IEC 60086-6

Edition 1.0 2020-02

INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

Primary batteries –
Part 6: Guidance on environmental aspects

Piles électriques –
Partie 6: Recommandation sur les aspects liés à l'environnement

IEC 60086-6:2020-02(en-fr)

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PRIMARY BATTERIES –

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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.
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International Standard IEC 60086-6 has been prepared by IEC technical committee 35: Primary cells and batteries.

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

FDIS	Report on voting
35/1436/FDIS	35/1440/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 60086 series, published under the general title *Primary 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- withdrawn,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.

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INTRODUCTION

Every product has some effect on the environment during its manufacture, distribution, use, and disposal. These effects can range from slight to significant; they can be short-term or long-term; and they can occur at the global, regional, or local level. Provisions in battery standards can significantly influence the extent of these environmental effects.

Environmental stewardship in the battery industry embraces a multiplicity of activities, from design, manufacturing, transportation, storage, and recycling, to disposal of the batteries.

There are often questions on the applicability of regulations to batteries. This document provides guidance on regulations applicable and not applicable to batteries, as well as procedures for measuring environmental characteristics.

PRIMARY BATTERIES –

Part 6: Guidance on environmental aspects

1 Scope

This part of IEC 60086 applies to all chemistries of portable primary cells and batteries standardized in the 60086 series.

The purpose of this document is to provide guidance on the proper scientific protocols for testing the environmental performance of batteries; the symbols used to convey messages for collection, recycling, or other ideas; and the aspects and functional unit(s) to be included in assessing the environmental impact of batteries with modern life-cycle analysis techniques.

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 60086-1:2015, *Primary batteries-Part 1: General*

ASTM Standard D 93-79 or D 93-80, *Standard Test Methods for Flash Point by Pensky-Martens Closed Cup Tester*

ASTM Standard D 3278-78, *Standard Test Methods for Flash Point of Liquids by Small Scale Closed-Cup Apparatus*

United States EPA Publication SW–846, Method 1110A *"Test Methods for Evaluating Solid Waste, Physical/Chemical Methods"*

United States EPA Publication SW–846, Method 1311 *"Test Methods for Evaluating Solid Waste, Physical/Chemical Methods"*

United States EPA Publication SW–846, Method 9040C *"Test Methods for Evaluating Solid Waste, Physical/Chemical Methods"*

3 Terms and definitions

For the purposes of this document, the following terms and definitions 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
cadmium free
battery that contains less than 20 parts per million cadmium per the weight of the entire battery

3.2
environmental impact assessment (EIA)
process to determine the magnitude and significance of environmental impacts within the confines of the goals, scope, and objective defined in the life cycle assessment

3.3
end of life (EOL)
state of a product when it is finally removed from use

3.4
input fraction
mass of collected waste batteries entering the recycling process

3.5
life cycle
consecutive and interlinked stages, and all directly associated significant inputs and outputs, of a system from the extraction or exploitation of natural resources to the final disposal of all materials as irretrievable wastes or dissipated energy

3.6
mercury free
battery that contains less than 5 parts per million mercury per the weight of the entire battery

3.7
"natural" environment
(hereafter referred to as environment) attributes that affect quality of life, such as water, air, and soil quality; conservation of energy and materials; and avoidance of wastes

3.8
output fraction
mass of materials produced from the input fraction as a result of the recycling process, without undergoing further treatment, that have ceased to be waste or that will be used for their original purpose or for other purposes, but excluding energy recovery

3.9
preparation for recycling
treatment of waste batteries prior to any recycling process, which includes but is not limited to storage, handling, dismantling of battery packs, or separation of fractions that are not part of the battery itself

3.10
recycling
reprocessing in a production process of waste materials for their original purpose or other purposes, but excluding energy recovery

3.11
recyclability
property of a substance or a material and parts made thereof that makes it possible to be recycled

3.12
recycling efficiency
ratio obtained by dividing the mass of output fractions accounting for recycling by the mass of the waste batteries input fraction expressed as a percentage, to the highest degree that is technically feasible while avoiding excessive costs

3.13
toxicity
degree to which a particular substance is harmful to health

4 General considerations

4.1 Overview

This document takes into account environmental aspects and considerations as follows.

4.2 General

Attempts to address a given environmental effect might have consequences at any or all of the stages of a battery's life cycle. Nevertheless, a battery's environmental effects should be considered when standards are developed. Provisions in standards should reflect generally accepted environmental improvement strategies, including pollution prevention and resource conservation.

4.3 Intent of this document

Requirements should reflect generally accepted environmental regulations or national laws and should not reflect environmental improvement strategies of specific countries or regions.

A review of environmental aspects in battery standards should be considered when innovative technology provides environmental benefits.

Provisions in standards that are too prescriptive might stifle innovation and environmental improvements. Consideration about such negative effect is necessary for amendment of standard.

4.4 Battery selection

Whether or not the selection of the electrochemical system is considered to be one of the steps in the design of a battery, the choice of systems will have an effect on the battery's environmental impacts.

Selection of the appropriate electrochemical system for the performance requirements of the device will have an effect on the battery's environmental impact. Credible information and clear guidance will help users to make the right choices when purchasing batteries.

In some applications, the use of rechargeable batteries might offer an environmental advantage over other types of batteries as they can be recharged and reused. The use of rechargeable batteries should be considered for those applications, but the decision should address performance requirements, duty cycle, the presence of toxic or non-renewable materials in the battery, recharging facilities, and total amount of energy consumed during recharging over the lifetime of the battery, among other factors, to assure that an environmental and cost-effective advantage will be achieved.

A rechargeable battery or lithium primary battery will yield environmental benefits when used in high-drain products, e.g., electric toys, or by heavy users of portable power, regardless of device. A standard alkaline battery and carbon zinc battery will deliver a favourable environmental outcome when used in everyday devices with medium to low drains, or in case of lighter patterns of use.

4.5 Collection rate

Some laws and regulations require a minimum collection rate. The collection rate is calculated by dividing the total weight of the batteries that are collected during a calendar year by the average annual weight of batteries that were estimated to have been place on the market during the previous three calendar years.

5 Requirements and recommendations for the environment

5.1 Overview

Regulations regarding batteries have been established in various countries. The batteries placed on the market in these countries should conform to the latest respective regulations as summarized in Annex A. Annex A is not an exhaustive list of all battery related regulations. Battery producers should take local laws and regulations into account when considering:

a) Battery design;

b) The purchase of components or the selection of suppliers;

c) Quality control and analysis of components and raw materials; and

d) Marking.

5.2 General

The following applies to hazardous materials, their content limits, the preparation of batteries for analysis, and the method of analysing hazardous substances in batteries

Components such as attached terminals, lead wires, and exterior cases other than the batteries should be separately analysed and their contents confirmed. The content of each component other than the batteries can be obtained by each individual analysis or information of suppliers.

5.3 Requirements and recommendations in regards to heavy metals

a) Mercury content shall be no more than 0,000 5 % by weight

b) Lead content should be no more than 0,004 % by weight

c) Cadmium content should be no more than 0,002 % by weight

NOTE 1 Button zinc silver oxide batteries with a mercury content < 2% and button zinc air batteries with a mercury content < 2% are excluded.

NOTE 2 The above requirements only apply to the batteries specified in IEC 60086-2. Restriction of hazardous substances in batteries depends on national regulations.

Some battery chemistries do not include these hazardous substances as shown in Table 1.

Table 1 – Actual condition of hazardous substances in batteries

Letter	Type of battery (reference)	Mercury	Lead	Cadmium	Verification Testing Needed
No Letter	Carbon zinc battery	XY	XY	XY	Yes
A	Neutral electrolyte zinc air battery	XY	XY	X	Yes
B	Lithium carbon monofluoride battery	NA	NA	NA	No
C	Lithium manganese dioxide battery	NA	NA	NA	No
E	Lithium thionyl chloride battery	NA	NA	NA	No
F	Lithium iron disulphide battery	NA	NA	NA	No
G	Lithium copper oxide battery	NA	NA	NA	No
L	Alkaline battery or				
	Alkaline zinc manganese dioxide battery	XY	XY	X	Yes
	Button shape	XY	X	X	Yes
	Cylindrical shape				
P	Alkaline zinc air battery	XY	XY	X	Yes
S	Zinc silver oxide battery	XY	XY	X	Yes

Y : there may be intentional addition

X : there may be inclusion of impurity

NA : there is neither intentional addition nor inclusion of impurity

NOTE Intentional addition means the aim to give a certain function(s) to a battery by addition of certain substances

5.4 Disassembly method

5.4.1 General

The outline of the disassembly method of dry batteries (alkaline batteries and carbon zinc batteries) is described below as a preparatory process for pre-treatment (acid decomposition etc.) and measurement of substances such as Cd, Hg, and Pb.

It is possible to prepare a measurement sample by collectively processing the constituent components of the battery without sorting, however, it may cause such loss that target substances (Cd, Hg and Pb) can sublimate or cannot dissolve during sample production, and may be influenced by interference between elements during measurement. Taking into account such risk, sorting components before preparing the sample and measuring is favourable to treatment without sorting by specific components. Nevertheless, alternate methods like freezing and crushing etc. can be adopted if it is difficult to sort battery components for specific reasons.

NOTE The above is only applicable to common cylindrical battery.

5.4.2 Sorting components

The components, parts, and materials of a battery are classified into 4 categories. If metal parts are divided as finely as possible, acid dissolution and measurement become easier. Labels that can be peeled off are regarded as plastic parts, but those that are baked or painted onto metal casing are regarded as metal parts. The 4 categories are as following:

1) Cathode mass (including Electrolyte), Carbon rod
2) Anode gel (including Electrolyte), Anode zinc can
3) Plastic, Paper parts (including Separator)
4) Metal parts (Iron-Nickel series parts, Aluminium alloy parts, Copper alloy parts)

5.4.3 Outline of disassembly procedure

5.4.3.1 Alkaline batteries

Batteries should be weighed before disassembly. The parts which can be peeled off like the label etc. are removed. Regarding adhesive which is used on the outside and inside of a battery, all should be removed and treated as plastic parts. After removing, the battery is disassembled and sorted into the 4 categories. If necessary, an electrolyte soaked in separator is washed with a minimal amount of water and treated as anode gel. With or without washing, the separator is dried appropriately. In addition, electrolyte which leaked during disassembly is gathered and treated as anode gel.

All of each component, part, and material should be used for analysis (pre-process). Alternatively, a portion of them can be sampled and used for analysis (pre-process). In this case, total weight and sampled weight are measured before analysis in order to convert the analysis data to the total quantity of hazardous substances.

If a metal part is plated, the base material that has been plated is used as target for sorting. If the plating material and base material are unknown, confirmation by fluorescent X-ray analysis and sorting accordingly is recommended.

5.4.3.2 Carbon zinc batteries

Battery should be weighed before disassembly. The parts which can be peeled off like the label and insulation tube etc. are removed. Regarding paste, adhesive and so on which are used on the outside and inside of a battery, all should be removed and treated as plastic parts. After removing, the battery is disassembled by using tools etc. and sorted into the 4 categories. If necessary, an electrolyte soaked in separator is washed with a minimal amount of water and treated as cathode mass. With or without washing, the separator is dried appropriately.

All of each component, parts and materials should be used for sample preparation and analysis. Alternatively, a portion of them can be sampled and used for sample preparation and analysis. In this case, total weight and sampled weight are measured before analysis in order to convert the analysis data to the total quantity of hazardous substances.

If a metal part is plated, base material rather than the plating material should be used as a target for sorting. If the plating material and base material are unknown, confirmation by fluorescent X-ray analysis and sorting accordingly is recommended.

5.4.4 Qualifications for disassembly

Disassembly should be conducted by an instructed or skilled person.

5.5 Sample preparation and analysis method

Sample preparation and analysis for mercury, cadmium and lead should be implemented on the basis of the following standards.

IEC 62321: 2008

IEC 62321-4: 2013

IEC 62321-5: 2013

5.6 Marking

Marking requirements are given in 4.1.6 of IEC 60086-1:2015. A symbol meaning waste batteries must be brought to a collection point should be marked on battery or its packaging according to the following: