INTERNATIONAL STANDARD

IEC 60095-1

Seventh edition
2006-11

Lead-acid starter batteries –

Part 1:
General requirements and methods of test

*This **English-language** version is derived from the original **bilingual** publication by leaving out all French-language pages. Missing page numbers correspond to the French-language pages.*

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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LEAD-ACID STARTER BATTERIES –

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FOREWORD

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International Standard IEC 60095-1 has been prepared by IEC technical committee 21: Secondary cells and batteries.

This seventh edition cancels and replaces the sixth edition published in 2000. It constitutes a complete technical revision. In this edition, most of the tests and requirements have been modified, including mainly: the charge acceptance test, the cranking performance test, the charge retention test and the endurance test.

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

FDIS	Report on voting
21/644/FDIS	21/649/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.

IEC 60095 consists of the following parts, under the general title *Lead-acid starter batteries:*

Part 1: General requirements and methods of test

Part 2: Dimensions of batteries and dimensions and marking of terminals

Part 4: Dimensions of batteries for heavy trucks

The committee has decided that the contents of this publication will remain unchanged until the maintenance result 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- withdrawn;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.

LEAD-ACID STARTER BATTERIES –

Part 1: General requirements and methods of test

1 Scope

This part of IEC 60095 is applicable to lead-acid batteries with a nominal voltage of 12 V, used primarily as a power source for the starting of internal combustion engines, lighting and for auxiliary equipment of internal combustion engine vehicles. These batteries are commonly called "starter batteries".

This standard is not applicable to batteries for other purposes, such as the starting of railcar internal combustion engines.

This standard specifies:

– general requirements;
– essential functional characteristics, relevant test methods and results required,

for several classes of starter batteries

– according to the general type of application;
– according to the type of product.

2 Normative references

The following referenced documents are indispensable for the application 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, *International Electrotechnical Vocabulary (IEV) – Chapter 482: Primary and secondary cells and batteries*

IEC 60095-2, *Lead-acid starter batteries – Part 2: Dimensions of batteries and dimensions and marking of terminals*

IEC 60095-4, *Lead-acid starter batteries – Part 4: Dimensions of batteries for heavy trucks*

3 Terms and definitions

For the purposes of this document, the terms and definitions of IEC 60050-482 apply.

4 Classification and designation of starter batteries – Electrolyte density and open circuit voltage

4.1 Battery classification according to application

Three classes of batteries are defined according to their application, as follows:

– Class A: batteries for starter applications with usual cycling capability and normal mechanical resistance;

– Class B: batteries for starter applications which have an important higher requirement in cycling ability and /or mechanical resistance;

– Class C: batteries for starter applications and high temperature duty.

4.2 Battery designation according to type

Batteries are designated according to their type, as follows:

– Vented (flooded) battery: a vented battery is a secondary battery having a cover provided with one or more openings through which gaseous products may escape.

– Valve-regulated (with gas recombination) battery: a valve-regulated battery is a secondary battery that is closed under normal conditions and has an arrangement that allows the escape of gas if the internal pressure exceeds a predetermined value. The battery cannot normally receive an addition of water or electrolyte. In this type of battery, the electrolyte is immobilised.

4.3 Electrolyte density and open circuit voltage

The density of the electrolyte in all fully charged vented batteries shall be in the range 1,27 kg/l to 1,30 kg/l at 25 °C unless otherwise specified by the manufacturer.

NOTE For valve-regulated batteries, the electrolyte is not accessible and, therefore, its density cannot be checked.

The open circuit voltage (OCV) at 25 °C, of fully charged batteries after a minimum 24 h stand on open circuit, shall be in the range of 12,70 V to 12,90 V for vented types and 12,80 V minimum for valve regulated types unless otherwise specified by the manufacturer.

The manufacturer shall specify the value and tolerance of the electrolyte density or OCV. If such information is not available, vented battery testing shall be carried out with a density of 1,28 kg/l ± 0,01 kg/l at 25 °C or an OCV of 12,76 V ± 0,06 V at 25 °C and valve regulated battery testing shall be carried out with a minimum OCV of 12,80 V.

5 Condition on delivery

New vented batteries may be supplied either:

– in a state ready for use, or

– in a dry-charged (or charge-conserved) state not filled with electrolyte. The density of the electrolyte to fill these batteries before use (unless otherwise recommended by the manufacturer) shall be :

1,28 kg/l ± 0,01 kg/l at 25 °C

Valve-regulated batteries are normally supplied in a state ready for use.

6 General requirements

6.1 Identification, labelling

Batteries according to this standard shall bear the following characteristics on at least the top or one of their four sides.

6.1.1 The identification of manufacturer or supplier

6.1.2 Class of battery: (IEC) A, B or C (see 4.1)

NOTE In some countries, the class is indicated by the battery numbering system. In these cases, there is no need to include the class on the label.

6.1.3 Nominal voltage: 12 V

6.1.4 Capacity: (see 7.1.2)

– either 20 hour capacity C_n (Ah),

– or reserve capacity C_{rn} (min).

NOTE In some countries, the capacity is indicated by the battery numbering system. In these cases, there is no need to include the capacity on the label.

6.1.5 Nominal cranking current: I_{cc} (A) (see 7.1.1)

6.1.6 Safety labelling

Batteries shall be marked with the six coloured symbols as described in part 1 of Annex B. However, to be in compliance with some national regulations, additional wording or special labelling can be used (for example, the safety label for North America area shown in Clause B.2).

6.1.7 Valve-regulated batteries

Valve regulated batteries shall bear special indication mentioning that the battery shall not be opened.

6.2 Marking of the polarity

The terminals shall be identified according to the requirements of IEC 60095-2 or IEC 60095-4.

6.3 Water loss designation

Vented starter batteries may be designated as "Low water loss" or "Very low water loss" according to IEC 60095-1, if they comply with the requirements of 9.5 and 9.7. If they do not comply, they are designated as "Normal".

This additional designation shall be indicated either on the battery label or in the catalogue.

NOTE Starter batteries are subject to a wide variety of operating conditions, for example temperature, overcharge voltage, etc., that have an influence on the decomposition of water from the electrolyte, regardless of internal design features. Thus, the terms "low water loss" or "very low water loss" in the sense of this standard are linked to well-defined conditions in 9.7 that do not cover the complete range of practical operating conditions.

6.4 Fastening of the battery

Where batteries are fastened to the vehicle by means of integral parts (for example, bottom ledges), these shall be in compliance with the requirements of IEC 60095-2 and 60095-4.

7 Functional characteristics

7.1 Electrical characteristics

7.1.1 *The cranking performance* is the discharge current I_{cc}, as indicated by the manufacturer, which a battery can supply according to 9.3.

7.1.2 The *capacity* of a starter battery is defined for a temperature of 25 °C ± 2 °C.

It may be indicated by the manufacturer as either:

– nominal 20 hour capacity C_n , or

– nominal reserve capacity $C_{r,n}$.

The 20 hour nominal capacity C_n is the electric charge in ampere hours (Ah) that a battery can supply with a current:

$$I_n = \frac{C_n}{20} \text{ (A)}$$

until the terminal voltage falls to U_f = 10,50 V.

The effective 20 hour capacity C_e shall be determined by discharging a battery with constant current I_n to U_f = 10,50 V (see 9.1). The resultant discharge time, in hours, is used for the verification of C_n.

The nominal reserve capacity $C_{r,n}$ is the period of time (in minutes) for which a battery can maintain a discharge current of 25 A to a cut-off voltage U_f = 10,50 V.

The effective reserve capacity $C_{r,e}$ shall be determined by discharging a battery with the constant current I = 25 A to U_f = 10,50 V (see 9.2). The resultant discharge time, in minutes, is used for the verification of $C_{r,n}$.

NOTE For the correlation (relationship) of C_n and $C_{r,n}$, see Annex A.

7.1.3 The *charge acceptance* is expressed as the current I_{ca} which a partially discharged battery accepts at 0 °C and a constant voltage of 14,40 V

7.1.4 The *charge retention* is defined as the cold cranking performance of the charged and filled battery after storage on open circuit under defined conditions of temperature and time (see 9.5).

7.1.5 *Endurance test consists of two parts:*

7.1.5.1 *Corrosion test* represents the ability of a battery to perform repeated overcharge/storage periods (see 9.6).