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COMMENTED VERSION

Secondary cells and batteries containing alkaline or other non-acid electrolytes - Vented nickel-cadmium prismatic rechargeable ~~single~~ cells and batteries for use in industrial applications

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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Secondary cells and batteries containing alkaline or other non-acid electrolytes - Vented nickel-cadmium prismatic rechargeable ~~single~~ cells and batteries 1 for use in industrial applications

FOREWORD

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This commented version (CMV) of the official standard IEC 60623:2026 edition 6.0 allows the user to identify the changes made to the previous IEC 60623:2017 edition 5.0. Furthermore, comments from IEC subcommittee 21A experts are provided to explain the reasons of the most relevant changes, or to clarify any part of the content.

A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text. Experts' comments are identified by a blue-background number. Mouse over a number to display a pop-up note with the comment.

This publication contains the CMV and the official standard. The full list of comments is available at the end of the CMV.

IEC 60623 has been prepared by subcommittee 21A: Secondary cells and batteries containing alkaline or other non-acid electrolytes, of IEC technical committee 21: Secondary cells and batteries. It is an International Standard.

This sixth edition cancels and replaces the fifth edition published in 2017. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) added a test for internal DC resistance;

b) added a subclause for pulse power calculation;

c) added a test for constant power measurement;

d) added a subclause on the determination of durability parameters.

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

Draft	Report on voting
21A/935/CDV	21A/959/RVC

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

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at http://www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at http://www.iec.ch/publications.

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, or

– revised.

1 Scope

This document specifies marking, designation, dimensions, tests and requirements for vented nickel-cadmium prismatic secondary single cells and battery systems made of them for use in industrial applications. 1

NOTE In this context, "prismatic" refers to cells having rectangular sides and base.

When there exists an IEC standard specifying test conditions and requirements for cells used in special applications and which is in conflict with this document, the former takes precedence.

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 60050-482:2004, *International Electrotechnical Vocabulary (IEV) - Part 482: Primary and secondary cells and batteries*

IEC 60050-482:2004/AMD2:2020, *International Electrotechnical Vocabulary (IEV) - Part 482: Primary and secondary cells and batteries*

IEC 61434, *Secondary cells and batteries containing alkaline or other non-acid electrolytes - Guide to designation of current in alkaline secondary cell and battery standards*

IEC 60417, Graphical symbols for use on equipment, available at http://www.graphical-symbols.info/equipment

3 Terms, definitions, symbols and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60050-482:2004 and the following apply.

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

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

3.1.1
vented cell
secondary cell having a cover provided with an opening through which products of electrolysis and evaporation are allowed to escape freely from the cell to the atmosphere

Note 1 to entry: The opening ~~may~~ can be fitted with a venting system.

Note 2 to entry: The vented cell is the smallest unit manufactured in series, and the primary vehicle for electrical characterization.

3.1.2
monobloc battery
battery with multiple separate but electrically connected cell compartments each of which is designed to house an assembly of electrodes, electrolyte, terminals or interconnections and possible separators

Note 1 to entry: The cells in a monobloc battery can be connected in series or in parallel.

Note 2 to entry: See 5.4.2.

[SOURCE: IEC 60050-482:2004 [1], 482-02-17, modified – Note 2 to entry has been added.]

3.1.3
crate
container with frame walls for holding several cells or batteries **2**

Note 1 to entry: See 5.4.2.

[SOURCE: IEC 60050-482:2004 [1], 482-05-10, modified – The word "battery" has been removed from the term, and Note 1 to entry has been added.]

3.1.4
tray
container with a base and walls for holding several cells or batteries **3**

Note 1 to entry: See 5.4.2.

[SOURCE: IEC 60050-482:2004 [1], 482-02-35, modified – The word "battery" has been removed from the tterm, and Note 1 to entry has been added.]

3.1.5
ageing factor
quantitative factor expressing the degradation in the ability of the battery, due to usage, to deliver electrical energy under specified operating conditions such as, but not limited to, operating ambient temperature, cycling considering depth of discharge (DOD), and maintenance practices (applied according to manufacturer's instructions)

3.1.6
battery module
module
group of cells connected together either in a series or parallel, or both configuration, without protective devices

Note 1 to entry: NiCd battery module does not include any hardware (e.g. fuse or electronic board). **4**

Note 2 to entry: Protective devices (e.g. temperature sensor) are part of the battery system.

3.1.7
battery system
battery
system that can include battery tray(s), battery crate(s), monobloc(s), battery module(s), electronic components/equipment and associated electromechanical connections

Note 1 to entry: Any component necessary to obtain the safety and durability of the battery system is included (e.g. battery thermal management system, BTMS)

Note 2 to entry: See 5.4.2 and 10.1.

Note 3 to entry: The battery system manufacturer can be the end user or the equipment manufacturer, in case they install for example heating/cooling systems, ventilation common to the global equipment but necessary for the battery.

Note 4 to entry: The battery system performances are derived from cell electrical characterization.

3.1.8
battery information system
electronic system collecting and analyzing battery data to provide additional information, i.e. information not necessary for battery operation

Note 1 to entry: Additional information, for example, can be parameters necessary for condition-based maintenance.

3.1.9
end user
organization which operates the battery system

Note 1 to entry: The end user is normally an organization which operates the device equipped with the battery system, unless the responsibility is delegated to a main contractor or consultant.

3.1.10
system integrator
organization which has the technical responsibility of the complete battery system and charging system

Note 1 to entry: The system integrator can be the end user or the equipment manufacturer, or none of them.

3.1.11
manufacturer
organization which has the technical responsibility for its scope of supply

Note 1 to entry: The manufacturer can be the equipment manufacturer or the system integrator of a battery system, a cell manufacturer, etc. If necessary to explicitly distinguish, "equipment manufacturer", "battery system manufacturer" or "cell manufacturer" is expressed.

3.1.12
cumulated requested service
CRS
total amount of service requested by the buyer or the end user, expressed in duration (months or years) or delivered energy in kWh, under for example representative ambient and operating conditions as expressed **5**

Note 1 to entry: Refer to Clause 10 and Clause 11.

3.1.13
nominal voltage
suitable approximate value of the voltage used to designate or identify a cell or a battery

Note 1 to entry: The nominal voltage of a vented nickel-cadmium rechargeable single cell is 1,2 V.

Note 2 to entry: The nominal voltage of a battery of n series connected cells is equal to n times the nominal voltage of a single cell.

[SOURCE: IEC 60050-482:2004 [1], 482-03-31, modified – Replacement of the words "a battery or an electrochemical system" by "or a battery" and addition of Notes 1 and 2 to entry.]

3.1.14
discharge voltage
~~**closed circuit voltage**~~
~~DEPRECATED: on load voltage~~
<cell or battery> voltage between the terminals of a cell or battery when being discharged

[SOURCE: IEC 60050-482:2004 [1], 482-03-28, modified – The admitted and deprecated terms have been removed.]

3.1.15
rated capacity
capacity value of a cell or battery determined under specified conditions and declared by the manufacturer

Note 1 to entry: The rated capacity is the quantity of electricity C_5 Ah (ampere-hours) declared by the manufacturer which a single cell can deliver during a 5 h period when charging, storing and discharging under the conditions specified in 7.3.2.

[SOURCE: IEC 60050-482:2004 [1], 482-03-15, modified – Addition of the words "cell or" in the definition, and of Note 1 to entry.]

3.1.16
state of charge
SOC
remaining capacity to be discharged, normally expressed as a percentage of the cell rated capacity according to 7.3.2.2

3.1.17
state of charge at end of life
SOC at end of life
remaining capacity to be discharged at end of life, normally expressed as 70 % of the cell rated capacity **6** (3 h 30 min discharge with 7.3.2.2 conditions)

3.1.18
CCCV charge
CCCV
method of charge consisting in a charge at constant current followed by a charge at constant voltage

3.2 Symbols and abbreviated terms

BOL	beginning of life
BTMS	battery thermal management system
CCCV	constant current constant voltage
CRS	cumulated requested service
DOD	depth of discharge
EOL	end of life
NiCd	nickel-cadmium
P_c	constant power for cycling evolution
RTE	round-trip efficiency
SOC	state of charge
REP	applications with frequent and repetitive charge and discharge cycles
OND	applications with sporadic on-demand energy delivery
MOB	mobile equipment
STA	stationary equipment

4 Parameter measurement tolerances

The overall accuracy of controlled or measured values, relative to the specified or actual values, shall be within the following tolerances:

a) ±1 % for voltage;

b) ±1 % for current;

c) ±2 °C for temperature;

d) ±0,1 % for time;

e) ±1 % for capacity.

These tolerances comprise the combined accuracy of the measuring instruments, the measurement techniques used, and all other sources of error in the test procedure.

The details of the instrumentation used shall be provided in any report of results.

5 Designation and marking

5.1 Cell designation (mandatory)

Vented nickel-cadmium prismatic secondary single cells shall be designated by the letter "K" followed by a letter "L", "M", "H" or "X" which signifies

– low rate of discharge (L),
– medium rate of discharge (M),
– high rate of discharge (H), and
– very high rate of discharge (X).

NOTE 1 These types of cells are typically but not exclusively used for the following discharge rates:

a) L up to 0,5 I_t A;

b) M up to 3,5 I_t A;

c) H up to 7,0 I_t A;

d) X up to and above 7,0 I_t A.

NOTE 2 These currents are expressed as multiples of I_t A, where $I_t\text{A} = C_5\text{Ah}/1\,\text{h}$ (see IEC 61434:1996 [2]).

NOTE 3 In case the cells have internal separations but a common electrolyte, they are still considered as a single cell. 7

This group of two letters shall be followed by a group of figures indicative of the rated capacity of the cell in ampere-hours. Cells that have been tested at 20 °C and 5 °C but not at −18 °C shall carry an additional marking of T5.

EXAMPLE KH 185 or KH 185 T5

Cells tested with CCCV charges shall carry the marking of CCCV followed by the current used: for example, KH 185 P CCCV R1.

5.2 Cell designation (optional)

The additional marking ~~shall~~ can be added to the mandatory marking. When the marking would exceed the available space on the cell, this information may be omitted on the cell but shall be provided in the documentation corresponding to the cell and in the type test report, or in a shared IT system accessible to the end user based on information on the cell label (e.g. data matrix).

As an option, cells in cases of plastic material ~~shall~~ can be designated by the letter "P" after the figures (for example: KH 185 P), or in case of steel material with a letter "S".

If there is no mention concerning the marking for temperature, the cells shall have been tested at −18 °C, 5 °C and 20 °C. Cells tested at other temperatures shall carry an additional marking of "T" followed by tested temperatures. In case the cell is characterized with both low and high temperature, they shall be indicated in increasing order with a solidus separating them: for example: KH 185 P T-35/+45.

Cells tested at rapid charge shall carry the marking "R" and the value of the tested rapid charge current, expressed in multiple of I_t A: for example, KH 185 P R1.

High grade cycling cells shall carry an additional marking "C" followed by the number of cycles: for example, KH 185 P C1500.

Cells having been tested with multiple types of tests shall carry the marking for the various tests performed: for example, KH 185 P T-35/+45 CCCV R1 C1500.

5.3 Cell termination

This document does not specify cell termination.

5.4 Battery designation

5.4.1 Battery structure formulation

In case of batteries where there are cells in series with crates or modules with a different number of the same capacity cells, the detailed information is not necessary in the designation; it is a constructive information already provided in the drawing.

Cells designation according to 5.1 or 5.2 followed by the battery structure formulation describes

a) the number of cells in the minimum constitutive(s) entity(ies), and on the right side of the number, it describes their connection mode in series (S) or in parallel (P) - see Annex C, and

b) in the event that the minimum constitutive entities are connected in series or in parallel, the number of minimum constitutive entities, and on the right side of the number, it describes their connection mode in series (S) or in parallel (P) - see Annex C including some examples.

The battery designation shall include the breakdown structure of the battery. The descriptive path followed to formulate the battery is from the smallest entity to the largest one.

EXAMPLE 1 "KM130(80S)" designates a prismatic vented nickel-cadmium battery. Its rated capacity is 130 Ah with 80 cells. It is designed for a medium discharge rate.

EXAMPLE 2 "KH100((2P)84S)" designates a prismatic vented nickel-cadmium battery system. Its rated capacity is 100 Ah. It is designed for a high discharge rate.

5.4.2 Definitions of components of a battery system

In order to clarify the definitions, 5.4.2 presents practical examples.

See Figure 1 (images are examples) for the case of mobile applications.

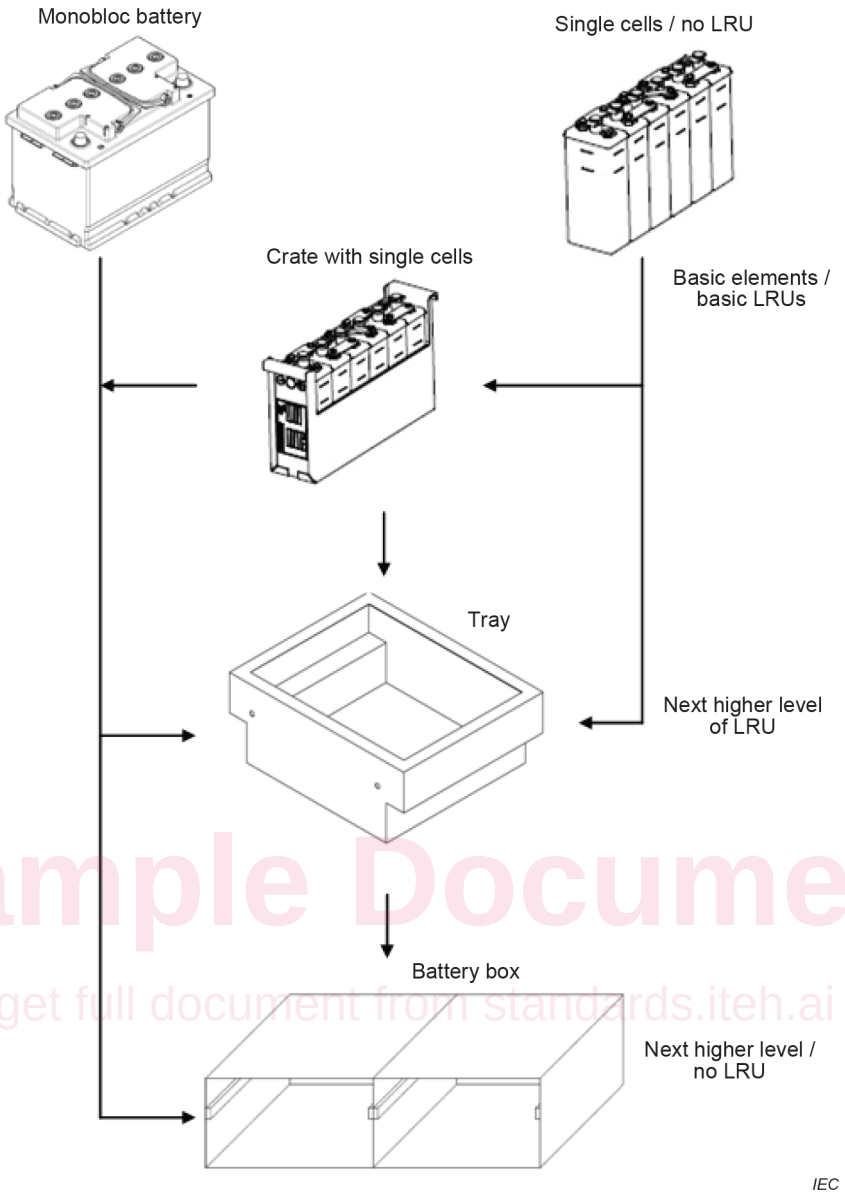

Figure 1 – Definition of cell(s), monobloc battery, crate, tray, and box - Example of mobile application

It is possible that some batteries do not include all the components showed in Figure 1, for example single cells can be installed in a tray without crates. Some battery technologies can include further components (e.g. module) if necessary.

For the case of stationary applications, see Figure 2 and Figure 3 as examples, also illustrating the structure described in Annex C.