

Code of practice for

# Selection, installation and maintenance of electrical apparatus for use in potentially explosive atmospheres (other than mining applications or explosive processing and manufacture) —

**Part 4: Installation and maintenance  
requirements for electrical apparatus  
with type of protection “i” —  
Intrinsically safe electrical  
apparatus and systems**

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# Cooperating organizations

The General Electrotechnical Engineering Standards Committee, under whose direction this British Standard was prepared, consists of representatives from the following Government departments and scientific and industrial organizations:

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|                                                                                     | Institute of Petroleum                                                                  |
|                                                                                     | Institution of Gas Engineers                                                            |
|                                                                                     | Lighting Industry Federation Ltd.                                                       |

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# Foreword

Many gases, vapours, mists and dusts encountered in industry are flammable. When ignited they may burn readily and with considerable explosive force if mixed with air in the appropriate proportions. It is often necessary to use electrical apparatus in locations where such flammable materials may be present, and appropriate precautions should therefore be taken to ensure that all such apparatus is adequately protected so as to reduce the likelihood of ignition of any external explosive atmosphere. When using electrical apparatus, potential ignition sources include electrical arcs and sparks, hot surfaces and, in certain circumstances, frictional sparks.

In general electrical safety is ensured by implementing one of two considerations. Either the electrical apparatus should be located, whenever practicable, outside hazardous areas; or the electrical apparatus should be designed, installed and maintained in accordance with measures recommended for the area in which the apparatus is located.

Several techniques are available for the protection of electrical apparatus in hazardous areas. Some of these techniques (or “types of protection” as they are known) have been used for many years and have come to be regarded as traditional. Other types of protection have been introduced only recently.

This code of practice describes the basic safety features of these types of protection, full details of which are given in the relevant standards, and recommends the selection, installation and maintenance procedures that should be adopted to ensure the safe use of electrical apparatus in hazardous areas. This code takes account therefore of the significant developments that have taken place in area classification and in the design, manufacture and use of electrical apparatus for hazardous areas since the preparation of the earlier code of practice CP 1003.

For ease of reference Part 1 of this code has been divided into a number of sections, each dealing with a particular aspect of the safe use of electrical apparatus in hazardous areas.

**This code of practice represents a standard of good practice and takes the form of recommendations. Compliance with it does not confer immunity from relevant statutory and legal requirements.**

## Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 18, 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.



## 0 Introduction

This document is Part 4 of code of practice BS 5345. The code offers guidance in the selection, installation and maintenance of electrical apparatus for use in areas where flammable materials are generated, processed, handled or stored, and which are therefore potentially hazardous.

In common with the earlier code of practice for the use of electrical apparatus in hazardous areas, CP 1003-1:1964, CP 1003-2:1966 and CP 1003-3:1967, the present code is divided into a number of Parts. Each Part deals with the installation and maintenance requirements appropriate to one of the types of protection which may be used to achieve electrical safety, or with basic requirements and considerations which are fundamental to the use of electrical apparatus in hazardous areas, and which therefore provide the basis for the other Parts of the code.

The full list of Parts is as follows:

- *Part 1: Basic requirements for all Parts of the code;*
- *Part 2: Classification of hazardous areas<sup>1)</sup>;*
- *Part 3: Installation and maintenance requirements for electrical apparatus with type of protection “d”. Flameproof enclosure<sup>1)</sup>;*
- *Part 4: Installation and maintenance requirements for electrical apparatus with type of protection “i”. Intrinsically safe apparatus and systems;*
- *Part 5: Installation and maintenance requirements for electrical apparatus with type of protection “p”. Pressurisation and continuous dilution<sup>1)</sup>;*
- *Part 6: Installation and maintenance requirements for electrical apparatus with type of protection “e”. Increased safety<sup>1)</sup>;*
- *Part 7: Installation and maintenance requirements for electrical apparatus with type of protection N<sup>1)</sup>;*
- *Part 8: Installation and maintenance requirements for electrical apparatus with type of protection “s”. Special protection<sup>1)</sup>;*
- *Part 9: Installation and maintenance requirements for electrical apparatus with type of protection “o”. Oil-immersed apparatus and with type of protection “q”. Sand filled apparatus<sup>1)</sup>;*
- *Part 10: Installation and maintenance requirements for electrical apparatus for use with combustible dusts<sup>1)</sup>;*
- *Part 11: Specific industry applications<sup>1)</sup>;*

— *Part 12: The use of gas detectors<sup>1)</sup>.*

This Part of the code should be read in conjunction with the other Parts, and in conjunction particularly with Parts 1 and 2 which, taken together, describe the fundamental considerations which affect the selection, installation and maintenance of all electrical apparatus used in hazardous areas.

The code of practice is based on the concept, which is accepted internationally, of dealing with the risk of fire and explosion by area classification. This concept recognizes the differing degrees of probability with which explosive (flammable) concentrations of combustible gas or vapour may arise in installations in terms of both the frequency of occurrence and the probable duration of existence on each occasion.

The detailed considerations which are to be taken into account are described in Part 2 of the code. For completeness, and for the convenience of readers, the definitions appropriate to area classification are repeated here. It should be noted that whereas formerly classified areas were known as Divisions, they are now called Zones. Three sets of conditions are recognized, viz:

- Zone 0** In which an explosive gas-air mixture is continuously present or present for long periods.
- Zone 1** In which an explosive gas-air mixture is likely to occur in normal operation.
- Zone 2** In which an explosive gas-air mixture is not likely to occur in normal operation, and if it occurs it will exist only for a short time.

It should be noted that this concept of area classification deals only with risks due to flammable gases and vapours and, by implication, mists. It does not deal with combustible dusts which may lie quiescent for long periods of time until disturbed into suspension by a suitable mechanism. An area classification concept is being developed for dusts.

By implication, an area which is not classified as Zone 0, 1 or 2 is deemed to be a non-hazardous or safe area. If doubt exists as to the classification of an area which is judged to be hazardous or potentially hazardous, guidance should be sought at an early stage from the authority having jurisdiction in the industry or area concerned (see Parts 1 and 2 of the code).

<sup>1)</sup> In course of preparation.

Electrical apparatus used in each of the classified Zones should be suitably protected by design and manufacture, and should also be installed and maintained so as to ensure its safe use. The code of practice BS 5345, in offering guidance in the selection, installation and maintenance of suitably protected apparatus, should be used for all new installations. It should also be used for changes to existing installations, though it is recognized that minor changes only to certain existing installations may need to be made in accordance with the recommendations of the earlier code. It is intended however, that CP 1003-1, CP 1003-2 and CP 1003-3 will eventually be withdrawn from use.

Notwithstanding application of the installation recommendations of the code to new installations and changes to existing installations, the recommendations for maintenance should be applied to all electrical apparatus and installations, irrespective of age and date of installation. It should also be noted that the installation and maintenance recommendations described in the code are supplementary to and not alternative to any regulations which would apply to installations in non-hazardous areas (see also Part 1 of the code).

## Section 1. General

### 1 Scope

This Part of BS 5345 considers the concept of ensuring electrical safety in hazardous areas by means of type of protection “i”: intrinsic safety, and offers guidance on the installation and maintenance of electrical apparatus and systems, which are protected in accordance with this type of protection, in hazardous areas.

Only explosion risks due to the presence of flammable gases and vapours are considered in this Part of the code. Combustible dusts are excluded from this Part and are dealt with in Part 10.

**NOTE** Expert advice on the application of intrinsic safety may be obtained through the organizations listed in Appendix A.

### 2 References

The titles of the publications referred to in this code are listed on the inside back cover.

## 3 Definitions and explanation of terms

The definitions and explanations of terms given in Part 1 of this code of practice apply equally to this Part. The definitions and explanations of terms which apply particularly to the concept of type of protection “i” are as follows:

### 3.1

#### **intrinsic safety**

a protection technique based upon the restriction of electrical energy within apparatus and of interconnecting wiring, exposed to a potentially explosive atmosphere, to a level below that which can cause ignition by either sparking or heating effects. Because of the method by which intrinsic safety is achieved it is necessary to ensure that not only the electrical apparatus exposed to the potentially explosive atmosphere but also other electrical apparatus with which it is interconnected is suitably constructed

### 3.2

#### **intrinsically safe circuit**

a circuit in which no spark nor any thermal effect produced under prescribed test conditions (which include normal operation and specified fault conditions) is capable of causing ignition of a given explosive atmosphere

### 3.3

#### **electrical apparatus**

an electrical apparatus is an assembly of electrical components, circuits and/or parts of circuits, usually within a single enclosure

**NOTE** The term “usually” has been introduced to indicate that an apparatus may occasionally be in more than one enclosure (for example, a telephone instrument or a portable radio transceiver with a hand microphone).

### 3.4

#### **intrinsically safe electrical apparatus**

electrical apparatus in which all the circuits are intrinsically safe

### 3.5

#### **associated electrical apparatus**

electrical apparatus in which the circuits are not all intrinsically safe but which contains circuits that can affect the safety of intrinsically safe circuits connected to it

**NOTE** Associated electrical apparatus may be either:

- electrical apparatus which has an alternative standard type of protection suitable for its use in the appropriate potentially explosive atmosphere, or
- electrical apparatus not so protected which cannot therefore be used within a potentially explosive atmosphere. Example: A recorder which is not in a potentially explosive atmosphere, but which is connected to a thermocouple situated within a potentially explosive atmosphere where only the recorder input circuit is intrinsically safe.