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IEC 60086-6 : 2020

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भाग 6 पर्यावरणीय पहलू पर मार्गदर्शन

Primary Batteries

Part 6 Guidance on Environmental Aspects

ICS 29.220.10

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NATIONAL FOREWORD

This Indian Standard (Part 6) which is identical to IEC 60086-6 : 2020 'Primary batteries — Part 6: Guidance on environmental aspects' issued by the International Electrotechnical Commission (IEC) was adopted by the Bureau of Indian Standards on the recommendation of the Primary Cells and Batteries Sectional Committee and approval of the Electrotechnical Division Council.

This standard is published in various parts. Other parts in this series are:

Part 4 Safety of lithium batteries
Part 5 Safety of batteries with aqueous electrolyte

The text of the IEC standard has been approved as suitable for publication as an Indian Standard without deviations. Certain conventions are, however, not identical to those used in Indian Standards. Attention is particularly drawn to the following:

a) Wherever the words 'International Standard' appears referring to this standard, they should be read as 'Indian Standard'; and

b) Comma (,) has been used as a decimal marker, while in Indian Standards the current practice is to use a point (.) as the decimal marker.

In this adopted standard, reference appears to International Standards for which Indian Standards also exist. The corresponding Indian Standards, which are to be substituted, are listed below along with their degree of equivalence for the editions indicated:

International Standard	*Corresponding Indian Standard*	*Degree of Equivalence*
IEC 60086-1 : 2015 Primary batteries — Part 1: General	IS 6303 : 2018 Primary batteries — General (*second revision*)	Modified

The Committee has reviewed the provisions of the following international standards referred in this adopted standard and decided that they are acceptable for use in conjunction with this standard.

International Standard	*Title*
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''

Only English language text has been retained while adopting it in this Indian Standard, and as such the page numbers given here are not the same as in the International Standard.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated expressing the result of a test, shall be rounded off in accordance with IS 2 : 2022 'Rules for rounding off numerical values (*second revision*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

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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.

Indian Standards

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:

a) Where collection and recycling laws or regulations exist, batteries should be marked with the symbol shown in Figure 1.

b) In countries or regions where a different symbol is required, batteries should be marked with the required symbol.

c) In countries or regions without a required battery symbol, this symbol does not mean bringing waste batteries to a collection point is obligated.

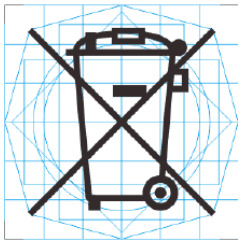

Figure 1 – Crossed-out wheeled bin

NOTE 1 Refer to Annex II of Directive 2006/66/EC of the European parliament and of the council of 6 September 2006.

NOTE 2 The URL for the official symbol is http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32006L0066

6 Disposal of battery

6.1 General

Primary batteries meeting the requirements of 5.2 are not a threat to the environment during normal use and waste management. Batteries should be disposed of in accordance with local laws and regulations.

NOTE If collected, the United States Department of Transportation in interpretation reference number 09-0150 concluded that carbon zinc batteries 6V and less and alkaline batteries 9V and less do not need terminal protection and are not subject to regulation as they do not pose an unreasonable risk in transportation.

6.2 Confirmation of characteristics of hazardous waste

6.2.1 General

Primary batteries including alkaline batteries and carbon zinc batteries are not a threat to the environment during normal use and waste management as they do not meet the criteria to be considered a hazardous waste as outlined below. Generally, if waste does not meet any of the four criteria of toxicity, ignitability, reactivity, and corrosivity, then the waste is not considered a hazardous waste.

6.2.2 Toxicity

Toxicity is defined through the Toxicity Characteristic Leaching Procedure (TCLP) test procedure. The TCLP determines whether materials known to be harmful to human health or the environment can leach into groundwater from landfills. A generally accepted test method for determining toxicity is United States EPA Publication SW-846, Method 1311.

6.2.3 Ignitability

A solid waste exhibits the characteristic of ignitability if a representative sample of the waste has any of the following properties:

a) It is a liquid other than an aqueous solution containing less than 24 % alcohol by volume and has flash point less than 60°C, as determined by a Pensky-Martens Closed Cup Tester, using the test method specified in ASTM Standard D 93-79 or D 93-80, or a Setaflash Closed Cup Tester, using the test method specified in ASTM Standard D 3278-78.

b) It is not a liquid and is capable, under standard temperature and pressure, of causing fire through friction, absorption of moisture, or spontaneous chemical changes and, when ignited, burns so vigorously and persistently that it creates a hazard.

c) It is an ignitable compressed gas.

Under standard temperature and pressure conditions, batteries will not cause a fire through friction, absorption of moisture, or spontaneous chemical changes.

6.2.4 Reactivity

A solid waste exhibits the characteristic of reactivity if a representative sample of the waste has any of the following properties:

a) It is normally unstable and readily undergoes violent change without detonating.

b) It reacts violently with water.

c) It forms potentially explosive mixtures with water.

d) When mixed with water, it generates toxic gases, vapours, or fumes in a quantity sufficient to present a danger to human health or the environment.

e) It is a cyanide or sulphide bearing waste which, when exposed to pH conditions between 2 and 12,5, can generate toxic gases, vapours, or fumes in a quantity sufficient to present a danger to human health or the environment.

f) It is capable of detonation or explosive reaction if it is subjected to a strong initiating source or if heated under confinement.

g) It is readily capable of detonation or explosive decomposition or reaction at standard temperature and pressure.

h) It is a forbidden explosive, as defined in United States 49 CFR 173.54, or is a Division 1.1, 1.2, or 1.3 explosive, as defined in Unites States 49 CFR 173.50 and 173.53.

Batteries contain no sulphides or cyanides, and they do not meet any other reactivity criteria, including “reacts violently with water.”

6.2.5 Corrosivity

A solid waste exhibits the characteristic of corrosivity if a representative sample of the waste has either of the following properties:

a) It is aqueous and has a pH less than or equal to 2 or greater than or equal to 12,5, as determined by a pH meter using Method 9040C in United States EPA Publication SW–846.

b) It is a liquid and corrodes steel (SAE 1020) at a rate greater than 6,35 mm per year at a test temperature of 55 °C, as determined by Method 1110A in United States EPA Publication SW–846.

Batteries are a solid waste, not a liquid waste. This precludes batteries from being corrosive, since a corrosive waste, by definition, must be liquid.

6.3 Control of hazardous waste

If hazardous material content is confirmed, relevant regulations shall be complied with. Refer to Annex E as informative regulation.

7 Environmental considerations

7.1 General

Every product has some effect on the environment, occurring at all stages of the product's life cycle. Consideration of environmental impacts from raw material production, manufacturing, consumption, and collection of waste is recommended to limit the effects of batteries on the environment. Matters and approaches to be considered generally are described in ISO Guide 64:2008 Clause 4.

7.2 Environmental assessment

7.2.1 General

Environmental impact assessments are recommended during the design of batteries. These assessments should include the following hierarchy of waste management principles.

7.2.2 Reduction

Batteries should be designed to reduce potential toxicity impacts and consumption of non-renewable resources.

7.2.3 Reuse

The opportunity to reuse materials should be considered. Examples include the recovery and reuse of products (e.g., electronic subassemblies, semiconductor devices, and safety devices, for example), which are physically combined with batteries. It is not possible to effectively and safely reuse batteries that are collected. The resale and reuse of primary batteries after they have been originally placed on the market should not be encouraged as this will lead to quality and safety problems.

7.2.4 Recycling

7.2.4.1 General

The opportunity for recycling can be increased by the design of batteries and by the development of more cost- and energy-efficient recycling technologies. Battery design can affect the recyclability of batteries through the selection of materials that are compatible with recycling processes, as well as by form factors that facilitate separation of parts and materials.

Recycling efficiency

If recycling efficiency is to be evaluated, the recycling efficiency of a process is calculated simply given as the following theoretical formula:

$$R_E = \sum m_{output} / m_{input} \times 100[mass\%]$$

Where:

R_E calculated recycling efficiency of a recycling process [in mass %]

m_{output} the mass of output fractions accounting for recycling per calendar year

m_{input} the mass of input fractions entering the battery recycling process per calendar year

NOTE This formula shows the concept of calculating the recycling efficiency. Only the recycler can calculate the actual recycling efficiency.

The recycling efficiency is calculated on the basis of the overall chemical composition (at elemental/compound level) of the input and output fractions. The following applies in respect to the input fraction:

a) recyclers shall determine the share of different types of waste batteries present in an input fraction by conducting a sorting analysis of the fraction (by continuous or representative sampling);
b) the chemical composition of each type of waste battery present in the input fraction is determined on the basis of the chemical composition of new batteries when placed on the market, or available data of recyclers, or on information provided by the battery producers;
c) recyclers shall determine the overall chemical composition of the input fraction by applying chemical composition analysis to the types of batteries present in the input fraction.

Emissions to the atmosphere are not accounted for the recycling efficiency.

The mass of output fractions accounting for recycling is the mass, on a dry weight basis, of the elements or compounds contained in fractions resulting from the recycling of waste batteries per calendar year [in tons]. The following may be accounted for output fractions:

a) the carbon that is actually used as a reducing agent or that is a component of an output fraction of the recycling process, if it results from the input waste batteries, on the condition that it is certified by an independent scientific authority and made publicly available. The carbon that is used for energy recovery is not accounted for the recycling efficiency.
b) the oxygen, used as an oxidizing agent, if it results from the input waste batteries and if it is a component of an output fraction of the recycling process. The oxygen coming from the atmosphere is not accounted for the recycling efficiency.
c) battery materials contained in slag suitable and used for recycling purposes other than landfill construction or backfilling operations, provided that this is in line with national requirements.

The mass of input fractions entering the battery recycling process is the mass of collected waste batteries on a dry weight basis entering the recycling process per calendar year [in tons], including:

a) fluids and acids,
b) the mass of external jacket of waste batteries,

and excluding:

the mass of outer casings belonging to battery packs.

7.2.4.2 Recommendation

A recycling process should achieve a minimum recycling efficiency of 50 % by average weight.

7.2.5 Raw material usage

Regulations regarding batteries have been established in several countries and they restrict the manufacturing, and placing on the market of batteries that contain banned substances. Taking into account relevant regulations is necessary when choosing raw materials for battery production. (See Annex A)

7.2.6 Manufacturing

Batteries intended for use in most consumer electronic appliances are mass produced and utilize highly automated manufacturing and assembly processes. Manufacturing feedback to the battery designer during the initial design stage might result in significant environmental improvement opportunities in product and process.

Impact assessments of such facilities might consider:

a) Energy and services consumption for each manufacturing stage with a comparison to previous processes;
b) Physical and chemical emissions from manufacturing with opportunities for their abatement, control, or elimination;
c) Identification of all process manufacturing waste streams (water, air) with expected concentrations and flow rates;
d) A listing of all materials used in the process including:
    1) Those materials to be reclaimed or recycled;
    2) Those materials requiring disposal, with plans for their disposal/reduction.

7.3 Packaging considerations

7.3.1 General

Batteries have stored energy (i.e. capacity), however knowing the remaining capacity within a battery is not possible without specific laboratory measurements. If the battery is short circuited, crushed or opened there is a safety risk, such as leakage, heating, or venting.

Packaging is a fully integrated component of the product and cannot be considered separately. Proper packaging is also directly related to the protection from these risks during transportation and storage.

It is therefore important to understand the added value that packaging offers.

7.3.2 Maintain safety and quality

For the best consumer experience protection should be taken:

i) From short circuit
ii) From crushing of cells
iii) Impact of package drop

7.3.3 Convey required information that is both regulated and voluntary

i) Safety warnings
ii) Manufacture contact information
iii) Product details (chemistry, type, etc.)
iv) Instruction for proper use

8 Identifying product environmental aspects using a systematic approach

Article 5 of ISO Guide 64:2008 is helpful tool for identifying product environmental aspects by using the Environmental checklist.

9 Life cycle assessment

Life cycle assessment should be done according to the guidelines outlined in ISO 14040.

When life cycle assessment of battery components and raw materials is conducted, official inventory data can be used.

Annex A
(informative)

Battery specific laws and regulations

A.1 General

Laws and regulations regarding batteries have been established in various regions, countries states and provinces, and this document lists those requirements. Typical laws or regulations, their URLs, and their key aspects are listed below. The list of laws and regulations in this annex should relate to chemical bans, and/or collection and recycling of primary batteries listed in the IEC 60086 series.

NOTE Annex A is based on the most recent regulations at the time of publication; however some may have been since updated. This information is intended to be used as a reference.

A.2 Minamata Convention on Mercury

Recognizing that mercury is a chemical of global concern owing to its long-range atmospheric transport, its persistence in the environment once anthropogenically introduced, its ability to bioaccumulate in ecosystems and its significant negative effects on human health and the environment. As a global approach, for the purpose of protection of human health and environment from anthropogenic emissions and releases of mercury and mercury compounds, the “Minamata Convention on Mercury” was adopted on October 2013 and entered into force on August 16, 2017.

Article 4 of the Minamata Convention states that Each Party shall not allow, by taking appropriate measures, the manufacture, import or export of mercury-added products listed in Part I of Annex A after the phase-out date specified for those products, except where an exclusion is specified in Annex A or the Party has a registered exemption pursuant to Article 6, and actual legislation will be implemented by each party. Mercury-added products and phase-out date is as shown in Table A.1.

Table A.1 – Products subject to Article 4, paragraph 1

Mercury-added products	Date after which the manufacture, import or export of the product shall not be allowed (phase-out date)
Batteries, except for button zinc silver oxide batteries with a mercury content < 2 % and button zinc air batteries with a mercury content < 2 %	2020

A.3 Africa – Tunisia

Order of the Minister of Industry and Trade dated 14 November 2016, related to non-rechargeable primary batteries.

The production, marketing and import of batteries containing more than 0,000 5 % by weight of mercury or more than 0,002 % by weight of cadmium, including in the case where such batteries are incorporated in appliances, is prohibited. This prohibition does not apply to "button" type batteries or batteries composed of "button" type cells containing not more than 2 % by weight of mercury.

This prohibition does not apply to batteries intended for use in:

– Emergency and alarm systems, including security lighting,
– Medical equipment,
– Wireless power tools.

http://www.legislation.tn/fr/detailtexte/Arr%C3%AAt%C3%A9-num-2016-5805-du-14-11-2016-jort-2017-003__2017003058054?shorten=bJqD

A.4 Asia

A.4.1 China

China RoHS 2: Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Products

http://www.miit.gov.cn/n1146285/n1146352/n3054355/n3057254/n3057264/c4608532/content.html

Substances and restriction:

Lead, mercury, Hexavalent chrome, PBB, PBDE: 1000 ppm

Cadmium: 100 ppm

Effective from July 1, 2016

Step 1: Self-declaration of manufacturers/suppliers

Step 2: EEP qualification management regime (pending)

Chinese mandatory standards: GB 24427 and GB 24428 (see Table A.2 and Table A.3)

Table A.2 – GB 24428-2009

Battery type	Designation	Limitation of Mercury content (mg/g)	
		No Mercury	Mercury contained
Silver oxide button batteries	SR62, SR63, SR65, SR64, SR60, SR67, SR66, SR58, SR68, SR59, SR69, SR41, SR57, SR55, SR48, SR56, SR54, SR42, SR43, SR44	≦ 0,005	≦ 20
	SR516, SR521, SR527, SR614, SR616, SR621, SR626, SR712, SR714, SR716, SR721, SR726, SR731, SR736, SR754, SR916, SR920, SR927, SR936, SR1126, SR1130, SR1136, SR1142, SR1154	≦ 0,005	≦ 20
Zinc air button batteries	PR70, PR41, PR48, PR43, PR44	≦ 0,005	≦ 20
Alkaline manganese button batteries	LR9, LR53, LR41, LR55, LR54, LR43, LR44	≦ 0,005	≦ 20

Table A.3 – GB 24427-2009

Battery type	Designation	Limitation of Mercury, Cadmium and Lead contents (µg/g)			
		Mercury content		Cadmium	Lead
		Low Mercury	No Mercury		
Alkaline manganese batteries	LR8D425, LR1, LR03, LR6, LR14, LR20, 3LR12, 4LR61, 4LR25X, 4LR25-2, 6LR61	-	≦ 1	≦ 20	≦ 40
Non alkaline manganese batteries (Carbon zinc)	R1, R03, R6P, R6S, R14P, R14S, R20P, R20S, R40, 2R10, 3R12P, 3R12S, 4R25X, 4R25Y, 4R25-2, S4, 6F22, 6F100	≦ 250	≦ 1	≦ 200	≦ 2 000

A.4.2 Chinese Taiwan (Province of China)

China Taiwan's competent department for the environment, announcement No.0930006567

http://recycle1.epa.gov.tw/sys/business/doc/rule/0930006567.htm

This symbol (see Figure A.1) is based on the URL shown below:

https://oaout.epa.gov.tw/law/LawContent.aspx?id=GL006483#lawmenu

https://hwms.epa.gov.tw/dispPageBox/getFile/Get.aspx?FileLocation=PJ-EPATW%5cFiles%5c&FileName=559.zip&ReName=Regulation

Figure A.1 – Chinese Taiwan (Province of China) collection symbol

Announcement of revised law No. 1040016236 about "Restriction of manufacturing, import and sales of battery" (see Table A.4)

Table A.4 – Target and restriction (Chinese Taiwan Province of China)

Target	Restriction	Marking
1) Cylindrical a) Carbon zinc battery b) Alkaline battery	Hg ≦ 1 ppm Cd ≦ 20 ppm	Registry number is given by administration of local authority after application of documents. Registry number shall be marked on minimum packaging of battery, or outer carton of equipment.
2) Button a) Alkaline battery b) Silver oxide battery c) Mercury oxide battery	Hg ≦ 5 ppm Cd ≦ 20 ppm	

A.4.3 Japan

Act on Preventing Environmental Pollution of Mercury (see Table A.5)

https://elaws.e-gov.go.jp/search/elawsSearch/elaws_search/lsg0500/detail?lawId=427AC0000000042

Table A.5 – Target and restriction of Mercury (Japan)

Target	Restriction	Enforcement date
Silver oxide button cell	Hg < 1%	Jan. 1, 2018
Zinc air button cell	Hg < 2%	Jan. 1, 2018
Alkaline button cell	No mercury	Dec. 31, 2020
All battery other than above	No mercury	Jan. 1, 2018

A.4.4 Korea, Republic of

Executive order No.26088, 2015.2.3 (Act on the promotion of saving and recycling of resources)

http://www.law.go.kr/LSW/lsInfoP.do?lsiSeq=168120&joNo=000100#J1:0

Appendix 6.4 Target and recycle fee

Target Recycle fee

Mercury oxide battery 39,6 won /g

Silver oxide battery 35,5 won /g

Nickel cadmium battery 0,78 won /g

Lithium primary battery 0,80 won /g

Alkaline battery/ Carbon zinc battery 0,35 won /g

Nickel-MH battery 0,16 won /g

Act No.13859 (Electric and household goods safety management Act)

https://www.google.co.jp/url?sa=t&rct=j&q=&esrc=s&source=web&cd=3&cad=rja&uact=8&ved=0ahUKEwjn24vJqLfUAhWGebwKHd7-C6gQFgg2MAI&url=http%3A%2F%2Flaw.go.kr%2FlsInfoP.do%3FlsiSeq%3D180398&usg=AFQjCNGh2jNovOEzt8LiAPIunqZvegF9_A

The below URL is a reference of KC mark logo (see Figure A.2):

http://www.summitdata.com/Documents/Changed_KCC_Guide.pdf

Figure A.2 – The symbol of KC mark

A.5 Europe

A.5.1 EU

2006/66/EC, directive (Battery directive)

http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32006L0066

Member States shall prohibit the placing on the market of:

a) (a) all batteries or accumulators, whether or not incorporated into appliances, that contain more than 0,000 5 % of mercury by weight; and
b) portable batteries or accumulators, including those incorporated into appliances, that contain more than 0,002 % of cadmium by weight.

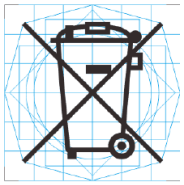

Figure A.3 – Crossed-out wheeled bin

The symbol shown in Figure A.3 is according to Annex II of 2006/66/EC.

1907/2006/EC, REACH

REACH addresses the production and use of chemical substances and their potential impacts on human health or the environment. REACH requires all companies manufacturing or importing chemical substances into the European Union in quantities of one ton or more per year to register these substances with the European Chemicals Agency (ECHA).

REACH also regulates substances that are of particular concern because they may have very serious effects on human health or the environment. These substances are listed on the “Candidate List of Substances of Very High Concern for Authorization” (SVHC), Annex XIV. If a substance listed on the candidate list above a concentration of 0,1 % by weight is contained in articles, this triggers additional information and notification obligations for companies producing, importing, and supplying these articles.

Batteries are not included as an obligation in “Registration and authorization of substances contained in article” from article 7 of the REACH regulations. This is explained in detail in Tables 6, 8, and 9 of appendix 1 of “Guidance on requirements for substances in articles Version 4.0 – June 2017” from ECHA. Also, batteries are excluded as an obligation in “Requirement of Safety data sheet” for the same reasons.

Articles applicable to batteries are “Duty to communicate information on substances in articles”, article 33, and related articles. Batteries manufactured or assembled in the EU are subjected to the requirements of article 67 regarding substances listed in annex XVII.

A.5.2 Norway

A set of laws applicable to the battery directive are included in the below law.

Regulations on recycling and treatment of waste: Forskrift om gjenvinning og behandling av avfall

Chapter 3. Discarded batteries: Kapittel 3. Kasserte batterier

http://weee-europe.com/files/pdf-2016/NO_Batt-Forskrif-Kapittel-3-989_2012.pdf

A.5.3 Switzerland

A set of laws applicable to the battery directive are included in the below law.

Ordinance on the Reduction of Risks relating to the Use of Certain Particularly Dangerous Substances, Preparations and Articles. (English)

https://www.admin.ch/opc/en/classified-compilation/20021520/index.html

A.6 Latin America

A.6.1 Argentina

Law No.26.184: Portable electric energy Act

Ley No. 26.184, ENERGIA ELECTRICA PORTATIL

https://www.argentina.gob.ar/normativa/nacional/ley-26184-123408/texto

Scope: Cylindrical or non-round shape Alkaline battery and Zinc carbon battery

Restriction:

Hg: 0,000 5 %

Cd: 0,015 %

Pb: 0,200 %

A.6.2 Brazil

CONAMA resolution No.401 of Nov.4, 2008

RESOLUÇÃO CONAMA n° 401, de 4 de novembro de 2008

http://www.mma.gov.br/port/conama/legislacao/CONAMA_RES_CONS_2008_401.pdf

a) Scope: Primary battery, Secondary battery
b) Restriction:
    1) Alkaline battery, Carbon zinc battery
        Hg: 0,000 5 % (Button cell or smaller than R03: 2,0 %)
        Cd: 0,002 %
        Pb: 0,1 %
    2) Lead acid battery
        Hg: 0,005 %
        Cd: 0,010 %
c) Marking (the below symbols are listed in Annex 1 of this law)
    1) Alkaline battery, Carbon zinc battery

The symbols shown in Figure A.4 are listed in Annex 3 of RESOLUÇÃO Nº 17, DE 3 DE SETEMBRO DE 2012.

http://pesquisa.in.gov.br/imprensa/jsp/visualiza/index.jsp?data=04/09/2012&jornal=1&pagina=154&totalArquivos=204

Figure A.4 – The symbols for collection of batteries

2) Lead acid battery

The symbols shown in Figure A.5 are listed in Annex 1 of this law.

Figure A.5 – The symbols for collection and recycling of batteries

A.6.3 Colombia

Resolution 0172/2012

RESOLUCIÓN 0172 DE 2012

http://www.sic.gov.co/recursos_user/reglamentos_tecnicos/reglamento_tecnico_pilas.pdf

Scope: Alkaline battery: LR20, LR14, LR6, LR03, 4LR44, 6LR61, 4LR25X

Carbon zinc battery: R20, R14, R6, R03, 6F22, 4R25X

Restriction: 0,000 5 wt % for Hg, 0,002 wt % for Cd, 0,2 wt % for Pb

A.6.4 Costa Rica

General Regulations for the Classification and Management of Hazardous Wastes No.37788-S-MINAE

Reglamento General para la Clasificación y Manejo de Residuos Peligrosos No.37788-S-MINAE

http://www.pgrweb.go.cr/scij/Busqueda/Normativa/Normas/nrm_texto_completo.aspx?param1=NRTC&nValor1=1&nValor2=75279&nValor3=93281&param2=1&strTipM=TC&lResultado=2&strSim=simp

Three type secondary batteries are included in Annex 1

Lead acid battery: S159 Acumuladores de plomo

Ni-Cd battery: S201 Acumuladores de níquel-cadmio

All batteries containing Hg: S202 Baterías con mercurio

A.7 North America

A.7.1 Canada

A.7.1.1 Federal Law

Products Containing Mercury Regulations (SOR/2014-254)

https://ec.gc.ca/lcpe-cepa/eng/regulations/detailReg.cfm?intReg=203

Scope: All batteries containing Hg more than 0,000 5%.

A.7.1.2 British Columbia

Recycling Regulation, B.C. Reg. 449/2004, Environmental Management Act.

http://www.bclaws.ca/Recon/document/ID/freeside/449_2004

Scope: Following batteries weighing less than 5 kg each: Ni-Cd battery, Ni-MH battery, Lithium ion battery, Nickel-zinc battery, Valve regulated lead battery, Lithium primary battery, Alkaline battery, Button cell, Coin cell, Carbon zinc battery

A.7.1.3 Manitoba

Regulation 16/2010, Household Hazardous Material and Prescribed Material Stewardship Regulation

https://web2.gov.mb.ca/laws/regs/annual/2010/016.pdf

Scope: Following batteries weighing less than 5 kg each: Ni-Cd battery, Ni-MH battery, Lithium ion battery, Nickel-zinc battery, Valve regulated lead battery, Lithium primary battery, Alkaline battery, Button cell, Coin cell, Carbon zinc battery

A.7.1.4 Ontario

Waste diversion Act

https://www.ontario.ca/laws/statute/02w06

Scope: Removable primary batteries: Carbon zinc battery, Alkaline battery, Lithium primary battery, Button cell (Alkaline, Silver oxide, Zinc air), Lithium coin cell

A.7.1.5 Quebec

Regulation respecting the recovery and reclamation of products by enterprises

http://legisquebec.gouv.qc.ca/en/ShowDoc/cr/Q-2,%20r.%2040.1

Scope: Following batteries weighing less than 5 kg each: Ni-Cd battery, Ni-MH battery, Lithium ion battery, Nickel-zinc battery, Valve regulated lead battery, Lithium primary battery, Alkaline battery, Button cell, Coin cell, Carbon zinc battery

A.7.2 United States of America

A.7.2.1 California

California’s Universal Waste Rule

http://www.dtsc.ca.gov/HazardousWaste/UniversalWaste/

Best Management Practices for Perchlorate Materials

https://govt.westlaw.com/calregs/Browse/Home/California/CaliforniaCodeofRegulations?guid=I9F6BD270D4BB11DE8879F88E8B0DAAAE&originationContext=documenttoc&transitionType=Default&contextData=(sc.Default)&bhcp=1

NOTE Following designation shall be marked on outer carton of applicable batteries.

“Perchlorate Materials-special handling may apply.”

A.7.2.2 Maine

PUBLIC Law, Chapter 206, LD 1398, 125th Maine State Legislature. An Act To Amend the Laws

(See sub-§9, sub-§11 and sub-§12 of sec. 24. 38 MRSA §1661-C)

http://www.mainelegislature.org/legis/bills/bills_125th/chappdfs/PUBLIC206.pdf

Scope: Button cell (zinc-air and Alkaline manganese), silver oxide button cell battery stamped with the designation 357, 364, 371, 377, 395, SR44W, SR621SW, SR626SW, SR920SW or SR927SW

A.7.2.3 Minnesota

325E.125 General and special purpose battery requirements

https://www.revisor.mn.gov/statutes/?id=325E.125

115A.9155 Disposal of certain dry cell batteries

https://www.revisor.mn.gov/statutes/?id=115A.9155

A.7.2.4 Rhode Island

Mercury Reduction and Education Act of Rhode Island General Laws 23-24.9.

https://www.lawserver.com/law/state/rhode-island/ri-laws/rhode_island_general_laws_chapter_23-24-9

Dry Cell Battery Control of Rhode Island General Laws 23-60.1.

https://www.lawserver.com/law/state/rhode-island/ri-laws/rhode_island_general_laws_chapter_23-60-1

A.7.2.5 Vermont

The Primary Battery Stewardship Law (Act 139)

http://www.leg.state.vt.us/docs/2014/Acts/ACT139.pdf

Annex B
(informative)

Global regulations not applicable to batteries

B.1 General

The RoHS and WEEE directives are recognized as international standards of environmental regulation for electrical and electric equipment. Since batteries are used in electrical and electric equipment, the RoHS and WEEE directives have significant influence on batteries. Both directives state that they do not apply to batteries, however, this is not widely known. RoHS Directive 2011/65/EU.

Section 4 of the FAQ on Directive 2006/66/EU says:

Recital 29 of the Batteries Directive states that the RoHS Directive (which has been recast in the form of Directive 2011/65/EU) does not apply to batteries and accumulators used in electrical and electronic equipment. In addition, recital 14 of the RoHS Directive specifically states that RoHS should apply without prejudice to the Batteries Directive. The Batteries Directive and the RoHS Directive have similar but different substance restrictions. The RoHS Directive restricts the use of heavy metals, such as mercury and cadmium, in electrical and electronic equipment but it does not apply to batteries. The Batteries Directive restricts the use of mercury and cadmium in batteries.

B.2 WEEE Directive 2012/19/EU

Section 4 of the FAQ on Directive 2006/66/EU says:

The Batteries Directive applies to all batteries and accumulators placed on the EU market, ‘without prejudice’ to the WEEE Directive (Article 2(1)). This means that batteries and accumulators used in electrical and electronic equipment (EEE) fall within the scope of the Batteries Directive unless there are specific provisions in the WEEE Directive that apply to batteries and accumulators, if the batteries are part of the EEE when it becomes waste.

Portable batteries and accumulators, including those incorporated into appliances, should be reported as specified in Article 10(3) of the Batteries Directive.

B.3 EuP Directive 2005/32/EC

The EuP Directive was replaced by the ErP Directive.

B.4 ErP 2009/125/EC

SCOPE: “Energy-using product” or “EuP” means a product which, once placed on the market and/or put into service, is dependent on energy input (electricity, fossil fuels and renewable energy sources) to work as intended, or a product for the generation, transfer and measurement of such energy, including parts dependent on energy input and intended to be incorporated into an EuP covered by this Directive which are placed on the market and/or put into service as individual parts for end-users and of which the environmental performance can be assessed independently.

B.5 PVC and Halogens per IEC 61249-2-21

IEC 61249-2-21 contains limits for chlorine and bromine (900 ppm for either one or no more than 1 500 ppm in combination) which is only applicable to laminates and prepregs used to make circuit boards.

B.6 Directive 2005/84/EC Phthalate Directive

The Directive states that DEHP, DBP, and BBP shall not be used as a substance or constituent of preparation, at concentrations of greater than 0,1 % by mass of the plasticised material, in toys and childcare articles. The Directive also states that DNIP, DIDP, and DnOP shall not be used as substances or as constituents of preparations, at concentrations of greater than 0,1 % by mass of the plasticised material, in toys and childcare articles that can be placed in the mouth by children. Such toys and childcare articles containing these phthalates in concentration greater than the limit mentioned above shall not be placed on the market.

Batteries do not fall within the definition of a toy or child care article, therefore this Directive does not apply to batteries.

B.7 ELV Directive 2012/19/EU

Section 4 of the FAQ on Directive 2006/66/EU says:

Directive 2000/53/EC on ‘End-of Life Vehicles’ (the ELV Directive) covers certain categories of vehicles, including their components, such as batteries. The Batteries Directive applies to all batteries and accumulators including automotive batteries and accumulators, ‘without prejudice’ to the ELV Directive (Article 2(1)). This means that batteries and accumulators in vehicles covered by the ELV Directive fall within the scope of the Batteries Directive, unless there are specific provisions in the ELV Directive that apply to batteries and accumulators used in such vehicles.

Annex C
(informative)

Compliance Checklist

C.1 General

In order to verify compliance with this document, the requirements are listed in Table C.1.

Table C.1 – Compliance Checklist

Compliance Requirement	Compliance Verification
Mercury free requirement	Per: 5.2
Lead content	Per: 5.2
Cadmium content	Per: 5.2

Annex D
(informative)

Basel Convention

D.1 General

The Basel convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, usually known as the Basel Convention, is a national treaty of more than 180 countries and organizations. Globalization of shipping made transboundary movement of waste more accessible, and many Less Developed Countries (LDCs) were desperate for foreign currency. Consequently, the trade in hazardous waste, particularly to LDCs, grew rapidly. It also caused many environmental incidents to LDCs in 1980s. Aware of the growing international concern about the need for stringent control of transboundary movement of hazardous wastes, the Basel convention was adopted by United Nations Environment Programme (UNEP) in March 1989 as a treaty addressing the international sound management of transboundary movement of hazardous wastes, and entered into force on May 5, 1992.

D.2 Classification of hazardous wastes

a) Wastes that are subject to be hazardous wastes are set out in article 1 of the Basel Convention as follows:

   1) Wastes that belong to any category contained in Annex I, unless they do not possess any of the characteristics contained in Annex III.

   2) Wastes that are not covered under paragraph 1) but are defined as, or are considered to be, hazardous wastes by the domestic legislation of the Party of export, import or transit.

b) As described in paragraph a), recognition of which hazardousness depends on verification of both criteria of Annex I and III, it is so abstract that it may lead to each Party having a different interpretation. The conference of the parties to the Basel Convention decided to incorporate List A, identifying wastes characterized as hazardous and List B, identifying non-hazardous wastes as Annex VIII and Annex IX to the Basel Convention respectively. The wastes that are not included in Annex VIII or Annex IX are subject to Annex I and Annex III as before. Lists A and B are updated on an ongoing basis.

D.3 Hazardousness of primary batteries

In general, waste primary batteries are included in list B of Annex IX of the Basel Convention.

B1090 : Waste batteries conforming to a specification, excluding those made with lead, cadmium or mercury.

Waste primary batteries those are applicable to List A of Annex VIII are identified as hazardous wastes.

A1170 : Unsorted waste batteries excluding mixtures of only list B batteries. Waste batteries not specified on list B containing Annex I constituents to an extent to render them hazardous.

According to the identification by the Basel Convention, waste primary batteries contained with only waste batteries of no inclusion of mercury, cadmium and lead are regarded as no hazardous wastes, and permitted the transboundary movement. These batteries can be disposed of with general waste because they are not a threat to the environment. Waste batteries should be disposed of in accordance with local laws and regulations.

NOTE Basel Convention Summary

http://www.basel.int/TheConvention/Overview/TextoftheConvention/tabid/1275/Default.aspx

Annex I – Categories of Wastes to be Controlled

Annex II – Categories of Wastes Requiring Special Consideration

Annex III – List of Hazardous Characteristics

Annex IV – Disposal Operations

Annex VA – Information to be Provided on Notification

Annex VB – Information to be Provided on the Movement Document

Annex VI – Arbitration

Annex VII – Not yet in effect

Annex VIII – List A

Annex IX – List B

Annex A – List of States of Transit

Annex B – Financial Limits

Ref: 268-18

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[3] ISO 14040:2006, *Environmental management—Life cycle assessment—Principles and framework*

[4] IEC 62321 (all parts), *Determination of certain substances in electrotechnical products*

[5] IEC 62321-4:2013, *Determination of certain substances in electrotechnical products – Part 4: Mercury in polymers, metals and electronics by CV-AAS, CV-AFS, ICP-OES and ICP-MS*

[6] IEC 62321-5:2013, *Determination of certain substances in electrotechnical products – Part 5: Cadmium, lead and chromium in polymers and electronics and cadmium and lead in metals by AAS, AFS, ICP-OES and ICP-MS*

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