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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 5: Installation and maintenance
requirements for electrical apparatus
protected by pressurization “p” and by
continuous dilution, and for
pressurized rooms**

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British Electrical Systems Association (BEAMA)	Fire Offices Committee
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Department of Trade (Marine Division)	National Coal Board
	Rotating Electrical Machines Association (BEAMA)
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The following bodies were also represented in the drafting of the standard, through subcommittees and panels:

Associated Offices Technical Committee	Electric Cable Makers' Confederation
Chief and Assistant Chief Fire Officers' Association	Electronic Components Industry Federation
Council for Electrical Equipment for Flammable Atmospheres (BEAMA)	Institution of Electrical Engineers
Department of Energy (Petroleum) (Oil)	Institution of Gas Engineers
Department of the Environment (Building Research Establishment) (Fire Research Station)	

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Foreword

This British Standard code of practice has been prepared under the direction of the General Electrotechnical Engineering Standards Committee.

BS 5345 is a revision of CP 1003-1, CP 1003-2 and CP 1003-3 and should be used for all new installations of electrical apparatus in potentially explosive atmospheres. However, CP 1003 will be retained temporarily as a reference guide for the many existing plants installed according to the earlier code.

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 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 in order 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, protection against ignition by electrical apparatus is achieved by implementing one of two procedures. 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 more 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 therefore takes account 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 CP 1003.

It is important to note that this code of practice deals with *explosion* hazards due to the presence of flammable gas/air mixtures; it does not provide guidance on the extra precautions to be taken where such gases involve a *toxic* hazard.

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 to iv, pages 1 to 16, 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

BS 5345 gives guidance in the selection, installation and maintenance of electrical apparatus for use in areas where flammable materials are generated, processed, handled or stored, and that 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 that may be used to achieve electrical safety, or with basic requirements and considerations that are fundamental to the use of electrical apparatus in hazardous areas, and that 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;*
- *Part 3: Installation and maintenance requirements for electrical apparatus with type of protection “d”. Flameproof enclosure;*
- *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 protected by pressurization “p” and by continuous dilution, and for pressurized rooms;*
- *Part 6: Installation and maintenance requirements for electrical apparatus with type of protection “e”. Increased safety;*
- *Part 7: Installation and maintenance requirements for electrical apparatus with type of protection “N”;*
- *Part 8: Installation and maintenance requirements for electrical apparatus with type of protection “s”. Special protection;*
- *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;¹⁾*
- *Part 10: The use of gas detectors¹⁾²⁾.*

¹⁾ In course of preparation.

²⁾ It has been decided by the responsible Technical Committee that BS 5345 will not apply to combustible dusts and, therefore, the proposed Part “Installation and maintenance requirements for electrical apparatus for use with combustible dusts” referred to, as Part 10, in other Parts of this code published before this decision will not appear as a Part of BS 5345. The proposed Part 11 “Specific industry applications” will consist of a bibliography of relevant codes and requirements and will not be a Part of BS 5345.

This Part of BS 5345 should be read in conjunction with the other Parts, and in particular 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.

BS 5345 is based on the concept of area classification which recognizes the differing degrees of probability with which explosive (flammable) concentrations of flammable 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 that should be taken into account in deciding on an area classification 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 Zones are recognized, i.e.:

- 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 only exist 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 are outside the scope of this code.

By implication, an area that 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 that is judged to be hazardous or potentially hazardous, guidance should be sought at an early stage from those with expert knowledge of the area classification of similar installations (see Parts 1 and 2 of the code).

Electrical apparatus used in each of the classified Zones should be suitably protected by design and manufacture, and should also be installed, operated and maintained so as to ensure its safe use.

BS 5345, in offering guidance in the selection, installation and maintenance of suitably protected apparatus, replaces CP 1003 and 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.

Notwithstanding application of the installation recommendations of this code 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 given in the code are supplementary to, and not alternative to, requirements that would apply to general industrial installations (see also Part 1 of the code).

Section 1. General principles

1 Scope

This Part of BS 5345 gives recommendations for the technique of using the pressure of a protective gas to prevent the ingress of an external atmosphere to a space which may contain a source of ignition, when selecting, installing and maintaining electrical apparatus in a hazardous area.

Recommendations are also given for the technique of continuous dilution to a concentration below the lower explosive limit (LEL) of the atmosphere within a space containing a source of gas emission that may result in an explosive gas/air mixture.

The code does not apply to the use of these techniques in Zone 0.

The code applies only to situations where the protective gas is non-combustible. It does not cover the additional precautions for specialized applications where flammable gas, vapour or liquid may be used to displace air that otherwise may be present, so that safety is assured by maintaining an atmosphere in a concentration above the upper explosive limit (UEL).

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

2 Definitions and explanation of terms

The definitions and terms generally applicable to hazardous areas and electrical apparatus used therein are included in Part 1 of this code, to which reference should be made. The definitions and terms that are particularly relevant to individual types of protection are given in the appropriate Parts of the code. For the purposes of this Part of BS 5345, the following definitions apply.

NOTE Definitions marked with an asterisk are identical or technically equivalent to definitions given in BS 5501-1 and BS 5501-3.

2.1 electrical apparatus*

all items applied as a whole or in part for the utilization of electrical energy. These include, among others, items for the generation, transmission, distribution, storage, measurement, regulation, conversion, and consumption of electrical energy and items for telecommunications

2.2 pressurization

the technique of preventing the ingress of the external atmosphere, which may be explosive, to enclosures by maintaining a protective gas therein at a pressure above that of the external atmosphere

2.3 continuous dilution

the technique of preventing the formation of an explosive gas/air mixture in an enclosure by the supply of a protective gas at such a rate that the concentration of the gas/air mixture is always kept below the lower explosive limit

2.4 pressurized apparatus

apparatus in which a protective gas is maintained at a pressure greater than that of the surrounding atmosphere

2.5 pressurized enclosure

the assembly of walls, surfaces or casings enclosing the electrical apparatus that serves to contain the protective gas

NOTE The pressurized enclosure may or may not be also the enclosure surrounding the live parts and ensuring the protection in other respects of the electrical apparatus.

2.6 over-pressure

that pressure at which an enclosure is maintained above the surrounding atmosphere so that the ingress of the external atmosphere is prevented