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INTERNATIONAL STANDARD

NORME INTERNATIONALE

General purpose lead-acid batteries (valve-regulated types) – Part 1: General requirements, functional characteristics – Methods of test

Batteries d'accumulateurs au plomb-acide pour usage général (types à soupapes) – Partie 1: Exigences générales et caractéristiques fonctionnelles – Méthodes d'essai

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FOREWORD

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International Standard IEC 61056-1 has been prepared by IEC technical committee 21: Secondary cells and batteries.

This third edition cancels and replaces the second edition of IEC 61056-1 published in 2002. It constitutes a technical revision.

The main changes consist in adding new battery designations and an update of the requirements like the one concerning the marking.

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

FDIS	Report on voting
21/768/FDIS	21/774/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.

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

A list of all parts of the IEC 61056 series, published under the general title *General purpose lead-acid batteries (valve-regulated types)*, can be found on the IEC website.

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

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- withdrawn,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

GENERAL PURPOSE LEAD-ACID BATTERIES (VALVE-REGULATED TYPES) –

Part 1: General requirements, functional characteristics – Methods of test

1 Scope

This Part of IEC 61056 specifies the general requirements, functional characteristics and methods of test for all general purpose lead-acid cells and batteries of the valve-regulated type :

- for either cyclic or float charge application;
- in portable equipment, for instance, incorporated in tools, toys, or in static emergency, or uninterruptible power supply and general power supplies.

The cells of this kind of lead-acid battery may either have flat-plate electrodes in prismatic containers or have spirally wound pairs of electrodes in cylindrical containers. The sulphuric acid in these cells is immobilized between the electrodes either by absorption in a micro-porous structure or in a gelled form.

NOTE The dimensions, terminals and marking of the lead-acid cells and batteries which are applied by this standard are given in IEC 61056-2.

This part of IEC 61056 does not apply for example to lead-acid cells and batteries used for

- vehicle engine starting applications (IEC 60095 series),
- traction applications (IEC 60254 series), or
- stationary applications (IEC 60896 series).

Conformance to this standard requires that statements and claims of basic performance data by the manufacturer correspond to these test procedures. The tests may also be used for type qualification.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60417, *Graphical symbols for use on equipment*

IEC 60445, *Basic and safety principles for man-machine interface, marking and identification – Identification of equipment terminals, conductor terminations and conductors*

IEC 61056-2:2012, *General purpose lead-acid batteries (valve-regulated types) – Part 2: Dimensions, terminals and marking*

3 Terms and definitions

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

3.1
general purpose lead-acid cells and batteries of the valve-regulated type
cells and batteries which provide the valve mechanism that opens when the internal pressure of the battery rises and has a function to absorb oxygen at its negative plates

3.2
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

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

3.4
nominal voltage
suitable approximate value of the voltage used to designate or identify a cell, a battery or an electrochemical system

3.5
final voltage
specified voltage of a battery at which the battery discharge is terminated

3.6
discharge current
I_{20}
discharge current for which the duration of discharge under the specified conditions is 20 h to a final voltage of 1,75 V/cell

Note 1 to entry The unit of I_{20} shall be ampere (A).

3.7
discharge current
I_1
discharge current for which the duration of discharge under the specified conditions is 1 h to a final voltage of 1,60 V/cell

Note 1 to entry The unit of I_1 shall be ampere (A).

3.8
rated capacity
C_{20}
quantity of electricity, declared by the manufacturer, which under the specified conditions can be discharged from the battery at a rate of I_{20} to a final voltage of 1,75 V/cell

Note 1 to entry The unit of C_{20} shall be ampere hour (Ah).

3.9
rated capacity
C_1
quantity of electricity, declared by the manufacturer, which under the specified conditions can be discharged from the battery at a rate of I_1 to a final voltage of 1,60 V/cell

Note 1 to entry The unit of C_1 shall be ampere hour (Ah).

3.10
actual capacity
C_a
quantity of electricity, which can be discharged from the battery at a specified rate of discharge to a specified final voltage

Note 1 to entry The unit of C_a shall be ampere hour (Ah).

3.11
DOD
depth of discharge

measure of a battery´s state of discharge, expressed in percent as the ratio between the discharged capacity and the battery´s rated capacity

3.12
high-rate discharge characteristic
the discharge characteristics of a battery when discharged at a comparatively large current relative to its capacity

3.13
gas recombination efficiency
the ratio between gas emitted from the cell and the amount of gas produced inside the cell by the float current

Note 1 to entry Amount of gas = 0,63 L/Ah*cell at normal temperature pressure.

3.14
regulating valve
a valve which operates at a certain internal pressure to exhaust gas but prevents external air from entering into the battery

3.15
charge retention
ability of a cell or battery to retain capacity on open circuit under specified conditions

3.16
deep discharge
discharge equivalent to the most portion of capacity of a battery

3.17
cyclic application
battery operation characterized by regular discharge followed by recharge

3.18
float application
battery operation where the battery is permanently connected to a d.c. constant voltage source, keeping the battery fully charged

Note 1 to entry In the case of power outage or surge loads, the battery takes over or supports the load.

4 General requirements

4.1 Construction

4.1.1 Batteries of this kind are composed of one or more cells. Multicell-batteries may be supplied either as monobloc batteries (see IEC 60050-482) or as mechanically and electrically interconnected single cells.

The number of cells connected in series in a battery is designated by the letter "n" throughout this standard.

4.1.2 Batteries shall be fitted with valves. The valve shall not allow gas (air) to enter into the cell but shall allow gas to escape from the cell at a certain internal pressure which does not lead to deformation or other damage of the cell or battery container.

4.1.3 Batteries or cells shall be designed so that neither water nor electrolyte can be added. They shall be suitable for storage and discharge in any orientation (for example, upside down) without leakage of liquid from valves and/or terminal seals. They shall also withstand storage at 20 °C ± 5 K and maximum 80 % relative humidity for one year in inverted orientation without leakage.

4.1.4 All battery components, for example, terminals, intercell connectors, containers, etc. shall be designed for current rates as specified in 5.4.

4.1.5 For charging, batteries or cells shall not be installed in any direction beyond 90 ° from the upright position.

4.2 Mechanical strength

Batteries shall be designed to withstand mechanical stresses, vibrations and shocks occurring in normal transportation, handling and use.

4.3 Designation

The batteries shall be identified by at least the following information on the surface in durable printing:

– supplier's or manufacturer's name or trade mark;
– type designation or product name;
– nominal voltage ($n \times 2{,}0$ V);
– rated capacity C_{20} (see 5.1.2);
– polarity;
– date of manufacture, its abbreviation or code;
– safety symbols according to national or international standards;
– recycling symbols (see IEC 61429).

If the values of functional characteristics or specific requirements are different from the values specified in Clause 5 below, these values shall be supplied with the battery or mentioned in the battery instructions.

Additional data such as recommended charging voltage U_c or charging current I_c, capacity at other discharge rates, battery weight, etc. shall be supplied with the battery in a suitable way.

4.4 Marking of polarity

The battery shall carry a marking of polarity of both terminals by the plus symbol + (60417-5005: Positive polarity) and the minus symbol – (60417-5006: Negative polarity) on the lid adjacent to the terminals. In the case where the battery carries a marking of polarity of both terminals by colour it shall be as specified in IEC 60446.The positive terminal shall be identified with red and the negative terminal with black/blue colour.

5 Functional characteristics and specific requirements

5.1 Capacity

5.1.1 The essential characteristic of a cell or battery is its capacity for the storage of electric energy. This capacity, expressed in ampere-hours (Ah), varies with the conditions of use (discharge current, end of discharge voltage, temperature).

5.1.2 The rated capacity C_{20} is a reference value, to be declared by the manufacturer, which is valid for the discharge of a new battery at the reference temperature of 25 °C and a discharge current:

$$I_{20} = \frac{C_{20}}{20} \quad (1)$$

in which discharge time is 20 h, to a final voltage $U_f = n \times 1{,}75$ V and

where

I_{20} is expressed in amperes, and

C_{20} is expressed in ampere-hours.

5.1.3 The rated capacity C_1 is a reference value, optionally to be declared by the manufacturer, valid for the discharge at 25 °C and a discharge current:

$$I_1 = \frac{C_1}{1} \quad (2)$$

in which discharge time is 1 h, to a final voltage $U_f = n \times 1{,}60$ V and

where

I_1 is expressed in amperes, and

C_1 is expressed in ampere-hours.

5.1.4 The actual capacity C_a shall be determined by discharging a fully charged battery (see 6.1.3) with constant current I_{20} in accordance with 7.2. The resultant value shall be used for comparison with the reference value C_{20} or for control of the state of a battery after long periods of service.

5.1.5 The determination of the actual capacity C_a in accordance with 7.2 may also be used for comparison with particular performance data (for example, C_1) indicated by the supplier. In this case, the current I_{20} shall be substituted by the particular current corresponding to the relevant performance data.

5.2 Endurance

5.2.1 Cycle service endurance

The cycle service endurance represents the ability of a battery to perform repeated discharge/recharge cycles. This performance shall be tested by a series of cycles under specified conditions with 50 % DOD at I = 3,4 × I_{20} or at I = 5 × I_{20} after which the actual capacity of the battery shall be not less than 50 % of the nominal capacity in ampere-hours (see 7.4). The number of cycles shall be not less than 200.

5.2.2 Float service endurance

The float service endurance represents the life performance of a battery in float application. The endurance determined in the test 7.5 and 7.6 shall not be less than two years at 25 °C or 260 days at 40 °C.

5.3 Charge retention

The charge retention is defined as that part of the actual capacity C_a on discharge with I_{20}, expressed as a percentage, which can be discharged with the same current I_{20} after storage on open circuit under specified conditions of temperature and time (see 7.7). Those conditions provided, the retained charge shall be not less than 75 % of C_a.

5.4 Maximum permissible current

Batteries shall be suitable to maintain a current of I_m = 40 × I_{20} for 300 s and of I_h = 300 × I_{20} for 5 s, unless otherwise specified by the manufacturer, without distortion or other damage to the battery (see 7.8).

5.5 Charge acceptance after deep discharge

Batteries according to this part may be subject to very deep discharge by an unintentional connection to a load over long periods of time. They shall then be rechargeable with constant voltage U_c (for U_c see 6.1.3) within a period of 48 h (see 7.9).

5.6 High-rate discharge characteristics

The high-rate discharge characteristic of a bettery is its capability to be discharged with high current relative to its capacity. During discharge with 20 × I_{20}, the discharge time shall reach 27 min or more within 5 cycles of charging and discharging.

5.7 Gas emission intensity

This value quantifies the escape of gas from the battery during charge with the manufacturer's recommended charging method.

When the gas emission intensity is determined during constant voltage float charging (see 7.10.1), the value G_e shall not be greater than 0,05 ml × cell^{-1} × h^{-1} × Ah^{-1}. When the