SLOVENSKI STANDARD
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Svinčeno-kislinske zaganjalne baterije - 5. del: Lastnosti baterijskih ohišij in ročic

Lead-acid starter batteries - Part 5: Properties of battery housings and handles

Blei-Akkumulatoren-Starterbatterien - Teil 5: Eigenschaften der Batteriekästen und -griffe

Batteries d'accumulateurs de démarrage au plomb - Partie 5: Propriétés des poignées et des bacs et couvercles de batteries

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Blei-Akkumulatoren-Starterbatterien - Teil 5: Eigenschaften der Batteriekästen und -griffe

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CENELEC

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

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Foreword

This European Standard was prepared by the Technical Committee CENELEC TC 21X, Secondary cells and batteries. It was submitted to the Unique Acceptance Procedure and was accepted by CENELEC as EN 50342-5 on 2010-11-01.

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

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)	2011-11-01
– latest date by which the national standards conflicting with the EN have to be withdrawn	(dow)	2013-11-01

Contents

Figures

Table

1 Scope

This European Standard covers multicell battery housings produced of polypropylene as the preferred material for lead-acid batteries as an energy storage device for cranking combustion engines, for lighting and for additional equipment used in road vehicles. These batteries are all referred to as starter batteries.

This European Standard describes battery housings for batteries usable within the engine compartment and for installation under conditions where they are protected from light.

Batteries of this European Standard do not provide additional features for special protection from light. Therefore, batteries with limited protection from light are to be treated as a special case.

The purpose of this European Standard is to describe the properties of battery housings for its use in combustion vehicles by means of uniform examination procedures and by defining the requirements for the raw material and the complete part.

The test procedure and requirements for the complete housing are described in the main part. Test procedures for the raw material are determined in Annex A. Annex B recommends possible test procedures for the material properties taken out of the complete housings, without being normative.

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.

EN 50342-2	Lead-acid starter batteries – Part 2: Dimensions of batteries and marking of terminals
IEC 60050-482	International Electrotechnical Vocabulary – Part 482: Primary and secondary cells and batteries
EN ISO 527 (series)	Plastics – Determination of tensile properties (ISO 527 series)

3 Definitions

For the purposes of this document, the terms and definitions given in IEC 60050-482 and the following apply.

3.1
battery housing
welded unit of battery case and lid

3.2
battery container
case with multiple cell compartments

3.3
Battery lid
cover for common covering of all cells of a battery case

3.4
hold-downs
ledges at the lower part of the battery case for fixation within vehicle. (see EN 50342-2 and EN 50342-4)

4 Examinations

4.1 General

Depending on the requirements, the examination has to be carried out on standardized samples of raw materials, battery case, battery housing, or complete battery.

4.2 Examination of the raw materials

4.2.1 General

The examination of the raw materials has to be performed by the supplier of the raw material in accordance to specifications of Annex A and, if not agreed otherwise, be documented in the material specification of a new PP material to be purchased.

These examinations are preferably ISO Standards. The specimens shall be selected according to the specifications in Annex A and the tests are to be carried out according to the specifications in Annex A. For documentation the form of Annex A shall be used.

The samples must be aged before starting the test for at least 4 days at (23°± 0,5) °C and must be tested within 3 months.

The material properties which have only low impact on the complete housing properties, e. g. due to the design of the battery housing, are mentioned in the annexes only for information.

4.2.2 Examination on resistance against chemical substances

The purpose of this test is to check if chemical substances which can occur in the vicinity of batteries and have some chemical affinity to PP can significantly weaken the material properties.

The test shall be carried out on specimens 5A according to EN ISO 527. The specimens are prepared by injection moulding and must be aged at 100 °C for 4d before starting the test. Each sample has to be weighed and all samples for one liquid are treated together under reflux at a temperature and time according to Table 1. In Annex E a laboratory equipment for heat treatment under reflux is depicted. For statistical reasons the test shall be carried out on at least 6 samples.

After treatment each sample shall be dried, weighed and then tested on tensile according to EN ISO 527. The maximum change in weight and tensile strength at yield relative in % to the initial data before treatment with chemicals is given in Table 1.

Table 1 – Resistance against chemicals

Substance	Test temperature for boiling under reflux °C	Test time for boiling under reflux h	Max. change in weight %	Max. change in tensile at yield %
Synthetic motor oil	70	72	10	-20
Gasoline [a] > 95 ROZ	70	72	10	-30
Diesel [b]	70	72	20	-30
Biodiesel [c] (Rape seed methyl ester)	70	72	15	-30
Brake fluid DOT 4	70	72	1	± 5
Cooling agent (Commercial mixture)	70	72	< 0,5	± 5
Sulphuric acid 1,28 g/ml at 25 °C	70	1 000	< 0,5	± 5

[a] According to DIN 51604-B , [b] according to DIN EN 590 , [c] according to DIN EN 14214

4.3 Examinations of the battery case

4.3.1 General

These examinations have to be performed by the manufacturer of the battery / case / lid and documented with an “Initial Sample Inspection Report” that shall be provided to the purchaser or by the battery producer in case of complete batteries.

4.3.2 Test on disruptive strength

The purpose of this test is to prove an injection quality without risk of acid leakage by small holes.

- Apparatus: Commercial high voltage generator with connected adequate test electrodes, in most cases two adjacent plates [1)]. The voltage must be adjustable up to 25 kV ± 2 KV DC or AC sinus peak to peak with a frequency of 50±10 Hz. The maximum output current of the generator must be adjustable to a current limit ≤ 1 mA.
- Execution: The sample to be tested must be dry. It has to be positioned between the test electrodes in a way, that one electrode contacts the internal side, the other the outer side of the sample. The applied voltage has to be adjusted to generate field strength of at least 5kV / mm up to about 10kV. To find the operation threshold a test sample e.g. a battery case with a thrilled hole of 1.0 ± 0.1 mm in diameter can be used. The electric field is adjusted until the set current limit is reached.
- Requirement: No disruptive discharge = set current limit is reached.
  - [1)] Electrodes with brush design can be beneficial. The electric field is higher on the surface of a tip but decreases with square of distance; system must be checked by experiment.

4.3.3 Warm storage

The purpose of this test is to prove the stability of the battery case. The test discovers internal tensions of the injection moulding process which would result in a warping of the container.

- Apparatus: Heated cabinet with sufficient power. The air temperature shall be recovered to the target temperature within 10 min after the probe has been installed therein. The temperature must be kept at ± 2 °C.

- Execution: The battery case is put into the preheated heat cabinet (120 ± 2) °C in a way that it is not mechanically stressed. It shall not touch other probes or the walls of the heat cabinet and it should be evenly distributed to the available space.

  After 2 h of storage the battery case shall be taken out of the heat cabinet and shall be cooled to room temperature.
- Requirements: The surface must remain even, no change of the original colour shall occur. Deformation of the walls to the central position less than 1.5 % referred to the width of the cells. Changes in overall dimensions in length width and height shall be less than 1.5 %.

4.3.4 Top load test

The purpose of this test is to check if the lid will withstand the forces of top loaded fixations and is performed on complete batteries.

- Apparatus: Heating cabinet with sufficient size to be loaded with one battery and power to heat up the battery to 85 ± 2°C.
  Stamp with a size of 2 cm x 2 cm of heat resistant material (steel, aluminium, copper) loaded with a weight of 25 ± 1 kg (equivalent to 250N / 4cm² = 61,6 N/cm²).
  The system shall be fixed mechanically by a stabilization frame which assures the force being applied even without tilting.
  Metering device with a precision of ±0,1 mm
- Execution: The battery is placed into the heating cabinet and the stamp is positioned between two centre cells above the cell separate wall. The cabinet is closed and heated to 85 ± 2°C. After 24 h the battery is taken out and allowed to cool down to room temperature and the impression of the stamp is measured with the metering device.
- Requirements: The depth of the impression should not exceed 3 mm.

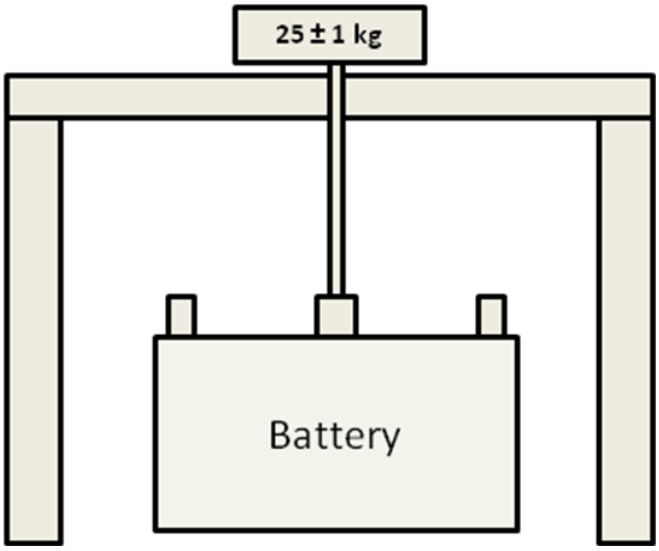

Figure 1 – Top load test

4.3.5 Examination on specimens taken out of a battery case

These examinations shall document the combination of raw material, design and injection process. For some information specimens can also taken out of the walls of the battery housing and checked according to Annex B. It has to be considered, that specimen cut out of battery cases are not according to standard ISO conditions and the results can vary largely. This information can only be used for special aspects for information or comparison and not as standard.

4.3.6 Heat resistance test

The purpose of this test is to secure, that during a normal battery life even under elevated temperatures as they may occur in hot climate regions or batteries mounted near the engine, there will be no degradation of the PP material. Degradation during battery life would result in a damage of the container and acid loss.

The test is carried out preferably with welded dummies but also containers and lids can be used. The parts are placed into a heating cabinet. A direct contact of the parts in the walls or floor mats must be avoided so isolating spacers out of wood or heat resistance poly material have to be used. The parts are placed into a heating cabinet and exposed to 150 ± 2°C of circulating air.

After 300 h exposure (or 400 h for materials with increased heat stability) the parts have to be taken out of the cabinet, cooled for 24 h to room temperature. After 24 h inspection and test can be made.

Requirements: no thermal decomposition, brittleness or cracks should be detected by visual and manual inspection.

Drop a ball with (900 ± 20) g weight and 60 mm diameter from a high of 30 cm to the surface of the tested part: no mechanical damage shall occur. White marks (stress whitening) can be accepted.

4.4 Examinations on the battery

4.4.1 General

With these examinations the service performance of the battery housing for the use in combustion engine vehicles shall be proved.

4.4.2 Bulge test

The purpose of this test is to verify the stiffness of the battery housing at higher temperatures. The stiffness influences the mechanical durability of the battery. The test is performed with a battery housing (box and lid welded).

- Apparatus: Heated cabinet with sufficient power. The air temperature shall be recovered to the target temperature of 90 °C latest after 10 min after the probe has been installed therein. The temperature must be kept at ± 2 °C.

  Metering device with a precision of ± 0.05 mm.

- Execution: The battery housing is filled with ethylene glycol up to the maximum marking. After 24 h at room temperature the dimension is measured over the front sides (case walls parallel to the plates) and recorded as L1.

  The battery housing is to be placed into the heat cabinet for 24 h at (90 ± 2) °C. Afterwards the battery is taken out of the heat cabinet. Within 30 s of the measurement of maximum dimension over the front sides is repeated and recorded as L2.

- Requirement: ((L2 – L1)/L1) x 100 % < 3 %.

4.4.3 Impact test

The test shall prove the relation of hardness to toughness of the battery housing which is critical at low temperature. The test is performed with a battery housing (dummy – box and lid welded), battery or parts of battery housing (box and lid separate).

- Apparatus:
  - Polished steel ball with (900 ± 20) g mass 60 mm diameter.
  - Dropping device with control of height (e.g. plastic tube).
  - Steel plate as support, minimum thickness 10 mm.
  - Freezer of appropriate size, in order to accept the sample and the lower part of the dropping device.

- Execution: To ensure a specimen temperature of (-30 ± 3) °C at ball impact the sample has to be stored for at last 24 in the freezer.

  During the test, the sample should be placed evenly and plane with the samples reversed surface on the steel plate to allow contact with the cooled air. Depending on the battery design this fit could be difficult, and the use of individually designed supports for even fit must be applied.

  The bottom of the battery housing should be hit once by the ball from a 30 cm height in the middle of each cell. If the injection points are located in the centre of the cells the ball should hit the surface aside and not directly on the injection points – in any case the ball should never directly drop to the injection points. If needed, not only the bottom but also all sides can be tested in the same way.

  For clear decisions on a reliable statistical basis the test has to be performed with at least 10 samples randomly picked over 8 h production (Annex D can be used as example).

- Requirements: Maximum number of damage has to be defined in a statistical way (see Annex D). White marks at the hit places will be tolerated.

  In case of doubt the tested parts can be filled with coloured water and placed on a white blotting paper to detect cracks.

4.4.4 Strength of the handles tested with continuous load

The purpose of this test is to prove the strength of the handles and their fixations to the battery for manual handling. If handles are fixed at the lid the welding of lid and box is tested additionally. The test is performed with a battery housing (box and lid welded) or fixed lid only.

The handles including their fixations to the battery should withstand to the forces that normally occur when a person transports or handles the battery. By handling the batteries with handling-apparatus and/or robots the below mentioned load limits may not be exceeded.

• Apparatus: - Climate chamber with sufficient power.

- Pulling device (tensile test apparatus) with sufficient force.

- Holding plate of 70 mm width.

• Execution: The test is performed at, -30 °C, 23 °C and +50 °C, in each case ± 2 °C.

The battery or lid with handle shall be fixed to the pulling device in a manner allowing one handle to be pulled up vertically. The handle is hocked into the holding plate and is connected to the pulling device. Then the handle is pulled with a speed of 50mm/min until to the re-quested force has been reached.

Batteries with handles fixated at the lid have to be fixed in a manner, that the welding joint between box and lid is extremely used with pulling force.

• Requirement: Three-times of the battery weight to a max. force of 800 N.

Deformations of the handles are acceptable.

The transport function must be secured.

The welding must be checked after this test with the following procedure. One of the two gas openings of the cover is closed, the other is applied with a tube. The battery is immerged into a water bath, with the lid totally flooded. A pressure of 200 mbar is applied for 5 min. No leakage of air may be observed (plugs, welding, etc.).

4.4.5 Strength of the handles tested with sudden load

The purpose of this test is to establish what happens if one handle of a battery is suddenly subjected to the total weight of the battery plus the momentum resulting from the battery falling a set defined distance. This happens if the battery is pulled out of a storage rack. The battery is placed on a mobile table. The battery is attached with a steel wire rope and a slit steel tube or adequate support (length 70 mm, diameter depending of the thickness of the handles, at least some space between 1 mm - 2 mm more than diameter). The mobile table is moved suddenly until the battery drops. Instead of a mobile table also a crane can be used to pull the battery

This test should be carried out using 5 batteries of the same type that have been stored at -30 °C, 23 °C and 60 °C for a minimum of 12 h. The test must be done immediately after the battery is taken out of the storage room.

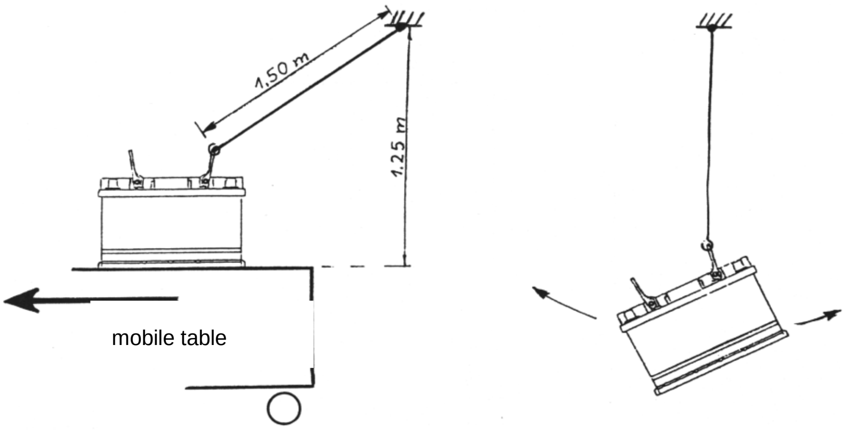

Figure 2 – Sudden load test

• Requirement: The handles of the battery must withstand the test without damage or rupture.

The personnel running this test must be equipped with sufficient personal security equipment to be prepared if the handle breaks and the battery falls to ground.

4.4.6 Hardness of hold-downs for bottom fixation

The purpose of this test is to prove the hardness of the fastening ledges within the range of elasticity against forces occurring when the battery is fastened to the vehicle. The test covers standard bottom hold downs with a height of 10.5 mm according to EN 50342-2.