

INTERNATIONAL STANDARD

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

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IEC Secretariat
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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

FOREWORD

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IEC 60622 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 fourth edition cancels and replaces the third edition published in 2002. This edition constitutes a technical revision.

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

- a) optional characterization of cells designed for performances at very low or very high temperature, or both;
- b) optional characterization of cells tested with **CCCV** charge (also known as IU curve);
- c) optional characterization of cells designed for rapid charge;

d) optional characterization of cells designed for high cycling.

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

Draft	Report on voting
21A/980/FDIS	21A/993/RVD

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>.

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1 Scope

IEC 60622 specifies marking, designation, dimensions, tests and requirements for sealed nickel-cadmium prismatic secondary single cells, and battery systems made of them for use in industrial applications.

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 60417, *Graphical symbols for use on equipment - 12-month subscription to regularly updated online database comprising all graphical symbols published in IEC 60417 (available from: <http://www.graphical-symbols.info/equipment>)*

3 Terms and definitions

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>

3.2

sealed cell

secondary cell which remains closed and does not release either gas or liquid when operated within the limits specified by the manufacturer

Note 1 to entry: A sealed cell can be equipped with a vent to prevent a dangerously high internal pressure and is designed to typically operate during its life in its original sealed state.

Note 2 to entry: The limits specified by the manufacturer are mainly regarding charge and temperature.

Note 3 to entry: A sealed cell does not require addition to the electrolyte.

[SOURCE: IEC 60050-482:2004 [1], 482-05-17, modified – Note 1 has been slightly revised and Note 2 and 3 to entry have been added.]

3.3

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.]

3.4

battery crate

container with frame walls for holding several cells or batteries

Note 1 to entry: See 5.4.2.

[SOURCE: IEC 60050-482:2004 [1], 482-05-10, modified – Note 1 to entry has been added.]

3.5

tray

container with a base and walls for holding several cells or batteries

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 term, and Note 1 to entry has been added.]

3.6

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 as per manufacturer's instructions)

3.7

battery module

module

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

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

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

3.8

battery system

battery

system that can include battery tray(s), battery crate(s), monobloc(s), battery module(s), electronic components or 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.

3.9

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.

3.10**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.

3.11**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.

3.12**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.

3.13**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 e.g representative ambient and operating conditions as expressed

Note 1 to entry: Refer to [Clause 10](#) and [Clause 11](#).

3.14**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.]

3.15**discharge 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 term and the deprecated terms have been deleted.]

3.16**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 "a cell or" in the definition, and of Note 1 to entry.]

3.17**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

3.18**state of charge at end of life**

SOC at end of life

remaining capacity to be discharged at end of life, normally expressed as 60 % of the cell rated capacity (3 h discharge with 7.3.2.2 conditions)

3.19**CCCV charge**

CCCV

method of charge consisting of a charge at constant current followed by a charge at constant voltage

3.20 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
LRU	line replaceable unit
MOB	mobile equipment
NiCd	nickel-cadmium
OND	applications with sporadic on-demand energy
P_c	constant power for cycling evolution
REP	applications with frequent repetitive charge and discharge cycles
RTE	round-trip efficiency
SOC	state of charge
SOH	state of health
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) $\pm 0,1$ % 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)

Sealed nickel-cadmium prismatic secondary single cells shall be designated by the letter "KC" 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),
- very high rate of discharge (X).

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

- L up to $0,5 I_t$ A,
- M up to $3,5 I_t$ A,
- H up to $7,0 I_t$ A,
- X up to and above $7,0 I_t$ A.

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

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

This group of three 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: for example: KCH 185 or KCH 185 T5.

Cells tested with CCCV charges shall carry the marking of CCCV: for example, KCH 185 P CCCV.

5.2 Cell designation (optional)

The additional marking can be added to the mandatory marking. When the marking exceeds the available space on the cell, this information can 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 be designated by the letter "P" after the figures (for example: KCH 185 P), or in case of steel materials 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: KCH 185 P T-35/+45.

Cells tested with CCCV charges shall carry the marking of CCCV: for example, KCH 185 P CCCV.

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, KCH 185 P R1.

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

Cells having been tested with multiple types of tests shall carry the marking for the various tests performed: for example, KCH 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

Modules, battery packs and battery systems shall be designated as described below.

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 is as follows:

- a) it describes 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, it describes 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 should include the breakdown structure of the battery. The descriptive path followed to formulate the battery is from the smallest entity to the largest one.

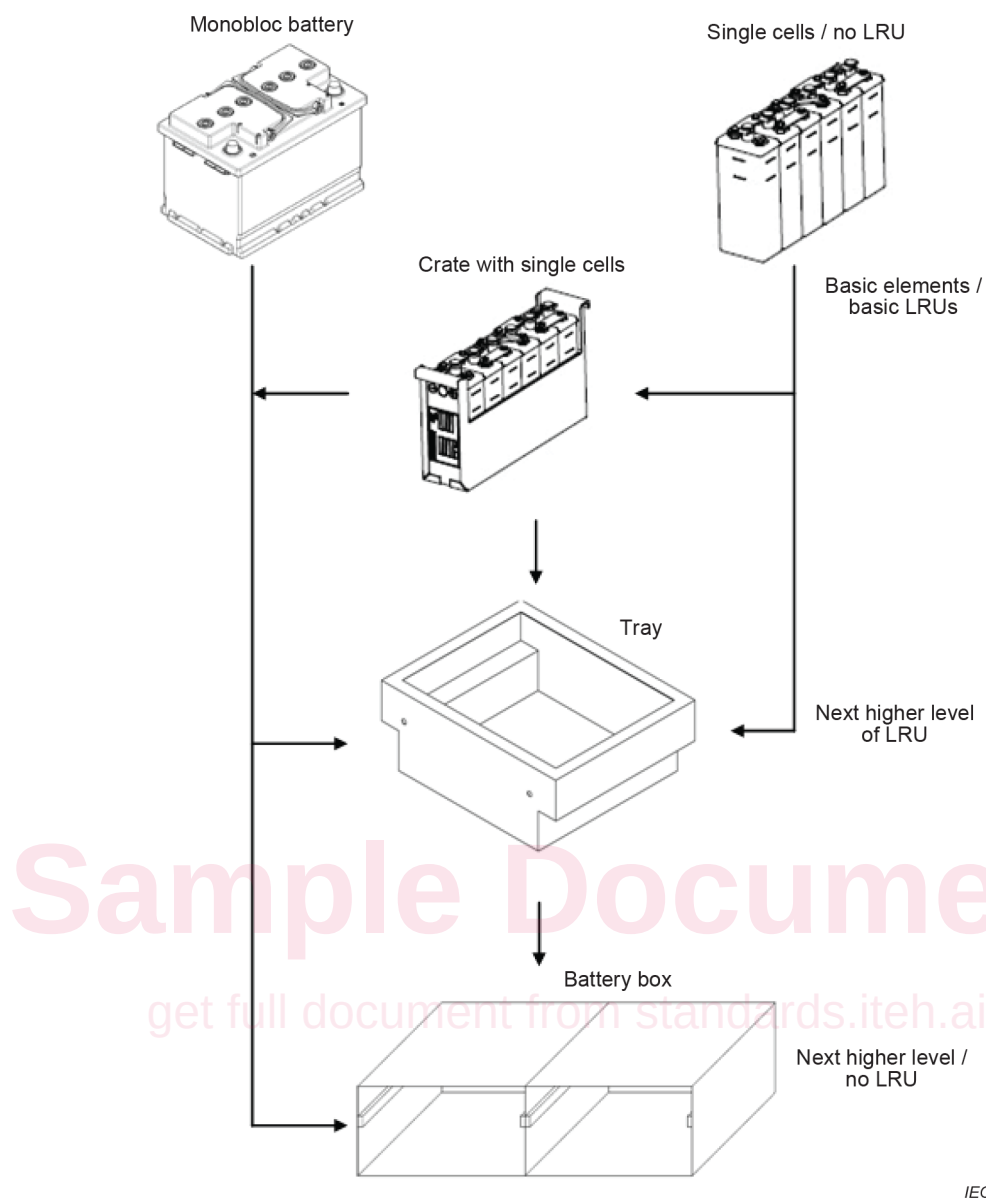
EXAMPLE 1 "KCM130(80S)" designates a prismatic sealed nickel-cadmium battery. Its rated capacity is 130 Ah with 80 cells in series. It is designed for a medium discharge rate.

EXAMPLE 2 "KCH100((2P)84S)" designates a prismatic sealed 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.



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

It is possible that some batteries will not include all of the above components, e.g. 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, with reference to [Annex C](#).