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**Primary batteries –
Part 4: Safety of lithium batteries**

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PRIMARY BATTERIES –

Part 4: Safety of lithium batteries

INTERPRETATION SHEET 1

This interpretation sheet has been prepared by IEC technical committee 35: Primary cells and batteries.

The text of this interpretation sheet is based on the following documents:

DISH	Report on voting
35/1445/DISH	35/1448/RVDISH

Full information on the voting for the approval of this interpretation sheet can be found in the report on voting indicated in the above table.

[IEC 60086-4:2019](https://standards.iteh.ai/catalog/standards/iec/f0bc5259-9dc5-4bf0-9ec1-456c1e8d28b6/iec-60086-4-2019)

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Question 1

In looking at IEC 60086-4 Edition 5.0 2019-04, I thought it was difficult to understand all of the marking requirements for swallowable batteries as well as the purpose of those requirements. Could you provide a detailed explanation?

Answer 1

The following list of statements reflects the intention of Table 9 and presents an interpretation of certain parts of Clause 9, and Annex F:

- a) Table 9 is intended to summarize requirements that are found in the text, namely in 7.2 a), 9.1 and 9.2, and in Annex F.

- b) The structure of table 9 is similar to the list in 9.1 (items "a" to "f") and 9.2 (items "a" thru "b").
- c) From item a) in 9.2 it is not clear what exactly is required to appear on the packaging and what on the battery: the safety sign alone (Table D.1 item E, or Figure F.1) or the complete product safety label (Figure 9).

The purpose of measures to prevent accidental ingestion of batteries is to eliminate the opportunity for children to get stuck batteries in the oesophagus.

The battery that requires measures to prevent accidental ingestion is a swallowable battery size which fits within the limits of the ingestion gauge and is applied to direct sale in consumer-replaceable applications in which children have opportunity to contact swallowable batteries.

There is no description requiring the marking of Caution for ingestion on battery/cell with a diameter of 20 mm or more in the text. However, due to the consideration of measures to prevent accidental ingestion, it was determined that the marking of Caution for ingestion on a battery/cell with a diameter of 20 mm or more is needed and its requirement is shown in Table 9. Therefore, a pictogram must be engraved as a substitute of Caution for ingestion due to a battery/cell with a diameter of 20 mm or more having no space to display the marking.

The type of "caution for ingestion" that is required on the immediate packaging of swallowable batteries is one of the safety signs as shown in Figure F.1. Where there is enough space on the packaging, additional information per Figure 9 (the safety label or only its text) can be printed on the packaging or accompanying safety information about battery handling.

Table 1 of this Interpretation Sheet summarizes the requirements for marking of lithium button cells.

Table 1 – Marking requirements for swallowable batteries

Diameter	Requirement(s)
d < 16 mm	Cautionary advice in the form of the words KEEP OUT OF REACH OF CHILDREN or the safety symbol E of Table D.1 on the immediate packaging.
16 mm ≤ d < 20 mm	Child resistant packaging and cautionary advice in the form of the words KEEP OUT OF REACH OF CHILDREN or the safety symbol E of Table D.1 on the immediate packaging.
d ≥ 20 mm	Child resistant packaging, cautionary advice in the form of the words KEEP OUT OF REACH OF CHILDREN or the safety symbol E of Table D.1 on the immediate packaging, and the safety symbol E of Table D.1 on the positive side of the battery.
NOTE If applicable, the cautionary advice in the form of words should appear in one or more languages as appropriate for the market on which the cells and batteries are placed.	

Question 2

From 9.2 and in particular 9.2 a), it is not clear which kind of batteries are intended for direct sale in consumer-replaceable applications?

Answer 2

The kind of batteries that are included are those with general packaging such as blister packs sold in stores and on the internet, batteries packed with equipment and batteries which are contained in equipment and can be replaced by the consumer.

Question 3

Annex F is marked as "Informative", however "requirements" is stated in the title of Table 9. When referring to Table 9, do we have to consider Annex F as "normative" ?

Answer 3

Annex F contains supplementary material, the main text in the body of the standard takes priority over it. Therefore, even if Annex F is informative, the content listed in Table 9 has to be considered as requirements.

Question 4

In E.3.2 b), it is difficult to understand the test method of the torsion test. It is not clear how to twist "three times in both directions".

Answer 4

Following is an explanation how and how many times to twist the packaging and in which order to proceed.

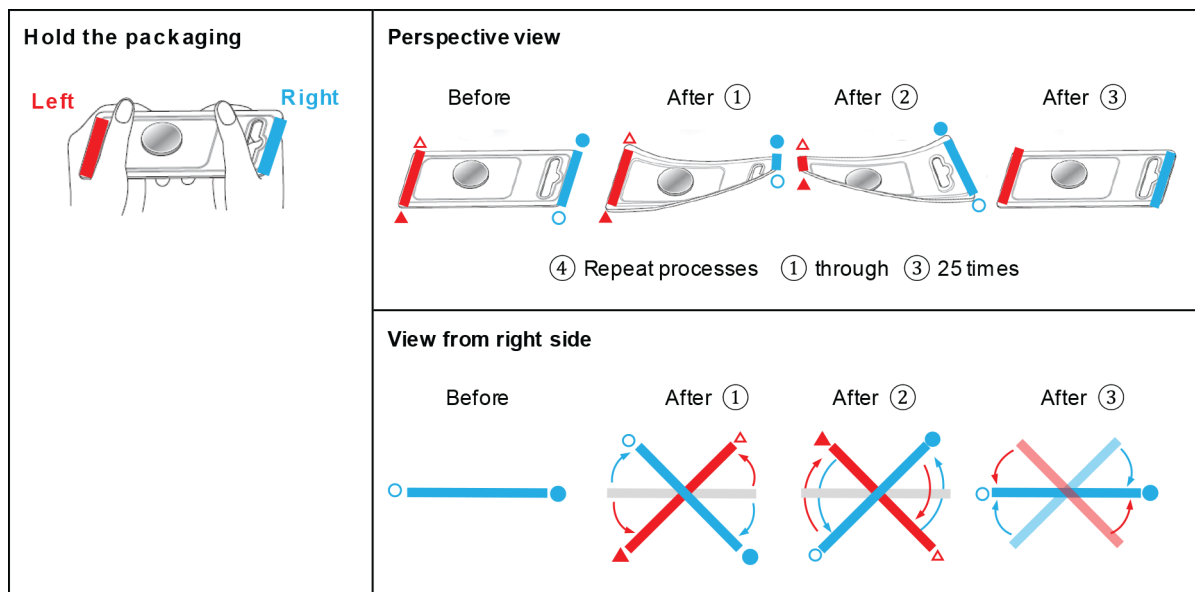
① First time – Hold the packaging with the fingers of one hand on each of its shorter sides from the state of 0 degrees (neutral state without torsion). Twist it diagonally with a torsion angle of 45° in opposite directions as shown in Figure E.2.

② Second time – Twist it diagonally 90° (45° back + 45° opposite direction) in opposite directions to the direction twisted at the first time

③ Third time – Return to neutral state without torsion (45° back)

④ Movements ①, ② and ③ are counted as 1 time (1 reciprocation) and are repeated 25 times (25 reciprocations).

Figure 1 of this Interpretation Sheet shows the movements of the torsion test. The red and blue lines represent the left and right edge of the packaging. The triangles and circles were added to keep track of the orientation during movements.



IEC

Figure 1 – Torsion test

Question 5

From 9.2 b), Table 9, and Annex E, it is not clear what the transition period is for the requirement of "Child resistant package" ?

Answer 5

The transition period is the same as Marking and packaging requirements, namely 2 years from the publication date of the fifth edition of IEC 60086-4.

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PRIMARY BATTERIES –**Part 4: Safety of lithium batteries****FOREWORD**

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INTRODUCTION

The concept of safety is closely related to safeguarding the integrity of people and property. This document specifies tests and requirements for lithium batteries and has been prepared in accordance with ISO/IEC guidelines, taking into account all relevant national and international standards which apply.

Lithium batteries are different from conventional primary batteries using aqueous electrolyte in that they contain flammable materials.

Consequently, it is important to carefully consider safety during design, production, distribution, use, and disposal of lithium batteries. Based on such special characteristics, lithium batteries for consumer applications were initially small in size and had low power output. There were also lithium batteries with high power output which were used for special industrial and military applications and were characterized as being “technician replaceable”. The first edition of this document was drafted to accommodate this situation.

However, from around the end of the 1980s, lithium batteries with high power output started to be widely used in the consumer replacement market, mainly as a power source in camera applications. Since the demand for such lithium batteries with high power output significantly increased, various manufacturers started to produce these types of lithium batteries. As a consequence of this situation, the safety aspects for lithium batteries with high power output were included in the second edition of this document.

Primary lithium batteries both for consumer and industrial applications are well-established safe and reliable products in the market, which is at least partly due to the existence of safety standards such as this document and, for transport, IEC 62281. The fourth edition of this document therefore reflects only minor changes which became necessary in order to keep it harmonized with IEC 62281 and to continuously improve the user information about safety related matters.

Guidelines addressing safety issues during the design of lithium batteries are provided in Annex A. Annex B provides guidelines addressing safety issues during the design of equipment where lithium batteries are installed. Both Annex A and B reflect experience with lithium batteries used in camera applications and are based on [23]¹.

Safety is freedom from unacceptable risk. There can be no absolute safety: some risk will remain. Therefore a product, process or service can only be relatively safe. Safety is achieved by reducing risk to a tolerable level determined by the search for an optimal balance between the ideal of absolute safety and the demands to be met by a product, process or service, and factors such as benefit to the user, suitability for purpose, cost effectiveness, and conventions of the society concerned.

As safety will pose different problems, it is impossible to provide a set of precise provisions and recommendations that will apply in every case. However, this document, when followed on a judicious “use when applicable” basis, will provide reasonably consistent standards for safety.

¹ Numbers in square brackets refer to the bibliography.

PRIMARY BATTERIES –

Part 4: Safety of lithium batteries

1 Scope

This part of IEC 60086 specifies tests and requirements for primary lithium batteries to ensure their safe operation under intended use and reasonably foreseeable misuse.

NOTE Primary lithium batteries that are standardized in IEC 60086-2 are expected to meet all applicable requirements herein. It is understood that consideration of this part of IEC 60086 might also be given to measuring and/or ensuring the safety of non-standardized primary lithium batteries. In either case, no claim or warranty is made that compliance or non-compliance with this standard will fulfil or not fulfil any of the user's particular purposes or needs.

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:~~2011~~, *Primary batteries – Part 1: General*

IEC 60086-2, *Primary batteries – Part 2: Physical and electrical specifications*

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>

NOTE Certain definitions taken from IEC 60050-482, IEC 60086-1, and ISO/IEC Guide 51 are repeated below for convenience.

3.1

battery

one or more cells electrically connected and fitted in a case, with terminals, markings and protective devices etc., as necessary for use

[SOURCE: IEC 60050-482:2004, 482-01-04, modified ("fitted with devices necessary for use, for example case" replaced by "electrically connected and fitted in a case", addition of "etc., as necessary for use")]

3.2

cell

basic functional unit, consisting of an assembly of electrodes, electrolyte, container, terminals and usually separators, that is a source of electric energy obtained by direct conversion of chemical energy

[SOURCE: IEC 60050-482:2004, 482-01-01]