

Code of practice for

**The selection,
installation and
maintenance of
electrical apparatus for
use in potentially
explosive atmospheres
(other than mining
applications or
explosives
processing) —**

**Part 6: Recommendations for type of
protection “e” — Increased safety**

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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:

British Electrical and Allied Manufacturers' Association (BEAMA)*	Electronic Components Industry Federation*
British Radio Equipment Manufacturers' Association	Electronic Engineering Association
British Steel Corporation	Engineering Equipment Users' Association*
Department of Energy (Electricity)	Health and Safety Executive*
Electric Cable Makers' Confederation*	Home Office
Electrical Contractors' Association*	Institution of Electrical Engineers*
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The organizations marked with an asterisk in the above list, together with the following, were directly represented on the committee entrusted with the preparation of this British Standard:

Association of Consulting Engineers	Department of the Environment
Association of Mining Electrical and Mechanical Engineers	Department of the Environment (Building Research Establishment)
British Electrical Systems Association (BEAMA)	(Fire Research Station)
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British Industrial Truck Association	Fire Protection Association
CBMPE	General Council of British Shipping
Chief and Assistant Chief Fire Officers' Association	Institute of Petroleum
Council for Electrical Equipment for Flammable Atmospheres (BEAMA)	Institution of Gas Engineers
Council of Underground Machinery Manufacturers	Institution of Mining Engineers
Department of Energy (Petroleum) (OIL)	Lighting Industry Federation Ltd.
	Rotating Electrical Machines Association (BEAMA)
	Scientific Instrument Manufacturers' Association

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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 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, electrical safety is ensured 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 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 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 the earlier code of practice 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 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.

0 Introduction

This document is Part 6 of code of practice BS 5345. The code 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: General recommendations;*
- *Part 2: Classification of hazardous areas¹⁾;*
- *Part 3: Installation and maintenance requirements for electrical apparatus with type of protection “d”. Flameproof enclosure¹⁾;*
- *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”. Pressurization and continuous dilution¹⁾;*
- *Part 6: Recommendations for type of protection “e”. Increased safety;*
- *Part 7: Installation and maintenance requirements for electrical apparatus with type of protection N¹⁾;*
- *Part 8: Installation and maintenance requirements for electrical apparatus with type of protection “s”. Special protection¹⁾;*
- *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 apparatus¹⁾.*

This Part of the code should be read in conjunction with the other Parts, particularly Parts 1 and 2 which, taken together, describe the fundamental considerations that 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 flammable 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 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 the authority having jurisdiction in the industry or area concerned (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 and maintained in a manner 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 from use.

¹⁾ In course of preparation.

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 describes the concept of ensuring electrical safety in hazardous areas by means of type of protection “e”: increased safety, and gives guidance on the selection, installation and maintenance of this type of electrical apparatus.

This code does not apply to the underground mining industry, where other precautions are necessary, though it is recognized that the code may be applied to the surface installations of mines.

Apparatus with type of protection “e”: increased safety is designed for use in areas with flammable gas and vapour risks. For the use of this apparatus in areas with flammable dust risks see Part 10 of the code.

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 terms generally applicable to hazardous areas and electrical apparatus used therein are included in Part 1 of the 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, the following definitions and terms apply.

3.1

type of protection “e”: increased safety

a method of protection by which additional measures are applied to electrical apparatus to give increased security against the possibility of excessive temperatures and of the occurrence of arcs and sparks during the service life of the apparatus. It applies only to electrical apparatus, no parts of which produce sparks or arcs or exceed the limiting temperature in normal service

3.2

clearance

the shortest distance through air between two conducting parts

3.3

creepage distance

the shortest distance between two conducting parts along the surface of the insulating parts

3.4

dynamic current limit I_{dyn}

the peak value of the maximum alternating current the dynamic effect of which the electrical apparatus can sustain without damage

3.5

limiting temperature

the maximum permissible temperature for apparatus or parts of apparatus. It is determined by:

- the danger of ignition of the explosive gas-air mixture;
- the thermal stability of the materials used.

the lower temperature is the one to be taken into consideration and is the critical limiting temperature

3.6

thermal current limit I_{th}

the r.m.s. value of the current which, when it flows for 1 s, heats up the conductors to the limiting temperature

3.7

starting current I_A

the highest r.m.s. value of that current which flows in the primary part of a stalled cage rotor motor or in an alternating current magnet with a seized armature after the transient phenomena have ceased, when the apparatus is supplied at rated voltage and rated frequency. It is normally measured a few seconds after application of rated voltage

3.8

starting current ratio I_A/I_N

the ratio between starting current I_A and rated current I_N

3.9

time t_E

the time taken for a.c. windings, when carrying the starting current I_A , to be heated up from the temperature reached in rated service, and at maximum ambient temperature, to the limiting temperature