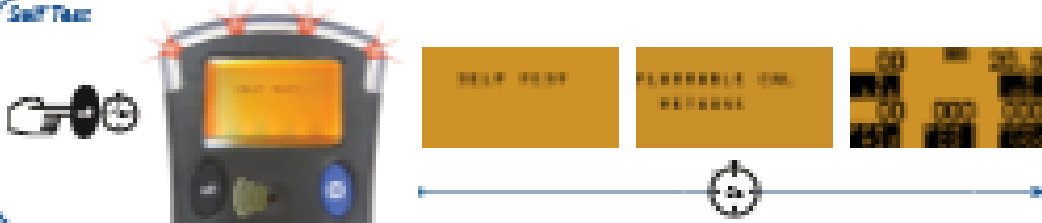
Alarm Indicators



Gas Alarm Acknowledge



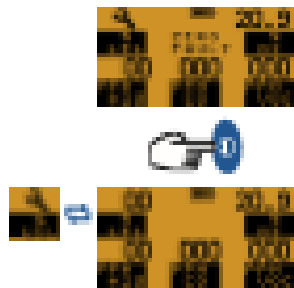
Self Test



Flow Fault



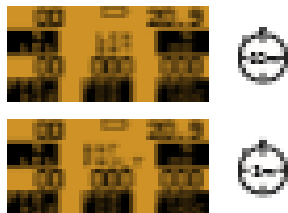
Zero Fault



Calibration Override



Battery Life



Charging



When to report CO data

- **BS7967 states 10ppm CO or greater in room air after 15 minutes must be investigated and remedied**
- **Levels above 30ppm in room air mean test should be stopped, appliances turned off, area ventilated and evacuated**

Practical experience from a BSS Examiner

- Mark Paris to talk about his experience of using a GMI PS500 for four months
- case study incident
- retrieving incident data
- reporting data
- recording the incident on the BSS 'Salesforce' database:
'Examination Detail'



Practical experience from a BSS Examiner 2

- **turn instrument on when leaving car – why?**
- **‘forget’ about the instrument and carry on!**
- **glance at display when doing flue spillage test or when something “smells” wrong**
- **alarm activation on any channel or CO readings in double figures need action**
- **always consider your own safety first**

Practical experience from a BSS Examiner 3

- report a relevant event afterwards
- connect instrument to PC via infrared cable
- find event data (summary data)
- copy and paste:
 - Salesforce BSS comments box (see pics)
- appliance record also needs to be sent
- Graham & Leigh will automatically receive an email if thresholds are exceeded

Practical experience from a BSS Examiner 4



**Morco
water heater.**

**Kidlington,
Oxford**

Alarm activated at 14:10, 06 December 2017

Ranges with active alarms are : PPM CO : 30 (Instantaneous alarm active)

.....

Maximum values during this session:

% CO₂ : 0.25

% LEL : 1

% O₂ : 21.0

PPM CO : 38

CO alarms from four CoGDEM member companies, BSI-certified for use on boats



The applicable standards

- **BS EN 50291** (construction and testing of domestic CO alarms)
now split into:
 - **BS EN 50291-1** for domestic dwellings
 - **BS EN 50291-2** new tests for recreational vehicles & craft
- much lobbying for EN 50291 to be published in EU Official Journal under the Construction Products Regulations (CPR)
- **BS EN 50292** guidance on selection, installation, use and maintenance. Updated in 2013 to cover recreational vehicles usage, low concentration displays etc

Third party testing

- test labs need to be UKAS accredited
- within the UK, third party compliance certificates are mainly BSI or LPCB
- BSI Kitemark includes factory audit (ISO 9001) and annual surveillance testing

bsi.



CoGDEM
The Council of Gas Detection and
Environmental Monitoring

Key elements of EN 50291

“Electrical apparatus for the detection of carbon monoxide in domestic premises – test methods and performance requirements”

- **constructional requirements**
- **visual indicators and audibility**
- **alarm thresholds**
- **sensor fault indication**
- **labelling and instructions**
- **third party tests**

Alarm thresholds

- **30 ppm – no alarm**
(tested with 33 ppm +/- 3 ppm for 120 mins)
- **50 ppm – must alarm between 60 & 90 mins**
(tested with 55 ppm +/- 5 ppm)
- **100 ppm – must alarm between 10 & 40 mins**
(tested with 110 ppm +/- 10 ppm)
- **300 ppm – must alarm before 3 minutes**
(tested with 330 ppm +/- 30 ppm)

Additional tests for EN 50291-2

Part 2: Electrical apparatus for the detection of carbon monoxide for continuous operation in fixed installations in recreational vehicles and similar premises including recreational craft — Additional test methods and performance requirements:

- **corrosion-resistant materials**
- **enhanced EMC (RF and power interference)**
- **static and dynamic orientation tests**
- **acceleration, vibration and shock resistance**

Additional clauses in EN 50292

5.2.2.2 Caravans and boats

Caravans and boats may have additional risks of carbon monoxide ingress through air vents due to the nearby presence of other vehicles, engines, generators or barbecues; however, this does not change the basic guidance on location of the alarm. Caravans and boats should be fitted with an alarm in the same room as any combustion appliance(s), located in accordance with 5.2.3.3. If the caravan or boat has a single living space which incorporates the sleeping accommodation, it can be considered to be equivalent to a bedsit, and a single alarm is sufficient. However, any sleeping accommodation that is in a separate room from the combustion appliance(s) should also contain an alarm, located in accordance with 5.2.3.4.

Additional clauses in EN 50292

5.2.3.5 Apparatus located in caravans and boats

It is not always possible to find an optimum location for an apparatus, for example, a small caravan or boat may not have suitable vertical surfaces available. Nevertheless, when fitting an apparatus in such situations, the two most important considerations when selecting an appropriate location are:

- not mounting the apparatus directly above a source of heat or steam; and
- mounting the apparatus at a distance of 1 m to 3 m from the nearest edge of the potential source.

Hydrogen cross-sensitivity

- CO sensors are electrochemical fuel cells
- Sensors react to CO or high concentrations of H₂
- ~15% cross-sensitivity to H₂
- CO alarm will activate at ~1800ppm H₂ (~5%LEL)
- Indicates battery charging fault and insufficient ventilation, needs urgent investigation



Questions and discussion

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