INTERNATIONAL STANDARD

IEC 60079-7

Third edition
2001-11

Electrical apparatus for explosive gas atmospheres –

Part 7: Increased safety "e"

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

ELECTRICAL APPARATUS FOR EXPLOSIVE GAS ATMOSPHERES –

Part 7: Increased safety "e"

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 60079-7 has been prepared by IEC technical committee 31: Electrical apparatus for explosive atmospheres.

This third edition cancels and replaces the second edition published in 1990, its amendment 1 (1991) and amendment 2 (1993). This third edition constitutes a technical revision.

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

FDIS	Report on voting
31/381/FDIS	31/388/RVD

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

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

Annexes C, D, E and F are given for information only.

The committee has decided that the contents of this publication will remain unchanged until 2004. At this date, the publication will be

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- withdrawn;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

ELECTRICAL APPARATUS FOR EXPLOSIVE GAS ATMOSPHERES –

Part 7: Increased safety "e"

1 Scope

This part of IEC 60079 specifies the requirements for the design, construction, testing and marking of electrical apparatus with type of protection increased safety "e" intended for use in explosive gas atmospheres. This standard applies to electrical apparatus with a rated value of supply voltage not exceeding 11 kV r.m.s. a.c. or d.c. Additional measures are applied to ensure that the apparatus does not produce arcs, sparks, or excessive temperatures in normal operation or under specified abnormal conditions.

These specific requirements are additional to the general requirements in IEC 60079-0 that apply to type of protection increased safety "e" unless specifically excluded.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of IEC 60079. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, 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. For undated references, the latest edition of the normative document referred to applies. Members of IEC and ISO maintain registers of currently valid International Standards.

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

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

IEC 60044-6, *Instrument transformers – Part 6: Requirements for protective current transformers for transient performance*

IEC 60050(426), *International Electrotechnical Vocabulary (IEV) – Chapter 426: Electrical apparatus for explosive atmospheres*

IEC 60050(486), *International Electrotechnical Vocabulary (IEV) – Chapter 486: Secondary cells and batteries*

IEC 60061-1, *Lamp caps and holders together with gauges for the control of interchangeability and safety – Part 1: Lamp caps*

IEC 60061-2, *Lamp caps and holders together with gauges for the control of interchangeability and safety – Part 2: Lampholders*

IEC 60064, *Tungsten filament lamps for domestic and similar general lighting purposes – Performance requirements*

IEC 60068-2-6, *Environmental testing – Part 2: Tests – Test Fc: Vibration (sinusoidal)*

IEC 60068-2-27, *Environmental testing – Part 2: Tests – Test Ea and guidance: Shock*IEC 60068-2-42, *Basic environmental testing procedures – Part 2: Tests – Test Kc: Sulphur dioxide test for contacts and connections*

IEC 60068-2-42, *Environmental testing – Part 2: Tests – Test Kc: Sulphur dioxide test for contacts and connections*

IEC 60079-0:1998, *Electrical apparatus for explosive gas atmospheres – Part 0: General requirements* [1]

IEC 60079-1, *Electrical apparatus for explosive gas atmospheres – Part 1: Flameproof enclosures "d"*

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

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

IEC 60079-17, *Electrical apparatus for explosive gas atmospheres – Part 17: Inspection and maintenance of electrical installations in hazardous areas (other than mines)*

IEC 60085, *Thermal evaluation and classification of electrical insulation*

IEC 60112, *Method for determining the comparative and the proof tracking indices of solid insulating materials under moist conditions*

IEC 60238, *Edison screw lampholders*

IEC 60317-3, *Specifications for particular types of winding wires – Part 3: Polyester enamelled round copper wires, class 155*

IEC 60317-7, *Specifications for particular types of winding wires – Part 7: Polyamide enamelled round copper wire, class 220*

IEC 60317-8, Specifications for particular types of winding wires – Part 8: Polyesterimide enamelled round copper winding wire, class 180

IEC 60317-13, *Specifications for particular types of winding wires – Part 13: Polyester or polyesterimide overcoated with polyamide-imide enamelled round copper wire, class 200*

IEC 60364-3, *Electrical installations of buildings – Part 3: Assessment of general characteristics*

IEC 60400, *Lampholders for tubular fluorescent lamps and starterholders*

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[1] A consolidated edition exists 1.1 (2000) that includes IEC 60079-0 (1998) and its amendment 1 (2000)

IEC 60432-1, *Incandescent lamps – Safety specifications – Part 1: Tungsten filament lamps for domestic and similar general lighting purposes*

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

IEC 60664-1, *Insulation coordination for equipment within low-voltage systems – Part 1: Principles, requirements, and tests* [2]

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

IEC 60947-7-1, *Low-voltage switchgear and controlgear, Part 7 – Ancillary equipment – Section 1: Terminal blocks for copper conductors*

IEC 60999-1, *Connecting devices – Electrical copper conductors – Safety requirements for screw-type and screwless-type clamping units – Part 1: General requirements and particular requirements for clamping units for conductors from 0,2 mm^2 up to 35 mm^2*

IEC 60999-2, *Connecting devices – Safety requirements for screw-type and screwless-type clamping units for electrical copper connectors – Part 2: Particular requirements for conductors from 35 mm^2 up to 300 mm^2*

IEC 61195, *Double-capped fluorescent lamps – Safety specifications*

IEC 62086-1, *Electrical apparatus for explosive gas atmospheres – Electrical resistance trace heating – Part 1: General and testing requirements*

3 Definitions

For the purpose of this part of IEC 60079, the definitions and certain terms used in IEC 60079-0, together with the following terms and definitions apply.

For the definitions of any other terms, particularly those of a more general nature, reference should be made to IEC 60050(426) or other appropriate parts of the IEV (International Electrotechnical Vocabulary).

NOTE Where a word, for example "battery", is shown in parentheses in a term, it may be omitted when there is no risk of confusion or misunderstanding.

3.1 cells and batteries

3.1.1
cell
assembly of electrodes and electrolytes which constitutes the smallest electrical unit of a battery

NOTE A sketch illustrating the various parts of a cell is given in figure 1. This sketch is included for descriptive purposes only and is not intended to imply any requirements or preference for a particular form of construction.

3.1.2
primary cell or battery
electrochemical system capable of producing electrical energy by chemical reaction

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2 A consolidated edition exists 1.1 (2000) that includes IEC 60664-1 (1992) and its amendment 1 (2000)

3.1.3
secondary cell or battery
electrically rechargeable electrochemical system capable of storing electrical energy and delivering it by chemical reaction

3.1.4
open cell or battery
secondary cell or battery having a cover provided with an opening through which gaseous products may escape

[IEV 486-01-18 modified]

3.1.5
sealed valve regulated cell or battery
cell or battery which is closed under normal conditions, but which has an arrangement which allows the escape of gas if the internal pressure exceeds a predetermined value. The cell cannot normally receive an addition to the electrolyte.

[IEV 486-01-20 modified]

NOTE This definition differs from the IEV definition 486-01-20 by virtue of the fact it applies to either a cell or battery.

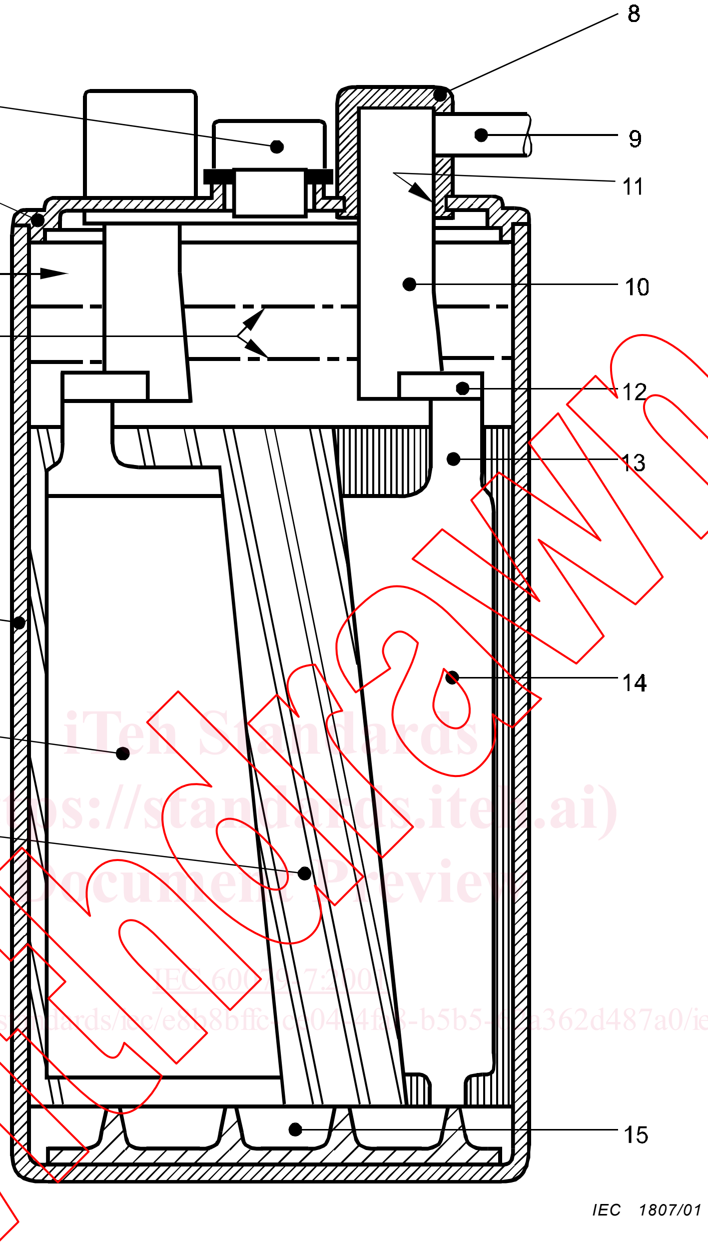
3.1.6
sealed gas-tight cell or battery
cell or battery which remains closed and does not release either gas or liquid when operated within the limits of charge or temperature specified by the manufacturer

NOTE 1 Such cell and batteries may be equipped with a safety device to prevent dangerously high internal pressure. The cell or battery does not require addition to the electrolyte and is designed to operate during its life in its original sealed state.

NOTE 2 The above definition is taken from IEC 60079-11. It differs from the IEV definition 486-01-21 by virtue of the fact it applies to either a cell or battery.

3.1.7
battery
assembly of two or more cells electrically connected to each other to increase the voltage or capacity

NOTE Where the terms "cell" or "cells" are used, the text refers to individual single cells. Where the terms "battery" or "batteries" are used, the text refers to both cells and batteries.



Key

1 Separator
2 Positive plate
3 Cell container
4 Electrolyte level (maximum/minimum)
5 Headspace
6 Electrolyte-tight lid seal
7 Filler and vent plug
8 Post encapsulation
9 Intercell connector
10 Terminal post
11 Electrolyte-tight terminal post seal
12 Group bar
13 Plate lug
14 Negative plate
15 Slurry space

Figure 1 – Parts of a cell

3.1.8
capacity
quantity of electricity or electric charge, which a fully charged battery can deliver under specified conditions

NOTE The SI unit for electrical charge is the coulomb (1 C = 1 As) but in practice, battery capacity is usually expressed in ampere-hours (Ah).

3.1.9
nominal voltage
(of a cell or battery) voltage specified by the manufacturer

3.1.10
maximum open circuit voltage
(of a cell or battery) voltage which is the maximum attainable voltage under normal conditions, that is, from either a new primary cell, or a secondary cell just after a full charge

NOTE The maximum open circuit voltage for acceptable cells is given in tables 9 and 10.

3.1.11
charging
act of forcing current through a secondary cell in the opposite direction to the normal flow to restore the energy stored originally

3.1.12
reverse charging
act of forcing current through either a primary cell or secondary cell in the same direction as the normal flow

NOTE For example in an expired battery.

3.1.13
deep discharge
event which reduces a cell voltage below that recommended by the cell or battery manufacturer

3.1.14
container (of a cell)
container for the plate pack and electrolyte of a cell made of a material impervious to attack by the electrolyte

[IEV 486-02-20]

3.1.15
(battery) container
enclosure to contain the battery

NOTE The cover is a part of the battery container.

3.1.16
plate pack
assembly of the positive and negative plate groups with separators

[IEV 486-02-15]

3.1.17
partition wall
integral part of a battery container dividing it into individual sections and increasing its mechanical strength

3.1.18
insulating barrier
electrical insulating material between groups of cells subdividing the battery

3.1.19
intercell connector
conductor of electricity used for carrying current between cells

3.2
clearance
shortest distance in air between two conductive parts

3.3
connections internal
terminations intended for connection in the factory under controlled conditions

3.4
connections external
terminations intended for connection in the field

3.5
creepage distance
shortest distance along the surface of an electrically insulating material between two conductive parts

3.6
increased safety "e"
type of protection applied to electrical apparatus 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 in normal service or under specified abnormal conditions

NOTE 1 This type of protection is denoted by "e". The "additional measures" are those required for compliance with this standard.

NOTE 2 Apparatus producing arcs or sparks in normal service is excluded by this definition of increased safety.

3.7
initial starting current I_A
highest r.m.s. value of current absorbed by an a.c. motor when at rest or by an a.c. magnet with its armature clamped in the position of maximum air gap when supplied at rated voltage and rated frequency

NOTE Transient phenomena are ignored.

3.8
limiting temperature
maximum permissible temperature for apparatus or parts of apparatus equal to the lower of the two temperatures determined by:

a) the danger of ignition of the explosive gas atmosphere;

b) the thermal stability of the materials used

NOTE This temperature may be the maximum surface temperature (see both 3.8 and clause 5 of IEC 60079-0) or a lower value (see 4.8).

3.9
normal service, motors
continuous operation at the nameplate rating (or set of ratings) including starting conditions

3.10
rated dynamic current I_{dyn}
peak value of the current, the dynamic effect of which the electrical apparatus can sustain without damage

3.11
rated short-time thermal current I_{th}
r.m.s. value of the current required to heat up the conductor within 1 s from the temperature reached in rated service at the maximum ambient temperature to a temperature not exceeding the limiting temperature

3.12
rated voltage
value of voltage assigned by the manufacturer to a component, device or equipment and to which operation and performance characteristics are referred

3.13
resistance-heating devices and resistance-heating units

3.13.1
resistance-heating device
part of a resistance heating unit comprising one or more heating resistors, typically composed of metallic conductors or an electrically conductive compound suitably insulated and protected

3.13.2
resistance-heating unit
apparatus comprising an assembly of one or more resistance heating devices associated with any devices necessary to ensure that the limiting temperature is not exceeded

NOTE It is not intended that the devices necessary to ensure that the limiting temperature is not exceeded should have type of protection "e", or any type of protection when they are located outside the hazardous area.

3.13.3
workpiece
object to which a resistance-heating device or unit is applied

3.13.4
self-limiting property
property such that the thermal output of a resistance-heating device at its rated voltage decreases as the temperature of its surroundings increases until the device reaches a temperature at which its thermal output is reduced to a value at which there is no further rise in temperature

NOTE The temperature of the surface of the element is then effectively that of its surroundings.

3.13.5
stabilized design
concept where the temperature of the resistance-heating device or unit will, by design and use, stabilize below the limiting temperature, under the most unfavourable conditions, without the need for a protective system to limit the temperature

3.14
short-circuit current I_{sc}
maximum r.m.s. value of the short-circuit current to which the apparatus may be subjected in service

NOTE This maximum value is recorded in the documentation according to 23.2 of IEC 60079-0.