

© Copyright SEK. Reproduction in any form without permission is prohibited.

Litiumceller och litiumbatterier – Säkerhet vid transport

Safety of primary and secondary lithium cells and batteries during transport

Som svensk standard gäller europastandarden EN 62281:2013. Den svenska standarden innehåller den officiella engelska språkversionen av EN 62281:2013.

Nationellt förord

Europastandarden EN 62281:2013

består av:

- **europastandardens ikraftsättningsdokument**, utarbetat inom CENELEC
- **IEC 62281, Second edition, 2012 - Safety of primary and secondary lithium cells and batteries during transport**

utarbetad inom International Electrotechnical Commission, IEC.

Tidigare fastställd svensk standard SS-EN 62281, utgåva 1, 2004, gäller ej fr o m 2016-01-09.

Standarder underlättar utvecklingen och höjer elsäkerheten

Det finns många fördelar med att ha gemensamma tekniska regler för bl a säkerhet, prestanda, dokumentation, utförande och skötsel av elprodukter, elanläggningar och metoder. Genom att utforma sådana standarder blir säkerhetskraven tydliga och utvecklingskostnaderna rimliga samtidigt som marknadens acceptans för produkten eller tjänsten ökar.

Många standarder inom elområdet beskriver tekniska lösningar och metoder som åstadkommer den elsäkerhet som föreskrivs av svenska myndigheter och av EU.

SEK är Sveriges röst i standardiseringsarbetet inom elområdet

SEK Svensk Elstandard svarar för standardiseringen inom elområdet i Sverige och samordnar svensk medverkan i internationell och europeisk standardisering. SEK är en ideell organisation med frivilligt deltagande från svenska myndigheter, företag och organisationer som vill medverka till och påverka utformningen av tekniska regler inom elektrotekniken.

SEK samordnar svenska intressenters medverkan i SEKs tekniska kommittéer och stödjer svenska experters medverkan i internationella och europeiska projekt.

Stora delar av arbetet sker internationellt

Utformningen av standarder sker i allt väsentligt i internationellt och europeiskt samarbete. SEK är svensk nationalkommitté av International Electrotechnical Commission (IEC) och Comité Européen de Normalisation Electrotechnique (CENELEC).

Standardiseringsarbetet inom SEK är organiserat i referensgrupper bestående av ett antal tekniska kommittéer som speglar hur arbetet inom IEC och CENELEC är organiserat.

Arbetet i de tekniska kommittéerna är öppet för alla svenska organisationer, företag, institutioner, myndigheter och statliga verk. Den årliga avgiften för deltagandet och intäkter från försäljning finansierar SEKs standardiseringsverksamhet och medlemsavgift till IEC och CENELEC.

Var med och påverka!

Den som deltar i SEKs tekniska kommittéarbete har möjlighet att påverka framtida standarder och får tidig tillgång till information och dokumentation om utvecklingen inom sitt teknikområde. Arbetet och kontakterna med kollegor, kunder och konkurrenter kan gynnsamt påverka enskilda företags affärsutveckling och bidrar till deltagarnas egen kompetensutveckling.

Du som vill dra nytta av dessa möjligheter är välkommen att kontakta SEKs kansli för mer information.

SEK Svensk Elstandard

Box 1284
164 29 Kista
Tel 08-444 14 00
www.elstandard.se

English version

**Safety of primary and secondary lithium cells and batteries
during transport
(IEC 62281:2012)**

Sécurité des piles et des accumulateurs
au lithium pendant le transport
(CEI 62281:2012)

Sicherheit von Primär- und Sekundär-
Lithiumbatterien beim Transport
(IEC 62281:2012)

This European Standard was approved by CENELEC on 2013-01-09. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

Management Centre: Avenue Marnix 17, B - 1000 Brussels

Foreword

The text of document 35/1303/FDIS, future edition 2 of IEC 62281, prepared by IEC TC 35 "Primary cells and batteries" and 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 approved by CENELEC as EN 62281:2013.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2013-10-09
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2016-01-09

This document supersedes EN 62281:2004.

EN 62281:2013 includes the following significant technical changes with respect to EN 62281:2004:

- a) distinction between small and large cell or battery by gross mass rather than by lithium content or Watt-hour rating ("nominal" energy);
- b) combination of the no mass loss (NM) and no leakage (NL) criteria into one criteria (NL);
- c) extension of an acceptable mass loss of 0,2 % from 5 g to 75 g mass of a cell or battery;
- d) reduction of large batteries to be tested under tests T-1 to T-5 and T-8 from 4 to 2 samples;
- e) reduction of test samples required for small battery assemblies (5.2.2);
- f) reduction of the vibration amplitude to 2 g for large batteries in T-3 vibration test method;
- g) replacement of the impact test by the crush test for prismatic, pouch, button, and coin cells as well as cylindrical cells with no more than 20 mm in diameter.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC [and/or CEN] shall not be held responsible for identifying any or all such patent rights.

Endorsement notice

The text of the International Standard IEC 62281:2012 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 60086-4	NOTE	Harmonized as EN 60086-4.
IEC 60068-2-6	NOTE	Harmonized as EN 60068-2-6.
IEC 60068-2-27	NOTE	Harmonized as EN 60068-2-27.

Annex ZA (normative)

Normative references to international publications with their corresponding European publications

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

NOTE When 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 61960	-	Secondary cells and batteries containing alkaline or other non-acid electrolytes - Secondary lithium cells and batteries for portable applications	EN 61960	-
IEC 62133	-	Secondary cells and batteries containing alkaline or other non-acid electrolytes - Safety requirements for portable sealed secondary cells, and for batteries made from them, for use in portable applications	EN 62133	-
IEC 62660-1	-	Secondary lithium-ion cells for the propulsion of electric road vehicles - Part 1: Performance testing	EN 62660-1	-

CONTENTS

INTRODUCTION.....	6
1 Scope.....	7
2 Normative references	7
3 Terms and definitions	7
4 Requirements for safety.....	10
4.1 General considerations.....	10
4.2 Quality plan	11
4.3 Packaging	11
5 Type testing, sampling and re-testing	11
5.1 Type testing	11
5.2 Battery assemblies	12
5.2.1 Secondary batteries for use in battery assemblies	12
5.2.2 Small battery assemblies	12
5.2.3 Large battery assemblies.....	12
5.3 Sampling	12
5.4 Re-testing	13
6 Test methods and requirements.....	13
6.1 General.....	13
6.1.1 Safety notice	13
6.1.2 Ambient temperature	14
6.1.3 Parameter measurement tolerances	14
6.1.4 Pre-discharge and pre-cycling	14
6.2 Evaluation of test criteria.....	14
6.2.1 Shifting.....	14
6.2.2 Distortion.....	14
6.2.3 Short-circuit.....	14
6.2.4 Excessive temperature rise.....	14
6.2.5 Leakage	14
6.2.6 Venting.....	15
6.2.7 Fire.....	15
6.2.8 Rupture	15
6.2.9 Explosion.....	15
6.3 Tests and requirements – Overview.....	15
6.4 Transport tests	16
6.4.1 Test T-1: Altitude	16
6.4.2 Test T-2: Thermal cycling	16
6.4.3 Test T-3: Vibration.....	17
6.4.4 Test T-4: Shock	17
6.4.5 Test T-5: External short-circuit.....	18
6.4.6 Test T-6: Impact/crush.....	18
6.5 Misuse tests	20
6.5.1 Test T-7: Overcharge.....	20
6.5.2 Test T-8: Forced discharge.....	20
6.6 Packaging test.....	20
Test P-1: Drop test.....	20

6.7	Information to be given in the relevant specification	21
6.8	Evaluation and report	21
7	Information for safety.....	22
7.1	Packaging	22
7.2	Handling of battery cartons.....	22
7.3	Transport	22
7.3.1	General	22
7.3.2	Air transport	22
7.3.3	Sea transport.....	22
7.3.4	Land transport	22
7.3.5	Classification	22
7.4	Display and storage.....	22
8	Instructions for packaging and handling during transport – Quarantine	23
9	Marking	23
9.1	Marking of primary and secondary (rechargeable) cells and batteries	23
9.2	Marking of the packaging and shipping documents	23
	Bibliography.....	25
	Figure 1 – Example of a test set-up for the impact test.....	19
	Figure 2 – Example for the marking of packages with primary or secondary (rechargeable) lithium cells or batteries	24
	Table 1 – Number of primary test cells and batteries for type testing	12
	Table 2 – Number of secondary test cells and batteries for type testing	13
	Table 3 – Number of packages with primary or secondary test cells and batteries.....	13
	Table 4 – Mass loss limits.....	15
	Table 5 – Transport and packaging tests and requirements	16
	Table 6 – Vibration profile (sinusoidal)	17
	Table 7 – Shock parameters	18

INTRODUCTION

Primary lithium cells and batteries were first introduced in military applications in the 1970s. At that time, little commercial interest and no industrial standards existed. Consequently, the United Nations (UN) Committee of Experts on the Transport of Dangerous Goods, although usually referring to industrial standards for testing and criteria, introduced a sub-section in the Manual of tests and criteria concerning safety tests relevant to transport of primary lithium cells and batteries. Meanwhile, commercial interest in primary and secondary (rechargeable) lithium cells and batteries has grown and several industrial standards exist. However, the existing IEC standards are manifold, not completely harmonized, and not necessarily relevant to transport. They are not suitable to be used as a source of reference in the UN Model Regulations. Therefore this group safety standard has been prepared to harmonize the tests and requirements relevant to transport.

This International Standard applies to primary and secondary (rechargeable) lithium cells and batteries containing lithium in any chemical form: lithium metal, lithium alloy or lithium-ion. Lithium-metal and lithium alloy primary electrochemical systems use metallic lithium and lithium alloy, respectively, as the negative electrode. Lithium-ion secondary electrochemical systems use intercalation compounds (intercalated lithium exists in an ionic or quasi-atomic form within the lattice of the electrode material) in the positive and in the negative electrodes.

This International Standard also applies to lithium polymer cells and batteries, which are considered either as primary lithium-metal cells and batteries or as secondary lithium-ion cells and batteries, depending on the nature of the material used in the negative electrode.

The history of transporting primary and secondary lithium cells and batteries is worth noting. Since the 1970s, over ten billion primary lithium cells and batteries have been transported, and since the early 1990s, over one billion secondary (rechargeable) lithium cells and batteries utilizing a lithium-ion system have been transported. As the number of primary and secondary lithium cells and batteries to be transported is increasing, it is appropriate to also include in this standard the safety testing of packaging used for the transportation of these products.

This International Standard specifically addresses the safety of primary and secondary lithium cells and batteries during transport and also the safety of the packaging used.

The UN Manual of Tests and Criteria [1]¹ distinguishes between lithium metal and lithium alloy cells and batteries on the one hand, and lithium ion and lithium polymer cells and batteries on the other hand. While it defines that lithium metal and lithium alloy cells and batteries can be either primary (non-rechargeable) or rechargeable, it always considers lithium ion cells and batteries as rechargeable. However, test methods in the UN Manual of Tests and Criteria are the same for both secondary lithium metal and lithium alloy cells and batteries and lithium ion and lithium polymer cells and batteries. The concept is only needed to distinguish between small and large battery assemblies. Battery assemblies assembled from (primary or secondary) lithium metal and lithium alloy batteries are distinguished by the aggregate lithium content of all anodes (measured in grams), while battery assemblies assembled from lithium ion or lithium polymer batteries are distinguished by their “nominal” energy (measured in Watt-hours).

¹ Numbers in square brackets refer to the Bibliography

SAFETY OF PRIMARY AND SECONDARY LITHIUM CELLS AND BATTERIES DURING TRANSPORT

1 Scope

This International Standard specifies test methods and requirements for primary and secondary (rechargeable) lithium cells and batteries to ensure their safety during transport other than for recycling or disposal. Requirements specified in this standard do not apply in those cases where special provisions given in the relevant regulations, listed in 7.3, provide exemptions.

NOTE Different standards may apply for lithium-ion traction battery systems used for electrically propelled road vehicles.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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

IEC 62133, *Secondary cells and batteries containing alkaline or other non-acid electrolytes – Safety requirements for portable sealed secondary cells, and for batteries made from them, for use in portable applications*

IEC 62660-1, *Secondary lithium-ion cells for the propulsion of electric road vehicles – Part 1: Performance testing*