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Electrical apparatus for explosive gas atmospheres –

Part 0: General requirements

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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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 specifications, 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 60079-0 has been prepared by technical committee 31: Electrical apparatus for explosive atmospheres.

This third edition cancels and replaces the second edition published in 1983 and constitutes a technical revision.

This International Standard is based on the text of European Standard EN 50014 (1992) published by CENELEC.

This consolidated version of IEC 60079-0 is based on the third edition (1998) [documents 31/248/FDIS and 31/252/RVD], and its amendment 1 (2000) [documents 31/322/FDIS and 31/331/RVD].

It bears the edition number 3.1.

A vertical line in the margin shows where the base publication has been modified by amendment 1.

Annexes B and C form an integral part of this standard.

Annexes A and D are for information only.

The committee has decided that the contents of this publication will remain unchanged until 2005. At this date, the publication will be

- reconfirmed;
- withdrawn;
- replaced by a revised edition, or
- amended.

ELECTRICAL APPARATUS FOR EXPLOSIVE GAS ATMOSPHERES –

Part 0: General requirements

1 Scope

This part of IEC 60079 specifies the general requirements for construction, testing and marking of electrical apparatus, Ex cable entries and Ex components, intended for use in potentially explosive atmospheres of gas, vapour and mist.

This standard does not specify requirements for safety, other than those directly related to the explosion risk.

This standard is or will be supplemented or modified by the following parts of IEC 60079 concerning specific types of protection:

– IEC 60079-1: flameproof enclosures "d";
– IEC 60079-2: pressurized enclosures "p";
– IEC 60079-5: powder filling "q";
– IEC 60079-6: oil immersion "o";
– IEC 60079-7: increased safety "e";
– IEC 60079-11: intrinsic safety "i";
– IEC 60079-18: encapsulation "m";
– IEC 60079-22: caplights for mines susceptible to firedamp (under consideration).

This part of IEC 60079 and the parts of IEC 60079 mentioned above are not applicable to the construction of electromedical apparatus, shot-firing exploders, test devices for exploders and for shot-firing circuits.

NOTE 1 In addition to the types of protection listed above, IEC 60079-15 is applicable for use in a potentially explosive atmosphere.

NOTE 2 Apparatus not conforming with this standard or the standards listed in this clause may be considered safe by a national or other authorised body for use in potentially explosive atmospheres. In such cases, the apparatus is identified with the symbol "s".

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of IEC 60079. 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 60079 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 60034-5:1991, *Rotating electrical machines – Part 5: Classification of degrees of protection provided by enclosures of rotating electrical machines (IP code)*

IEC 60079-1:1990, *Electrical apparatus for explosive gas atmospheres – Part 1: Construction and verification test of flameproof enclosures of electrical apparatus*

IEC 60079-1A:1975, *Electrical apparatus for explosive gas atmospheres – Part 1: Construction and verification test of flameproof enclosures of electrical apparatus – First supplement: Appendix D: Method of test for ascertainment of maximum experimental safe gap*

IEC 60079-2:1983, *Electrical apparatus for explosive gas atmospheres – Part 2: Electrical apparatus, type of protection "p"*

IEC 60079-3:1990, *Electrical apparatus for explosive gas atmospheres – Part 3: Spark-test apparatus for intrinsically-safe circuits*

IEC 60079-4:1975, *Electrical apparatus for explosive gas atmospheres – Part 4: Method of test for ignition temperature*

IEC 60079-5:1997, *Electrical apparatus for explosive gas atmospheres – Part 5: Powder filling "q"*

IEC 60079-6:1995, *Electrical apparatus for explosive gas atmospheres – Part 6: Oil-immersion "o".*

IEC 60079-7:1990, *Electrical apparatus for explosive gas atmospheres – Part 7: Increased safety "e"*

IEC 60079-11:1991, *Electrical apparatus for explosive gas atmospheres – Part 11: Intrinsic safety "i"*

IEC 60079-15:1987, *Electrical apparatus for explosive gas atmospheres – Part 15: Electrical apparatus with type of protection "n"*

IEC 60079-18:1992, *Electrical apparatus for explosive gas atmospheres – Part 18: Encapsulation "m"*

IEC 60079-19:1993, *Electrical apparatus for explosive gas atmospheres – Part 19: Repair and overhaul for apparatus used in explosive atmospheres (other than mines or explosives)*

IEC 60079-20:1996, *Electrical apparatus for explosive gas atmospheres – Part 20: Data for flammable gases and vapours, relating to the use of electrical apparatus*

IEC 60192:1973, *Low-pressure sodium vapour lamps*

IEC 60216-1:1990, *Guide for the determination of thermal endurance properties of electrical insulating materials – Part 1: General guidelines for ageing procedure and evaluation of test results*

IEC 60216-2:1990, *Guide for the determination of thermal endurance properties of electrical insulating materials – Part 2: Choice of test criteria*

IEC 60529:1989, *Degrees of protection provided by enclosures (IP Code)*

IEC 60662:1980, *High-pressure sodium vapour lamps*

IEC 60947-1:1996, *Low-voltage switchgear and controlgear – Part 1: General rules*

ISO 48:1994, *Rubber, vulcanized or thermoplastic – Determination of hardness (hardness between 10 IRHD and 100 IRHD)*

ISO 178:1993, *Plastics – Determination of flexural properties*

ISO 179:1993, *Plastics – Determination of Charpy impact strength*

ISO 262:1973, *ISO general purpose metric screw threads – Selected sizes for screws, bolts and nuts*

ISO 273:1979, *Fasteners – Clearance holes for bolts and screws*

ISO 286-2:1988, *ISO system of limits and fits – Part 2: Tables of standard tolerance grades and limit deviations for holes and shafts*

ISO 527-2:1993, *Plastics – Determination of tensile properties – Part 2: Test conditions for moulding and extrusion plastics*

ISO 965-1:1980, *ISO general purpose metric screw threads – Tolerances – Part 1: Principles and basic data*

ISO 965-2:1980, *ISO general purpose metric screw threads – Tolerances – Part 2: Limits of sizes for general purpose bolt and nut threads – Medium quality*

ISO 1817:1985, *Rubber, vulcanized – Determination of the effect of liquids*

ISO 1818:1975, *Vulcanized rubbers of low hardness (10 to 35 IRHD) – Determination of hardness*

ISO 4014:1988, *Hexagon head bolts – Product grades A and B*

ISO 4017:1988, *Hexagon head screws – Product grades A and B*

ISO 4026:1993, *Hexagon socket set screws with flat point*

ISO 4027:1993, *Hexagon socket set screws with cone point*

ISO 4028:1993, *Hexagon socket set screws with dog point*

ISO 4029:1993, *Hexagon socket set screws with cup point*

ISO 4032:1986, *Hexagon nuts, style 1 – Product grades A and B*

ISO 4762:1989, *Hexagon socket head cap screws – Product grade A*

ISO 4892-1:1994, *Plastics – Methods of exposure to laboratory light sources – Part 1: General guidance*

3 Definitions and symbols

For the purpose of this part of IEC 60079, the following definitions apply:

3.1
electrical apparatus
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

3.2
potentially explosive atmosphere
an atmosphere which could become explosive (the danger is a potential one)

3.3
explosive gas atmosphere
a 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

3.4
explosive test mixture
a specified explosive mixture used for the testing of electrical apparatus for potentially explosive atmospheres

3.5
ignition temperature of an explosive gas atmosphere
the lowest temperature of a heated surface which, under specified conditions according to IEC 60079-4, will ignite a flammable substance in the form of a gas or vapour mixture with air

3.6
service temperature
the temperature reached when the apparatus is operating at its rating

3.7
maximum service temperature
the highest value of the service temperatures

NOTE Each apparatus may reach different service temperatures in different parts.

3.8
maximum surface temperature
the highest temperature which is attained in service under the most adverse conditions (but within the recognized tolerances) by any part or surface of an electrical apparatus, which would be able to produce an ignition of the surrounding explosive atmosphere

NOTE 1 The manufacturer will prescribe the product standard and also, in his particular design, he should take into account the following other conditions:

– fault conditions specified in the standard for the type of protection concerned;

– all operating conditions specified in any other standard specified by him including recognized overloads;

– any other operating condition specified by him.

NOTE 2 The relevant surface temperature may be internal or external depending upon the type of protection concerned.

3.9
enclosure
all the walls, doors, covers, cable entries, rods, spindles, shafts, etc., which contribute to the type of protection and/or the degree of protection IP of the electrical apparatus

3.10
type of protection
the specific measures applied to electrical apparatus to avoid ignition of a surrounding explosive atmosphere

3.11
degree of protection of enclosure (IP)
a numerical classification according to IEC 60529 preceded by the symbol IP applied to the enclosure of electrical apparatus to provide for

– protection of persons against contact with or approach to live parts and against contact with moving parts (other than smooth rotating shafts and the like) inside the enclosure,
– protection of the electrical apparatus against ingress of solid foreign objects and, where indicated by the classification,
– protection of the electrical apparatus against harmful ingress of water.

NOTE The enclosure which provides the degree of protection IP is not necessarily identical to the apparatus enclosure for the types of protection listed in clause 1.

3.12
rated value
a quantity value assigned, generally by the manufacturer, for a specified operating condition of a component, device or apparatus

3.13
rating
the set of rated values and operating conditions

3.14
cable entry
a device permitting the introduction of one or more electric and/or fibre optics cables into an electrical apparatus so as to maintain the relevant type of protection

3.15
Ex cable entry
a cable entry tested separately from the apparatus enclosure but certified as an apparatus and which can be fitted to the apparatus enclosure during installation without further certification

3.16
conduit entry
a means of introducing a conduit into an electrical apparatus so as to maintain the relevant type of protection

3.17
compression element
an element of a cable entry acting on the sealing ring to enable the latter to fulfil its function

3.18
clamping device
an element of a cable entry for preventing tension or torsion in the cable from being transmitted to the connections

3.19
sealing ring
a ring used in a cable or conduit entry to ensure the sealing between the entry and the cable or conduit

3.20
terminal compartment
a separate compartment or part of a main enclosure, communicating or not with the main enclosure, and containing connection facilities

3.21
connection facilities
terminals, screws or other parts, used for the electrical connection of conductors of external circuits

3.22
bushing
an insulating device carrying one or more conductors through an internal or external wall of an enclosure

3.23
Ex component
a part of electrical apparatus for potentially explosive atmospheres, which is not intended to be used alone in such atmospheres and requires additional certification when incorporated into electrical apparatus or systems for use in potentially explosive atmospheres

3.24
symbol "X"
symbol used as a suffix to a certificate reference to denote special conditions for safe use

3.25
symbol "U"
symbol used as a suffix to a certificate reference to denote an Ex component

NOTE The symbols X and U should not be used together.

3.26
certificate
a document confirming that the apparatus is in conformity with the requirements, the type tests and, where appropriate, the routine tests in the standard referred to therein. A certificate can relate to an Ex apparatus or an Ex component

NOTE A certificate may be produced by the manufacturer, the user, or a third party, for example, an IEC Ex accepted certification body, a national certification body, or an authorised person.

4 Apparatus grouping and temperature classification

4.1 Electrical apparatus for potentially explosive atmospheres is divided into the following:

– Group I: electrical apparatus for mines susceptible to firedamp;

– Group II: electrical apparatus for places with a potentially explosive atmosphere, other than mines susceptible to firedamp.

Electrical apparatus intended for mines where the atmosphere, in addition to firedamp, may contain significant proportions of other flammable gases (i.e. other than methane); it shall be constructed and tested in accordance with the requirements relating to Group I and also to the subdivision of Group II corresponding to the other significant flammable gases. This electrical apparatus shall then be marked appropriately (for example "Ex d I/IIB T3" or "Ex d I/II (NH_3)").

4.2 Electrical apparatus of Group II may be subdivided according to the nature of the potentially explosive atmosphere for which it is intended.

4.2.1 For the types of protection flameproof enclosure "d", and intrinsic safety "i", electrical apparatus of Group II is subdivided into IIA, IIB and IIC as required in the specific standards concerning these types of protection.

NOTE 1 This subdivision is based on the maximum experimental safe gap (MESG) for flameproof enclosures or the minimum ignition current (MIC) for intrinsically safe electrical apparatus (see annex A).

NOTE 2 Apparatus marked IIB is suitable for applications requiring Group IIA apparatus. Similarly, apparatus IIC is suitable for applications requiring Group IIA or Group IIB apparatus.

4.2.2 For all types of protection, apparatus of Group II shall be marked as a function of its maximum surface temperature according to 5.1.2.

4.3 The electrical apparatus may be tested for a particular explosive atmosphere. In this case, it shall be certified and marked accordingly.

5 Temperatures

5.1 Maximum surface temperature

5.1.1 For electrical apparatus of Group I, the maximum surface temperature shall be specified in relevant documentation according to 23.2.

This maximum surface temperature shall not exceed

– 150 °C on any surface where coal dust can form a layer;

– 450 °C where coal dust is not expected to form a layer (for example due to sealing or ventilation), provided that

  a) the actual maximum surface temperature is marked on the apparatus, or

  b) the symbol X is placed after the certificate reference to indicate the conditions for safe use.

NOTE When choosing electrical apparatus of Group I, the user should take into account the influence and the smouldering temperature of coal dusts if they are likely to be deposited in a layer on surfaces with temperatures above 150 °C.

5.1.2 Group II electrical apparatus shall be arranged and marked according to 27.2 f) and shall be

– either preferably classified in a temperature class given in table 1;
– or defined by the actual maximum surface temperature;
– or, if appropriate, restricted to the specific gas for which it is intended.

Table 1 – Classification of maximum surface temperatures for Group II electrical apparatus

Temperature class	Maximum surface temperature °C
T1	450
T2	300
T3	200
T4	135
T5	100
T6	85

5.2 Ambient temperatures

Electrical apparatus shall normally be designed for use in the ambient temperature range between –20 °C and +40 °C; in this case, no additional marking is necessary.

When the electrical apparatus is designed for use in a different range of ambient temperatures, it is considered to be special; the ambient temperature range shall then be stated by the manufacturer and specified in the certificate; the marking shall then include either the symbol T_a or T_{amb} together with the special range of ambient temperatures or, if this is impracticable, the symbol X shall be placed after the certificate reference, according to 27.2 i) (see table 2).

Table 2 – Ambient temperatures in service and additional marking

Electrical apparatus	Ambient temperature in service	Additional marking
Normal	Maximum: +40 °C Minimum: –20 °C	None
Special	Stated by the manufacturer and specified in the certificate	T_a or T_{amb} with the special range, for example: –30 °C ≤ T_a ≤ +40 °C or the symbol X

5.3 Surface temperature and ignition temperature

The lowest ignition temperature of the explosive atmospheres concerned shall be above the maximum surface temperature. However, for components having a total surface area of not more than 10 cm^2, their surface temperature may exceed that for the temperature class marked on the electrical apparatus for Group II or the corresponding maximum surface temperature for Group I, if there is no risk of ignition from these components, with a safety margin of

- 50 K for T1, T2 and T3;
- 25 K for T4, T5 and T6 and Group I.