Button cell

Button, coin, or watch cells

A **watch battery** or **button cell** is a small single cell battery shaped as a squat cylinder typically 5 to 12 mm in diameter and 1 to 6 mm high—like a button on a garment, hence the name. Button cells are used to power small portable electronics devices such as wrist watches, pocket calculators, and hearing aids. Some cells larger than the dimensions above are also called button cells, but are less commonly used. Lithium cells are generally similar but somewhat larger; they tend to be called either lithium cells or batteries or **coin cells** rather than button cells.

Devices using button cells are usually designed to use a cell giving a long service life, typically well over a year in continuous use in a wristwatch. Most button cells have low self-discharge and hold their charge for a long time if not used. Higher-power devices such as hearing aids, where high capacity is important and low self-discharge less so as the cell will usually be used up before it has time to discharge, may use zinc-air cells which have much higher capacity for a given size, but discharge over a few weeks even if not used.

Button cells are single cells, usually disposable primary cells. Common anode materials are zinc or lithium. Common cathode materials are manganese dioxide, silver oxide, carbon monofluoride, cupric oxide or oxygen from the air. Mercuric oxide button cells were formerly common, but are no longer available due to the toxicity and environmental hazard of mercury.

Cells have a metal can forming the bottom body, with a circular insulated top cap. The can is the positive and the top the negative terminal.

Cells of different chemical composition made in the same size are mechanically interchangeable. However, the composition can affect service life and voltage stability. Using the wrong cell may lead to short life or improper operation (for example, light metering on a camera requires a stable voltage, and silver cells are usually specified). Sometimes different cells of the same type and size and specified capacity in mAh are optimised for different loads by using different electrolytes, so that one may have longer service life, than the other if supplying a relatively high current.

Properties of different types

Silver cells may have very stable output voltage until it suddenly drops very rapidly at end of life. This varies for individual types; one manufacturer (Energizer) offers 3 silver oxide cells of the same size, 357-303, 357-303H,and EPX76, with capacities ranging from 150 to 200 mAh, voltage characteristics ranging from gradually reducing to fairly constant, and some stated to be for continuous low drain with high pulse on demand, others for photo use.

Mercury batteries also supply a stable voltage, but are now banned in many countries due to their toxicity and environmental impact.

Alkaline batteries are made in the same button sizes as other types, but typically provide less capacity and less stable voltage (it drops gradually in use) than more costly silver oxide or lithium cells. They are often sold as cheap watch batteries to, and sometimes by, people who do not know the difference.[1]

Zinc-air batteries use air as the depolarizer and have much higher capacity than other types (they use air from the atmosphere which does not need to be supplied in the battery). A seal is removed before use to allow air to enter the cell; the cell will then self-discharge in a few weeks even if not used up.

For comparison, a cell of diameter 11.6 mm and height 5.4 mm from one reputable manufacturer has the following properties.[2] In many cases there are several batteries of the same chemistry and size with different capacities and properties; figures listed are merely indicative.

- Silver: capacity 200 mAh to an end-point of 0.9 V, internal resistance 5–15 ohms, weight 2.3 g
- Alkaline (manganese dioxide): 150 mAh (0.9), 3-9 ohms, 2.4 g
- Mercury 200mAh, 2.6 g

- Zinc-air 620 mAh, 1.9 g

Examining datasheets for a manufacturer's range[2] may find a high-capacity alkaline cell with a capacity as high as one of the lower-capacity silver types; or a particular silver cell with twice the capacity of some particular alkaline cell. If the powered equipment requiring a relatively high voltage (e.g., 1.3V) to operate correctly, a silver cell with a flat discharge characteristic will give *much* longer service than an alkaline cell—even if it has the same specified capacity in mAh to an end-point of 0.9V. If some device seems to "eat up" batteries after the original supplied by the manufacturer is replaced, it may be useful to check the device's requirements and the replacement battery's characteristics. For digital calipers, in particular, some are specified to require at least 1.25V to operate, others 1.38V.[3][4]

Datasheets for some cheaper cells, particularly alkaline, are not available, so it is not possible to say whether capacities are about the same as for documented types.[5] Discussions on web forums suggest that they can be very poor.[6]

In some ways the size is the most important property of a button cell: cells of different chemistry are to a considerable extent interchangeable. In practice only cells of fairly similar voltages are made in any given size; there is no "CR1154" 3V lithium battery mechanically interchangeable with a 1.5V silver or alkaline size 1154 cell. Use of a battery of significantly higher voltage than equipment is designed for can cause permanent damage, but use of a cell of the right voltage but unsuitable characteristics can only lead to short battery life or failure to operate equipment.

Electrochemical system

The first letter identifies the chemical composition of the battery, which also implies a nominal voltage:

Letter code	Common name	Positive electrode	Electrolyte	Negative electrode	Nominal voltage	End-point voltage
L	Alkaline	Manganese dioxide	Alkali	Zinc	1.5	1.0
S	Silver	Silver oxide	Alkali	Zinc	1.55	1.2
P	Zinc-air	Oxygen	Alkali	Zinc	1.4	1.2
C	Lithium	Manganese dioxide	Organic	Lithium	3	2.0
B		Carbon monofluoride	Organic	Lithium	3	2.0
G		Copper oxide	Organic	Lithium	1.5	1.2
M,N(withdrawn)	Mercury	Mercuric oxide	Alkaline	Zinc	1.35/1.40	1.1