

# INTERNATIONAL STANDARD



Lead-acid starter batteries – **STANDARD PREVIEW**  
Part 1: General requirements and methods of test  
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INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

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ICS 29.220.20; 43.040.10

ISBN 978-2-8322-6250-4

**Warning! Make sure that you obtained this publication from an authorized distributor.**

## CONTENTS

FOREWORD.....	4
1 Scope.....	6
2 Normative references .....	6
3 Terms and definitions .....	6
4 Designation of starter batteries – Electrolyte density and open circuit voltage .....	7
4.1 Designation according to type .....	7
4.2 Dry-charged batteries .....	7
4.3 Electrolyte density and open circuit voltage.....	8
5 Condition on delivery .....	8
6 General requirements .....	8
6.1 Identification, labelling .....	8
6.1.1 General .....	8
6.1.2 The identification of manufacturer or supplier .....	8
6.1.3 Nominal voltage: 12 V.....	8
6.1.4 Capacity or reserve capacity (see 7.1.2) and nominal cranking current (see 7.1.1).....	8
6.1.5 Production date code.....	9
6.1.6 Safety labelling.....	9
6.1.7 Recycling labelling.....	9
6.1.8 Valve-regulated batteries.....	9
6.2 Marking of the polarity .....	9
6.3 Fastening of the battery.....	9
7 Functional characteristics .....	10
7.1 Electrical characteristics .....	10
7.2 Mechanical characteristics .....	11
8 General test conditions .....	11
8.1 Sampling of batteries .....	11
8.2 Charging method – Definition of a fully charged battery .....	11
8.3 Test equipment.....	11
8.3.1 Measuring instruments.....	11
8.3.2 Water bath.....	12
8.3.3 Environmental chamber .....	12
8.4 Test sequence .....	12
8.4.1 Batteries filled and charged .....	12
8.4.2 Dry-charged or conserved-charge batteries .....	13
9 Tests methods .....	14
9.1 20 h capacity check $C_e$ .....	14
9.2 Reserve capacity check $RC_e$ .....	14
9.3 Cranking performance test.....	14
9.3.1 Cranking performance test – Standard temperature (–18 °C).....	14
9.3.2 Cranking performance test – Very cold climates .....	15
9.3.3 High current discharge test at low temperature .....	15
9.4 Charge acceptance test .....	16
9.5 Charge retention test .....	16
9.6 Endurance test for batteries .....	16

9.6.1	Corrosion test.....	16
9.6.2	Optional endurance cycle test for passenger car batteries – Maximum capacity 100 Ah.....	18
9.7	Water consumption test .....	19
9.8	Vibration resistance test .....	19
9.9	Electrolyte retention test .....	20
9.10	Cranking performance for dry-charged (or conserved-charge) batteries after activation .....	20
10	Requirements .....	20
Annex A (normative)	Correlation between $C_n$ and $RC_n$ .....	22
Annex B (informative)	Water consumption test – Conversion of test temperatures and test durations.....	23
B.1	General.....	23
B.2	Conversion formula.....	23
Annex C (informative)	Safety labelling .....	24
C.1	Definition of the six coloured symbols .....	24
C.2	Safety labelling – Label for North America area .....	24
Bibliography	.....	26
Figure C.1	– Symbol dimensions.....	24
Figure C.2	– Safety labelling – Label for North America area, former version (still valid) .....	25
Figure C.3	– Safety labelling – Label for North America area, new version.....	25
Table 1	– Charging method.....	11
Table 2	– Accuracy of test equipment.....	12
Table 3	– Test sequence.....	13
Table 4	– Parameters cycle test.....	17
Table 5	– Vibration resistance – Levels V1 to V3 .....	19
Table 6	– Summary of requirements .....	21
Table C.1	– Definition of safety symbols according to ISO 7010.....	24

## INTERNATIONAL ELECTROTECHNICAL COMMISSION

**LEAD-ACID STARTER BATTERIES –****Part 1: General requirements and methods of test**

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

This eighth edition cancels and replaces the seventh edition published in 2006. This edition constitutes a technical revision.

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

- a) charge acceptance test;
- b) cranking performance test;
- c) charge retention test; and
- d) endurance test added.

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

FDIS	Report on voting
21/974/FDIS	21/987/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 60095 series, published under the general title *Lead-acid starter 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.

A bilingual version of this publication may be issued at a later date.

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## 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 document is applicable to batteries for the following purposes:

- batteries for passenger cars;
- batteries for commercial and industrial vehicles.

This document is not applicable to batteries for other purposes, such as the starting of railcar internal combustion engines or for motorcycles and other power sport vehicles.

This document defines many general properties of lead-acid batteries. Single sections can be referenced in other parts of the IEC 60095 series even if the application is excluded in the scope of this document.

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This document specifies the:

- general requirements; [standards.iteh.ai/catalog/standards/sist/5b2325df-a541-4ac8-8d8f-68e22c71750b/iec-60095-1-2018](https://standards.iteh.ai/catalog/standards/sist/5b2325df-a541-4ac8-8d8f-68e22c71750b/iec-60095-1-2018)
- 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 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, *International Electrotechnical Vocabulary – 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 vehicles*

#### 3 Terms and definitions

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

#### **flooded battery**

lead-acid battery having a cover provided with one or more openings through which gaseous products may escape

### 3.2

#### **enhanced flooded battery**

##### **EFB battery**

flooded lead-acid battery with additional special design features to significantly improve the cycling capability compared to standard flooded batteries

### 3.3

#### **valve regulated lead-acid battery**

##### **VRLA battery**

lead-acid battery which is closed under normal conditions but which has an arrangement that allows the escape of gas if the internal pressure exceeds a predetermined value

Note 1 to entry: The VRLA battery cannot receive addition to the electrolyte and after activation of dry-charged VRLA.

Note 2 to entry: In VRLA batteries the electrolyte is immobilized.

### 3.4

#### **absorbent glass mat battery**

##### **AGM battery**

VRLA battery in which the electrolyte is immobilized by absorption in a glass mat

### 3.5

#### **gel battery**

VRLA battery in which the electrolyte is immobilized by fixing as a gel

## **4 Designation of starter batteries – Electrolyte density and open circuit voltage**

### **4.1 Designation according to type**

Batteries are designated according to their type, as follows:

- flooded batteries (vented);
- enhanced flooded batteries, EFB;
- valve regulated lead-acid batteries, VRLA;
  - absorbent glass mat batteries, AGM;
  - gel batteries.

### **4.2 Dry-charged batteries**

Lead-acid batteries may be supplied in a dry-charged state. Dry-charged batteries can be activated by filling with the defined electrolyte indicated by internal or external marks or according to the manufacturer's activation instructions. After activation, these batteries are ready to use.

### 4.3 Electrolyte density and open circuit voltage

The density of the electrolyte in all fully charged vented batteries shall be in the range of 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 to 13,10 V 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  $\pm$  0,01 kg/l at 25 °C or an OCV of 12,76 V  $\pm$  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  $\pm$  0,01 kg/l at 25 °C;

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

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## 6 General requirements [68e22c71750b/iec-60095-1-2018](https://standards.iteh.ai/catalog/standards/sist/5b2325df-a541-4ac8-8d8f-68e22c71750b/iec-60095-1-2018)

### 6.1 Identification, labelling

#### 6.1.1 General

Batteries complying with this document shall bear the following characteristics on at least the top or one of their four sides.

#### 6.1.2 The identification of manufacturer or supplier

The name of the manufacturer or supplier shall be indicated.

#### 6.1.3 Nominal voltage: 12 V

The nominal voltage of 12 V shall be indicated.

#### 6.1.4 Capacity or reserve capacity (see 7.1.2) and nominal cranking current (see 7.1.1)

Three options are possible for the identification and labelling of capacity (or reserve capacity) and nominal cranking current:

##### Option 1:

- 20 h capacity  $C_{20}$  (Ah);
- with nominal cranking current  $I_{cc}$  (A) (see 7.1.1 and 9.3.1) defined at  $-18$  °C with  $U_{10s} \geq 7,5$  V and  $U_{90s} \geq 6,0$  V (under  $I_{cc}/0,6$ ).

**Option 2:**

- reserve capacity  $RC$  (minutes);
- with nominal cranking current  $I_{cc}$  (A) (see 7.1.1 and 9.3.1) defined at  $-18\text{ °C}$  with  $U_{30\text{ s}} \geq 7,20\text{ V}$ .

**Option 3:**

- 20 h capacity  $C_{20}$  (Ah);
- with nominal cranking current  $I_{cc}$  (A) (see 7.1.1 and 9.3.1) defined at  $-18\text{ °C}$  with  $U_{30\text{ s}} > 7,20\text{ V}$ .

NOTE These three options are in accordance with the present use in the different areas in the world.

The preferred version is Option 1.

**6.1.5 Production date code**

Batteries shall be marked with the date of production. This can be part of a more complex code.

**6.1.6 Safety labelling**

If under national regulations, coloured safety symbols are required to be used, they should follow the design as set out in Annex C, Clause C.1.

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 Annex C, Clause C.2).

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**6.1.7 Recycling labelling**

Batteries shall be marked for separate collection and recycling, if required by local area regulations.

**6.1.8 Valve-regulated batteries**

VRLA batteries shall be marked using the term "VRLA". In addition it is recommended that VRLA batteries shall bear special indication that the battery shall not be opened.

EXAMPLE: "VRLA – Do not open"

**6.2 Marking of the polarity**

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

**6.3 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 of IEC 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 according to the option chosen (Option 1 or Option 2), which a battery can supply according to 9.3.

**7.1.2** The capacity of a starter battery is defined for a temperature of  $25\text{ °C} \pm 2\text{ °C}$ .

It may be indicated by the manufacturer as either:

- nominal 20 h capacity  $C_{20}$ , or
- nominal reserve capacity  $RC_n$ .

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

$$I_n = C_n / 20\text{ h} \quad (\text{A})$$

until the terminal voltage falls to  $U_f = 10,50\text{ V}$ .

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

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

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

NOTE For the correlation (relationship) of  $C_n$  and  $RC_n$ , see Annex A.

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

**7.1.4** The charge retention is rated by 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** The endurance test consists of two parts:

- the corrosion test represents the ability of a battery to perform repeated overcharge/storage periods (see 9.6.1.1).
- the cycling test represents the ability of a battery to perform repeated discharge/recharge cycles and long rest periods on open circuit. This ability shall be tested by a series of cycles and rest periods under specified conditions after which the cold cranking or the capacity performances shall be determined (see 9.6.1.2 or 9.6.2).