

# Secondary cells and batteries containing alkaline or other non-acid electrolytes — Mechanical tests for sealed portable secondary cells and batteries

The European Standard EN 61959:2004 has the status of a  
British Standard

ICS 29.220.99

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This British Standard is the official English language version of EN 61959:2004. It is identical with IEC 61959:2004. Together with BS EN 61960:2004 and BS EN 62133:2003 it supersedes BS EN 61960-1:2001 and BS EN 61960-2:2002 which will be withdrawn on 1 March 2007.

The UK participation in its preparation was entrusted by Technical Committee PEL/21, Secondary cells and batteries, to Subcommittee PEL/21/1, Secondary cells and batteries containing alkaline and other non-acidic electrolytes, which has the responsibility to:

- aid enquirers to understand the text;
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Incorporates Corrigendum June 2004

English version

**Secondary cells and batteries containing alkaline  
or other non-acid electrolytes –  
Mechanical tests for sealed portable secondary cells and batteries  
(IEC 61959:2004)**

Accumulateurs alcalins et autres  
accumulateurs à électrolyte non acide -  
Essais mécaniques pour accumulateurs  
portables étanches  
(CEI 61959:2004)

Akkumulatoren und Batterien mit  
alkalischem oder anderen  
nichtsäurehaltigen Elektrolyten -  
Mechanische Prüfungen für tragbare  
gasdichte Akkumulatoren und Batterien  
(IEC 61959:2004)

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Comité Européen de Normalisation Electrotechnique  
Europäisches Komitee für Elektrotechnische Normung

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Ref. No. EN 61959:2004 E

## Foreword

The text of document 21A/393/FDIS, future edition 1 of IEC 61959, prepared by SC 21A, Secondary cells and batteries containing alkaline or other non-acid electrolytes, of IEC TC 21, Secondary cells and batteries, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 61959 on 2004-03-01.

This European Standard, together with EN 61960:2004 and EN 62133:2003, supersedes EN 61960-1:2001 and EN 61960-2:2001.

The following dates were fixed:

- latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2004-12-01
- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 2007-03-01

Annex ZA has been added by CENELEC.

The contents of the corrigendum of June 2004 have been included in this copy.

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## Endorsement notice

The text of the International Standard IEC 61959:2004 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 61951-1	NOTE	Harmonized as EN 61951-1:2003 (not modified).
IEC 61951-2	NOTE	Harmonized as EN 61951-2:2003 (not modified).
IEC 61960	NOTE	Harmonized as EN 61960:2004 (not modified).

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# SECONDARY CELLS AND BATTERIES CONTAINING ALKALINE OR OTHER NON-ACID ELECTROLYTES – MECHANICAL TESTS FOR SEALED PORTABLE SECONDARY CELLS AND BATTERIES

## 1 Scope

This International standard specifies tests and requirements for verifying the mechanical behaviour of sealed portable secondary cells and batteries during handling and normal use. Relevant national and International standards have been taken into consideration.

This standard provides test objectives, methods of tests and acceptance criteria relevant to sealed portable secondary cells and batteries of different electrochemical systems (Ni-Cd, Ni-MH and Lithium) sizes and shapes (cylindrical, prismatic and button).

## 2 Normative references

The following referenced documents are indispensable for the application 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(486), *International Electrotechnical Vocabulary (IEV) – Chapter 486: Secondary cells and batteries*

IEC 60068-2-6, *Environmental testing – Part 2: Test – Test Fc: Vibration (sinusoidal)*

IEC 60068-2-32, *Environmental testing – Part 2: Tests. Test Ed: Free fall*

IEC 60068-2-47, *Environmental testing – Part 2-47: Test methods – Mounting of components, equipment and other articles for vibration, impact and similar dynamic tests*

## 3 Terms and definitions

For the purpose of this document, the definitions contained in IEC 60050-486, for electrical terms, in IEC 60068-2-6 and IEC 60068-2-32 for mechanical terms and the following apply.

### 3.1

#### **hard pack battery**

a battery assembly within a rigid case with built-in terminals

## 4 Requirement for mechanical tests

The ability of a cell or a battery to withstand mechanical stresses shall be verified by carrying out a vibration test and a free fall test based on the methods described in IEC 60068-2-6 and IEC 60068-2-32. Charge and discharge procedures referred to in this standard are referenced to the applicable IEC performance standards listed in the bibliography.

### 4.1 Vibration test

Each cell or battery shall be charged in accordance with the charging procedure for electrical tests defined in the applicable IEC performance standard. In the case of batteries, all final voltages specified in these standards shall be multiplied by the number of series connected cells.

When the charging has been completed, the following vibration test shall be carried out, using a test method which complies with the general requirement of IEC 60068-2-6. The cell or battery on test shall be securely fastened and, if relevant, referring to IEC 60068-2-47.

The vibration test shall be carried out in an ambient temperature of  $20\text{ °C} \pm 5\text{ °C}$  under the conditions given in Table 1.

**Table 1 – Conditions for vibration**

Vibration parameters	Parameters values
Frequency	10 Hz – 500 Hz
Vibration amplitude	0,35 mm peak or max. 50 m/s <sup>2</sup>
Axes of vibration	3 mutually perpendicular axes for all types of cells or batteries.
Sweep cycles	5 cycles
Sweep speed	1 octave per minute
NOTE This test will take approximately 55 minutes per axis.	

After completion of the test, the cell or battery shall be discharged in the same ambient temperature, at a constant current of  $0,2 I_t A$ , to a final voltage as defined in the applicable IEC performance standard.

The cell or battery shall then be stored in an ambient temperature of  $20\text{ °C} \pm 5\text{ °C}$  for a period of not less than 4 days and not more than 6 days.

The following verifications shall then be performed.

The open circuit voltage shall be not less than the values given in Table 2.

**Table 2 – Open circuit voltages**

Cell or battery designation	Cells	Batteries <sup>a</sup>
Ni-Cd (nickel-cadmium)	1,0 V	$n \times 1,0\text{ V}$
Ni-MH (nickel-metal hydride)	1,0 V	$n \times 1,0\text{ V}$
Li (lithium)	3,0 V	$n \times 3,0\text{ V}$
<sup>a</sup> $n$ is the number of series connected cells.		

The cell or battery shall then be charged, in an ambient temperature of  $20\text{ °C} \pm 5\text{ °C}$ :

- for nickel systems charge at a constant current of  $0,1 I_t A$  for 16 h and discharge in the same ambient temperature, at a constant current of  $0,2 I_t A$ , in accordance with the relevant electrical test procedures defined in the applicable IEC performance standards.
- for lithium systems charge according to the method declared by the manufacturer and discharge in the same ambient temperature, at a constant current of  $0,2 I_t A$ , in accordance with the relevant electrical test procedures defined in the applicable IEC performance standards.

Acceptance criteria:

- the duration of discharge at a constant current of  $0,2 I_t A$  shall be not less than 5 h;
- visual inspection shall be carried out: no visible liquid leakage, no venting.

#### 4.2 Free fall test (cells and hard pack batteries only)

Each cell or battery shall be charged in accordance with the charging procedure for electrical test defined in the applicable IEC performance standard. In the case of batteries all final voltages specified in these standards shall be multiplied by the number of series connected cells.

When the charging has been completed, the following free fall test shall be carried out, using a test method that complies with the general requirements of IEC 60068-2-32.

The free fall test shall be carried out in an ambient temperature of  $20\text{ °C} \pm 5\text{ °C}$  under the conditions given in Table 3.

**Table 3 – Conditions for free fall**

Free fall parameter	Parameter value
Test surface	Hardwood
Height of fall	See Table 4
Number of drops	1 drop along each direction of the 3 mutually perpendicular axes for all types of cells or batteries.

**Table 4 – Height of fall as a function of weight**

Weight	Weight $\leq$ 100 g	100 g < Weight $\leq$ 250 g	250 g < Weight $\leq$ 500 g
Cells (all types)	1,00 m	1,00 m	1,00 m
Batteries (hard packs)	1,00 m	0,75 m	0,50 m

After completion of the test, the cell or battery shall be discharged in the same ambient temperature, at a constant current of  $0,2 I_t A$ , to a final voltage as defined in the applicable IEC performance standards.

The cell or battery shall then be stored in an ambient temperature of  $20\text{ °C} \pm 5\text{ °C}$  for a period of not less than 4 days and not more than 6 days.



The following verifications shall then be performed:

- the open circuit voltage shall be not less than the values given in Table 2;
- the cell or battery shall then be charged, in an ambient temperature of 20 °C ± 5 °C:
  - for nickel systems charge at a constant current of 0,1 I<sub>t</sub>A for 16 h and discharge in the same ambient temperature, at a constant current of 0,2 I<sub>t</sub>A, in accordance with the relevant electrical test procedures defined in the applicable IEC performance standards;
  - for lithium systems charge according to the method declared by the manufacturer and discharge in the same ambient temperature, at a constant current of 0,2 I<sub>t</sub>A, in accordance with the relevant electrical test procedures defined in the applicable IEC performance standards.

Acceptance criteria:

- the duration of discharge at a constant current of 0,2 I<sub>t</sub> A shall be not less than 5 h;
- visual inspection shall be carried out: no visible liquid leakage, no venting.

NOTE This standard does not specify height of fall for batteries weighting more than 500 g which should be the subject of agreement between the customer and the manufacturer.

## 5 Type approval

For type approval the sequence of tests and sample sizes given in Table 5 shall be used.

**Table 5 – Sample size for type tests**

Test	Cell	Battery	Number of defective cells or batteries tolerated
2.1	5	5	0
2.2	5	5	0

## 6 Batch acceptance

Tests for batch acceptance, if required, shall be by agreement between supplier and purchaser.

## Bibliography

IEC 61951-1, *Secondary cells and batteries containing alkaline or other non-acid electrolytes – Portable sealed rechargeable single cells – Part 1: Nickel-cadmium*

IEC 61951-2, *Secondary cells and batteries containing alkaline or other non-acid electrolytes – Portable sealed rechargeable single cells – Part 2: Nickel-metal hydride*

IEC 61960, *Secondary cells and batteries containing alkaline or other non-acid electrolytes – Secondary lithium cells and batteries for portable applications*

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**Annex ZA**  
(normative)

**Normative references to international publications  
with their corresponding European publications**

The following referenced documents are indispensable for the application 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.

NOTE Where an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60050-486	- <sup>1)</sup>	International Electrotechnical Vocabulary (IEV) Chapter 486: Secondary cells and batteries	-	-
IEC 60068-2-6	- <sup>1)</sup>	Environmental testing Part 2: Tests - Test Fc: Vibration (sinusoidal)	EN 60068-2-6	1995 <sup>2)</sup>
IEC 60068-2-32	- <sup>1)</sup>	Part 2: Tests - Test Ed: Free fall	EN 60068-2-32	1993 <sup>2)</sup>
IEC 60068-2-47	- <sup>1)</sup>	Part 2-47: Test methods - Mounting of components, equipment and other articles for vibration, impact and similar dynamic tests	EN 60068-2-47 + corr. June	1999 <sup>2)</sup> 2000

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1) Undated reference.

2) Valid edition at date of issue.

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