

INTERNATIONAL STANDARD

NORME INTERNATIONALE



**Lead-acid starter batteries –
Part 6: Batteries for micro-cycle applications**

**Batteries d'accumulateurs de démarrage au plomb –
Partie 6: Batteries pour applications microcycles**



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2019 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de l'IEC ou du Comité national de l'IEC du pays du demandeur. Si vous avez des questions sur le copyright de l'IEC ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de l'IEC de votre pays de résidence.

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

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

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigendum or an amendment might have been published.

IEC publications search - webstore.iec.ch/advsearchform

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee,...). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and once a month by email.

IEC Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: sales@iec.ch.

Electropedia - www.electropedia.org

The world's leading online dictionary on electrotechnology, containing more than 22 000 terminological entries in English and French, with equivalent terms in 16 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary

67 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

A propos de l'IEC

La Commission Electrotechnique Internationale (IEC) est la première organisation mondiale qui élabore et publie des Normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

A propos des publications IEC

Le contenu technique des publications IEC est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

Recherche de publications IEC - webstore.iec.ch/advsearchform

La recherche avancée permet de trouver des publications IEC en utilisant différents critères (numéro de référence, texte, comité d'études,...). Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

IEC Just Published - webstore.iec.ch/justpublished

Restez informé sur les nouvelles publications IEC. Just Published détaille les nouvelles publications parues. Disponible en ligne et une fois par mois par email.

Service Clients - webstore.iec.ch/csc

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: sales@iec.ch.

Electropedia - www.electropedia.org

Le premier dictionnaire d'électrotechnologie en ligne au monde, avec plus de 22 000 articles terminologiques en anglais et en français, ainsi que les termes équivalents dans 16 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

Glossaire IEC - std.iec.ch/glossary

67 000 entrées terminologiques électrotechniques, en anglais et en français, extraites des articles Termes et Définitions des publications IEC parues depuis 2002. Plus certaines entrées antérieures extraites des publications des CE 37, 77, 86 et CISPR de l'IEC.

INTERNATIONAL STANDARD

NORME INTERNATIONALE



**Lead-acid starter batteries –
Part 6: Batteries for micro-cycle applications**

**Batteries d'accumulateurs de démarrage au plomb –
Partie 6: Batteries pour applications microcycles**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 29.220.20

ISBN 978-2-8322-7366-1

**Warning! Make sure that you obtained this publication from an authorized distributor.
Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.**

CONTENTS

FOREWORD.....	4
1 Scope.....	6
2 Normative references	6
3 Terms, definitions, abbreviated terms and symbols.....	7
3.1 Terms and definitions.....	7
3.2 Abbreviated terms and symbols	7
4 Designation of batteries for micro-cycle applications – Electrolyte density and open circuit voltage	8
4.1 Designation according to type	8
4.2 Electrolyte density and open circuit voltage.....	8
5 Condition on delivery	8
6 General requirements	9
6.1 Identification, labelling	9
6.1.1 General	9
6.1.2 The identification of manufacturer or supplier	9
6.1.3 Nominal voltage: 12 V.....	9
6.1.4 Capacity or reserve capacity and nominal cranking current.....	9
6.1.5 Production date code	9
6.1.6 Safety labelling.....	9
6.1.7 Recycling labelling.....	9
6.1.8 Identification of start and stop.....	9
6.1.9 Valve-regulated batteries.....	9
6.2 Marking of the polarity	9
6.3 Fastening of the battery	10
7 Functional characteristics	10
7.1 Electrical characteristics	10
7.2 Mechanical characteristic	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.....	11
8.3.3 Environmental chamber	11
8.4 Test sequence	11
9 Tests methods	13
9.1 20 h capacity check C_e	13
9.2 Reserve capacity check RC_e	13
9.3 Cranking performance test.....	13
9.3.1 Cranking performance test – Standard temperature (-18 °C).....	13
9.3.2 Cranking performance test – Very cold climates	14
9.4 Charge acceptance tests	14
9.4.1 Charge acceptance 1 (at 0 °C).....	14
9.4.2 Specific charge acceptance tests for batteries for micro-cycle applications (at 25 °C).....	14
9.5 Charge retention test	19

9.6	Endurance test for batteries	19
9.6.1	Corrosion test	19
9.6.2	Cycling test 50 % DoD	19
9.6.3	Cycling test 17,5 % DoD	19
9.6.4	Micro-cycles test, start and stop cycle endurance test	20
9.7	Vibration resistance test	23
9.8	Electrolyte retention test	23
10	Requirements	23
Annex A (normative)	Specific requirements for measuring equipment capability	26
A.1	Equipment requirements for the dynamic charge acceptance test DCA (see 9.4.2, OPTION B)	26
A.2	Equipment requirements for the micro-hybrid test MHT (see 9.6.4, OPTION B)	26
Annex B (normative)	Flow chart of DCA test procedure	27
Bibliography	31
Figure 1	– Sub-phases of the DCR_{SS} part: 90 s drive phases (steps 45 to 51)	19
Figure B.1	– DCA_{pp} = DCA pulse profile	27
Figure B.2	– DCR_{SS} = DCA real world simulation with stop/start	28
Figure B.3	– Trip first part	29
Figure B.4	– Trip second part	30
Table 1	– Test/battery OPTION A	12
Table 2	– Test/battery OPTION B	13
Table 3	– DCA – Pre-cycling	15
Table 4	– DCA – Charge acceptance $qDCA$ procedure	16
Table 5	– DCA – DCA_{pp} procedure	16
Table 6	– DCA – DCR_{SS} part	18
Table 7	– Endurance 17,5 % DoD – Cycling units	20
Table 8	– Battery preparation	21
Table 9	– Micro-cycle	22
Table 10	– Check-up, after cycling	22
Table 11	– Data evaluation	23
Table 12	– Summary of requirements OPTION A	24
Table 13	– Summary of requirements OPTION B	25
Table A.1	– Equipment requirements	26
Table A.2	– Equipment requirements	26

INTERNATIONAL ELECTROTECHNICAL COMMISSION

LEAD-ACID STARTER BATTERIES –

Part 6: Batteries for micro-cycle applications

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International standard IEC 60095-6 has been prepared by IEC technical committee 21: Secondary cells and batteries.

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

FDIS	Report on voting
21/1013/FDIS	21/1018/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.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

LEAD-ACID STARTER BATTERIES –

Part 6: Batteries for micro-cycle applications

1 Scope

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

The batteries within the scope of this document are used for micro-cycle applications in vehicles which can also be called start-stop (or stop-start, idling-stop system, micro hybrid or idle-stop-and-go) applications. In cars with this special capability, the internal combustion engine is switched off during a complete vehicle stop, during idling with low speed or during idling where there is no need to support the vehicle movement by the internal combustion engine. During the phases in which the engine is switched off, most of the electric and electronic components of the car are supplied by the battery without support of the alternator. In addition, in most cases an additional regenerative braking (recuperation or regeneration of braking energy) function is installed. The batteries under these applications are stressed in a completely different way compared to classical starter batteries. Aside from these additional properties, these batteries need to crank the ICE and support the lighting and also auxiliary functions in a standard operating mode with the support of the alternator when the internal combustion engine is switched on. All batteries within the scope fulfil basic functions, which are tested under the application of IEC 60095-1.

This document specifies the general requirements and methods of test specific to lead-acid batteries used for micro-cycle applications.

This document is applicable to batteries for the following purposes:

- lead-acid batteries of the dimensions according to IEC 60095-2 for vehicles with the capability to automatically switch off the ICE during vehicle operation either in standstill or when moving ("start-stop")
- lead-acid batteries of the dimensions according to IEC 60095-2 for vehicles with start-stop applications with the capability to recover braking energy or energy from other sources.

Li-ion technology is excluded from this document.

NOTE The applicability of this document also for batteries according to IEC 60095-4 is under consideration.

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 (IEV) – Part 482: Primary and secondary cells and batteries*

IEC 60095-1:2018, *Lead-acid starter batteries – Part 1: General requirements and methods of test*