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Electrical apparatus for the detection of combustible gases in domestic premises — Guide on the selection, installation, use and maintenance

bsi.

National foreword

This British Standard is the UK implementation of EN 50244:2016. It supersedes BS EN 50244:2000 which is withdrawn.

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Electrical apparatus for the detection of combustible gases in domestic premises - Guide on the selection, installation, use and maintenance

Appareils électriques pour la détection des gaz combustibles dans les locaux à usage domestique - Guide de sélection, d'installation, d'utilisation et de maintenance

Elektrische Geräte für die Detektion von brennbaren Gasen in Wohnhäusern - Leitfaden für Auswahl, Installation, Einsatz und Wartung

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European foreword

This document (EN 50244:2016) has been prepared by CLC/TC 216 “Gas detectors”.

The following dates are fixed:

- latest date by which this document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2017-03-14
- latest date by which the national standards conflicting with this document have to be withdrawn (dow) 2019-03-14

This document supersedes EN 50244:2000.

EN 50244:2016 includes the following significant technical changes with respect to EN 50244:2000 (various minor changes have also been made):

— General information added to cover domestic premises, boats and caravans. This is a result of the splitting of EN 50194 into EN 50194-1 and EN 50194-2.

— In Clause 4 text has been added regarding alarm set points for apparatus complying with EN 50194-1.

— A new Clause 5 has been created to provide further information to the user concerning the differences between Type A and Type B devices.

— Former Clause 5 has been renumbered Clause 6, text has been reformulated to avoid repetition and make it easier to understand.

— New Figures 1 and 2 created, to show the typical locations of combustible gas alarms when used with Natural Gas and LPG installations.

— The text in Clause 7 “Executive Actions” has been aligned with EN 50292, where applicable, for combustible gas alarms.

— In Clause 8 “Advice to the User”, additional text has been added to highlight the differences between location of a combustible gas detector and a carbon monoxide alarm.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC [and/or CEN] shall not be held responsible for identifying any or all such patent rights.

Introduction

This European Standard is intended to be a guide for people who, in the course of their professional activities, are required to install combustible gas detectors in domestic premises. It is also aimed at anyone who might supply such gas detectors to members of the public for subsequent installation by competent persons according to national regulations, so that advice may be given based on good engineering practice.

Apparatus for the detection of combustible gases are not a substitute for good gas installation practice and regular servicing of gas appliances, although they may provide an added margin of reassurance for users of gaseous fuels. Domestic combustible gas detectors with or without some form of executive function may overcome fears of fuel safety and can be particularly beneficial in certain circumstances.

1 Scope

This European Standard provides information on the selection, installation, use and maintenance of apparatus for the detection of combustible gas designed for continuous operation in a fixed installation in domestic premises as described in the EN 50194 series. This guide should be read in conjunction with any additional relevant national or local regulations.

The European Standard refers to the installation of two types of apparatus designed to operate in the event of an escape of town gas, natural gas or liquefied petroleum gas:

— Type A apparatus - to provide a visual and audible alarm and an executive action in the form of an output signal that may actuate directly or indirectly a shut-off device and/or other ancillary device;

— Type B apparatus - to provide visual and audible alarms only.

This guide is not applicable to the use of apparatus:

— for the detection of toxic gases such as carbon monoxide, see EN 50292;

— for industrial or commercial premises, see EN 60079-29-2.

2 Normative references

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

EN 1775, *Gas supply - Gas pipework for buildings - Maximum operating pressure less than or equal to 5 bar - Functional recommendations*

EN 50194 (all parts), *Electrical apparatus for the detection of combustible gases in domestic premises*

EN 60079-29-2, *Explosive atmospheres — Part 29-2: Gas detectors — Selection, installation, use and maintenance of detectors for flammable gases and oxygen (IEC 60079-29-2)*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
lower explosive limit
LEL
volume ratio of combustible gas or vapour in air below which an explosive gas atmosphere will not be formed

3.2
upper explosive limit
UEL
volume ratio of combustible gas or vapour in air above which an explosive gas atmosphere will not be formed

3.3
continuous operation
apparatus which is continuously powered with continuous or intermittent automatic sensing

3.4
sensor
assembly in which the sensing element is housed that may contain associated circuit components

3.5
sensing element
device, the output of which will change in the presence of combustible gas

3.6
ventilation
movements and replacement of air resulting from wind, temperature gradients, or artificial means (e.g. fans or extractors)

3.7
relative density
density of gas or vapour relative to the density of air at the same pressure and at the same temperature

Note 1 to entry: Air is equal to 1,0.

3.8
gas detection apparatus
apparatus comprising the sensor, remote sensor if applicable, alarm and other circuit components, power supply and for type A apparatus a means of providing an output signal

3.9
domestic premises
house or building which is the place of residence or home of a household, family or person

3.10
fixed installation
apparatus which is intended to have all parts except replaceable batteries permanently installed

3.11
output signal
signal characterized by a standby state and an activated state by which action may be initiated

EXAMPLE Triggering of a shut-off device.

3.12
warm-up time
time interval between the time when the apparatus is switched on and the time when the apparatus is fully operational

3.13
volume ratio (v/v) (commonly referred to as concentration)
ratio of the volume of a component to the volume of the gas mixture

4 Sensing of combustible gas

There are three main hazards arising from combustible gases: explosion, poisoning and annoxia (insufficient oxygen). This document deals only with the explosion hazard of combustible gases.

Distributed gas has an odour added at source to ensure that the general public may recognize any leakage by a characteristic smell. Most people may detect this odour at quite low gas concentration levels (2 % LEL, or less) but some medical conditions as well as increasing age may result in a reduction in the sense of smell. A gradually increasing gas concentration may also

go unnoticed due to olfactory fatigue (temporary inability to distinguish an odour, due to continued exposure of a smell.)

The conditions under which combustion occurs are variable and is dependent upon the gas composition. When the concentration level of gas is between the LEL and UEL and there is a source of ignition, the gas mixture will burn or explode. For natural gas, the LEL is between 4 % v/v and 5 % v/v of gas in air and the UEL is about 15 % v/v of gas in air. For LPG, the LEL is between 1 % v/v and 2 % v/v of gas in air and the UEL is about 10 % v/v of gas in air.

The alarm set points of devices compliant with the EN 50194 series shall be between 3 % and 20 % LEL of the gas to be detected, which means that an alarm will activate well before an ignition hazard occurs.

Each apparatus is specifically designed and calibrated for a specific gas hence it is essential that an apparatus, calibrated for one gas, is not used to detect another.

5 Types of apparatus

There are many different types of gas sensors available, for example, catalytic, semiconductor and infrared, details of which may be found in EN 60079-29-2. Gas detection apparatus should comply with the requirements of EN 50194-1 and EN 50194-2, as applicable.

Various additional options may be available to the person selecting the apparatus to be installed, in addition to gas detection.

Some systems may incorporate sensors other than those for detection of flammable gases, such as carbon monoxide, and care should be taken to avoid confusion between different signals that may require conflicting actions by the user. Such problems might best be overcome by integrating individual apparatus, together with a centralized control and alarm annunciator.

The main choice is between type A or type B apparatus (that is, with or without an executive function, see Clause 7) either of which may involve further considerations as follows:

— Type A:

  May be particularly useful for people with some physical disability that might delay a manual response to an alarm. They are more likely to be used in a fixed (rather than portable or transportable) installation, because of the need to transmit an output signal for activation of the ancillary device(s). However developments in communication technologies (such as wireless) may allow even greater flexibility, so long as the overall reliability of the gas detection system is not compromised.

  The principal advantage of Type A devices is that the output signal can be used to activate an isolation valve to shut off the incoming gas supply.

— Type B:

  Intended for either fixed or portable installation, with portable apparatus almost certainly powered from high capacity internal batteries alone. Besides the usual siting considerations, special care should be taken with portable units to ensure that they are always properly positioned in relation to the ambient air being sampled. In addition, the user should be cautioned against intermittent operation of the apparatus and dropping or damaging it while being re-located.

  Type B devices have the disadvantage in that there is no automatic executive action possible.

6 Installation

6.1 General

The manufacturer is required to provide suitable instructions for the correct and safe installation of the apparatus. These should be read carefully before installing or operating the apparatus.

Generally, the same siting considerations apply to both type A and type B apparatus.

Combustible gases used in domestic premises generally fall into two categories, lighter than air and heavier than air. Information on these gases can be found in 6.2.

The design and layout of domestic premises (as well as caravans and boats) and the number, type and position of combustible gas sources vary widely. General guidance is given in the following clauses on where and where not to locate the apparatus in order to minimize the risk of misleading indications. To select a position for a gas detector, the source and nature of the possible gas release should be considered.

6.2 Gas releases

6.2.1 General

Natural gas to domestic premises is generally Methane, the less commonly used Town Gas is a mixture of methane, hydrogen, nitrogen and carbon monoxide. These gases are lighter than air.

Liquefied petroleum gas (LPG) is a mixture of propane and butane and is commonly stored in cylinders or tanks on the premises of the user, as opposed to being piped into the premises from a mains supply. In general, LPG is supplied as butane containing a few percent propane or propane containing a few percent butane. LPG / air mixtures are also supplied. All of these gas mixtures are considerably heavier than air.

6.2.2 Source of the gas escape

The most likely origin for an escape of gas in domestic premises is from the gas appliances themselves and the connections between appliances and the fixed gas distribution system in buildings. The most common origin of a gas release is from the appliance itself, as they may be moved and the connection disturbed or damaged. Another cause of gas release, especially if cookers or boilers combustion apparatus without flame failure control are in use, is the extinction of the flame, or its non-ignition, whether by spilling of liquid, or draughts or misuse by the user, for example not switching off the gas supply after use.

The fixed distribution system inside the building, assuming that it has been correctly installed, and tested, is usually gas-tight as long as the building integrity is maintained or the pipes are not damaged by works, shocks, etc. Therefore a leak from the fixed installation is unlikely, except in extreme circumstances, such as earth movement.

It is possible that gas may penetrate inside a building by migrating along pipes or cables from an escape in the external gas mains supply. In this case, gas may be released in any ground-floor or underground room in the building depending on the escape position and the underground structure. In this situation the gas detector will likely be located in another room where there is no significant gas concentration and therefore will not detect the gas.

In the majority of the cases, gas will be released at low pressure, even if the flow is high hence the effect of pressure on its dispersion behaviour will be unimportant.

6.2.3 Examples of behaviour of gas releases

6.2.3.1 Room having poor or no ventilation

The typical case is the one of a single room, with its doors and windows closed and without any ventilation such as an air vent.

In this situation:

Natural gas will tend to fill all the volume above the level of the escape. The gas concentration below the level of the escape will be much lower than the concentration above the escape. It may be considered that above the level of the escape the gas concentration is uniform wherever it is measured.

LPG, by virtue of being heavier than air, will tend to fill all the volume below the level of the escape. The gas concentration below the level of the escape will be much higher than the concentration above the escape. It may be considered that the gas concentration in the room is likely to be uniform near the floor wherever it is measured.

In both cases, the speed at which the gas concentration increases depends upon the gas flow rate and the volume of the room. Due to the absence of ventilation, there will be minimal dilution of the combustible gas and a flammable concentration may be reached rapidly.

Such poorly ventilated areas will contravene the requirements of EN 1775 regarding new installations and extensions to existing installations.

6.2.3.2 Ventilated room

This case describes a room with ventilation or with its doors or windows open or slightly open. The airflow, which brings clean air into the room, will limit the maximum concentration of the gas to a value depending upon the gas to airflow ratio. The size of the room will only have an influence on the time needed to reach this maximum concentration, i.e. the smaller the room, the shorter the time required.

The same distribution of concentration with height as described in 6.2.3.1 will be observed.

For natural gas and town gas an upward airflow will tend to accentuate the concentration difference between the ground and the ceiling; conversely, a downward airflow will tend to make the concentration more uniform along the height of the room. The same effect may be observed with a heat source such as a radiator which will create an upward draught due to the heat generated and a downward draught along the walls thereby mixing the air.

For LPG, downward airflow will accentuate and therefore enhance the concentration at low level. An upward air flow will tend to make the concentration more uniform throughout the height of the room. The effect of any ventilation above the height of any gas release may have negligible effect on the uniformity of the gas concentration and may result in “pooling” of gas below the ventilation point.

6.2.3.3 Multiple rooms

This is a typical case of an apartment with several rooms with opened internal doors on the same floor or different floors. This situation is much more complicated and only general observations may be made. The gas concentration will be higher in the room where the escape occurs and will decrease in the other rooms further away from the origin of the escape.

In all the rooms,

- Natural and town gas concentration distribution with height will be uniform or slightly higher near the ceiling;

- LPG concentration distribution with height will be lower towards the floor.

6.2.4 Positioning of the gas detector

6.2.4.1 General

Ideally, an apparatus should be installed in every room containing a gas appliance. If this is not possible, the gas detector should be installed in the room where a gas escape is most likely to occur; this would typically be the kitchen, due to the presence of a gas cooker and other gas appliances. Escapes from boilers are less likely because boilers are themselves fixed appliances and are typically sealed appliances.

6.2.4.2 Natural Gas and Town Gas

The gas detector should be installed above the level of a possible gas escape and near the ceiling (typically < 0,3 m from the ceiling), in a place where air movements are not impeded by furniture and furnishings. Apparatus with latching alarms should be positioned such that the user is able to reset the alarm. The location should not be vulnerable to impact or splashing during normal routine operations such as cleaning in the area.

6.2.4.3 LPG

The gas detector should be mounted as low as possible (typically 0,1 m above the floor) and in a place where air movements are not impeded by furniture. Apparatus with latching alarm should be positioned such that the user is able to unlatch the alarm. The location should not be vulnerable to impact or splashing during normal routine operations such as cleaning in the area.

6.2.4.4 Both Device Types

The detector should not be installed:

— in an enclosed space (e.g. in a cupboard or behind a curtain);

— directly above a sink;

— next to a door or window;

— next to an extractor fan;

— in an area where the temperature may drop below −10 °C or exceed 40 °C;

— where dirt and dust may block the sensor;

— in a damp or humid location.

Its location should not be too close to openings or ventilation ducts since the airflow at these places may be high and may locally decrease the gas concentration.

The apparatus should not be installed immediately above or next to gas appliances since small gas releases may occur before ignition that may result in unwanted alarms. It should be noted that installation near cookers may lead to:

— alarms produced by cooking vapours and not gas escapes;

— contamination by grease that may impede the correct operation of the apparatus.

Figures 1 and 2 show the typical siting of a combustible gas detectors.

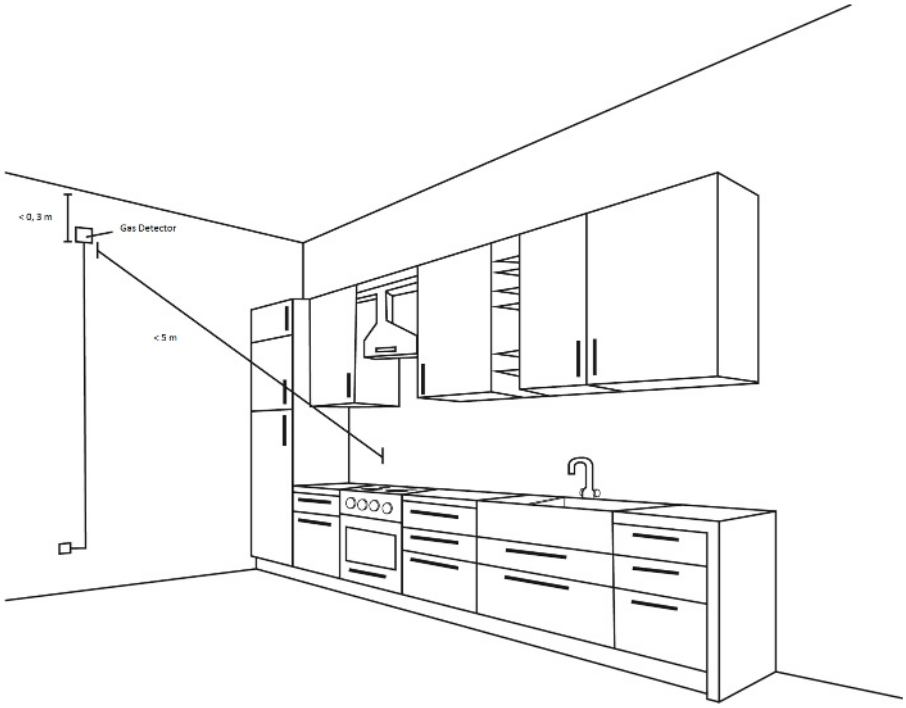

Figure 1 — Typical detector location for natural gas or town gas installations

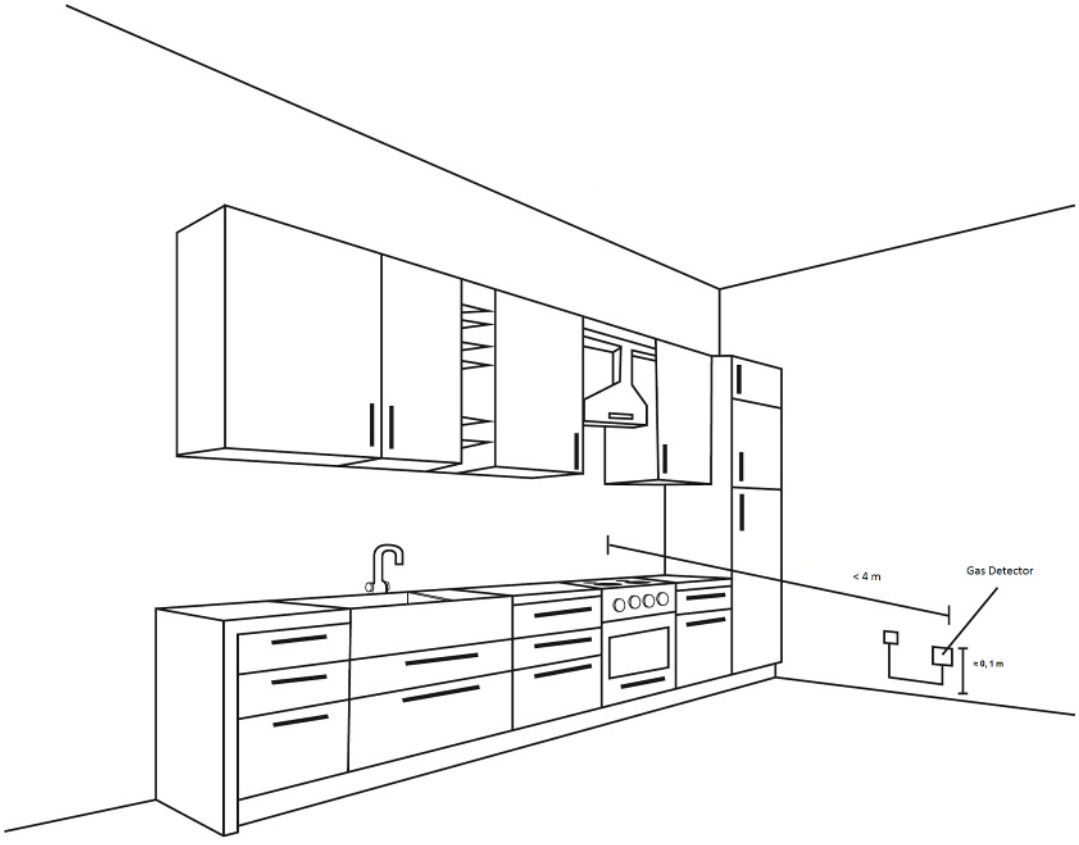

Figure 2 — Typical detector location for LPG installations

6.2.4.5 Special Considerations for Recreational Vehicles

When installing a device into a boat, caravan or mobile home, the general principles of 6.2.4.2 to 6.2.4.4 should be applied taking into account the restricted space available.

Care should be taken to ensure that the detector is not damaged in use and is suitable for the environment into which it is going to be installed.

Devices in accordance with EN 50194-2 will generally be suitable for these environments.

6.3 Remote Detector Heads

Some domestic combustible gas detectors are supplied as systems with a central control system and remote sensor heads with an interconnection between the components of the apparatus. This has the advantage of being able to place multiple sensors into a premises to aid in locating the source of an escape.

Remote detector heads are particularly suitable for boats and caravans, as there may be insufficient space to locate a conventional detector.

Remote detector heads should be located in accordance with the guidance in 6.2 and the control panel in a location where the user can access the controls easily, away from the potential gas hazard

6.4 Mains power supply

The mains wiring to the apparatus should be permanently installed and it should not be possible to switch off the power to the device, unless for maintenance. A plug and socket type connection should not be used, due to the ease with which the apparatus may be disconnected from the power supply.

7 Executive functions (type A apparatus only)

7.1 General

Type A apparatus are fitted with an output function for triggering different ancillary devices, as described in 7.2 to 7.8.

Installers should take into account that an in-built delay of up to 2 min for triggering the output signal is allowed by the EN 50194 series. This is to allow time to reset the apparatus in the case of accidental activation of the alarm.

7.2 Shut-off valve

The output signal may be used for triggering a shut-off valve on the incoming gas pipe. Such a valve should require a manual action for resetting to the open position. The installation and use of the valve shall be in accordance with EN 1775 and national regulations.

7.3 Ventilation fan

Many kitchens are equipped with an extraction fan. However, it is inappropriate for the gas detection apparatus to be used to operate such a fan as the electric motor may be placed in the air flow which could contain the combustible gas. Such an extraction equipment could cause a spark and can be an ignition hazard.

7.4 Main electric switch

The gas detection apparatus should not be used to operate the main electrical switch to the incoming mains supply to the dwelling since such action may create additional hazards for occupants of the premises and may inadvertently switch off the gas detection apparatus.

7.5 Remote alarm

The output signal may be used to activate a remote alarm. This is particularly useful when the building is unattended as it allows external personnel to take appropriate action. This may also be beneficial for individuals with specific medical conditions and for old or disabled persons.

7.6 Additional visual alarm

Those with impaired hearing should choose a type A apparatus connected to one or more visual indicators. The delay time between alarm and triggering output signal should in this case be as short as possible.

7.7 Link between detector and ancillary device

The detector should be linked to an ancillary device in accordance with the manufacturer's instructions. It is recommended that disconnection of the ancillary device should give rise to a fault signal. This link may be used to connect several apparatus, so that gas detected in one room may be signalled across multiple devices

7.8 Fault relays

Some apparatus may also feature fault relays, in case of malfunction of the device. These may be used to activate a gas valve or remote indicator based on the user’s preference.

8 Advice to the user

8.1 Manufacturer's instructions

Once the gas detector has been correctly installed, and tested as necessary, the manufacturer's instructions on routine operation should be studied thoroughly. The installer should carefully explain these instructions to the user, paying special attention to 8.2 to 8.7.

The user may also be the installer.

8.2 Location

The reasons for the location of the apparatus and any special care required, particularly with low mounted units or apparatus mounted near cooking or heating appliances, should be explained to the user; see 6.2.4.

Particular emphasis should be given to the difference between the optimum location for a combustible gas detector and that for a carbon monoxide gas detector (see also EN 50292).

Some combustible gas alarms may have additional detection capability, for example CO sensors for warning of toxic gas hazards. It is particularly important that the manufacturer’s instructions on siting should be followed as the optimum location for CO detection may not be the same.

8.3 Power supply

It should be emphasized that the apparatus should be powered continuously for maximum safety. A warning should be given that interruption of the power supply or removal of batteries when the apparatus is in an alarm condition could cause a spark and hence cause an ignition hazard. It should also be explained that if the home is uninhabited for a long time, or if there is no potential source of combustible gas present, the apparatus may be switched off during this period by the user.

8.4 Indicators

All visual and audible indications which may be produced by the detector, including differences during initial warm-up and normal operation should be explained to the user. The meaning of all fault warning signals, including low-battery indication, if relevant, should be described together with the consequent action which should be taken. It is important that the alarm state signal and any reset facilities should be fully explained together with recommended actions; see Clause 8. The user should be advised of any in-built delays in operation of the unit, whether between visual and audible indication, or between audible alarm and executive action.

8.5 Alarms

The user's attention should be drawn to the list of possible interfering substances given in the instruction manual, together with their likely effects on the sensor, either in the short or long term. However, a warning should be given that there could be other substances occurring within a particular household which could cause similar effects.

The user should be advised that the device may also respond to brief gas emissions, for example, during initial start-up of an appliance.

Most people are able to smell gas at concentrations below the alarm level, the user should be made aware that this situation does not necessarily indicate a failure of the device.

8.6 Maintenance

All routine procedures including testing recommended by the manufacturer should be explained to the user. The user should be advised that apparatus failing a routine test should be returned to the installer or supplier, or be replaced.

8.7 Lifetimes

The user should be advised of the manufacturer's recommendations on sensor lifetime, and be shown the date when replacement of the complete device will be due, as visibly indicated on the apparatus in the installed position.

For battery-powered apparatus, the user should be advised of the expected battery life and the implication of the low-battery indication. The proper procedure for renewing the battery should be explained including the battery size and type.

Apparatus may have an automatic end-of-life feature that raises a fault-warning signal when it is necessary to replace the apparatus; the user should be advised of the nature of this indication.

9 Emergency actions

If the apparatus initiates an alarm signal or there is a smell of gas, keep calm and carry out the following actions, not necessarily in this order:

— Extinguish all naked flames, including all smoking material;

— Turn off all gas appliances;

— Do not switch on or off any electrical equipment; including gas detection apparatus, lights and battery powered equipment;

— Turn off the gas supply at the gas main control and/or, with a LPG supply, the storage tank;

— Open doors and windows to increase ventilation;

— Do not use a telephone in the building where the presence of gas is suspected.

If the alarm continues to operate, even after an alarm resetting action, where appropriate, and the cause of the leak is not apparent and/or cannot be corrected, vacate the premises and IMMEDIATELY NOTIFY the gas supplier and/or the gas emergency 24 h service in order that the installation may be tested and made safe and any necessary repair carried out.

If the alarm stops or a latching alarm is reset according to the instructions of the manufacturer and the reason for the alarm having operated is identified, (for example, a gas tap switched on with the burner unlit), after stopping the gas release and ensuring all appliances are turned off, the main gas supply may be reinstated.

Care should be taken with battery-powered apparatus, since the cessation of an alarm may be due to the battery being discharged, rather than a decrease in ambient combustible gas level. The premises should be re-entered with care and only after checking combustible gas concentrations to confirm the absence of the hazard.

For type A apparatus, a delay of up to two minutes may occur between the audible alarm and the triggering output signal. However, even if the gas detector is fitted with a triggering device, for example, for closing a solenoid valve on the incoming gas pipe, the same procedure as described above should be followed.

The closure of the main gas valve, coupled with increased ventilation may cause the alarm to stop, however, the gas supply should not be reinstated until the cause of the escape is identified and corrected.

Bibliography

[1] EN 50292, *Electrical apparatus for the detection of carbon monoxide in domestic premises — Guide on the selection, installation, use and maintenance*

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