

Aircraft batteries —

Part 2: Design and construction requirements

The European Standard EN 60952-2:2004 has the status of a British Standard

ICS 29.220.20; 49.060

National foreword

This British Standard is the official English language version of EN 60952-2:2004. It is identical with IEC 60952-2:2004. It supersedes BS EN 60952-2:1993 which will be withdrawn on 1 November 2007. Together with BS EN 60952-1:2004 and BS EN 60952-3:2004, it supersedes BS 6G 205-1:1995, which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee PEL/21, Secondary cells and batteries, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

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Batteries d'aéronefs
Partie 2: Exigences de conception
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(CEI 60952-2:2004)

Flugzeugbatterien
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CENELEC

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

Central Secretariat: rue de Stassart 35, B - 1050 Brussels

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Foreword

The text of document 21/612/FDIS, future edition 2 of IEC 60952-2, prepared by IEC TC 21, Secondary cells and batteries, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 60952-2 on 2004-11-01.

This European Standard supersedes EN 60952-2:1993.

The changes made involve the inclusion of those formats that can be standardised along with their connectors and electrical interfaces.

It is recognised that additional data may be required by other organisations (national standards bodies, AECMA, SAE, etc.). The present standard can be used as a framework to devise tests for generation of the required data.

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) 2005-08-01
- latest date by which the national standards conflicting
with the EN have to be withdrawn (dow) 2007-11-01

Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 60952-2:2004 was approved by CENELEC as a European Standard without any modification.

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AIRCRAFT BATTERIES –

Part 2: Design and construction requirements

1 Scope

This part of IEC 60952 defines the physical design, construction and material requirements for nickel-cadmium and lead-acid aircraft batteries containing vented or valve-regulated cells or monoblocs. The batteries are used for both general purposes and specific aerospace applications.

The specific topics addressed in this part serve to establish acceptable quality standards required to qualify a battery as airworthy and are divided into two classes (class I and II) as defined in Clause 3 of IEC 60952-1.

A preferred range of aircraft batteries is specified in Annex A, but this part of IEC 60952 may be used for other battery sizes, arrangements and ratings. For particular applications, other design requirements may be stipulated. These will be in addition to the requirements of this part and will be covered by specific documents.

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 60952-1, *Aircraft batteries – Part 1: General test requirements and performance levels*

3 Terms and definitions

Clause 3 of IEC 60952-1 is applicable.

4 General construction requirements

Batteries complying with this standard shall be capable of meeting the requirements of IEC 60952-1 upon commissioning in accordance with manufacturer instructions or as specified in the product specification.

4.1 General purpose requirements for class I and II applications

Batteries designed for utilization in the aerospace environment shall be sufficiently robust and shall withstand the rigors of normal application, handling, manoeuvres and the full range of operating conditions permitted for the aircraft concerned.

4.2 General requirements

- a) **WARNING:** Any change from the original battery manufacturer's design and construction requires re-qualification. During maintenance, do not mix cells or components of different construction or manufacture in the same battery as this could result in a safety issue.
- b) The terminal arrangements should be such as to obviate the possibility of incorrect connection. The type of arrangements shall be selected from the examples shown in Annex B.
- c) The containers shall be constructed of impervious material. The battery manufacturer shall declare the flammability characteristics of the outer containers.

4.3 Installation considerations

- a) Location: Batteries and their containers shall be securely fixed in positions such that they are easily accessible for inspection, replacement and necessary tests.
- b) Temperature of electrolyte: The method of installation shall ensure that, under operating conditions, the temperature of the electrolyte is maintained within the limits necessary for satisfactory operation. This shall normally be achieved by suitable location of the batteries within the aircraft.
- c) Ventilation: Ventilation adequate for the prevention of dangerous concentrations of ignitable or toxic gases shall be provided for the battery and compartment in which batteries are installed. These arrangements shall take account of the quantities of gas likely to be released under conditions of thermal instability of the battery.
- d) Corrosion: Batteries should be accompanied on a tray which is resistant to corrosion by the electrolyte. This tray should be so installed that it will not normally be removed with the battery.
- e) Flammability: Battery case material requirements may vary according to the location of the battery within the aircraft. For example, batteries located within an area which may be subject to a fuel fire shall be fire proof, batteries in crew or passenger compartments shall be flame resistant, while batteries installed in flame resistant or fireproof battery boxes may be flammable. Consideration must be given to toxic fumes given off by many "flame retardant" materials when they burn

4.4 Workmanship

The battery shall be manufactured in such a manner as to be uniform in quality and shall be free from defects that will affect life, functioning, and appearance. Batteries shall not have loose contacts, improper moulding or fabrication, damaged or improperly assembled contacts, peeling, flaking or chipping of plating or finish, mechanical damage due to testing environments, nicks or burrs of metal parts of surfaces, nor improper or incorrect marking. A description of the requirements is shown in Table 1. Upon delivery, prior to testing and following testing the batteries shall be examined for compliance .

Table 1 – Workmanship requirements

Number	Description	Inspection method
1	Electrical contact surfaces obstructed by insulation compounds	Visual
2	Pitting or blow holes on the external cell container	Visual
3	Electrolyte leakage	Visual
4	Location and polarity of terminals not as specified	Visual
5	Terminal and identification markings not as specified	Visual
6	Terminal seals missing or defective	Visual
7	Corrosion	Visual
8	Particles of foreign material	Visual
9	Welds containing blow holes, cracks, or slag inclusions	Visual
10	Burrs on battery container or cover	Visual
11	Improper colour on outside of container and cover	Visual

5 Electrolytes

Those batteries designated “sealed” do not require the addition of distilled/de-ionised water to the electrolyte during use or qualification testing. Maintainable types require the electrolyte to be adjusted to a certain level within the cell. The addition of distilled/de-ionised water should only be made when the battery is fully charged, as the level will vary depending upon its state of charge. The manufacturer shall define the procedure for determining and adjusting the electrolyte levels.

- a) Potassium hydroxide electrolyte: nickel-cadmium batteries shall use an electrolyte consisting of an aqueous solution of potassium hydroxide.
- b) Sulphuric acid electrolyte: the electrolyte shall be an aqueous solution of sulphuric acid.

5.1 Electrolyte resistance

Components used inside the battery shall demonstrate resistance to electrolyte as required by IEC 60952-1.

5.2 Electrolyte level

The cells of all flooded batteries shall have a clearly defined means of identifying the proper electrolyte fill level. This may be by means of a permanent index mark in the filler neck, step, notch, slot or some other obvious method. A specific method may be defined in the product specification.

5.3 Leakage

Electrolyte leakage of batteries and components shall be evaluated according to the requirements of IEC 60952-1.

6 Dissimilar metals

Where dissimilar metals are used in intimate contact, suitable protection against galvanic corrosion shall be applied.

7 Corrosion prevention - Vented nickel-cadmium batteries only

After the battery has been assembled, all exposed metal surfaces of the cells, inter-cell connectors, and associated hardware shall be coated with an electrolyte resistant, corrosion preventive compound. Vent valve rubber sleeves, vent openings, and the interfaces between current carrying surfaces shall not be exposed to the corrosion preventive film. The coating shall be applied evenly and without voids.

8 Battery containers and components

The dimensions and locations of receptacles, hold-downs and vent tubes shall conform to the format examples in Annex A.

8.1 Battery containers and covers

The battery container and cover shall be free of rough spots, pits, blowholes and other deformations. The product specification may specify whether or not the lid shall be removable.

8.2 Electrical bonding

Where metallic hold downs are used, provision shall be made to provide a bare conductive surface on all hold down bars, brackets, or attachment points, for electrical bonding with the airframe unless detailed otherwise in the product specification. This may be accomplished by leaving part of the outer 22 mm of the hold down bar uncoated or by spot facing the coating to bare metal.

8.3 Cell jars and monoblocs

The cell container and cover shall be free of rough spots, pits, blowholes and other deformations

They shall be made from insulating material which is resistant to the operating conditions. The components shall be joined together by a permanent weld or adhesive which is resistant to atmospheric pressure.

The cell container utilised in nickel-cadmium batteries shall be made of self-extinguishing non-porous, alkali-resistant material, such as polyamide.

The cell container utilised in lead acid batteries shall be made of non-porous, acid-resistant material, such as polypropylene, polystyrene and polycarbonate.

9 Venting arrangements

9.1 Battery requirements

The design of the battery shall employ a method of ambient air dilution of the gases generated during overcharge. The purging system may be either by natural ventilation or by assisted ventilation.

In natural ventilation, the battery container and/or cover shall have sufficient holes or louvres to ensure gas dissipation in still air. Such holes or louvres shall be adequately protected to prevent access by foreign objects.

For assisted ventilation, the liberated gases from all the cells shall pass into a venting chamber, having ports for the purging air. The battery manufacturer shall declare compliance with the appropriate clause in IEC 60952-1. There are two preferred methods of achieving a purging air flow:

- a) the entry of air into the battery is via an entry housing with an integral non-return valve. It shall not be possible to connect a pipe to the inlet side of the valve. The air is taken from the battery by a pipe connection;
- b) the air is taken to and from the battery by pipe connections and the direction of ventilation is immaterial.

The manufacturer shall declare compliance with 6.5 of IEC 60952-1.

9.2 Cell requirements

9.2.1 Vented filler cap for vented cell

Each cell shall be fitted with a vent filler cap made of non-conductive material, which is resistant to electrolyte and equipped with a sealing device.

The vent filler cap shall contain a device to permit the escape of gas. For aerobatic use specified vent filler caps can be used to prevent the escape of liquid when the battery is inverted.

The vent filler cap shall fulfill its function in all specified tests, at the pressure defined by the manufacturer.

9.2.2 Valve for valve regulated cell

Each cell shall be fitted with a valve designed to allow the escape of gas in case of abusive conditions.

10 Inter-cell connectors for nickel-cadmium batteries

10.1 General

Exposed inter-cell connections shall be designed and installed in such a way as not to interfere with the removal of the cell vented filler caps. Epoxy or other plastics shall not be used to cover the internal connectors or their fasteners. The manufacturer shall provide details of the correct torque setting for the inter-cell connectors for each type of battery supplied.

Inter-cell connectors may be designed to be either removable or non-removable at the request of the purchaser. Non-removable connecting links are described in 10.2. All inter-cell connectors shall conform to the following guidelines:

- a) be constructed of adequate size to match the current capabilities of the battery;
- b) be constructed so as to not create corrosion or reactions from dissimilar metals; and
- c) be capable of withstanding exposure to electrolyte.

10.2 Special purpose inter-cell connections – non-removable

Certain styles of low-maintenance, limited-repair nickel-cadmium batteries may be requested with "non-removable" inter-cell connectors. The mounting hardware for this type of application prevents the removal of the individual cells for maintenance. The inter-cell connections shall not interfere with the removal of removable charger harnesses and tamper-resistant hardware shall not be used on receptacles or harnesses. To impede cell removal, the inter-cell connectors used in limited repair batteries shall be attached to the cell posts by the use of tamper-resistant means, such as tamper-resistant fasteners, that shall be difficult to remove but which shall not injure the cell upon removal. Rivets, welding, or adhesive methods shall not be used to attach the intercell connectors of limited repair batteries.

11 Handles

Each handle shall be capable of supporting the weight of the battery by a factor of at least 1,5 times the weight of the battery.

WARNING: Battery vent tubes are not intended for use as lifting handles.

Other requirements for battery lifting handles, if required, shall be defined in the product specification and shall detail appropriate human factors such as:

- a) provide sufficient space to be used with cold weather protection;
- b) not restrict normal use by fouling ancillary equipment.

12 Latches

Latches may be used to fasten the battery cover to the container body by a system of catches mounted on the container body and strikes mounted on the cover. The position of the latches and mounting method may be defined in the product specification.

13 Materials and components for flooded nickel-cadmium batteries

For flooded nickel-cadmium batteries, aluminium, polycarbonate, or polyester shall not be used in the construction of any nickel-cadmium battery, cell or component covered by this standard. Except for the hold-down pad, neoprene shall not be used in the construction of any nickel-cadmium battery, cell, or component covered by this specification. When specified by the procuring activity or the qualification activity, the manufacturer shall supply a certification of conformity of the material or component. In the absence of certification from the source, a certificate of analysis or certified inspection data will be required.