

Guide to the application of BS EN 60079-14

ICS 29.260.20

NO COPYING WITHOUT BSI PERMISSION EXCEPT AS PERMITTED BY COPYRIGHT LAW



Document Sharing Hub

Committees responsible for this Published Document

The preparation of this Published Document was entrusted by Technical Committee GEL/31, Electrical apparatus for use in explosive atmospheres, to Subcommittee GEL/31/11, Codes of practice for electrical apparatus for explosive atmospheres, upon which the following bodies were represented:

- Association of Electrical Machinery Trades
- BG Plc
- British Electrical Systems Association (BEAMA Ltd.)
- Council for Electrical Equipment for Flammable Atmospheres (BEAMA)
- ERA Technology Ltd.
- Electrical Contractors Association
- Energy Industries Council
- Engineering Equipment and Materials Users' Association
- GAMBICA (BEAMA Ltd.)
- Gland Manufacturers' Technical Committee
- Health and Safety Executive
- Institute of Physics
- Institute of Quality Assurance
- Institution of Electrical Engineers
- Lighting Industry Federation Ltd.
- Maritime and Coastguard Agency
- Ministry of Defence
- National Inspection Council for Electrical Installation Contracting
- Safety Assessment Federation Ltd.
- Sira Ltd.

Co-opted members

This Published Document, having been prepared under the direction of the Electrotechnical Sector Strategy and Policy Committee, was published under the authority of the Standards Committee and comes into effect on 15 January 2000

© BSI 01-2000

Amendments issued since publication

Amd. No.	Date	Comments

The following BSI references relate to the work on this Published Document:
Committee reference GEL/31/11

ISBN 0 580 33124 5

CONTENTS

Clause	Page
Foreword to PD 60079-14	iv
Foreword	v
Introduction	vi
1 Scope and object	1
2 Normative references	1
3 Definitions and terms [see IEC 50(426)]	2
4 General	6
4.1 General requirements	6
4.2 Documentation	7
5 Selection of electrical apparatus (excluding cables and conduits)	8
5.1 Specific information	8
5.2 Selection according to zones	8
5.3 Selection according to the ignition temperature of the gas or vapour	10
5.4 Selection according to apparatus grouping	11
5.5 External influences	11
6 Protection from dangerous (incendive) sparking	12
6.1 Danger from live parts	12
6.2 Danger from exposed and extraneous conductive parts	12
6.3 Potential equalization	13
6.4 Static electricity	14
6.5 Lightning protection	14
6.6 Electromagnetic radiation	14
6.7 Cathodically protected metallic parts	14

7	Electrical protection	14
8	Emergency switch-off and electrical isolation	15
8.1	Emergency switch-off	15
8.2	Electrical isolation	15
9	Wiring systems	15
9.1	General	15
9.2	Cable systems for zone 0	17
9.3	Cable systems for zones 1 and 2	18
9.4	Conduit systems	19
10	Additional requirements for type of protection "d" – Flameproof enclosures	20
10.1	Solid obstacles	20
10.2	Protection of flameproof joints	20
10.3	Cable entry systems	21
10.4	Motors supplied at varying frequency and voltage	23
10.5	Conduit systems	23
11	Additional requirements for type of protection "e" – Increased safety	23
11.1	Degree of protection of enclosures (IEC 34-5 and IEC 529)	23
11.2	Cage induction motors – Thermal protection in operation	24
11.3	Wiring systems	25
11.4	Resistance heating devices	26
12	Additional requirements for type of protection "i" – Intrinsic safety	27
12.1	Introduction	27
12.2	Installations for zones 1 and 2	27
12.3	Installations for zone 0	36

13	Additional requirements for type of protection "p" – Pressurized apparatus	37
13.1	Ducting	38
13.2	Action to be taken on failure of pressurization	39
13.3	Multiple pressurized enclosures with a common safety device	40
13.4	Purging	40
14	Additional requirements for apparatus for use in zone 2	41
14.1	Degree of protection of enclosures (IEC 34-5 and IEC 529)	42
14.2	Energy-limited apparatus and circuits	42
14.3	Wiring systems	42
14.4	Motors supplied at varying frequency and voltage	43
15	Special applications (additional clause)	43
15.1	Battery operated vehicles	43
15.2	Personal electrical apparatus	43
	Annex A (normative) Verification of intrinsically safe circuits with more than one associated apparatus with linear current/voltage characteristics	44
	Annex B (informative) Methods of determining the maximum system voltages and currents in intrinsically safe circuits with more than one associated apparatus with linear current/voltage characteristics (as required by annex A)	45
	Annex C (informative) Frictional sparking risks with light metals and their alloys	47
	Annex D (informative) Determination of cable parameters	48
	Annex ZA (normative) Normative references to international publications with their corresponding European publications	49
	Bibliography	51

Foreword to PD 60079-14

The ratification by CENELEC in 1997 of EN 60079-14, *Electrical apparatus for explosive gas atmospheres — Part 14: Electrical installations in hazardous areas (other than mines)*, entailed the withdrawal by 1 December 1999 of any conflicting national standards. Accordingly, the remaining parts (i.e. parts 1, 3, 4, 5, 6, 7 and 8) of BS 5345, *Selection, installation and maintenance of electrical apparatus for use in potentially explosive atmospheres (other than mining applications and explosive processing and manufacture)*, were withdrawn on that date.

EN 60079-14 was published by BSI in October 1998 as BS EN 60079-14, and is thus now the national standard appropriate for new installations and plant revisions. The withdrawal of BS 5345 does not of itself imply that it should not continue to be used in respect of existing plant and installations for which it was originally employed.

The BSI Technical Committee responsible for installation matters (GEL/31/11) was concerned that, as published, EN 60079-14 lacked detailed guidance on some topics and that certain areas were not as adequately covered as in BS 5345. A number of extensive amendments have been proposed to IEC/CENELEC in order to rectify this position, but their adoption (if other national committees approve) and publication in the international and European fora is unlikely to be before 2002. This Published Document reflects those proposed amendments by presenting them in boxes at appropriate points in the text of EN 60079-14.

The table of data for flammable material for use with electrical equipment that appeared as table 7 of BS 5343-1:1989 has been replaced by table 1 of PD IEC 60079-20^{*)}

The BSI Technical Committee considers the guidance and information contained in this Published Document to represent the best currently available for UK applications, but emphasizes that **this publication is not to be regarded as a British Standard.**

Summary of pages

This document comprises a front cover, an inside front cover, pages i to vi, pages 1 to 51 and a back cover.

^{*)} In preparation

INTERNATIONAL ELECTROTECHNICAL COMMISSION

ELECTRICAL APPARATUS FOR EXPLOSIVE GAS ATMOSPHERES –**Part 14: Electrical installations in hazardous areas
(other than mines)****FOREWORD**

- 1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, the IEC publishes International Standards. Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. The IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of the IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested National Committees.
- 3) The documents produced have the form of recommendations for international use and are published in the form of standards, technical reports or guides and they are accepted by the National Committees in that sense.
- 4) In order to promote international unification, IEC National Committees undertake to apply IEC International Standards transparently to the maximum extent possible in their national and regional standards. Any divergence between the IEC Standard and the corresponding national or regional standard shall be clearly indicated in the latter.
- 5) The IEC provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with one of its standards.
- 6) Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. The IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 79-14 has been prepared by sub-committee 31J: Classification of hazardous areas and installation requirements, of IEC technical committee 31: Electrical apparatus for explosive atmospheres.

This second edition cancels and replaces the first edition published in 1984, and constitutes a technical revision.

The text of this standard is based on the following documents:

FDIS	Report on voting
31J/47/FDIS	31J/50/RDV

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This standard is to be read in conjunction with IEC 79-0 and with the standards for the specific types of protection listed in the scope.

Annex A forms an integral part of this standard.

Annex B is for information only.

INTRODUCTION

When electrical apparatus is to be installed in areas where dangerous concentrations and quantities of flammable gases, vapours, mists, ignitable fibres or dusts may be present in the atmosphere, protective measures are applied to reduce the likelihood of explosion due to ignition by arcs, sparks or hot surfaces, produced either in normal operation or under specified fault conditions.

This part of IEC 79 is supplementary to other relevant IEC standards, for example IEC 364 as regards electrical installation requirements, and also refers to IEC 79-0 and its associated standards for the construction, testing and marking requirements of suitable electrical apparatus.

By careful design of the electrical installation, it is frequently possible to locate much of the electrical apparatus in less hazardous or non-hazardous areas.

For an explosion to occur, an explosive atmosphere and a source of ignition need to co-exist. Protective measures aim to reduce to an acceptable level the likelihood that the electrical installation could become a source of ignition.

It has been found practical to classify hazardous areas into zones according to the likelihood of an explosive gas atmosphere being present (see IEC 79-10). Such classification allows appropriate types of protection to be specified for each zone.

Several types of protection are now available for electrical apparatus in hazardous areas (see IEC 79-0), and this standard gives the specific requirements for design, selection and erection of electrical installations in explosive atmospheres.

This standard is based on the assumption that electrical apparatus is correctly installed, tested, maintained and used in accordance with its specified characteristics.

Inspection, maintenance and repair aspects also form an important part of hazardous area installations and the user's attention is drawn to IEC 60079-17 and IEC 60079-19 for further information concerning these aspects.

NOTE – In the parts of this document which provide information additional to IEC 60079-14, IEC publications are referred to with the prefix “60”, with following zeroes added as necessary such that the number has five digits. This is in line with current BSI policy and means, for example, that IEC 79-17 is referred to as IEC 60079-17 in the boxed parts of the text and as IEC 79-17 elsewhere.

In any industrial installation, irrespective of size, there may be numerous sources of ignition apart from those associated with electrical apparatus. Precautions may be necessary to ensure safety, but guidance on this aspect is outside the scope of this standard.

ELECTRICAL APPARATUS FOR EXPLOSIVE GAS ATMOSPHERES –

Part 14: Electrical installations in hazardous areas (other than mines)

1 Scope and object

This part of IEC 79 contains the specific requirements for the design, selection and erection of electrical installations in explosive gas atmospheres.

These requirements are in addition to the requirements for installations in non-hazardous areas.

This standard applies to all electrical equipment and installations in hazardous areas whether permanent, temporary, portable, transportable or hand-held.

It applies to installations at all voltages.

This standard does not apply to:

- electrical installations in mines susceptible to firedamp;

NOTE – This standard may apply to electrical installations in mines where explosive gas atmospheres other than firedamp may be formed and to electrical installations in the surface installation of mines.

- electrical installations in areas where the hazard is due to ignitable dusts or fibres;
- inherently explosive situations, for example explosives manufacturing and processing;
- rooms used for medical purposes.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of IEC 79. At the time of publication, the editions indicated were valid. All normative documents are subject to revision, and parties to agreements based on this part of IEC 79 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 34-5:1991, *Rotating electrical machines – Part 5: Classification of degrees of protection provided by enclosures of rotating electrical machines (IP code)*.

IEC 50(426):1990, *International Electrotechnical Vocabulary (IEV) – Chapter 426: Electrical apparatus for explosive atmospheres*.

IEC 60-1:1989, *High-voltage test techniques – Part 1: General definitions and test requirements*.

IEC 79-0:1983, *Electrical apparatus for explosive gas atmospheres – Part 0: General requirements*.

Amendment 1 (1987).

Amendment 2 (1991).

IEC 79-1:1990, *Electrical apparatus for explosive gas atmospheres – Part 1: Construction and verification test of flameproof enclosures of electrical apparatus*.

IEC 79-2:1983, *Electrical apparatus for explosive gas atmospheres – Part 2: Electrical apparatus – Type of protection "p"*.

IEC 79-5:1967, *Electrical apparatus for explosive gas atmospheres – Part 5: Sand-filled apparatus*.

PD 60079-14:2000

IEC 79-6:1995, *Electrical apparatus for explosive gas atmospheres – Part 6: Oil-immersion "o"*.

IEC 79-7:1990, *Electrical apparatus for explosive gas atmospheres – Part 7: Increased safety "e"*.

IEC 79-10:1995, *Electrical apparatus for explosive gas atmospheres – Part 10: Classification of hazardous areas*.

IEC 79-11:1991, *Electrical apparatus for explosive gas atmospheres – Part 11: Intrinsic safety "i"*.

IEC 79-15:1987, *Electrical apparatus for explosive gas atmospheres – Part 15: Electrical apparatus with type of protection "n"*.

IEC/FDIS 79-17, *Electrical apparatus for explosive gas atmospheres – Part 17: Inspection and maintenance of electrical installations in hazardous areas (other than mines)*.¹⁾

NOTE – This standard has now been published as IEC 60079-17:1997.

IEC 79-18:1992, *Electrical apparatus for explosive gas atmospheres – Part 18: Encapsulation "m"*.

IEC 332-1:1993, *Tests on electric cables under fire conditions – Part 1: Test on a single vertical insulated wire or cable*.

IEC 364-4-41:1992, *Electrical installations of buildings – Part 4: Protection for safety – Chapter 41: Protection against electric shock*.

IEC 529:1989, *Degrees of protection provided by enclosure (IP code)*.

IEC 614-2-1:1982, *Specification for conduits for electrical installations – Part 2: Particular specifications for conduits – Section one: Metal conduits*.
Amendment 1 (1993).

IEC 614-2-5:1992, *Specification for conduits for electrical installations – Part 2: Particular specifications for conduits – Section 5: Flexible conduits*.

IEC 742:1983, *Isolating transformers and safety isolating transformers – Requirements*.

IEC 755:1983, *General requirements for residual current operated protective devices*.

3 Definitions and terms [see IEC 50(426)]

For the purpose of this part of IEC 79, the following definitions apply.

3.1 explosive gas atmosphere: Mixture with air, under atmospheric conditions, of flammable substances in the form of gas, vapour or mist, in which after ignition, combustion spreads throughout the unconsumed mixture.

NOTE – For the purposes of this standard, the terms “explosive gas atmosphere” and “explosive atmosphere” are synonymous.

¹⁾ At present at the stage of final draft international standard.

3.2 hazardous area: Area in which an explosive atmosphere is, or may be expected to be, present in quantities such as to require special precautions for the construction, installation and use of electrical apparatus.

NOTE – For the purposes of this standard, an area is a three-dimensional region or space.

3.3 non-hazardous area: Area in which an explosive gas atmosphere is not expected to be present in quantities such as to require special precautions for the construction, installation and use of electrical apparatus.

3.4 maximum surface temperature: Highest temperature which is attained in service under the most adverse operating conditions within the rating of the electrical apparatus by any part or surface of the apparatus which could produce an ignition of the surrounding explosive atmosphere.

NOTE – The most adverse conditions include recognized overloads and fault conditions recognized in the specific standard for the type of protection concerned.

3.5 group (of an electrical apparatus for explosive atmospheres): Classification of electrical apparatus related to the explosive atmosphere for which it is to be used.

NOTE – Electrical apparatus for use in explosive gas atmospheres is divided into two groups:

- group I: electrical apparatus for mines susceptible to firedamp;
- group II: (which can be divided into subgroups): electrical apparatus for places with an explosive gas atmosphere, other than mines susceptible to firedamp (see 5.4).

3.6 type of protection: Specific measures applied to electrical apparatus to avoid ignition of a surrounding explosive atmosphere by such apparatus.

3.7 sealing ring: Ring used in a cable or conduit entry device to ensure sealing between the entry and the cable or conduit.

3.8 maximum r.m.s. a.c. or d.c. voltage (U_m): Maximum voltage that can be applied to the non-intrinsically safe connection facilities of associated apparatus without invalidating intrinsic safety.

3.9 maximum input voltage (U_i): Maximum voltage (peak a.c. or d.c.) that can be applied to the connection facilities for intrinsically safe circuits without invalidating intrinsic safety.

3.10 maximum output voltage (U_o): Maximum output voltage (peak a.c. or d.c.) in an intrinsically safe circuit that can appear under open-circuit conditions at the connection facilities of the apparatus at any applied voltage up to the maximum voltage, including U_m and U_i .

NOTE – Where there is more than one applied voltage, the maximum output voltage is that occurring under the most onerous combination of applied voltages.

NOTE 2 – U_z is sometimes used to denote the output working voltage of a shunt diode safety barrier.

3.11 maximum input current (I_i): Maximum current (peak a.c. or d.c.) that can be applied to the connection facilities for intrinsically safe circuits without invalidating intrinsic safety.

3.12 maximum output current (I_o): Maximum current (peak a.c. or d.c.) in an intrinsically safe circuit that can be taken from the connection facilities of the apparatus.

3.13 maximum input power (P_i): Maximum input power in an intrinsically safe circuit that can be dissipated within an apparatus when it is connected to an external source without invalidating intrinsic safety.

3.14 maximum output power (P_o): Maximum electrical power in an intrinsically safe circuit that can be taken from the apparatus.

3.15 maximum internal capacitance (C_i): Total equivalent internal capacitance of the apparatus which is considered as appearing across the connection facilities of the apparatus.

3.16 maximum external capacitance (C_o): Maximum capacitance in an intrinsically safe circuit that can be connected to the connection facilities of the apparatus without invalidating intrinsic safety.

3.17 maximum internal inductance (L_i): Total equivalent internal inductance of the apparatus which is considered as appearing at the connection facilities of the apparatus.

3.18 maximum external inductance (L_o): Maximum value of inductance in an intrinsically safe circuit that can be connected to the connection facilities of the apparatus without invalidating intrinsic safety.

3.19 maximum internal inductance to resistance ratio (L_i/R_i): Ratio of inductance (L_i) to resistance (R_i) which is considered as appearing at the external connection facilities of the electrical apparatus.

3.20 maximum external inductance to resistance ratio (L_o/R_o): Ratio of inductance (L_o) to resistance (R_o) of any external circuit connected to the connection facilities of the electrical apparatus without invalidating intrinsic safety.

3.21 simple apparatus: Electrical component or combination of components of simple construction with well-defined electrical parameters which is compatible with the intrinsic safety of the circuit in which it is used. The following apparatus is considered to be simple apparatus:

- a) passive components, for example switches, junction boxes, resistors and simple semi-conductor devices;
- b) sources of stored energy with well-defined parameters, for example capacitors or inductors, whose values are considered when determining the overall safety of the system;
- c) sources of generated energy, for example thermocouples and photocells, which do not generate more than 1,5 V, 100 mA and 25 mW. Any inductance or capacitance present in these sources of energy are considered as in b).

3.22 intrinsically safe apparatus: Electrical apparatus in which all the circuits are intrinsically safe.

NOTE – Intrinsically safe apparatus should conform to IEC 60079-11, category “ia” or “ib”.

3.23 associated apparatus: Electrical apparatus in which the circuits or parts of circuits are not all necessarily intrinsically safe but which contains circuits that can affect the safety of the intrinsically safe circuits associated with it.

NOTE – The associated apparatus is normally the interface between an intrinsically safe circuit and a non-intrinsically safe circuit and is frequently located in the non-hazardous area. The associated apparatus may be, for example, shunt diode safety barriers or galvanic isolators.

3.24 normal operation: Operation of apparatus conforming electrically and mechanically with its design specification and used within the limits specified by the manufacturer.

NOTE – The limits specified by the manufacturer may include persistent operational conditions such as stalled rotors, failed lamps and overloads.

3.25 initial starting current I_A : Highest r.m.s. value of current absorbed by an a.c. motor at rest when supplied at the rated voltage and frequency.

3.26 starting current ratio I_A/I_N : Ratio between the initial starting current I_A and the rated current I_N .

3.27 time t_E : The time taken for an a.c. winding, when carrying the initial starting current I_A , to be heated up to the limiting temperature from the temperature reached in rated service at the maximum ambient temperature.

3.28 increased safety “e”: A type of protection in which additional measures are applied so as to give increased security against the possibility of excessive temperatures and of the occurrence of arcs and sparks inside and on external parts of electrical apparatus which does not produce arcs or sparks in normal service.

3.29 intrinsically safe circuit: Circuit in which all the apparatus is either intrinsically safe apparatus or simple apparatus.

NOTE – The circuit may also contain associated apparatus.

3.30 intrinsically safe sub-circuit: Part of an intrinsically safe circuit which is galvanically isolated from another part or other parts of the same intrinsically safe circuit.

3.31 intrinsically safe electrical system: An assembly of interconnected items of electrical apparatus, described in a descriptive system document, in which the circuits or parts of circuits intended to be used in a potentially explosive atmosphere are intrinsically safe.

3.32 galvanic isolation: An arrangement within an item of intrinsically safe apparatus such that a signal is transferred from the apparatus input to the apparatus output without any direct electrical connection between the two.

NOTE – Galvanic isolation frequently utilizes either magnetic (transformer or relay) or opto-coupled elements.

3.33 intrinsic safety “i”: A type of protection 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.

3.34 flameproof enclosure “d”: A type of protection where enclosures for electrical apparatus will withstand an internal explosion of the flammable gas or vapour which may enter it, without suffering damage and without communicating the internal flammation to the external flammable gas or vapour for which it is designed, through any joints or structural openings in the enclosure.

3.35 type of protection “n”: A type of protection applied to electrical apparatus such that, in normal operation, it is not capable of igniting a surrounding explosive atmosphere and a fault capable of causing ignition is not likely to occur.

3.36 pressurization “p”: The technique of guarding against the ingress of the external atmosphere to an enclosure by maintaining a protective gas therein at a pressure above that of the external atmosphere.

3.37 SELV (separated extra-low voltage): Extra-low voltage system (i.e. normally not exceeding 50 V a.c. or 120 V ripple-free d.c.) which is electrically separated from earth and from other systems in such a way that a single fault cannot give rise to an electric shock (e.g. a 50 V earth free system).

3.38 PELV (protective extra-low voltage): Extra-low voltage system which is not electrically separated from earth but which otherwise satisfies the requirements for SELV (e.g. a 50 V centre-tapped earth system).

4 General

4.1 General requirements

Electrical installations in hazardous areas shall also comply with the appropriate requirements for installations in non-hazardous areas.

CAUTION Electrical apparatus and materials should be installed and used within their electrical ratings for power, voltage, current, frequency, duty and such other characteristics where non-conformity might jeopardize the safety of the installation. In particular, care should be taken to ensure that the voltage and frequency are appropriate to the supply system with which the apparatus is used and that the temperature classification has been established for the correct voltage, frequency, etc..

In order to facilitate the selection of appropriate electrical apparatus and the design of suitable electrical installations, hazardous areas are divided into zones 0, 1 and 2 according to IEC 79-10.

Electrical apparatus should, as far as is reasonably practicable, be located in non-hazardous areas. Where it is not possible to do this, it should be located in the least hazardous area practicable.

All electrical apparatus and wiring in hazardous areas shall be selected in accordance with clauses 5 to 9 inclusive and the additional requirements for the particular type of protection (clauses 10 to 14).

Apparatus shall be installed in accordance with its documentation. Care should be taken to ensure that replaceable items, such as lamps, are of the correct type and rating. On completion of the erection, initial inspection of the apparatus and installation shall be carried out in accordance with IEC 79-17.

NOTE – If luminaires with fluorescent tubes are used, then the area should be confirmed to be free from group IIC gas/vapour before tubes are transported through the area or tubes are changed, unless suitable precautions are taken to prevent tubes being broken. Low pressure sodium lamps should not be used above any hazardous area owing to the risk of ignition from the free sodium from a broken lamp.

Installations should be designed and apparatus and materials installed with a view to providing ease of access for inspection and maintenance (see IEC 60079-17).

Apparatus and systems used in exceptional circumstances, for example research, development, pilot plant and other new project work, need not meet the requirements of clauses 5 to 9 provided that the installation is in use for limited periods only, is under the supervision of specially trained personnel and one or more of the following conditions as appropriate are met:

- measures are taken to ensure that a dangerous explosive atmosphere does not occur; or
- measures are taken to ensure that this apparatus is disconnected on the occurrence of a dangerous explosive atmosphere, in which case ignition after disconnection, for example due to heated parts, shall be prevented also; or
- measures are taken to ensure that persons and the environment are not endangered by fires or explosions in the experimental plant.

In addition, the measures to be taken are laid down in writing by persons who:

- shall be familiar with the requirements for this, and any other relevant standards and codes of practice concerning the use of electrical apparatus and systems for use in hazardous areas;
- have access to all information necessary to carry out the assessment.

4.2 Documentation

In order to correctly install or extend an existing installation, the following information is required, where applicable:

- area classification documents (see IEC 79-10);
- instructions for erection and connection;
- documents for electrical apparatus with special conditions, for example apparatus with certificate numbers which have the suffix "X";

NOTE 1 – Certificate details are also important to the installer and user in the following situations:

- a) for certificate numbers with suffix "B" (which relates to special conditions on apparatus to earlier national standards);
- b) for certificate numbers with suffix "U";
- c) for certificate numbers with suffix "S" (which relates to an intrinsically safe system certificate);
- d) for apparatus with type of protection "s".

- descriptive system document for the intrinsically safe system (see 12.2.5);
- manufacturer's/qualified person's declaration.

NOTE 2 – The manufacturer's/qualified person's declaration is applicable to situations where uncertified apparatus (other than simple apparatus in intrinsically safe circuits) is used.

The following additional documentation should be provided:

- 1) all necessary information to ensure correct installation of the apparatus should be provided in a suitable form to the personnel responsible for this activity;
- 2) location drawings (floor plans) identifying the position of each item of electrical apparatus and lists of electrical apparatus for inspection (see IEC 60079-17);
- 3) details of any relevant calculation, e.g. for purging rates for instruments or analyser houses;
- 4) information necessary for the repair of the electrical apparatus (see IEC 60079-19).

4.3 Certification (additional clause)

4.3.1 General

In zones 0 and 1 (as defined in IEC 60079-10), certified apparatus (except simple apparatus) is generally used as an aid to satisfying statutory requirements such as the Electricity at Work Regulations.

In zone 2 (as defined in IEC 60079-10), certification of the apparatus is optional.

In exceptional circumstances, e.g. research, development, pilot plant and other new project work where suitable certified apparatus is not obtainable, other apparatus may be used in zone 0 and zone 1. The users of such apparatus should obtain a document of conformity.

NOTE 1 – Simple apparatus used within an intrinsically safe circuit does not need to be certified.

NOTE 2 – A document of conformity shows that the apparatus has been examined and, where necessary, tested by a competent body and has been found to conform to the requirements of the appropriate standard for the particular type of protection. Such apparatus would not, however, bear the mark of a notified body.

NOTE 3 – The competent body uses techniques and facilities similar to those normally used by a notified body for the type of protection concerned.

Certificates issued under the EC ATEX Directive 94/9/EC will have the letters "ATEX" in the certificate number. Equipment will be marked with the category (1, 2 or 3) and a letter (G and/or D) to indicate suitability for gas or dust atmospheres.

NOTE 4 – Equipment group II, category 1G is suitable for zones 0, 1 and 2;
 equipment group II, category 2G is suitable for zones 1 and 2;
 equipment group II, category 3G is suitable for zone 2.

4.3.2 Acceptability of certification of apparatus for use within the UK

The following types of apparatus certification are acceptable for use within the UK.

- a) Certification to a European Standard by a European Community National Certifying Authority or notified body.
- b) Certification to a European Standard by a European Economic Area National Certifying Authority or notified body.
- c) Certification to a British Standard by a British National Certifying Authority.
- d) IECEx certification.

NOTE – Apparatus and systems certified as described in a) to d) above may be freely used provided that an appropriate translation of the certificate, if necessary, is obtained from the manufacturer, its conditions observed and any special conditions applied. In cases of doubt about the quality of the translation, advice should be sought from an appropriate National Certifying Authority or notified body.

- e) Other certification.

Apparatus certified to standards other than those given in a) to d) above may be used but in order to ensure correct application and installation, reference should be made to the relevant national code of practice that deals with these aspects. In cases where there is doubt about the application or installation of such apparatus, expert advice should be sought.

NOTE – From July 2003, all apparatus put onto the market within the European Union will be required to carry the CE mark in relation to the ATEX Directive 94/9/EC.

5 Selection of electrical apparatus (excluding cables and conduits)

5.1 Specific information

In order to select the appropriate electrical apparatus for hazardous areas, the following information is required:

- classification of the hazardous area;
- temperature class or ignition temperature of the gas or vapour involved according to 5.3;
- where applicable, gas or vapour classification in relation to the group or subgroup of the electrical apparatus according to 5.4;

NOTE – Of the types of protection listed in IEC 79-0, the apparatus subgroup is only required for protection types "d" (flameproof enclosure) and "i" (intrinsic safety). The apparatus subgroup is also required for certain apparatus with protection type "n" (see 5.4).

- external influences and ambient temperature.

5.2 Selection according to zones

5.2.1 Apparatus for use in zone 0

Electrical apparatus and circuits can be used in zone 0 if they are in accordance with IEC 79-11 (category "ia" – intrinsic safety) and with the requirements of 12.3 (see also 5.2.4).

Apparatus that conforms to BS EN 50284 may be used in zone 0.

Apparatus certified under the ATEX Directive 94/9/EC to equipment group II, category 1G may be used in zone 0 providing that it is installed and used in accordance with the manufacturer's instructions.

5.2.2 Apparatus for use in zone 1

Electrical apparatus can be used in zone 1 if it is constructed in accordance with the requirements for zone 0 or one or more of the following types of protection (see also 5.2.4):

Flameproof enclosure	"d"	according to IEC 79-1
Pressurized apparatus	"p"	according to IEC 79-2
Powder filling	"q"	according to IEC 79-5
Oil immersion	"o"	according to IEC 79-6
Increased safety	"e"	according to IEC 79-7
Intrinsic safety	"i"	according to IEC 79-11
Encapsulation	"m"	according to IEC 79-18

Apparatus certified under the ATEX Directive 94/9/EC to equipment group II, category 2G may also be used in zone 1 providing that it is installed and used in accordance with the manufacturer's instructions.

5.2.3 Apparatus for use in zone 2

The following electrical apparatus may be installed in zone 2:

- a) electrical apparatus for zone 0 or zone 1, or
- b) electrical apparatus designed specifically for zone 2 (for example type of protection "n" according to IEC 79-15), or

NOTE – In respect of “electrical apparatus designed specifically for zone 2”, the British Standard relating to type “n” apparatus is BS EN 50021 which is based on IEC 60079-15. IEC 60079-15 is currently being revised. Apparatus to BS 6941 or BS 4683-3 is also acceptable although BS 4683-3 should no longer be used for design purposes.

- c) electrical apparatus complying with the requirements of a recognized standard for industrial electrical apparatus which does not, in normal operation, have ignition-capable hot surfaces and
 - 1) does not, in normal operation, produce arcs or sparks, or
 - 2) in normal operation produces arcs or sparks but the values, in normal operation, of the electrical parameters (U, I, L and C) in the circuit (including the cables) do not exceed the values specified in IEC 79-11 with a safety factor of unity. The assessment shall be in accordance with the specification for energy limited apparatus and circuits given in IEC 79-15.

Unless safety is demonstrated by test, a surface is presumed to be ignition-capable if its temperature exceeds the ignition temperature of the explosive atmosphere concerned.

This electrical apparatus shall be in an enclosure with a degree of protection and mechanical strength at least suitable for non-hazardous areas with a similar environment. It requires no special marking, but it shall be clearly identified, either on the apparatus or in the documentation, that it has been assessed by a person who shall

- be familiar with the requirements of any relevant standards and codes of practice and their current interpretations;
- have access to all information necessary to carry out the assessment;
- where necessary, utilize similar test apparatus and test procedures to those used by national authorities.

d) apparatus in accordance with 5.2.4.

In the case of rotating electrical machines in accordance with items b), c) or d) above, incendive sparking shall not occur during start-up unless measures are taken to ensure that an explosive atmosphere is not present.

e) apparatus conforming to the ATEX Directive 94/9/EC to equipment group II, category 3G may also be used in zone 2 providing that it is installed and used in accordance with the manufacturer's instructions.

5.2.4 Selection of apparatus not available in accordance with IEC standards

In order to ensure the correct selection and installation of such apparatus (for example equipment marked "s" and identified with the zone of use in accordance with IEC 79-0), reference should be made to the relevant national standard or code of practice that deals with these aspects.

5.3 Selection according to the ignition temperature of the gas or vapour

The electrical apparatus shall be so selected that its maximum surface temperature will not reach the ignition temperature of any gas or vapour which may be present.

Symbols for the temperature classes which may be marked on the electrical apparatus have the meaning indicated in table 1.

Table 1 – Relationship between the temperature classes, surface temperatures and ignition temperature

Temperature class of electrical apparatus	Maximum surface temperature of electrical apparatus	Ignition temperature of gas or vapour
T1	450 °C	>450 °C
T2	300 °C	>300 °C
T3	200 °C	>200 °C
T4	135 °C	>135 °C
T5	100 °C	>100 °C
T6	85 °C	>85 °C

If the marking of the electrical apparatus does not include an ambient temperature range, the apparatus shall be used only within the temperature range from –20 °C to +40 °C.

If the marking of the electrical apparatus includes an ambient temperature range, the apparatus shall only be used within this range.

Simple apparatus used within an intrinsically safe circuit can be assumed to have a temperature classification of T4, provided that P_o does not exceed 1,3 W. Junction boxes and switches in intrinsically safe circuits, however, can be assumed to have a temperature classification of T6 because, by their nature, they do not contain heat dissipating components.