



BSI Standards Publication

Guide for the use of electronic portable combustion gas analysers for the measurement of carbon monoxide in dwellings and the combustion performance of domestic gas-fired appliances

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Foreword

Publishing information

This British Standard is published by BSI Standards Limited, under licence from The British Standards Institution, and came into effect on 28 February 2015. It was prepared by Panel GSE/30/-/21, *Gas Analysers*, under the authority of Technical Committee GSE/30, *Gas installations (1st, 2nd and 3rd family gases)*. A list of organizations represented on this committee can be obtained on request to its secretary.

Supersession

This British Standard supersedes BS 7967-1:2005, BS 7967-2:2005, BS 7967-3:2005 and BS 7967-4:2007, which are withdrawn. BS 7967-5, which covers the use of electronic portable combustion gas analysers in non-domestic premises, remains current.

Information about this document

This British Standard is intended to be used in conjunction with the gas appliance commissioning, servicing and maintenance instructions and the *Gas Industry Unsafe Situations Procedure* [1].

Its purpose is to provide:

- a) information that is intended to assist gas operatives (see **3.12**) in considering all the relevant issues and circumstances relating to the identification of sources of fumes and smells and the cause of carbon monoxide (CO) detector activation, or when spillage/leakage of combustion products is suspected or encountered from an unknown source;
 - b) information on combustion performance characteristics of a range of gas appliance types and the levels at which remedial action is to be taken;
 - c) advice on the actions to be taken when elevated concentrations of carbon monoxide (CO) are identified in dwellings;
 - d) the appropriate method(s) for using an electronic portable combustion gas analyser to:
 - check the combustion performance of gas appliances;
 - measure the concentrations of CO within a dwelling and, in certain circumstances (see Clause 1, Notes 4 and 5, and Commentary on 8.1), detect the presence of carbon dioxide (CO₂); and
 - identify sources of the CO spillage/leakage;
 - e) good practice guidance on the use of electronic portable combustion gas analysers as part of a servicing and/or maintenance procedure for gas appliances in dwellings; and
- NOTE Electronic portable combustion gas analysers are often referred to colloquially as “flue gas analysers” (FGAs).*
- f) guidance on the use of combustion gas analysis as a diagnostic tool to assist a gas operative to confirm the safe and efficient functioning of a gas appliance when work has been done on that appliance.

This standard:

- 1) is not intended to be an exhaustive step-by-step procedure, and gas operatives need to hold an appropriate certificate of gas safety competence (see Clause 4) 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;

- 2) supplements gas appliance manufacturers' servicing requirements through a generic approach to servicing and maintenance activity and by identifying situations where combustion gas analysis cannot be deployed or is not appropriate;
- 3) does not intend that a combustion gas analysis be used as a substitute for normal servicing and/or maintenance carried out in accordance with the gas appliance instructions;
- 4) recognizes that it is important that the gas appliance instructions are followed; and
- 5) continues to use the term "flue" in its traditional UK sense, as any structure used to conduct the combustion products from an appliance to the outside air; as opposed to the European approach in standards, where a "flue" is only the passageway in the structure through which the combustion products flow.

The documents available as downloads from the sites referenced throughout the document were last accessed on 10 February 2015.

Use of this document

As a guide, this British Standard takes the form of guidance and recommendations. It should not be quoted as if it were a specification or a code of practice and claims of compliance cannot be made to it.

It has been assumed in the preparation of this British Standard that the execution of its provisions will be entrusted to competent people (see Clause 4 for information on competence), for whose use it has been produced.

Presentational conventions

The guidance in this standard is presented in roman (i.e. upright) type. Any recommendations are expressed in sentences in which the principal auxiliary verb is "should". The word "may" is used in the text to express permissibility, e.g. as an alternative to the primary recommendation of the clause. The word "can" is used to express possibility, e.g. a consequence of an action or an event.

Commentary, explanation and general informative material is presented in smaller italic type, and does not constitute a normative element.

Notes give references and additional information that are important but do not form part of the recommendations. Commentaries give background information.

Contractual and legal considerations

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 cannot confer immunity from legal obligations.

Attention is drawn to the following statutory regulations.

- The Gas Safety (Installation and Use) Regulations 1998 [2]
- The Gas Safety (Installation and Use) Regulations (Northern Ireland) 2004 [3]
- The Gas Safety (Application) Order (Isle of Man) 1996 [4]
- The Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 2013 [5]
- The Gas Safety (Management) Regulations 1996 [6]
- The Gas Safety (Management) Regulations (Northern Ireland) 1997 [7]

1 Scope

1.1 This standard provides guidance for gas operatives on:

- a) the general use of an electronic portable combustion gas analyser conforming to BS EN 50379-3 and BS 7927:1998 incorporating Amendment No. 1:1999;

NOTE 1 This standard assumes that a portable combustion gas analyser [often referred to colloquially as a “flue gas analyser” (FGA)] of the type specified in BS EN 50379-3 or BS 7927:1998 incorporating Amendment No. 1:1999 is available to the gas operative and the operative is competent in its use and the interpretation of any reading obtained. This competence can be demonstrated by satisfactory completion of the relevant ACS assessments, which cover the use of electronic portable combustion gas analysers. See Clause 4 for further information on competence.

NOTE 2 BS EN 50379-3 superseded BS 7927:1998 incorporating Amendment No. 1:1999 on 1 March 2007. However, electronic portable combustion gas analysers conforming to BS 7927:1998 incorporating Amendment No. 1:1999 remain acceptable for the purposes of this standard.

- b) the use of such an electronic portable combustion gas analyser to determine ambient levels of carbon monoxide (CO) and, in certain circumstances (see Notes 4 and 5, and Commentary on 8.1), detect the presence of carbon dioxide (CO₂) in dwellings;

NOTE 3 A definition of a dwelling is given in 3.7.

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, EH40/2005 [8].

NOTE 5 Electronic portable combustion gas analysers that calculate CO₂ levels from an oxygen (O₂) measurement are:

- well proven for calculating CO₂ levels in combustion gases in the flue of an appliance;
- not suitable for measuring ambient levels of CO₂ in dwellings; and
- able to detect increases in the ambient CO₂ levels in ambient atmospheres and such increases in CO₂ will provide an early indication of increasing build-up of products of combustion in the room (see Commentary on 8.1).

- c) the use of an electronic portable combustion gas analyser to measure CO and CO₂ in combustion products from the following types of gas-fired appliances:

- 1) flueless appliances (type A appliances);
- 2) open-flue appliances (type B appliances);
- 3) room-sealed appliances (type C appliances); and
- 4) all appliances for which the gas appliance manufacturer has provided a purpose-designed sampling point or specific sampling instructions;

NOTE 6 Type A, type B and type C classification of gas-fired appliances is described in PD CEN/TR 1749 and in 3.21.

- d) the use of an electronic portable combustion gas analyser as a diagnostic instrument to assist a gas operative:

- 1) in confirming safe and/or efficient operation at the time of commissioning, in accordance with gas appliance instructions;
- 2) in determining the level of servicing required for a gas-fired appliance;

- 3) in confirming satisfactory combustion following servicing in accordance with gas appliance instructions; and
- 4) in confirming satisfactory combustion following maintenance.

NOTE 7 At the time of installation of a new appliance it is not necessary to carry out tests to measure the level of combustion products in the flue, unless the gas appliance instructions specify that a test be carried out (see 11.2).

NOTE 8 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 instructions. This standard describes the options of how they can be used in conjunction with gas appliance instructions.

1.2 This standard gives recommendations on:

- a) combustion performance action levels; and
- b) actions to be taken when CO is detected in dwellings.

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

NOTE The general recommendations for 3rd family installations contained within this standard also apply to gas installations supplied with LPG/air mixtures used in the Channel Islands or the Isle of Man, provided:

- *any installed gas equipment has been appropriately converted and is suitable for the gas being supplied, and*
- *the provisions of the standard do not conflict with local regulations or authorized local custom and practice.*

1.3 This standard gives references to further information on the effects of CO.

NOTE Information on the effects of CO can be found in the Institute for Environment and Health's IEH assessment on indoor air quality in the home (2): Carbon monoxide [9].

1.4 This standard does not:

- a) cover the obligations of an emergency service provider (ESP) in responding to a gas emergency or procedures for investigating incidents that are reportable under Section 11(1) of the Reporting of Injuries, Diseases and Dangerous Occurrence Regulations (RIDDOR) 2013 [5] and the Gas Safety (Management) Regulations (GSMR) 1996 [6];
- b) make recommendations arising from the determination of ambient CO₂ levels; or
- c) deal with the measurement of combustion products such as nitrogen oxides and aldehydes.

NOTE Combustion products from gas appliances also contain oxides of nitrogen (NO_x), predominantly nitrogen monoxide (nitric oxide, NO) and nitrogen dioxide (NO₂). Although this standard does not cover the measurement of these substances, quantities of such products could be present in the air and could cause harm and irritation to humans. For guidance on the health considerations associated with these combustion products, see the Institute for Environment and Health assessment on indoor air quality in the home: Nitrogen dioxide, formaldehyde, volatile organic compounds, house dust mites, fungi and bacteria [10].

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 7927:1998 incorporating Amendment No. 1:1999, *Heating appliances for domestic applications – Portable apparatus designed to detect and measure specific combustion flue gas products – Requirements*¹⁾

BS 5440-1:2008, *Flueing and ventilation for gas appliances of rated input not exceeding 70 kW net (1st, 2nd and 3rd family gases) – Part 1: Specification for installation of gas appliances to chimneys and for maintenance of chimneys*

BS EN 50291-1, *Electrical apparatus for the detection of carbon monoxide in domestic premises – Part 1: Test methods and performance requirements*

BS EN 50291-2, *Electrical apparatus for the detection of carbon monoxide in domestic premises – Part 2: Electrical apparatus for continuous operation in a fixed installation in recreational vehicles and similar premises including recreational craft – Additional test methods and performance requirements*

BS EN 50292, *Electrical apparatus for the detection of carbon monoxide in domestic premises, caravans and boats – Guide on the selection, installation, use and maintenance*

BS EN 50379-3, *Specification for portable electrical apparatus designed to measure combustion flue gas parameters of heating appliances – Part 3: Performance requirements for apparatus used in non-statutory servicing of gas fired heating appliances*

3 Terms and definitions

For the purposes of this British Standard the following terms and definitions apply.

- 3.1 action level**
appliance combustion performance at which action is to be taken
- 3.2 ambient**
atmosphere relating to the immediate surroundings, e.g. air inside the dwelling, air outside the dwelling
- 3.3 appliance compartment**
enclosure specifically constructed or adapted to accommodate one or more fuel-burning appliances
- 3.4 box radiant gas fire**
gas fire designed to heat a room by both radiation and convection, incorporating radiant box-shaped lattice fronted elements mounted vertically or near vertical and of a design that does not seek to simulate a solid fuel fire bed
- 3.5 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
- 3.6 customer-adjustable ventilation**
adjustable purpose-provided unit/assembly designed to allow ventilation

¹⁾ Withdrawn.

3.7 dwelling

unit of residential accommodation, including residential park homes, flats, bedsits, 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 recognized 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.

3.8 CO detector

device that detects the presence of CO (see 7.1)

3.9 electronic portable combustion gas analyser

electronic apparatus that detects and measures the presence of combustion gases and clearly displays the result

NOTE Hereafter referred to in this standard as "gas analyser".

3.10 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 (GSMR)1996 [6].

3.11 full strip and clean

work involving, but not exclusively, the gaining of access to the heat exchanger and burner assemblies and the removal of any corrosion products (such as shale) or debris that might impair the safe and efficient operation of the appliance

3.12 gas operative

person deemed competent to carry out work

NOTE Persons deemed competent to carry out gas work are those who hold certificates of gas safety competence acceptable to Gas Safe Register, which include (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. See Clause 4 for further information on competence.

3.13 GC number

number assigned to some appliance models as part of an appliance indexing system

NOTE GC numbers are made up of seven characters, which can be numbers or a combination of numbers and letters, e.g. GC 12-345-67. These are issued by British Gas and are included on an appliance data plate.

3.14 live fuel effect gas fire

appliance designed to simulate a solid fuel appliance

3.15 maintenance

combination of all actions intended to retain an appliance in, or restore it to, a state in which it can operate safely

3.16 permanent ventilation

non-adjustable purpose-provided unit/assembly designed to allow ventilation

3.17 safety check

examinations and tests to ensure that a gas appliance and any associated flue/chimney operate safely

NOTE An example of a safety check is the landlord's gas safety checks required by regulation 36(3) of the Gas Safety (Installation and Use) Regulations 1998 [2].

3.18 servicing

regular and planned (usually annual) activity carried out on an appliance to check and ensure that it is working safely and correctly

3.19 shaling

progressive corrosion of the flueways of a cast iron heat exchanger, leading to the development of rust flakes

NOTE Shaling can block the heat exchanger.

3.20 “suspect” gas appliance

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

3.21 types of gas appliance**3.21.1 type A appliance**

appliance not intended for connection to a flue or to a device for evacuating the combustion products to the outside of the room in which the appliance is installed

NOTE Hereafter referred to in this standard as “flueless appliance”.

3.21.2 type B appliance

appliance intended to be connected to a flue that evacuates the combustion products to the outside of the room containing the appliance, with the combustion air being drawn directly from the room

NOTE Hereafter referred to in this standard as “open-flue appliance”.

3.21.3 type C appliance

appliance in which the combustion circuit (air supply, combustion chamber, heat exchanger and evacuation of the combustion products) is sealed with respect to the room in which the appliance is installed

NOTE Hereafter referred to in this standard as “room-sealed appliance”.

3.22 work

installation, maintenance, servicing, removal, permanent adjustment, repair, repositioning, 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 [2]. 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 Competence

Persons carrying out work covered by the scope of this standard should ensure that they have the competence relevant for the task such as not to compromise the recommendations of this standard and, in particular, the safe installation, commissioning and operation of gas equipment.

COMMENTARY ON CLAUSE 4

Competence requires sufficient knowledge, practical skill and experience to carry out the job in hand safely, with due regard to good working practice. Knowledge should be kept up-to-date with changes in law, technology and safe working practice.

There are three principal aspects to competence for work associated with gas-fired appliances; these are:

- a) knowledge of the relevant Building Regulations [12], [13], [14], [15] for domestic premises;*
- b) ability to ensure that electrical work in dwellings is designed, installed, inspected and tested to the standard required by BS 7671;*
- c) registration for “gas work” with an appropriate authority.*

It is a statutory requirement in Great Britain, Isle of Man, Northern Ireland and Guernsey (see Table 1) that all “gas work” [item c)] be carried out by a business or self-employed person(s) that is a member of a “class of persons” registered with a registration body which has been approved by an approval body (see Table 1) to operate and maintain such a register.

At the time of publication, the only body with approval to operate and maintain a register of individuals/businesses who are “members of a class of persons” is the Gas Safe Register. Thus, it is essential that all businesses or self-employed gas engineers are registered with the Gas Safe Register.

The qualifications which persons need to have to be deemed competent to carry out gas work are given in Table 2.

Table 1 Approval bodies and statutory regulations by country/territory

Country/territory	Approval body	Statutory regulations
Great Britain	Health and Safety Executive (HSE)	Gas Safety (Installation and Use) Regulations 1998 [2]
Isle of Man	Health and Safety at Work Inspectorate (HSWI)	Gas Safety (Installation and Use) Regulations 1994, as amended and applied by the Gas Safety (Application) (Isle of Man) Order 1996 [4]
Northern Ireland	Health and Safety Executive Northern Ireland (HSENI)	Gas Safety (Installation and Use) Regulations (Northern Ireland) 2004 [3]
Guernsey	Health and Safety Executive for the States of Guernsey [HSE (Guernsey)]	Health and Safety (Gas) (Guernsey) Ordinance 2006 [16]

Table 2 Competence requirements by country/territory

Qualifications	Great Britain and Isle of Man	Northern Ireland	Guernsey
Current certificate(s) of competence in the type of gas work to be conducted, issued by an awarding body accredited by the United Kingdom Accreditation Service (UKAS) (ACS certification)	✓	✓	✓
National/Scottish Vocational Qualification (N/SVQ accredited by Ofqual), which is aligned in matters of gas safety	✓	✓	✓
National/Scottish Vocational Qualification (N/SVQ accredited by Ofqual), which is aligned under the HSC ACoP arrangement ^{A)} as approved with the registration body	✓	✓	✗
Any other scheme recognized by the gas registration body for registration purposes	✓	✓	✓

^{A)} Guidance on the individual competence required for gas work is given in industry guidance IGEM/IG/1, *Standards of training in gas work – Criteria and guidance in the development and delivery of training programmes in gas work* [17].

There are three principal aspects to competence for work associated with gas analysers. These are:

- 1) be competent in their use; and*
- 2) have an understanding of the results obtained; and*
- 3) have an awareness of the necessary safety actions and appropriate regulations (e.g. Gas Safety (Installation and Use) Regulations [2]).*

This competence can be demonstrated by satisfactory completion of the relevant ACS assessments which cover the use of gas analysers.

5 Gas analyser

5.1 Selection

5.1.1 A gas analyser should conform to BS EN 50379-3 or BS 7927:1998 incorporating Amendment No. 1:1999.

NOTE A more detailed description of a gas analyser is given in Annex A.

5.1.2 If the gas analyser is not marked as conforming to BS EN 50379-3 (or BS 7927:1998 incorporating Amendment No. 1:1999), the analyser manufacturer should be asked to provide written confirmation as to its suitability for the intended purpose.

5.1.3 A gas analyser's sensor response for CO and CO₂ can be affected by the presence of other gases and vapours that can, for example, come from cooking activities or common household materials such as cleaning fluids, polishes and paints. This sensor cross-sensitivity can lead to inaccurate readings.

5.1.4 The analyser instructions should be checked for what substances could interfere with analyser operation or reliability in the short or long term. If this information is not given or a substance not listed is suspected of causing interference, the gas analyser manufacturer should be consulted.

5.2 Preparation of gas analyser

5.2.1 Pre-checks before use

The gas analyser should be treated with care, and used and maintained in accordance with the gas analyser instructions. Before using the gas analyser it is essential to read operator manuals and ensure that the analyser has a current proof of calibration.

5.2.2 Preparation of gas analyser for use

The gas analyser should be switched on and the relevant "zero" procedure described in the gas analyser instructions should be carried out in outdoor air at a location as adjacent to the space in the building to be tested as is reasonably practicable. Once zeroed, it is essential that the gas analyser is not switched off during the test. If it is switched off, the gas analyser needs to be re-zeroed before taking any more readings.

These gas analysers read very low levels near to zero. Since they can fail to give any reading due to sensor failure, a check should be carried out using a flue gas sample, for example by measuring combustion products from a cooker grill burner or around a cold saucepan on a hotplate, or in the flue of an operating boiler.

For those gas analysers that calculate CO₂ from an O₂ measurement, it is good practice to check that the O₂ reading in outdoor air is 20.9%.

When CO₂ is being calculated, the relevant fuel gas should be selected on the gas analyser.

If the gas analyser cannot be zeroed, the gas analyser instructions should be consulted.

6 Investigation of reports of fumes, smells and spillage/leakage of combustion products in dwellings

6.1 Determining scope of 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.

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, loss of consciousness or hospitalization due to gas, or where there have been GSMR investigations (see Commentary) which have been completed, the gas operative may inspect and test the gas installation and appliances in accordance with 6.2 to 6.6 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).

COMMENTARY ON 6.1

In instances of death, loss of consciousness or hospitalization the ESP will normally have already attended the site and reported the incident, as required under the Reporting of Injuries, Diseases and Dangerous Occurrences Regulations (RIDDOR) 2013 [5], to the Health and Safety Executive (HSE). In such circumstances the gas supplier is normally 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, loss of consciousness or hospitalization, 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 office 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 13 and Clause 14.*

6.2 Safety principles

6.2.1 Basic rules

Whenever attending reports of fumes, smells, spillage of combustion products in dwellings and/or CO detector activation, gas operatives have to:

- a) consider their own safety as well as that of the occupants (see 6.2.2); and
- b) use a gas analyser or a personal CO alarm to ensure they do not enter atmospheres in which potentially dangerous levels of CO are present (see 6.2.2).

COMMENTARY ON 6.2.1b)

If using a gas analyser, sample at head height in every room entered for at least 60 s.

If using a personal CO alarm ensure it is worn in accordance with the manufacturer's instructions.

All investigations should adhere to the following basic rules in the order listed:

- 1) protect life;
- 2) protect property;
- 3) locate all fuel-burning appliances;
- 4) locate any escape of gas, fumes, smells or spillage/leakage of combustion products;
- 5) confirm the safe installation and operation of all suspect gas appliances;
- 6) make safe any identified unsafe appliances in accordance with the *Gas Industry Unsafe Situations Procedure* [1];
- 7) advise the customer of any remedial action that is required; and
- 8) complete all necessary reports, documentation and actions as advised in the *Gas Industry Unsafe Situations Procedure* [1] and Clause 13 and Clause 14.

6.2.2 CO investigation action levels

The following actions should be taken when faced with the presence of CO in any area of the dwelling during the investigation process:

- a) greater than 30 ppm – evacuate occupants to a safe environment (see Notes 2 and 3);
- b) 0 to 100 ppm – safe for gas operative to enter property for 30 min and begin investigation;
- c) greater than 100 ppm – stop work/turn off appliances, ventilate property and leave property immediately.

If, for any reason, CO levels do not fall sufficiently to allow the investigation to proceed, it is recommended that the property be evacuated/remains evacuated.

NOTE 1 These are general atmosphere CO values and not peak values measured adjacent to an appliance. They can be indicated by a personal alarm monitor or measured in accordance with the relevant test method described in 8.3.

NOTE 2 Advise others not to enter until the level has dropped below 10 ppm and preferably is down to outdoor background level.

NOTE 3 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 satisfies the tests described in 8.3.4.1 and is installed correctly to the cooker instructions and/or BS 6172.

COMMENTARY ON 6.2.2a)

With the exception of cookers (see Note 3), advise occupants to move to a CO-free atmosphere if CO levels above 30 ppm are noted.

A CO-free atmosphere might be another room or necessitate advising the occupants to leave the dwelling.

COMMENTARY ON 6.2.2b)

EH40/2005 Workplace exposure limits [8] allows 15 min exposure to CO at 200 ppm time-weighted average.

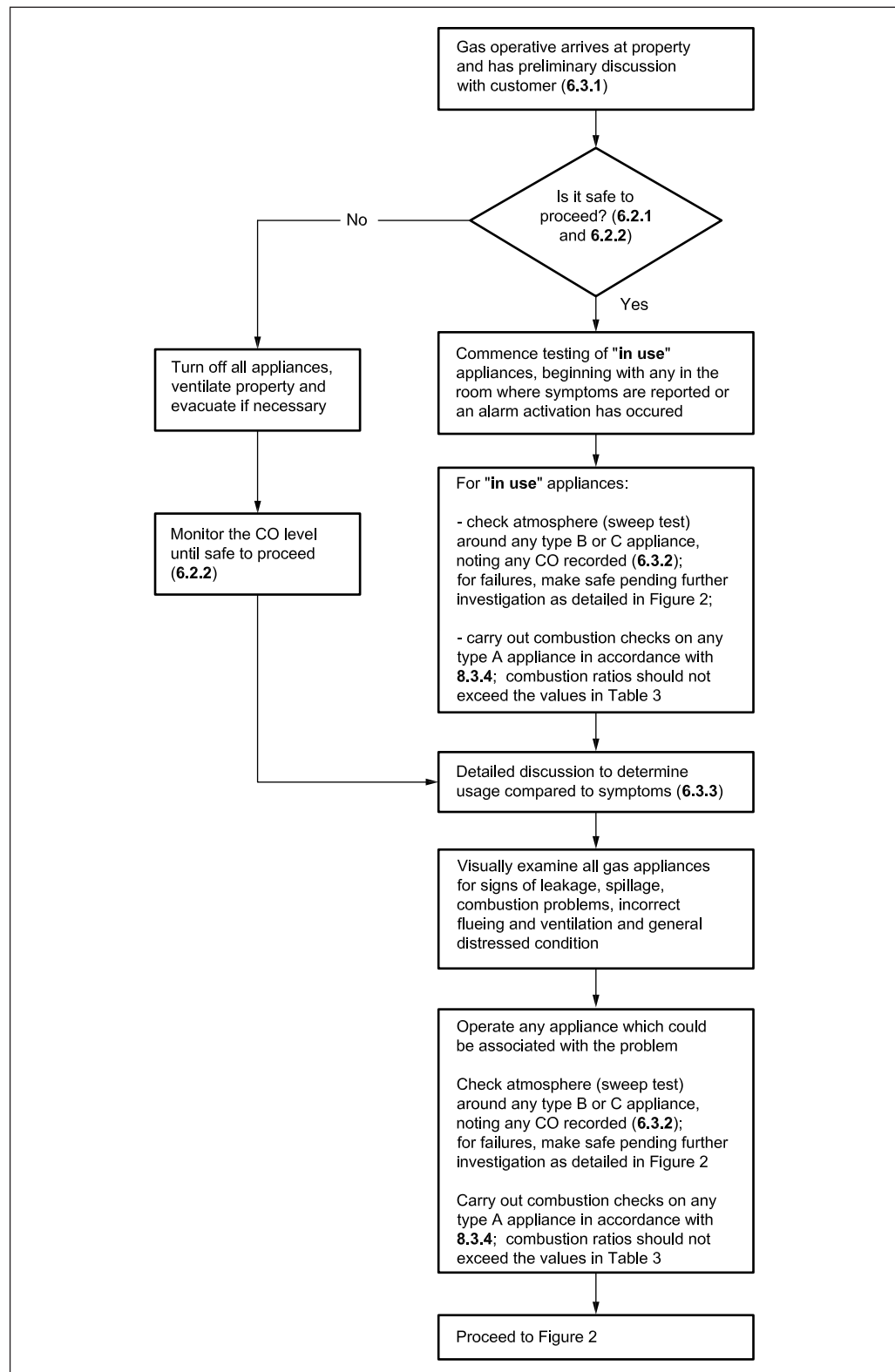
COMMENTARY ON 6.2.2c)

Open windows and doors to ventilate the dwelling before leaving. On re-entry check the atmosphere in the dwelling continually from the point of access inwards.

6.3 Preliminary procedure for carrying out checks for CO spillage/leakage from gas appliances

NOTE Proceed as described in Figure 1. More detailed advice is provided by the subclauses and notes referenced in Figure 1.

Figure 1 Flow chart of the preliminary procedure for carrying out checks for CO spillage/leakage from gas appliances



6.3.1 Possible circumstance identified by preliminary discussion with customer (see Figure 1)

A gas operative arriving at the site could encounter some of the following:

- 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 other fumes/smells;
- e) CO detector activation; and
- f) referral from ESP or an agent acting on behalf of the customer.

6.3.2 Sweep test for open-flue and room-sealed appliances

Prepare the gas analyser as described in 5.2 and set it to measure CO.

With the appliance in operation at full rate, slowly move the sampling probe above, around and below the appliance, keeping the tip approximately 100 mm away from the part of the appliance/chimney system being examined.

This test should last for a minimum of 2 min per appliance, and should include a minimum of two passes around the appliance or chimney/flue.

Ensure that when testing open-flue appliances doors and windows are closed and any fans (including those within other appliances) are in operation.

The test should also be carried out on the joints of any flue connected to the appliance.

Where access to the flue or its joint cannot be gained, the sweep test cannot be relied upon to confirm the flue's integrity.

Ensure the gas analyser returns to zero between tests.

Record the maximum level of CO measured for each test.

COMMENTARY ON 6.3.2

For open-flue appliances give particular emphasis to above and below the edges of any draught diverter. For room-sealed appliances carefully examine entry points for seals, thermocouples, etc. In each case, keep the tip of the sampling probe approximately 100 mm away from the area being examined.

6.3.3 Detailed discussion with customer (see Figure 1)

A discussion with the customer might include the following questions.

- a) Does the problem only occur 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?