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INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

High-temperature secondary batteries – Part 1: General requirements

Batteries d'accumulateurs à haute température – Partie 1: Exigences générales

IEC 62984-1:2020-03(en-fr)

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FOREWORD

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The text of this International Standard is based on the following documents:

FDIS	Report on voting
21/1031/FDIS	21/1041/RVD

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

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 62984 series, published under the general title *High-temperature secondary batteries*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific document. At this date, the document will be

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- withdrawn,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

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HIGH-TEMPERATURE SECONDARY BATTERIES –

Part 1: General requirements

1 Scope

This part of IEC 62984 specifies general aspects, definitions and tests for high-temperature secondary batteries for mobile and/or stationary use and whose nominal voltage does not exceed 1 500 V.

This document does not cover aircraft batteries, which are covered by IEC 60952 (all parts), or batteries for the propulsion of electric road vehicles, covered by IEC 61982 (all parts).

NOTE High-temperature batteries are electrochemical systems whose cells' internal minimum operating temperature is above 100 °C.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 60068-2-1:2007, *Environmental testing – Part 2-1: Tests – Test A: Cold*

IEC 60068-2-2:2007, *Environmental testing – Part 2-2: Tests – Test B: Dry heat*

IEC 60068-2-30:2005, *Environmental testing – Part 2-30: Tests – Test Db: Damp heat, cyclic (12 h + 12 h cycle)*

IEC 60068-2-52:2017, *Environmental testing – Part 2-52: Tests – Test Kb: Salt mist, cyclic (sodium chloride solution)*

IEC 60068-2-64:2008, *Environmental testing – Part 2-64: Tests – Test Fh: Vibration, broadband random and guidance*

IEC 60068-2-75:2014, *Environmental testing – Part 2-75: Tests – Test Eh: Hammer tests*

IEC 60068-2-78, *Environmental testing – Part 2-78: Tests – Test Cab: Damp heat, steady state*

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

IEC 61000-4-2, *Electromagnetic compatibility (EMC) – Part 4-2: Testing and measurement techniques – Electrostatic discharge immunity test*

IEC 61000-4-3, *Electromagnetic compatibility (EMC) – Part 4-3: Testing and measurement techniques – Radiated, radio-frequency, electromagnetic field immunity test*

IEC 61000-4-4, *Electromagnetic compatibility (EMC) – Part 4-4: Testing and measurement techniques – Electrical fast transient/burst immunity test*

IEC 61000-4-5, *Electromagnetic compatibility (EMC) – Part 4-5: Testing and measurement techniques – Surge immunity test*

IEC 61000-4-6, *Electromagnetic compatibility (EMC) – Part 4-6: Testing and measurement techniques – Immunity to conducted disturbances, induced by radio-frequency fields*

IEC 61000-4-11, *Electromagnetic compatibility (EMC) – Part 4-11: Testing and measurement techniques – Voltage dips, short interruptions and voltage variations immunity tests*

IEC 61000-4-29, *Electromagnetic compatibility (EMC) – Part 4-29: Testing and measurement techniques – Voltage dips, short interruptions and voltage variations on d.c. input power port immunity tests*

IEC 61000-4-34, *Electromagnetic compatibility (EMC) – Part 4-34: Testing and measurement techniques – Voltage dips, short interruptions and voltage variations immunity tests for equipment with mains current more than 16 A per phase*

IEC 61000-6-3, *Electromagnetic compatibility (EMC) – Part 6-3: Generic standards – Emission standard for residential, commercial and light-industrial environments*

IEC 61000-6-4, *Electromagnetic compatibility (EMC) – Part 6-4: Generic standards – Emission standard for industrial environments*

IEC 61373, *Railway applications – Rolling stock equipment – Shock and vibration tests*

IEC 62236-3-2, *Railway applications – Electromagnetic compatibility – Part 3-2: Rolling stock – Apparatus*

IEC 62262, *Degrees of protection provided by enclosures for electrical equipment against external mechanical impacts (IK code)*

CISPR 25, *Vehicles, boats and internal combustion engines – Radio disturbance characteristics – Limits and methods of measurement for the protection of on-board receivers*

3 Terms, definitions, symbols and abbreviated terms

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

3.1 Battery construction

3.1.1
cell
basic functional unit, consisting of an assembly of electrodes, electrolyte, container, terminals and usually separators, that is a source of electric energy obtained by direct conversion of chemical energy

Note 1 to entry: See primary cell and secondary cell.

[SOURCE: IEC 60050-482:2004, 482-01-01]

3.1.2
secondary cell
cell which is designed to be electrically recharged

Note 1 to entry: The recharge is accomplished by way of a reversible chemical reaction.

[SOURCE: IEC 60050-482:2004, 482-01-03]

3.1.3
module
standardized and interchangeable assembly of cells connected in series and/or parallel and associated hardware designed for easy assembly into a commercial battery

[SOURCE: IEC 61427-2:2015, 3.29]

3.1.4
battery
one or more cells fitted with devices necessary for use, for example case, terminals, marking and protective devices

[SOURCE: IEC 60050-482:2004, 482-01-04]

3.1.5
high-temperature battery
battery whose cells' internal minimum operating temperature is above 100 °C

Note 1 to entry: A high-temperature battery is inactive when the cells are at room temperature or lower.

3.1.6
(cell) electrode
electrode, electrically connected to one terminal of a cell, in electric contact with the electrolyte of that cell and on which the electrode reaction occurs

Note 1 to entry: For "electrode", see IEC 60050-151:2001, 151-13-01.

Note 2 to entry: The active material may be part of the electrode.

[SOURCE: IEC 60050-482:2004, 482-02-21]

3.1.7
terminal
conductive part of a device, electric circuit or electric network, provided for connecting that device, electric circuit or electric network to one or more external conductors

[SOURCE: IEC 60050-482:2004, 482-02-22]

3.1.8
negative terminal
accessible conductive part provided for the connection of an external electric circuit to the negative electrode of the cell

[SOURCE: IEC 60050-482:2004, 482-02-24]

3.1.9
positive terminal
accessible conductive part provided for the connection of an external electric circuit to the positive electrode of the cell

[SOURCE: IEC 60050-482:2004, 482-02-25]

3.1.10
electrolyte
liquid or solid substance containing mobile ions which render it ionically conductive

[SOURCE: IEC 60050-482:2004, 482-02-29, modified – The note has been omitted.]

3.1.11
active material
material which reacts chemically to produce electric energy when the cell discharges

Note 1 to entry: In secondary cells, the active material is restored to its original state during charge.

[SOURCE: IEC 60050-482:2004, 482-02-33]

3.1.12
enclosure
housing affording the type and degree of protection suitable for the intended application

[SOURCE: IEC 60050-195:1998, 195-02-35]

3.1.13
electrochemical reaction
chemical reaction involving oxidation or reduction of chemical components with a transfer of electrons to or from the active material

Note 1 to entry: The electrode reaction can also involve other chemical reactions including subreactions on a cell electrode.

[SOURCE: IEC 60050-482:2004, 482-03-01]

3.1.14
parallel connection (related to cells or batteries)
arrangement of cells or batteries wherein all the positive terminals and all the negative terminals, respectively, are connected together

[SOURCE: IEC 60050-482:2004, 482-03-39]

3.1.15
parallel series connection (related to cells or batteries)
arrangement of cells or batteries wherein parallel connected cells or batteries are connected in series

[SOURCE: IEC 60050-482:2004, 482-03-40]

3.1.16
series connection (related to cells or batteries)
arrangement of cells or batteries wherein the positive terminal of each cell or battery is connected to the negative terminal of the next cell or battery in sequence

[SOURCE: IEC 60050-482:2004, 482-03-41]

3.1.17
series parallel connection (related to cells or batteries)
arrangement of cells or batteries wherein in series connected cells or batteries are connected in parallel

[SOURCE: IEC 60050-482:2004, 482-03-42]

3.1.18
assembly of batteries
battery arrangement
cluster of several batteries, connected in parallel and in series

3.1.19
battery management system
BMS
electronic system associated with a battery which monitors and/or manages its state, calculates secondary data, reports that data and/or controls its environment to influence the battery's performance and/or service life

Note 1 to entry: The function of the battery management system can be fully or partially assigned to the battery pack and/or to equipment that uses this battery.

Note 2 to entry: A battery management system is also called a "battery management unit" (BMU).

Note 3 to entry: This note applies to the French language only.

3.1.20
battery support system
BSS
system which supports a battery and which includes functions, such as communication, fire prevention, electrical protection and control, air conditioning, anti-intrusion sensors, etc.

Note 1 to entry: This note applies to the French language only.

3.2 Battery functionality

3.2.1
capacity (for cells or batteries)
electric charge which a cell or battery can deliver under specified discharge conditions

Note 1 to entry: The SI unit for electric charge or quantity of electricity is the coulomb (1 C = 1 A·s) but in practice, capacity is usually expressed in ampere hours (A·h).

[SOURCE: IEC 60050-482:2004, 482-03-14]

3.2.2
rated capacity
C_r
capacity value of a battery determined under specified conditions and declared by the manufacturer

[SOURCE: IEC 60050-482:2004, 482-03-15, modified – The symbol has been added.]

3.2.3
battery energy
electric energy which a battery delivers under specified conditions

Note 1 to entry: The SI unit for energy is joule (1 J = 1 W·s), but in practice, battery energy is usually expressed in watthours (W·h) (1 W·h = 3 600 J).

[SOURCE: IEC 60050-482:2004, 482-03-21]

3.2.4
discharge (of a battery)
operation by which a battery delivers, to an external electric circuit and under specified conditions, electric energy produced in the cells

[SOURCE: IEC 60050-482:2004, 482-03-23]

3.2.5
discharge current
electric current delivered by a battery during its discharge

[SOURCE: IEC 60050-482:2004, 482-03-24]

3.2.6
discharge rate
electric current at which a battery is discharged

Note 1 to entry: The discharge rate is calculated as the rated capacity divided by the corresponding discharge time which results in an electric current.

[SOURCE: IEC 60050-482:2004, 482-03-25]

3.2.7
nominal value
value of a quantity used to designate and identify a component, device, equipment, or system

[SOURCE: IEC 60050-482:2004, 482-03-43, modified – The note has been omitted.]

3.2.8
nominal voltage
U_n
suitable approximate value of the voltage used to designate or identify a cell, a battery or an electrochemical system

[SOURCE: IEC 60050-482:2004, 482-03-31, modified – The symbol has been added.]

3.2.9
service life
total period of useful life of a cell or a battery in operation

Note 1 to entry: For primary batteries, service life relates to the total discharge time or capacity under specific conditions.

Note 2 to entry: For secondary cells and batteries, the service life may be expressed in time, number of charge/discharge cycles, or capacity in ampere hours (Ah).

[SOURCE: IEC 60050-482:2004, 482-03-46]

3.2.10
charging of a battery
operation during which a secondary cell or battery is supplied with electric energy from an external circuit which results in chemical changes within the cell and thus the storage of energy as chemical energy

[SOURCE: IEC 60050-482:2004, 482-05-27]

3.2.11
full charge
state of charge wherein all available active material is in a state such that the charging under the selected conditions produces no significant increase of capacity

[SOURCE: IEC 60050-482:2004, 482-05-42]

3.2.12
charge rate (relating to secondary cells and batteries)
I_t
electric current at which a secondary cell or battery is charged

Note 1 to entry: The charge rate is expressed as the reference current $I_t = C_r/n$ where C_r is the rated capacity declared by the manufacturer and n is the time base in hours for which the rated capacity is declared.

[SOURCE: IEC 60050-482:2004, 482-05-45, modified – The symbol has been added.]

3.2.13
state of charge
SOC
ratio of the actual electric charge available in a battery and the electric charge in fully charged state

Note 1 to entry: This note applies to the French language only.

3.2.14
standby state
state in which the battery does not actually charge or discharge but is immediately ready to operate

Note 1 to entry: Content based on IEC 60050-192:2015, 192-02-12.

3.2.15
idle state
non-operating up state during non-required time

Note 1 to entry: The adjective "idle" designates an item in an idle state.

Note 2 to entry: In some applications, an item in an idle state has some functioning subsystems, and is therefore considered to be operating.

Note 3 to entry: The idle state is related to charge/discharge of the battery and therefore a high-temperature secondary battery is in an idle state when it is within its operating temperature range but cannot charge or discharge.

[SOURCE: IEC 60050-192: 2015, 192-02-14, modified – "<of an item> and the deprecated term "free state" have been deleted from the term and Note 3 has been added.]

3.3 Symbols and abbreviated terms

The list of symbols and abbreviated terms is given in Table 1.

Table 1 – List of symbols and abbreviated terms

Symbol / Abbreviated term	Full term	Reference
AM	Amplitude modulation	
BMS	Battery management system	See 3.1.19
BSS	Battery support system	See 3.1.20
C_r	Rated capacity	See 3.2.2
CDN	Coupling decoupling network	
DUT	Device under test	
EESS	Electrical energy storage system	
EFT	Electrical fast transient	
EMC	Electromagnetic compatibility	
ESD	Electrostatic discharge	
I_t	Charge rate	See 3.2.12
PCS	Power conversion system	
SOC	State of charge	See 3.2.13
TDMA	Time division multiple access	
U_n	Nominal voltage	See 3.2.8
UFA	Uniform field area	

4 Environmental (service) conditions

4.1 General

In high-temperature secondary batteries, cells are kept at high temperature and enclosed within a thermal insulated enclosure. These batteries are therefore relatively insensitive to external ambient temperature.

However auxiliary parts such as temperature controllers, BMS etc., are not operating at high temperature and are therefore impacted by environmental conditions, which have to be taken into account.

Unless otherwise specified, high-temperature batteries are intended to be used at their rated characteristics under the normal environmental conditions listed in 4.2 or 4.4.

If the actual service conditions differ from these normal service conditions, high-temperature batteries will be designed to comply with the special service conditions listed in 4.3 or 4.5.

4.2 Normal service conditions for stationary installations

4.2.1 General

– Altitude: height above sea-level not exceeding 1 000 m

– Vibrations: vibrations during normal operation may be neglected; however vibrations occurring during transportation shall be taken into account.

– Humidity: RH ≤ 95 %, non-condensing