

Code of practice for

**Selection, installation,  
use and maintenance of  
apparatus for the  
detection and  
measurement of  
combustible gases  
(other than for mining  
applications or  
explosives processing  
and manufacture)**

UDC 614.834:621.6.028:620.1:[006.76 (083.75)] (083.71)

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# Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Electronic Equipment Standards Policy Committee (EEL/-) to Technical Committee EEL/29, upon which the following bodies were represented:

- BEAMA Ltd.
- British Coal Corporation
- British Gas plc
- Council of Gas Detection Equipment Manufacturers
- ERA Technology Ltd.
- Electricity Supply Industry in England and Wales
- Energy Industries Council
- Engineering Equipment and Materials Users' Association
- GAMBICA (BEAMA Ltd.)
- Health and Safety Executive
- Industrial Safety (Protective Equipment) Manufacturers' Association
- Society of British Gas Industries
- Trades Union Congress

This British Standard, having been prepared under the direction of the Electronic Equipment Standards Policy Committee, was published under the authority of the Board of BSI and comes into effect on 30 November 1989

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First published June 1988  
New edition November 1989

The following BSI references relate to the work on this standard:  
Committee reference EEL/29  
Draft for comment 88/27454 DC

ISBN 0 580 17703 3

## Amendments issued since publication

| Amd. No. | Date of issue | Comments |
|----------|---------------|----------|
|          |               |          |
|          |               |          |
|          |               |          |
|          |               |          |

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## Foreword

This British Standard has been prepared under the direction of the Electronic Equipment Standards Policy Committee. It replaces the 1988 edition which is withdrawn and contains a complete revision of clause 5 but it does not reflect a full review of the standard which will be undertaken in due course.

Many industrial processes involve the generation, processing, handling and storage of combustible and potentially explosive gases and vapours. Where such materials may be present, appropriate precautions have to be taken to design or locate electrical apparatus so that electrical arcs, sparks, hot surfaces or frictional sparks produced by them do not cause ignition.

Primary measures for minimizing explosion hazards in these circumstances are dealt with in BS 5345 and BS 5501. The use of apparatus for the detection of combustible gases and vapours provides a secondary means of protection in giving an indication, alarm, or even executive action in the event of the occurrence of a potentially explosive gas or vapour mixture with air.

**WARNING.** Combustible gas detection apparatus should be used whenever there is the possibility of a hazard to life or property caused by the accumulation of a combustible gas-air mixture.

The objective of this British Standard is to give guidance on the practical considerations that pertain to the general application of combustible gas detection apparatus. In the preparation of this new edition, the emphasis has been very firmly placed on guidance of a general nature, consideration of the complexities involved in the installation and/or use of detection apparatus in particular types of plant requiring specialized knowledge outside the scope of this standard. Nevertheless, BSI would welcome comprehensive proposals from users of the standard for expanding the guidance given on any of the aspects covered by the standard, for possible incorporation by amendment or in a future edition.

This standard was originally conceived as a further Part to BS 5345 that could be used, in particular, in conjunction with the requirements for construction and performance of gas detectors specified in BS 6020. Its publication as a separate standard has more recently been considered necessary in order to avoid any limitation of the scope to only those hazardous areas that are classified in accordance with BS 5345-2.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their 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 14, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

## 1 Scope

**1.1** This British Standard code of practice gives guidance on the selection, installation, use and maintenance of electrically operated group II apparatus for the detection and measurement of combustible gases. It applies to apparatus (i.e. instruments and systems) that indicate the presence of a combustible or potentially explosive mixture of gas or vapour with air by using an electrical signal from a gas sensor to produce a meter reading, to activate a visual or audible preset alarm or other device, or any combination of these.

**NOTE 1** BS 6020 specifies requirements for the construction and performance of apparatus for the detection and measurement of combustible gas or vapour mixtures with air, and it is recommended that apparatus complying with BS 6020 should be preferred. Nevertheless, the guidance given in this code of practice is intended to apply to all types of apparatus, not just to apparatus complying with BS 6020.

**NOTE 2** The titles of the publications referred to in this standard are listed on the inside back cover.

**1.2** This code applies only to apparatus intended for use in industrial and commercial safety applications, whether or not involving hazardous areas classified in accordance with BS 5345.

It is applicable to all new permanent installations and, where reasonably practicable, to existing permanent installations. It is also applicable to temporary installations, whether new or existing. The guidance on maintenance given in clause 7 is applicable to all installations.

**1.3** This code is not applicable to any of the following:

- a) apparatus intended only for the detection of toxic gases;
- b) apparatus of laboratory or scientific type intended only for analysis or measurement purposes;
- c) apparatus intended for underground mining applications;
- d) apparatus intended for applications in explosives processing and manufacture; and
- e) apparatus intended only for process control applications.

## 2 Definitions

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

**NOTE** The terms “combustible” and “flammable” in regard to gas/vapour-air mixtures are regarded as synonymous and the former is used, for convenience, throughout this standard.

### 2.1

#### **explosion protected apparatus**

any form of apparatus with a recognized type of protection as defined in BS 5345-1

### 2.2

#### **explosive range**

the range of gas or vapour mixtures with air between the explosive (flammable) limits

### 2.3

#### **lower explosive limit (LEL)**

the concentration of combustible (flammable) gas, vapour or mist in air below which an explosive gas atmosphere will not be formed

**NOTE** The lower explosive (flammability) limits for a number of materials are given in Table 7 of BS 5345-1:1989.

### 2.4

#### **upper explosive limit (UEL)**

the concentration of combustible (flammable) gas, vapour or mist in air above which an explosive gas atmosphere will not be formed

**NOTE** The upper explosive (flammability) limits for a number of materials are given in Table 7 of BS 5345-1:1989.

### 2.5

#### **group II apparatus**

apparatus for use in potentially explosive atmospheres, other than mines susceptible to firedamp

### 2.6

#### **fixed apparatus**

apparatus that is intended to have all its parts permanently installed

### 2.7

#### **portable apparatus**

apparatus that is designed to be readily carried by the user from place to place as required

### 2.8

#### **transportable apparatus**

apparatus that is not intended to be portable, but which can be readily moved from one place to another

### 2.9

#### **spot reading apparatus**

apparatus that is intended to be used for short periods of time as required

### 2.10

#### **continuous duty apparatus**

apparatus that is continuously powered but may have continuous or intermittent sensing

### 2.11

#### **continuous sensing**

a mode of operation in which the sensing element is continuously powered and in operation

**2.12****intermittent sensing**

a mode of operation in which the power to the sensor is supplied according to a predetermined cycle

**2.13****sensing element**

that part of a sensor that reacts in the presence of a flammable gas mixture to produce some physical change that can be used to activate a measuring or alarm function, or both

**2.14****sensor**

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

**2.15****catalytic sensor**

a sensor, the operation of which depends upon the oxidation of gases on an electrically heated catalytic element

**2.16****thermal conductivity sensor**

a sensor, the operation of which depends upon the change of heat loss by conduction of an electrically heated element located in the gas to be measured compared with that of a similar element located in a reference gas cell

**2.17****infra-red sensor**

a sensor, the operation of which depends upon the absorption of infra-red radiation by the gas being detected

**2.18****open path infra-red sensor**

a sensor that is capable of detecting gas at any location along an open path traversed by an infra-red beam

**2.19****semiconductor sensor**

a sensor, the operation of which depends upon changes of the electrical conductance of a semiconductor due to chemisorption of the gas being detected at its surface

**2.20****remote sensor**

a sensor that is not integral with the main body of the apparatus

**2.21****single point sensor**

a sensor that is capable of detecting gas at a single point location

**2.22****aspirated apparatus**

apparatus in which the transfer of gas from the atmosphere to the gas apparatus sensing element is by means of a hand-or powered-pump

**2.23****diffusion apparatus**

apparatus in which the transfer of gas from the atmosphere to the gas sensing element takes place by diffusion, i.e. there is no aspirated flow

**2.24****sample line**

the pipeline by means of which the gas being sampled is conveyed to the sensor

**2.25****sampling probe**

a separate sample line, which may or may not be supplied with a portable apparatus, that is attached to the apparatus as required

NOTE The sampling probe is usually short (e.g. of the order 1 m) and rigid (e.g. it may be telescopic), but may be connected by a flexible tube to the apparatus.

**2.26****clean air**

air that is free of combustible gases and contaminating substances

**3 Principles of operation of sensors****3.1 General**

The principles of operation of the most common types of sensors used in apparatus for the detection of combustible gases covered by this code are described in 3.2 to 3.5.

NOTE It is not intended, by means of this code, to discourage the use of apparatus using detection principles other than those described in 3.2 to 3.5 or to inhibit the development of new detection principles. However, it is of primary importance that the capabilities of the detection principle should be such that the performance of the apparatus is adequate for the intended application. Assessment of the apparatus against the performance requirements specified in BS 6020 may provide a basis for judgement in appropriate circumstances.

**3.2 Catalytic sensor**

The principle of operation of the catalytic sensor depends upon the oxidation of flammable gas at the surface of an electrically heated catalytic element (i.e. filament or bead). This oxidation causes the temperature of the sensing element to change as a function of the concentration of gas so detected. The change of electrical resistance is determined in a bridge circuit and the apparatus is calibrated to provide indications of gas concentrations and alarms.