



THE EUROPEAN PORTABLE BATTERY ASSOCIATION

Product Information Primary and Rechargeable Batteries

The Authoritative Voice of the Portable Battery Industry

Introduction

The following document provides product information on portable primary and rechargeable batteries. The information is compiled by the European Portable Battery Association.

For each battery type it lists the indicative chemical composition, the nominal voltage, the key-applications for which the battery can be used and specific considerations in relation to the recycling of portable batteries.

It is important to note that the Battery Directive 2006/66/EC, foresees specific substance limits for batteries. Following this Directive as amended by Directive 2013/56/EU, the following prohibitions are applicable:

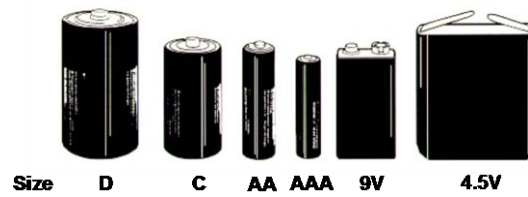
1) Mercury

- all batteries and accumulators cannot contain more than 0,0005% of Mercury by weight;
- as of 2 October 2015 the ban applies also to button cells;

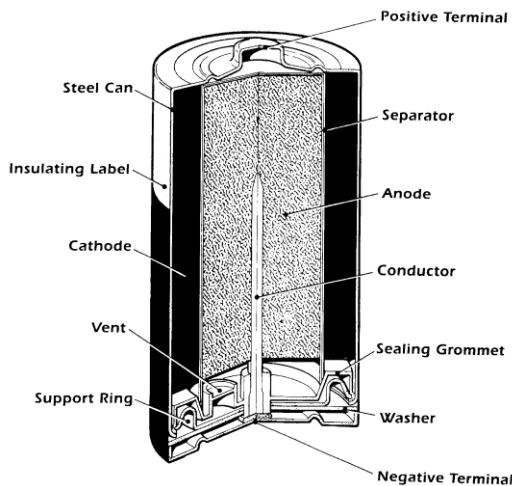
2) Cadmium

- Portable batteries cannot contain more than 0,002% of Cadmium by weight

GENERAL PURPOSE PRIMARY BATTERIES



Alkaline Manganese



Indicative Chemical Composition:

(will vary according to battery size and manufacturer)
 MnO_2 - 37%; Fe - 23%; Zn - 16%; H_2O - 9%; KOH - 5%; C - 4%; Brass - 2%; Others - 4%

Nominal voltage:

1.5V

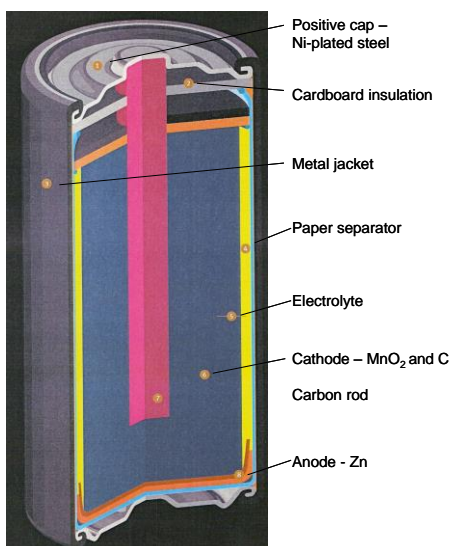
Applications:

Consumer electronics, cameras, toys, games consoles, smoke detectors, etc.

Recycling:

Can be recycled in steel industry to recover steel, manganese and zinc.

Zinc Carbon



Indicative Chemical Composition:

(will vary according to battery size and manufacturer)
 MnO_2 - 27%; Zn - 23%; H_2O - 18%; C - 10%; $\text{ZnCl}/\text{NH}_4\text{Cl}$ - 5%; Fe - 4%; Others - 13%

Nominal voltage:

1.5V

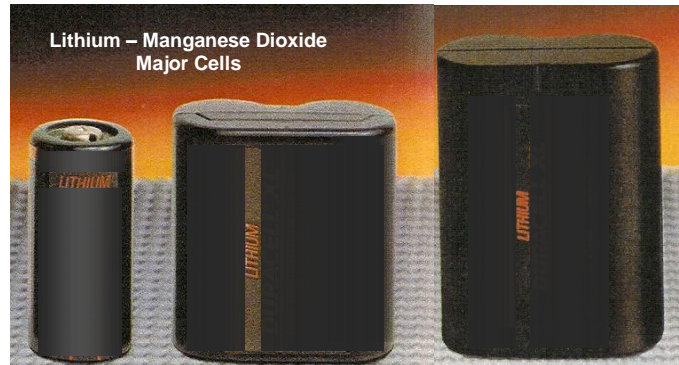
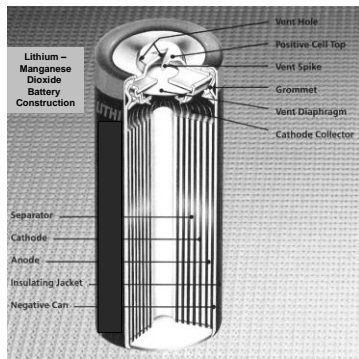
Applications:

Clocks, radios, door bells, flash lights, etc.

Recycling:

Can be recycled in steel industry to recover steel, manganese and zinc.

Lithium - Manganese Dioxide Major Batteries



Indicative Chemical Composition:

(will vary according to battery size)

Fe - 50%; MnO₂ - 30%; Plastic - 7%; Dimethoxyethane - 6%, Li - 3%; C - 2%; Ni - 2%

Nominal voltage:

3V

Applications:

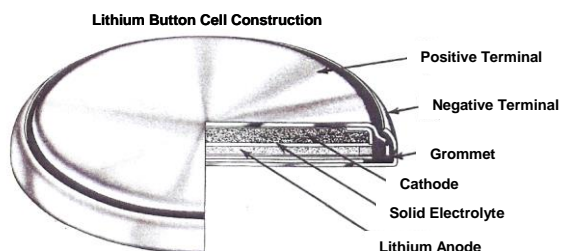
Cameras, toys.

Recycling:

Due to their small volume lithium batteries can be processed in the metals industry mixed with alkaline and zinc carbon batteries. This allows recovery of the steel and manganese.

Primary Button Cells

Lithium – Manganese Dioxide



Indicative Chemical Composition:

(will vary according to battery size)

Fe - 50%; MnO₂ - 28%; Cr – 10%; Plastic - 3%; Li - 3%; Dimethoxyethane - 2%, C - 2%; Ni - 2%

Nominal voltage

3V

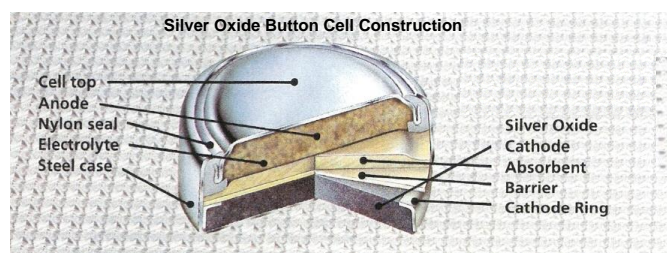
Typical applications

Photographic, car entry, electronics

Recycling Technology

May be processed with other button cells to recover the steel content. This can only be done if the percentage of Lithium-Manganese in the mix is low. Otherwise, these button cells are recycled in specialised facilities to recover the steel content.

Silver Oxide



Silver Oxide and Alkaline Manganese Button Cells

Indicative Chemical Composition:

(will vary according to battery size)

Fe - 42%; Ag₂O - 33%; Zn – 9%; Cu - 4%; MnO₂ – 3%; H₂O - 2%; Plastic - 2%; Ni - 2%; KOH - 1%; C - 0.5%; Hg - 0.4%; Others – 1,1%

Nominal Voltage

1.5V

Typical Applications

Watches

Recycling Technology

Can be recycled in specialist facilities that capture the mercury, recover the silver and produce a slag containing a mixture of metals. However in order to take advantage of this technology silver oxide button cells have to be collected separately from other button batteries. It is not generally possible to separate them automatically from a mixture of button cells.

Alkaline Manganese Dioxide

Indicative Chemical Composition:

(will vary according to battery size)

Fe - 37%; MnO₂ - 36%; Zinc - 11%; H₂O - 6%; Plastic - 3%; KOH - 2%; C - 2%; Ni - 1%; Hg - 0.6%;
Others – 1,4%

Nominal Voltage

1.5V

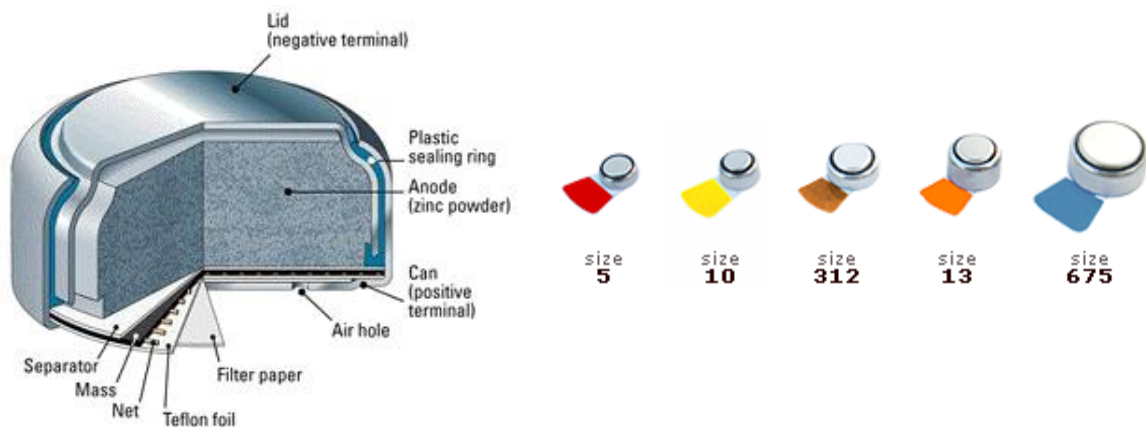
Typical Applications

Calculators, small electronic devices, remote controls.

Recycling Technology

Can be recycled in specialist facilities that capture the mercury and produce a slag containing a mixture of metals for the recovery of metals.

Zinc Air



Indicative Chemical Composition:

(will vary according to battery size)

Fe - 42%; Zinc - 35%; H₂O - 10%; Plastic - 4%; KOH - 4%; C – 1%; Hg - 1%; Others – 3%

Nominal voltage:

1.4V

Applications:

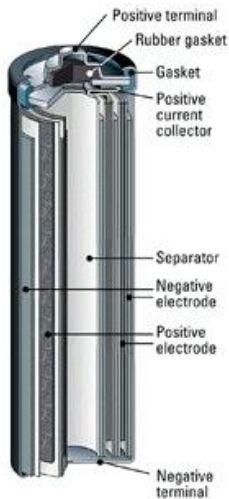
Hearing aids, pagers.

Recycling:

Can be recycled in specialist facilities that capture the mercury and produce a slag containing a mixture of metals.

Rechargeable Batteries

Rechargeable Single Cells and Packs for Cameras, Phones, Computers and Camcorders



Rechargeable Battery

Nickel Cadmium

Indicative Chemical Composition:
(will vary according to battery size)

Fe - 40%; Ni - 22%; Cd - 15%; Plastic - 5%; KOH - 2%; others – 16%

Nominal Voltage
1.2V

Typical applications
Emergency lighting and alarm systems, medical devices, power tools.

Recycling Technology
Can be recycled in pyro-metallurgical processes to recover the cadmium, nickel and iron.

Nickel Metal Hydride

Indicative Chemical Composition:
(will vary according to battery size)

Ni - 33%; Fe - 30%; Lanthanides - 10%; H₂O - 8%; Co - 3%; Plastic – 5%; KOH - 2%; Mn - 1%; Zn - 1%; others – 7%.

Nominal Voltage
1.2V

Typical Applications
Camcorders, Mobile Phones, Computers, IT equipment

Recycling Technology
Can be recycled together with nickel cadmium batteries to recover ferro nickel and cobalt

Lead Acid



Indicative Composition

(will vary according to battery size)

Lead (incl. Lead oxides) – 72%, Electrolyte (H₂SO₄) – 17%, Plastics – 9%; others – 2%

Nominal Voltage:

2 - 12V

Typical applications:

Alarms, UPS, electrical fencing, road construction

Recycling technology

Can be recycled in specialized facilities to recover the lead.

Lithium Ion

3 pictures

Indicative Composition

(will vary according to battery size)

Aluminium - 15-25%, Carbon, amorphous, powder - 0,1-1%, Copper foil – 5-15%, Diethyl Carbonate (DEC) – 1-10%, Ethylene Carbonate (EC) - 1-10%, Methyl Ethyl Carbonate (MEC) - 1-10%, Lithium Hexafluorophosphate (LiPF₆) - 1-5%, Graphite, powder - 10-30%, Lithium Cobalt Oxide (LiCoO₂) - 25-45%, Poly (vinylidene fluoride) (PVDF) -0.5-2%, Steel: balance, Nickel and inert polymer: balance

Nominal Voltage:

3.7V

Typical applications:

Mobile Phones, portable audio

Recycling technology

Li-Ion can be recycled in specialized with the primary recovery being the metal content

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