

Carbon monoxide in dwellings and the combustion performance of gas-fired appliances —

Part 1: Guide for identifying and managing sources of fumes, smells, spillage/leakage of combustion products and carbon monoxide detector activation

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Committees responsible for this British Standard

The preparation of this British Standard was entrusted to Technical Committee GSE/30, Gas installations (1st, 2nd and 3rd family gases), upon which the following bodies were represented:

Boiler and Radiator Manufacturers' Association Ltd
British Flue and Chimney Manufacturers Association
BSI Consumer Policy Committee
Catering Equipment Suppliers' Association
Centrica plc
Council for Registered Gas Installers
Department of Trade and Industry
Health and Safety Executive
Heating and Ventilating Contractors' Association
ICOM Energy Association
Institute of Domestic Heating and Environmental Engineers
Institution of Gas Engineers and Managers
LP Gas Association
Society of British Gas Industries
Co-opted members

The following bodies were also represented in the drafting of the standard:

Advantica Ltd
Association of Plumbing and Heating Contractors
Council of Gas Detection and Environmental Monitoring
Energywatch
National Grid Gas plc

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Foreword

This part of BS 7967 has been prepared under the direction of Technical Committee GSE/30.

BS 7967 consists of the following parts.

- *Part 1: Guide for identifying and managing sources of fumes, smells, spillage/leakage of combustion products and carbon monoxide detector activation.*
- *Part 2: Guide for using electronic portable combustion gas analysers in the measurement of carbon monoxide and the determination of combustion performance.*
- *Part 3: Guide for responding to measurements obtained from electronic portable combustion gas analysers.*
- *Part 4: Guide for using electronic portable combustion gas analysers as part of the process of servicing and maintenance of gas-fired appliances.¹⁾*

This part of BS 7967 is intended to be used in conjunction with BS 7967-2, BS 7967-3 and the *Gas Industry Unsafe Situations Procedure* [1].

The guidance in this standard is presented in a way that is intended to assist gas operatives in considering all the relevant issues and circumstances relating to the identification of sources of fumes, smells or carbon monoxide (CO) detector activation, or when spillage/leakage of combustion products is suspected or encountered from an unknown source. It is not intended to be an exhaustive step-by-step procedure and gas operatives (see definition 3.6) will need to hold an appropriate certificate of gas safety competence and use sound judgement in deciding how best to respond to individual cases.

Where a gas operative is carrying out routine servicing or repair work on an appliance, testing could indicate a spillage/leakage problem. In such cases, there is no obligation to carry out all the considerations, inspections and tests described in this guidance as the gas operative has personally identified the issue and the source of spillage/leakage is known. Only those subclauses in this standard that are concerned with the particular appliance involved would be relevant in such circumstances.

Attention is drawn to the following statutory regulations.

- The Gas Safety (Installation & Use) Regulations 1998 [2].
- Gas Safety (Installation and Use) Regulations (Northern Ireland) 2004 [3].
- Gas Safety (Application) Order (Isle of Man) 1996 [4].
- The Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 1995 [5].
- Gas Safety (Management) Regulations 1996 [6].
- Gas Safety (Management) Regulations (Northern Ireland) 1997 [7].

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 20, an inside back cover and a back cover.

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¹⁾ In preparation.

1 Scope

This part of BS 7967 gives guidance for gas operatives engaged in the activity of identifying and managing sources of fumes, smells, spillage/leakage of combustion products and carbon monoxide (CO) detector activation in dwellings.

This standard is for use with appliances using 1st, 2nd or 3rd family gases.

This standard does not cover the obligations of an emergency service provider (ESP) in responding to a gas emergency or procedures for investigating incidents that are reportable under 6.1 of Reporting of Injuries, Diseases and Dangerous Occurrence Regulations (RIDDOR) 1995 [5] and the Gas Safety (Management) Regulations (GSMR) 1996 [6].

NOTE 1 A description of a dwelling is given in definition 3.1.

NOTE 2 Electronic portable combustion gas analysers are not to be used as a substitute for normal service and maintenance carried out in accordance with gas appliance manufacturers' instructions. BS 7967-4²⁾ describes the options of how they can be used in conjunction with gas appliance manufacturers' instructions.

NOTE 3 This standard assumes that:

- a) a portable instrument of the type specified in BS 7967-2 capable of providing a measurement of CO in the atmosphere and determining combustion performance ratios, to the accuracy specified in BS 7967-2, is available to the gas operative; and
- b) the gas operative is familiar with BS 7967-2, which provides guidance on the use of these instruments.

NOTE 4 Combustion products from gas appliances will contain nitrogen oxides (NO_x), predominantly nitrogen monoxide (nitric oxide, NO) and nitrogen dioxide (NO₂). This standard does not deal with the measurement of combustion products such as nitrogen oxides and aldehydes. Such products could be present in the air in sufficient quantities to prove an irritant and could be harmful. For guidance on the occupational health considerations associated with these combustion products, reference can be made to the following documents.

- a) The Institute for Environment and Health's IEH assessment on indoor air quality in the home: Nitrogen dioxide, formaldehyde, volatile organic compounds, house dust mites, fungi and bacteria [8].
- b) The Health and Safety Executive's (HSE's) Chemical Hazard Alert Notices, CHAN 28 on nitrogen monoxide [9] and CHAN 29 on nitrogen dioxide [10]. Please note that these CHANs refer to occupational levels specifically related to the workplace situation. For further guidance refer to the HSE).³⁾

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS 7967-2:2005, *Carbon monoxide in dwellings and the combustion performance of gas-fired appliances — Part 2: Guide for using electronic portable combustion gas analysers in the measurement of carbon monoxide and the determination of combustion performance.*

BS 7967-3:2005, *Carbon monoxide in dwellings and the combustion performance of gas-fired appliances — Part 3: Guide for responding to measurements obtained from electronic portable combustion gas analysers.*

3 Terms and definitions

For the purposes of this part of BS 7967 the following terms and definitions apply.

3.1

dwelling

unit of residential accommodation including residential park homes, flats, bed-sits, maisonettes, terraced, semi-detached and detached houses (including all such residential accommodation situated within or forming part of commercial or industrial or agricultural premises), leisure accommodation and boats, excluding vessels with an international load line certificate

NOTE It is recognised that the guidance can be applied to premises other than dwellings, such as those supplying a small number of clients on a bed and breakfast basis.

²⁾ In preparation.

³⁾ HSE Infoline, Caerphilly Business Park, Caerphilly CF83 3GG, Tel. 0845 345 0055, www.hse.gov.uk.

3.2

customer

occupier of the dwelling, the owner of the dwelling and any person with authority for the time being to take appropriate action in relation to any gas fitting therein

3.3

electrical CO alarm

electrically operated gas detection apparatus designed for continuous use to give a warning alarm in the event of a hazardous accumulation of CO

3.4

electronic portable combustion gas analyser

electronic apparatus that will detect and measure the presence of combustion gases and clearly display the result

3.5

emergency service provider

ESP

person acting to prevent an escape of gas on behalf of a gas transporter

NOTE This definition is consistent with Regulation 7(11) of the Gas Safety (Management) Regulations 1996.

3.6

gas operative

person deemed competent to carry out work

NOTE 1 Persons deemed competent to carry out gas work are those who hold a certificate of gas safety competence acceptable to the Council for Registered Gas Installers (CORGI), which includes (without limitation) the Accredited Certification Scheme (ACS) and the Gas Services National Vocational Qualification (e.g. NVQ or SNVQ) that has been aligned with ACS.

NOTE 2 Under the Gas Safety (Installation and Use) Regulations 1998 [2] a business or self-employed person who carries out work has to be a “member of a class of persons approved for the time being by the Health and Safety Executive (HSE)”.

At the time of publication, the body with the HSE approval to operate and maintain a register of businesses who are “members of a class of persons” is CORGI.

3.7

“suspect” gas appliance

gas appliance which, after an initial appraisal, is considered to be a problem source

3.8

work

installation, maintenance, servicing, removal, permanent adjustment, repair, changing the position, alteration or renewal of a gas fitting or purging it of air or gas

NOTE This term is consistent with the definition given in Regulation 2 of the Gas Safety (Installation and Use) Regulations 1998. Guidance on Regulation 2 is contained in the Health and Safety Commission (HSC) Approved Code of Practice and Guidance, *Safety in the installation and use of gas systems and appliances* [11].

4 Safety principles

4.1 Basic rules

All investigations of fumes, smells, spillage/leakage of combustion products and CO detector activation, described in this standard, should adhere to the following basic rules in the order listed.

- a) Protect life.
- b) Protect property.
- c) Locate all fuel burning appliances.
- d) Locate any escape of gas, fumes, smells or spillage/leakage of combustion products.
- e) Confirm the safe installation and operation of all suspect gas appliances.
- f) Advise the customer of any remedial action that is required.
- g) Complete all necessary reports, documentation and actions as advised in the *Gas Industry Unsafe Situations Procedure* [1].

4.2 Death or major injury

In instances of death or major injury (i.e. loss of consciousness or acute illness requiring medical treatment) the ESP will normally have already attended the site and will have reported the incident, as required under the Reporting of Injuries, Diseases and Dangerous Occurrences Regulations (RIDDOR) 1995 [5], to the Health and Safety Executive (HSE). In such circumstances the gas supplier will normally be required under the Gas Safety (Management) Regulations (GSMR) 1996 [6] to carry out an investigation.

Where a gas operative becomes involved in a situation where it is identified that there has been a death or major injury, it is imperative that the gas operative ascertain whether the ESP and the gas supplier have completed their investigations. Where there is any doubt, it is imperative that the local HSE office⁴⁾ be contacted for advice before any work is started or before any gas appliance installation is interfered with in any way. Where the gas supplier's investigation is still outstanding:

- a) advise the customer that it is essential that the work to rectify any faults is postponed until the gas supplier's investigation has been completed; and
- b) follow the advice given in Clause 9.

4.3 Protection of life and property

With the exception of cookers (see Note 1), if CO levels above 30 ppm (see Note 2) are noted at any time during the working visit, all fuel burning appliances should be turned off wherever possible and the occupants advised to leave the dwelling immediately. Windows and doors should be opened to ventilate the dwelling before leaving. On re-entry, the atmosphere in the dwelling should be checked continually from the point of access inwards. The dwelling should not be considered safe to fully re-enter to carry out any further investigation until CO concentrations are below 10 ppm and preferably down to outdoor background levels. Other levels of CO exposure may be used as evacuation criteria for the gas operative, based on a risk assessment of the specific circumstances. These should take into account the length of exposure to the CO.

NOTE 1 Gas cookers can produce concentrations of CO in excess of 30 ppm within the room for short periods of time, particularly grills on initial ignition. Such concentrations may be allowed, provided the cooker meets the requirements of the tests described in BS 7967-2:2005, 5.4.5.1 and is installed correctly to the manufacturer's instructions and/or the appropriate British Standard. A list of relevant standards is given in the Bibliography.

NOTE 2 These are general atmosphere CO values measured in accordance with the method described in BS 7967-2 and not peak values measured adjacent to an appliance.

NOTE 3 Combustion products from gas appliances will contain nitrogen oxides (NO_x), predominantly nitrogen monoxide (nitric oxide, NO) and nitrogen dioxide (NO₂). This standard does not deal with the measurement of other combustion products such as nitrogen oxides and aldehydes. Such products could be present in the air in sufficient quantities to prove an irritant and could be harmful. For guidance on the occupational health considerations associated with these combustion products, reference can be made to:

- a) the Institute for Environment and Health's IEH assessment on indoor air quality in the home: Nitrogen dioxide, formaldehyde, volatile organic compounds, house dust mites, fungi and bacteria [8];
- b) the Health and Safety Executive's (HSE's) Chemical Hazard Alert Notices, CHAN 28 on nitrogen monoxide [9] and CHAN 29 on nitrogen dioxide [10]. Please note that these CHANs refer to occupational levels specifically related to the workplace situation. For further guidance refer to the HSE⁴⁾.

NOTE 4 One of the main combustion products from gas appliances is CO₂, which is mainly regarded as an asphyxiant but is also a toxic substance which could be present in the air in sufficient quantity to prove harmful. For guidance on the occupational health considerations of CO₂, reference can be made to the HSE Guidance note on *Workplace exposure limits*, EH40 [12].

5 Dwelling investigation

NOTE Gas operatives working in a customer's dwelling do so by invitation of the customer and it is imperative that any actions the gas operative might wish to take be done with the customer's permission.

5.1 General

Having taken all necessary initial actions to protect life and property and given due consideration to the issues as presented/understood, it is essential that the gas operative decides whether the circumstances are within the scope of this guidance before commencing further investigation.

Where there has been no death or major injury, or where there have been GSMR investigations which have been completed, the gas operative may inspect and test the gas installation and appliances in accordance with this guidance in order to identify the extent of the problem and the remedial action required. However, in the latter case, the GSMR investigations are likely to have already identified the faulty appliance(s).

⁴⁾ HSE Infoline, Caerphilly Business Park, Caerphilly CF83 3GG, Tel. 0845 345 0055, www.hse.gov.uk.

A gas operative arriving at the site can encounter the following circumstances.

- a) People who have experienced or are experiencing nausea, dizziness, chest pains, headaches and/or palpitations when appliances are or have been in use.

NOTE Some common illnesses exhibit similar symptoms to those resulting from exposure to CO.

- b) The presence or report of unusual smells, oppressive atmospheres, strange “tastes” and/or condensation when appliances are in use.
- c) Sooty marks/stains on or around appliances and flues.
- d) The presence of CO and/or CO₂.
- e) CO detector activation.
- f) Referral from ESP or an agent acting on behalf of the customer.

5.2 CO investigation procedure

The procedure for carrying out an investigation of CO in a dwelling is represented as a flow chart in Figure 1. The notes to Figure 1 are as follows.

NOTE 1 to Figure 1 A discussion might include the following questions.

- a) Does the problem only happen when appliances, including mobile/portable appliances, are or have been in use? Are there any safety warning notices/labels attached to the installation/appliances?
- b) Do customers feel unwell in the property and better when outside or away from the property and what are their symptoms?
- c) Is there a pattern to the occurrences, e.g. observed once, more than once or many times, in what circumstances (such as during particular weather conditions or domestic activities or from the use of a household chemical) or in a particular room?

NOTE 2 to Figure 1 If other fuel burning appliances are present and in operation, where practical check them for production of CO and spillage. If these appliances are thought to be the cause of the problem recommend the customer seek expert advice. For oil appliances, contact the Oil Firing Technical Association (08456 58 50 80, www.oftec.co.uk). For solid fuel appliances, contact the Solid Fuel Association (08456 01 44 06, www.solidfuel.co.uk).

NOTE 3 to Figure 1 Review information continuously and determine which appliances are suspect. Concentrate on suspect appliances first. For more information on gas appliance investigation refer to Clause 6.

NOTE 4 to Figure 1 If no faults found on suspect appliances, progressively check other gas appliances. If still no fault found, consider other sources. For more information refer to Clause 8 and Annex A.

NOTE 5 to Figure 1 If for any reason CO levels do not fall sufficiently to allow the investigation to proceed, it is recommended that the property be evacuated/remain evacuated. If sources of CO other than fuel burning appliances are suspected, refer to Clause 9.