BS EN 60079-14:2008

Incorporating corrigendum October 2011

BSI Standards Publication

Explosive atmospheres

Part 14: Electrical installations design, selection and erection

National foreword

This British Standard is the UK implementation of EN 60079-14:2008, incorporating corrigendum October 2011. It is identical to IEC 60079-14:2007. It supersedes BS EN 60079-14:2003 and BS EN 61241-14:2004, which are withdrawn.

The UK participation in its preparation was entrusted by Technical Committee EXL/31, Equipment for explosive atmospheres, to Subcommittee EXL/31/3, Codes of practice.

A list of organizations represented on this subcommittee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Published by BSI Standards Limited 2012.

ISBN 978 0 580 77104 0

ICS 13.230; 29.260.20

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 January 2009.

Amendments/corrigenda issued since publication

Date	Text affected
30 April 2012	Implementation of CENELEC corrigendum October 2011: CENELEC supersession information updated

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 60079-14

October 2008

ICS 29.260.20

Incorporating corrigendum October 2011

Supersedes EN 60079-14:2003 and EN 61241-14:2004

English version

Explosive atmospheres - Part 14: Electrical installations design, selection and erection

(IEC 60079-14:2007)

Atmosphères explosives - Partie 14: Conception, sélection et construction des installations électriques (CEI 60079-14:2007)

Explosionsfähige Atmosphäre - Teil 14: Projektierung, Auswahl und Errichtung elektrischer Anlagen (IEC 60079-14:2007)

CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

Central Secretariat: rue de Stassart 35, B - 1050 Brussels

Ref. No. EN 60079-14:2008 E

Foreword

The text of document 31J/150/FDIS, future edition 4 of IEC 60079-14, prepared by SC 31J, Classification of hazardous areas and installation requirements, of IEC TC 31, Equipment for explosive atmospheres, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 60079-14 on 2008-07-01.

This European Standard supersedes EN 60079-14:2003 and EN 61241-14:2004.

It constitutes a technical revision with respect to gases and vapours and incorporates the requirements for dusts from EN 61241-14:2004. The incorporation of requirements for dust is without technical change.

The significant technical changes with respect to EN 60079-14:2003 are as follows:

– knowledge, skills and competencies of "Responsible Persons", "Operatives" and "Designers" are explained in Annex F;
– Equipment Protection Levels (EPLs) have been introduced and are explained in the new Annex I;
– dust requirements included from EN 61241-14:2004.

NOTE Dust requirements are included as an interim presentation for the purpose of EN 60079-14:2008 and will be refined in a next edition with other required technical changes.

The following dates were fixed:

– latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2009-05-01
– latest date by which the national standards conflicting with the EN have to be withdrawn	(dow)	2011-07-01

Annexes ZA and ZB have been added by CENELEC.

———————

Endorsement notice

The text of the International Standard IEC 60079-14:2007 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC/TS 60034-17	NOTE	Harmonized as CLC/TS 60034-17:2004 (not modified).
IEC/TS 60034-25	NOTE	Harmonized as CLC/TS 60034-25:2005 (not modified).
IEC 60332-2-2	NOTE	Harmonized as EN 60332-2-2:2004 (not modified)
IEC 60742	NOTE	Harmonized as EN 60742:1995 (modified). Superseded by EN 61558 series (partially modified)
IEC 61008-1	NOTE	Harmonized as EN 61008-1:2004 (modified)
IEC 61010-1	NOTE	Harmonized as EN 61010-1:2001 (not modified)
IEC 61024-1	NOTE	Superseded by IEC 62305-3, which is harmonized as EN 62305-3:2006 (modified)

———————

Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

Publication	Year	Title	EN/HD	Year
IEC 60034-1	– [1)]	Rotating electrical machines - Part 1: Rating and performance	EN 60034-1	2004 [1)]
IEC 60034-5	– [1)]	Rotating electrical machines - Part 5: Degrees of protection provided by the integral design of rotating electrical machines (IP code) - Classification	EN 60034-5	2001 [2)]
IEC 60050-826	– [1)]	International Electrotechnical Vocabulary (IEV) - Part 826: Electrical installations	–	–
IEC 60060-1	– [1)]	High-voltage test techniques - Part 1: General definitions and test requirements	HD 588.1 S1	1991 [2)]
IEC 60079	Series	Explosive atmospheres	EN 60079	Series
IEC 60079-0 (mod)	– [1)]	Explosive atmospheres - Part 0: Equipment – General requirements	EN 60079-0	2006 [2)]
IEC 60079-1	– [1)]	Explosive atmospheres - Part 1: Equipment protection by flameproof enclosures "d"	EN 60079-1	2007 [2)]
IEC 60079-2	– [1)]	Explosive atmospheres - Part 2: Equipment protection by pressurized enclosure "p"	EN 60079-2	2007 [2)]
IEC 60079-5	– [1)]	Explosive atmospheres - Part 5: Equipment protection by powder filling "q"	EN 60079-5	2007 [2)]
IEC 60079-6	– [1)]	Explosive atmospheres - Part 6: Equipment protection by oil immersion "o"	EN 60079-6	2007 [2)]
IEC 60079-7	– [1)]	Explosive atmospheres - Part 7: Equipment protection by increased safety "e"	EN 60079-7	2007 [2)]
IEC 60079-11	– [1)]	Explosive atmospheres - Part 11: Equipment protection by intrinsic safety "i"	EN 60079-11	2007 [2)]
IEC/TR 60079-13	– [1)]	Electrical apparatus for explosive gas atmospheres - Part 13: Construction and use of rooms or buildings protected by pressurization	–	–

[1)] Undated reference.

[2)] Valid edition at date of issue.

Publication	Year	Title	EN/HD	Year
IEC 60079-15	– [1)]	Electrical apparatus for explosive gas atmospheres - Part 15: Construction, test and marking of type of protection "n" electrical apparatus	EN 60079-15	2005 [2)]
IEC/TR 60079-16	– [1)]	Electrical apparatus for explosive gas atmospheres - Part 16: Artificial ventilation for the protection of analyzer(s) houses	–	–
IEC 60079-18	– [1)]	Electrical apparatus for explosive gas atmospheres - Part 18: Construction, test and marking of type of protection encapsulation "m" electrical apparatus	EN 60079-18 + corr. April	2004 [2)] 2006
IEC 60079-19	– [1)]	Explosive atmospheres - Part 19: Equipment repair, overhaul and reclamation	EN 60079-19	2007 [2)]
IEC 60079-25	– [1)]	Electrical apparatus for explosive gas atmospheres - Part 25: Intrinsically safe systems	EN 60079-25 + corr. April	2004 [2)] 2006
IEC 60079-26	– [1)]	Explosive atmospheres - Part 26: Equipment with equipment protection level (EPL) Ga	EN 60079-26	2007 [2)]
IEC 60079-27	– [1)]	Explosive atmospheres - Part 27: Fieldbus intrinsically safe concept (FISCO)	EN 60079-27	2008 [2)]
IEC 60079-28	– [1)]	Explosive atmospheres - Part 28: Protection of equipment and transmission systems using optical radiation	EN 60079-28	2007 [2)]
IEC 60079-29-1 (mod)	– [1)]	Explosive atmospheres - Part 29-1: Gas detectors - Performance requirements of detectors for flammable gases	EN 60079-29-1	2007 [2)]
IEC 60079-29-2	– [1)]	Explosive atmospheres - Part 29-2: Gas detectors - Selection, installation, use and maintenance of detectors for flammable gases and oxygen	EN 60079-29-2 + corr. December	2007 [2)] 2007
IEC 60079-31	– [3)]	Explosive Atmospheres - Part 31: Equipment dust ignition protection by enclosure "tD"	EN 60079-31	– [3)]
IEC 60243-1	– [1)]	Electrical strength of insulating materials - Test methods - Part 1: Tests at power frequencies	EN 60243-1	1998 [2)]
IEC 60332-1-2	– [1)]	Tests on electric and optical fibre cables under fire conditions - Part 1-2: Test for vertical flame propagation for a single insulated wire or cable - Procedure for 1 kW pre-mixed flame	EN 60332-1-2	2004 [2)]
IEC 60364 (mod)	Series	Low-voltage electrical installations	HD 60364/ HD 384	Series

[3)] To be published.

Publication	Year	Title	EN/HD	Year
IEC 60364-4-41 (mod)	– [1)]	Low-voltage electrical installations - Part 4-41: Protection for safety - Protection against electric shock	HD 60364-4-41 + corr. July	2007 [2)] 2007
IEC 60529	– [1)]	Degrees of protection provided by enclosures (IP Code)	EN 60529 + corr. May	1991 [2)] 1993
IEC 60950 (mod)	Series	Information technology equipment - Safety	EN 60950	Series
IEC 61010-1	– [1)]	Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 1: General requirements	EN 61010-1 + corr. June	2001 [2)] 2002
IEC 61241	Series	Electrical apparatus for use in the presence of combustible dust	EN 61241	Series
IEC 61241-0 (mod)	– [1)]	Electrical apparatus for use in the presence of combustible dust - Part 0: General requirements	EN 61241-0	2006 [2)]
IEC 61241-1	– [1)]	Electrical apparatus for use in the presence of combustible dust - Part 1: Protection by enclosures "tD"	EN 61241-1 + corr. December	2004 [2)] 2006
IEC 61241-2-1	– [1)]	Electrical apparatus for use in the presence of combustible dust - Part 2: Test methods - Section 1: Methods for determining the minimum ignition temperatures of dust	–	–
IEC 61241-4	– [1)]	Electrical apparatus for use in the presence of combustible dust - Part 4: Type of protection 'pD'	EN 61241-4	2006 [2)]
IEC 61241-10	– [1)]	Electrical apparatus for use in the presence of combustible dust - Part 10: Classification of areas where combustible dusts are or may be present	EN 61241-10	2004 [2)]
IEC 61241-11	– [1)]	Electrical apparatus for use in the presence of combustible dust - Part 11: Protection by intrinsic safety 'iD'	EN 61241-11	2006 [2)]
IEC 61285	– [1)]	Industrial-process control - Safety of analyser houses	EN 61285	2004 [2)]
IEC 61558-2-6	– [1)]	Safety of power transformers, power supply units and similar - Part 2-6: Particular requirements for safety isolating transformers for general use	EN 61558-2-6	1997 [2)]
IEC 62305-3 (mod)	– [1)]	Protection against lightning - Part 3: Physical damage to structures and life hazard	EN 62305-3 + corr. September	2006 [2)] 2008
ISO 10807	– [1)]	Pipework - Corrugated flexible metallic hose assemblies for the protection of electric cables in explosive atmospheres	EN ISO 10807	1996 [2)]

Annex ZB
(informative)

ATEX Categories and Equipment Protection Levels (EPLs)

This European Standard has been written to incorporate the concept of Equipment Protection Levels (EPLs).

EPLs are analogous to the ATEX Categories, indeed the definitions are identical.

Wherever there is a reference to an EPL in the text it should be equated with the corresponding ATEX Category:

- EPL ‘Ga’ equates to ATEX Category 1G;
- EPL ‘Gb’ equates to ATEX Category 2G;
- EPL ‘Gc’ equates to ATEX Category 3G;
- EPL ‘Da’ equates to ATEX Category 1D;
- EPL ‘Db’ equates to ATEX Category 2D;
- EPL ‘Dc’ equates to ATEX Category 3D.

CONTENTS

INTRODUCTION. 10

1 Scope. 13
2 Normative references 13
3 Terms and definitions 16
3.1 General 16
3.2 Hazardous areas 16
3.3 Flameproof enclosure. 17
3.4 Increased safety. 17
3.5 Intrinsic safety - General 18
3.6 Intrinsic safety parameters 19
3.7 Pressurization 19
3.8 Type of protection 'n'. 19
3.13 Electrical supply systems 20
3.14 Equipment. 21
4 General 21
4.1 General requirements. 21
4.2 Documentation 22
4.3 Assurance of conformity of equipment 23
4.3.1 Equipment with certificates according to IEC standards. 23
4.3.2 Equipment without certificates according to IEC standards 23
4.3.3 Selection of repaired, second hand or existing equipment 23
4.4 Qualifications of personnel 23
5 Selection of equipment (excluding cables and conduits) 24
5.1 Information requirements. 24
5.2 Zones. 24
5.3 Relationship between Equipment protection levels (EPLs) and zones. 24
5.4 Selection of equipment according to EPLs. 25
5.4.1 Relationship between EPLs and types of protection. 25
5.4.2 Equipment for use in locations requiring EPL 'Ga' or 'Da'. 26
5.4.3 Equipment for use in locations requiring EPL ‘Gb’ or 'Db' 26
5.4.4 Equipment for use in locations requiring EPL ‘Gc’ or ‘Dc’. 26
5.5 Selection according to equipment grouping 26
5.6 Selection according to the ignition temperature of the gas, vapour or dust and ambient temperature. 27
5.6.1 General 27
5.6.2 Gas or Vapour 27
5.6.3 Dust 27
5.7 Selection of radiating equipment for dust. 30
5.7.1 Ignition process 30
5.7.2 Safety measures in zone 20 or 21. 30
5.7.3 Safety measures in zone 22 31
5.8 Selection of ultrasonic equipment for dust 31
5.8.1 Ignition process 31
5.8.2 Safety measures. 31

5.9 External influences . . . 31
5.10 Light metals as construction materials . . . 32
5.10.1 Gas or vapour . . . 32
5.10.2 Dust . . . 32
5.11 Transportable, Portable and Personal equipment . . . 33
5.11.1 General . . . 33
5.11.2 Transportable and Portable equipment - Gas . . . 33
5.11.3 Personal Equipment - Gas . . . 33
5.11.4 Dust . . . 33
5.12 Selection of rotating electrical machines . . . 34
5.12.1 General . . . 34
5.12.2 Motors fed from a converter supply . . . 34
5.13 Luminaires . . . 34
5.14 Plugs and socket outlets for dust . . . 34
5.14.1 General . . . 34
5.14.2 Mounting . . . 34
5.14.3 Location . . . 35
6 Protection from dangerous (incendive) sparking . . . 35
6.1 Danger from live parts . . . 35
6.2 Danger from exposed and extraneous conductive parts . . . 35
6.2.1 TN type of system earthing . . . 35
6.2.2 TT type of system earthing . . . 35
6.2.3 IT type of system earthing . . . 35
6.2.4 SELV and PELV systems . . . 35
6.2.5 Electrical separation . . . 36
6.2.6 Above hazardous areas . . . 36
6.3 Potential equalization . . . 36
6.3.1 General . . . 36
6.3.2 Temporary bonding . . . 37
6.4 Static electricity . . . 37
6.4.1 Gas . . . 37
6.4.2 Dust . . . 38
6.5 Lightning protection . . . 38
6.6 Electromagnetic radiation . . . 38
6.7 Cathodically protected metallic parts . . . 38
6.8 Ignition by optical radiation . . . 39
7 Electrical protection . . . 39
7.1 General . . . 39
7.2 Rotating electrical machines . . . 39
7.3 Transformers . . . 39
7.4 Resistance heating devices . . . 40
8 Emergency switch-off and electrical isolation . . . 40
8.1 Emergency switch-off . . . 40
8.2 Electrical isolation . . . 40
9 Wiring systems . . . 41
9.1 General . . . 41
9.2 Aluminium conductors . . . 41
9.3 Cables . . . 41

9.3.1 Cables for fixed wiring . 41
9.3.2 Cables supplying transportable and portable equipment . 41
9.3.3 Flexible connections for dust . 42
9.3.4 Flexible cables . 42
9.3.5 Non-sheathed single cores . 42
9.3.6 Overhead lines . 42
9.3.7 Avoidance of damage . 43
9.3.8 Cable surface temperature . 43
9.3.9 Flame propagation. 43
9.3.10 Connections of cables to equipment . 43
9.4 Conduit systems. 44
9.5 Cable and conduit systems. 45
9.5.1 EPL 'Ga' . 45
9.5.2 EPL 'Da' . 45
9.5.3 Cable and conduit systems for EPL ‘Gb’, ‘Gc’, ‘Db’ and ‘´Dc’ . 45
9.6 Installation requirements . 45
9.6.1 Circuits traversing a hazardous area . 45
9.6.2 Protection of stranded ends. 45
9.6.3 Unused cores . 45
9.6.4 Unused openings. 45
9.6.5 Fortuitous contact. 45
9.6.6 Jointing . 46
9.6.7 Openings in walls . 46
9.6.8 Passage and collection of flammables . 46
9.6.9 Static build-up for dust. 46
9.6.10 Accumulation of combustible dust. 46
10 Additional requirements for type of protection 'd' – Flameproof enclosures . 47
10.1 General . 47
10.2 Solid obstacles. 47
10.3 Protection of flameproof joints. 47
10.4 Cable entry systems. 48
10.4.1 General . 48
10.4.2 Selection of cable glands. 48
10.5 Conduit systems. 50
10.6 Motors. 50
10.6.1 Motors with a converter supply . 50
10.6.2 Reduced-voltage starting (soft starting) . 50
11 Additional requirements for type of protection ‘e’ – Increased safety. 51
11.1 Degree of ingress protection of enclosures (IEC 60034-5 and IEC 60529). 51
11.2 Wiring systems. 51
11.2.1 General . 51
11.2.2 Cable glands . 51
11.2.3 Conductor terminations. 52
11.2.4 Combinations of terminals and conductors for general connection and junction boxes . 52
11.3 Cage induction motors. 52
11.3.1 Mains-operated . 52
11.3.2 Winding temperature sensors . 53
11.3.3 Machines with rated voltage greater than 1 kV. 53

11.3.4 Motors with converter supply 54
11.3.5 Reduced-voltage starting (soft starting) 54
11.4 Luminaires 54
12 Additional requirements for types of protection 'i' – Intrinsic safety 54
12.1 Introductory remark 54
12.2 Installations to meet the requirements of EPL ‘Gb’ or ‘Gc’ 55
12.2.1 Equipment 55
12.2.2 Cables 56
12.2.3 Termination of intrinsically safe circuits 59
12.2.4 Earthing of intrinsically safe circuits 60
12.2.5 Verification of intrinsically safe circuits 61
12.3 Installations to meet the requirements of EPL 'Ga' 63
12.4 Special applications 64
13 Additional requirements for pressurized enclosures 65
13.1 Type of protection 'p' 65
13.1.1 General 65
13.1.2 Ducting 65
13.1.3 Action to be taken on failure of pressurization 66
13.1.4 Multiple pressurized enclosures with a common safety device 68
13.1.5 Purging 68
13.1.6 Protective gas 68
13.1.7 Wiring systems 69
13.2 Motors 69
13.2.1 Motors with a converter supply 69
13.2.2 Reduced-voltage starting (soft starting) 69
13.3 Type of protection 'pD' 69
13.3.1 Sources of protective gas 69
13.3.2 Automatic switch-off 70
13.3.3 Alarm 70
13.3.4 Common source of protective gas 70
13.3.5 Switching on electrical supply 70
13.3.6 Motors with a converter supply 71
13.4 Rooms for explosive gas atmosphere 71
13.4.1 Pressurized rooms and analyser houses 71
14 Additional requirements for type of protection 'n' 71
14.1 General 71
14.2 Degree of ingress protection of enclosures (IEC 60034-5 and IEC 60529) 72
14.3 Wiring systems 72
14.3.1 General 72
14.3.2 Cable glands 72
14.3.3 Conductor terminations 73
14.4 Motors 73
14.4.1 Machines with rated voltage greater than 1 kV 73
14.4.2 Motors with converter supply 73
14.4.3 Reduced-voltage starting (soft starting) 74
14.5 Luminaires 74
15 Additional requirements for type of protection 'o'– Oil immersion 74
16 Additional requirements for type of protection 'q' – Powder filling 74

17 Additional requirements for type of protection 'm' – Encapsulation. 74
18 Additional requirements for type of protection 'tD' – Protection by enclosure 74
18.1 Practices A and B. 74
18.2 Practice A 74
18.3 Practice B 75
18.4 Motors supplied at varying frequency and voltages. 75

Annex A (normative) Verification of intrinsically safe circuits with more than one associated apparatus with linear current/voltage characteristics 76
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) 77
Annex C (informative) Determination of cable parameters. 80
Annex D (informative) Safe work procedure guidelines for explosive gas atmospheres 82
Annex E (normative) Potential stator winding discharge risk assessment – Ignition risk factors 83
Annex F (normative) Knowledge, skills and competencies of 'Responsible Persons', 'Operatives' and 'Designers'. 84
Annex G (informative) Examples of dust layers of excessive thickness 87
Annex H (normative) Frictional sparking risks with light metals and their alloys. 88
Annex I (informative) Introduction of an alternative risk assessment method encompassing “equipment protection levels” for Ex equipment 89

Bibliography. 94

Figure 1 – Correlation between the maximum permissible surface temperature and depth of dust layers 29
Figure 2 – Selection chart for cable entry devices into flameproof enclosures for cables complying with item b) of 10.4.2 49
Figure 3 – Earthing of conducting screens 57
Figure B.1 – Series connection – Summation of voltage. 78
Figure B.2 – Parallel connection – Summation of currents 78
Figure B.3 – Series and parallel connections – Summations of voltages and summations of currents 79
Figure G.1a – Excessive layer on top of equipment. 87
Figure G.1b – Excessive layer on top of equipment due to low ignition temperature of the dust 87
Figure G.1c – Excessive layer at the sides of equipment 87
Figure G.1d – Completely submerged equipment 87
Figure G.1 – Examples for dust layers of excessive thickness with the requirement of laboratory investigation. 87

Table 1 – Equipment protection levels (EPLs) where only zones are assigned. 24
Table 2 – Relationship between types of protection and EPLs 25
Table 3 – Relationship between gas/vapour or dust subdivision and equipment group 26
Table 4 – Relationship between gas or vapour ignition temperature and temperature class of equipment 27

Table 5 – Limitations of areas 38
Table 6 – Minimum distance of obstruction from the flameproof flange joints related to the gas group of the hazardous area. 47
Table 7 – Assessment for T4 classification according to component size and ambient temperature 63
Table 8 – Determination of type of protection (with no flammable release within the enclosure). 65
Table 9 – Use of spark and particle barriers. 66
Table 10 – Action to be taken when the pressurization with the protective gas fails for electrical equipment without an internal source of release 67
Table 11 – Summary of protection requirements for enclosures 70
Table 12 – Dust tightness practice A. 75
Table 13 – Dust tightness practice B. 75
Table I.1 – Traditional relationship of EPLs to zones (no additional risk assessment) 91
Table I.2 – Description of risk of ignition protection provided 92

INTRODUCTION

Preventive measures to reduce the explosion risk from flammable materials are based on three principles, which shall be applied in the following order:

1) Substitution
2) Control
3) Mitigation

Substitution involves, for example, replacing a flammable material by one which is either not flammable or less flammable.

Control involves, for example:

a) reducing the quantity of flammables;
b) avoiding or minimising releases;
c) controlling the release;
d) preventing the formation of an explosive atmosphere;
e) collecting and containing releases; and
f) avoiding ignition sources.

NOTE 1 With the exception of item f), all of the above are part of the process of hazardous area classification.

Mitigation involves, for example:

1) reducing the number of people exposed;
2) providing measures to avoid the propagation of an explosion;
3) providing explosion pressure relief;
4) providing explosion pressure suppression; and
5) providing suitable personal protective equipment.

NOTE 2 The above items are part of consequence management when considering risk.

Once the principles of substitution and control (items a) to e)) have been applied, the remaining hazardous areas should be classified into zones according to the likelihood of an explosive atmosphere being present (see IEC 60079-10 or IEC 61241-10). Such classification, which may be used in conjunction with an assessment of the consequences of an ignition, allows equipment protection levels to be determined and hence appropriate types of protection to be specified for each location.

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.

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

When electrical equipment is to be installed in areas where dangerous concentrations and quantities of flammable gases, vapours, mists 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.

Many types of dust that are generated, processed, handled and stored, are combustible. When ignited they can burn rapidly 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 combustible materials are present, and suitable precautions must therefore be taken to ensure that all such apparatus is adequately protected so as to reduce the likelihood of ignition of the external explosive atmosphere. In electrical apparatus, potential ignition sources include electrical arcs and sparks, hot surfaces and frictional sparks.

Areas where dust, flyings and fibres in air occur in dangerous quantities are classified as hazardous and are divided into three zones according to the level of risk.

Combustible dust can be ignited by equipment in several ways:

- by surfaces of the apparatus that are above the minimum ignition temperature of the dust concerned. The temperature at which a type of dust ignites is a function of the properties of the dust, whether the dust is in a cloud or layer, the thickness of the layer and the geometry of the heat source;
- by arcing or sparking of electrical parts such as switches, contacts, commutators, brushes, or the like;
- by discharge of an accumulated electrostatic charge;
- by radiated energy (e.g. electromagnetic radiation);
- by mechanical sparking or frictional sparking associated with the apparatus.

In order to avoid dust ignition hazards it is necessary that:

- the temperature of surfaces on which dust can be deposited, or which would be in contact with a dust cloud, is kept below the temperature limitation specified in this standard;
- any electrical sparking parts, or parts having a temperature above the temperature limit specified in this standard:
  - are contained in an enclosure which adequately prevents the ingress of dust, or
  - the energy of electrical circuits is limited so as to avoid arcs, sparks or temperatures capable of igniting combustible dust;
- any other ignition sources are avoided.

Several types of protection are available for electrical equipment in hazardous areas (see IEC 60079-0), and this standard gives the specific requirements for design, selection and erection of electrical installations in explosive atmospheres.

This part of IEC 60079 is supplementary to other relevant IEC standards, for example IEC 60364 series as regards electrical installation requirements. This part also refers to IEC 60079-0 and its associated standards for the construction, testing and marking requirements of suitable electrical equipment.

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

Inspection, maintenance and repair aspects play an important role in control 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.

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

In IEC 61241-1, for protection by enclosure 'tD', two different types of practice, A and B, are specified and are intended to provide an equivalent level of protection.

Both of these practices are in common use and the requirements of each should be followed without mixing either the apparatus requirements or selection/installation requirements of the two practices. They adopt different methodology with the primary differences being:

Practice A	Practice B
Written principally as performance based requirements	Written as both performance and prescriptive based requirements
Maximum surface temperature is determined with 5 mm layer of dust and installation rules require 75 °C margin between the surface temperature and ignition temperature of the particular dust	Maximum surface temperature is determined with 12,5 mm layer of dust and installation rules require 25 °C margin between the surface temperature and ignition temperature of the particular dust
A method of achieving the required dust ingress protection by the use of resilient seals on joints and rubbing seals on rotating or moving shafts or spindles and determining dust ingress according to IEC 60529 -IP Code	A method of achieving the required dust ingress protection by specified widths and clearances between joint faces and, in the case of shafts and spindles, specified lengths and diametrical clearances between moving and stationary parts and determining dust ingress according to the heat cycling test

EXPLOSIVE ATMOSPHERES –

Part 14: Electrical installations design, selection and erection

1 Scope

This part of IEC 60079 contains the specific requirements for the design, selection and erection of electrical installations in hazardous areas associated with explosive atmospheres.

Where the equipment is required to meet other environmental conditions, for example, protection against ingress of water and resistance to corrosion, additional methods of protection may be necessary. The method used should not adversely affect the integrity of the enclosure.

The requirements of this standard apply only to the use of equipment under normal or near normal atmospheric conditions. For other conditions, additional precautions may be necessary. For example, most flammable materials and many materials which are normally regarded as non-flammable might burn vigorously under conditions of oxygen enrichment. Other precautions might also be necessary in the use of equipment under conditions of extreme temperature and pressure. Such precautions are beyond the scope of this standard.

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

This standard applies to all electrical equipment including fixed, portable, transportable and personal, and installations, permanent or temporary.

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.

– inherently explosive situations and dust from explosives or pyrophoric substances (for example explosives manufacturing and processing);
– rooms used for medical purposes;
– electrical installations in areas where the hazard is due to hybrid mixtures of combustible dust and explosive gas, vapour or mist.

This standard does not take into account of any risk due to an emission of flammable or toxic gas from the dust.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60034-1, *Rotating electrical machines – Part 1: Rating and performance*

IEC 60034-5, *Rotating electrical machines – Part 5: Degrees of protection provided by the integral design of rotating electrical machines (IP code) – Classification*