

Energizer Zinc Air (Zn/Ⓞ) Application Manual

System Description:

Miniature zinc air batteries are primarily designed to provide power to eyeglass, behind-the-ear, and in-the-ear miniature hearing aids. In most hearing aid applications, zinc air batteries can be directly substituted for silver oxide or mercuric oxide batteries and will typically give the longest hearing aid service of any common battery system.

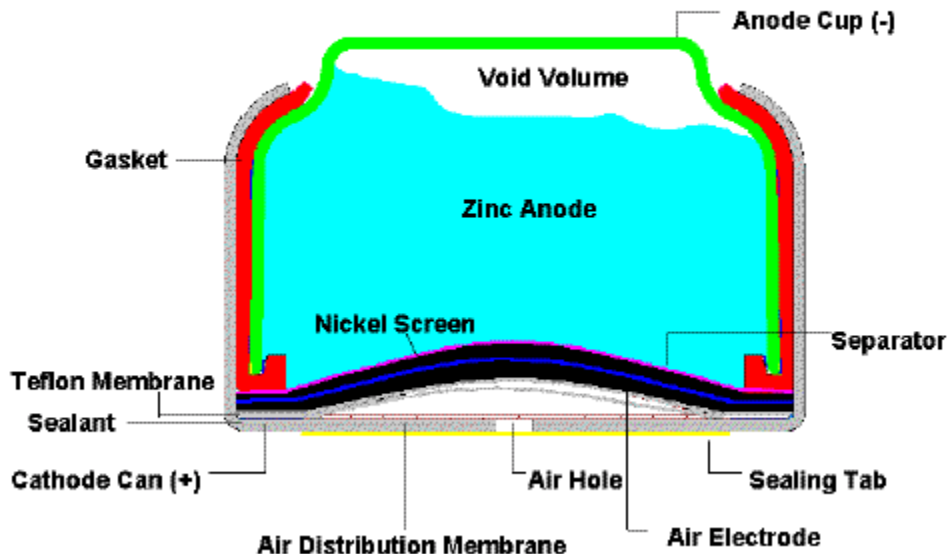
The general characteristics are:

- ✱ Highest capacity-to-volume ratio for miniature batteries..
- ✱ Relatively flat discharge curve.
- ✱ More stable voltage at high currents than mercuric oxide or silver oxide miniature batteries.
- ✱ Essentially constant internal resistance.
- ✱ Activated by removing covering (adhesive backed tab) from air access hole.
- ✱ Most effective in applications that consume battery capacity in a few weeks.
- ✱ Must have access to air (oxygen) to operate.
- ✱ Nominal voltage of 1.4
- ✱ Excellent service maintenance prior to tab removal.
- ✱ Available in common hearing aid battery sizes.

Battery Construction:

The electrodes in "Air Cell" batteries are gelled zinc powder anodes and catalyzed carbon cathodes. A hole in the battery container allows oxygen from the air to enter the cathode and be reduced on the carbon surface. At the same time, the zinc in the anode is oxidized in the same way as in a miniature mercuric oxide or silver oxide battery. A cutaway of an "Air Cell" battery is illustrated in the following diagram:

Miniature Zinc Air Cell



Cathodes are catalyzed carbon which reduce oxygen from the air.

Anodes are a gelled mixture of amalgamated zinc powder and electrolyte.

Electrolyte is a highly conductive solution of KOH in water.

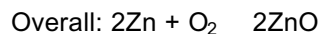
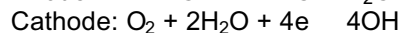
Separators are materials specially selected to prevent migration of solid particles between the electrodes.

Insulating and sealing gaskets are molded nylon.

Exterior battery surfaces of nickel are used to resist corrosion and to insure good electrical contact.

Electro-Chemistry:

The electrode reactions for a zinc air battery are as follows



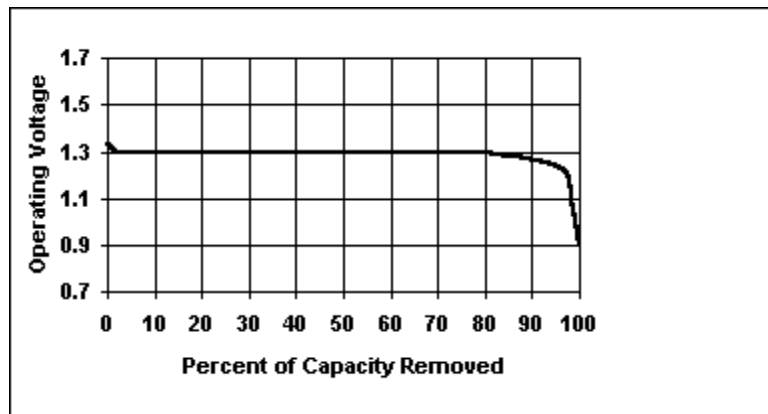
While typical voltage resulting from this reaction is 1.4, it will vary with current drawn from the battery and with depth of discharge.

The air must have an unobstructed path through the device and into the cathode so that the oxygen in the air is available to discharge the cathode. A hole (or holes) is provided in the battery container to allow the necessary oxygen into the battery. Because excessive moisture transport can degrade battery

performance, the container hole is sealed by an adhesive backed tab prior to consumer use. This tab must be removed when the battery is put into service.

The zinc air system provides the highest capacity to volume ratio of the various miniature battery systems. It has a relatively flat discharge curve and is less rate sensitive than mercuric oxide or silver oxide miniature batteries. "Air Cell" batteries have essentially constant internal resistance.

A typical discharge is:

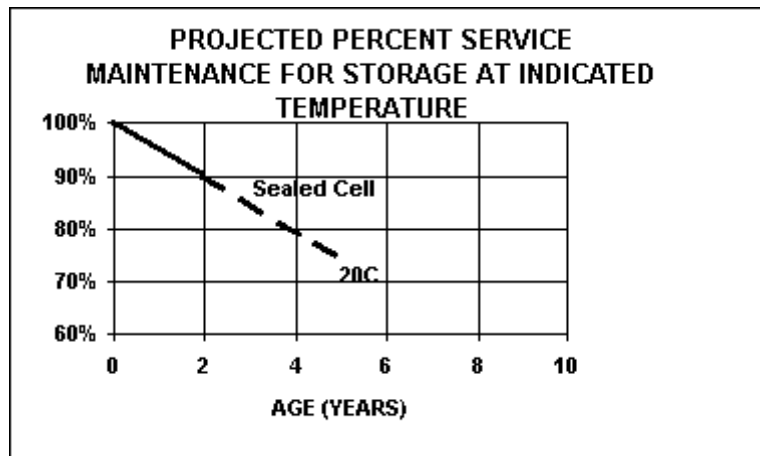
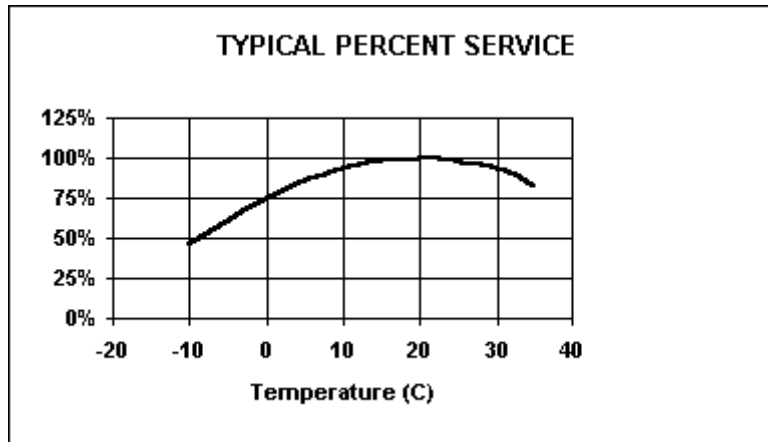


The key to miniature zinc air battery shelf life is the tab seal. This seal should not be removed until the battery is put into service. Miniature zinc air batteries stored at room temperature with the tabs left in place and subjected to typical hearing aid service tests show 95% of initial service after one year and 90% after two years. Accelerated testing indicates that room temperature service maintenance at four years should exceed 85%.

The activated (tab off) air cell batteries have an expected fresh capacity maintenance, depending on cell size, of 50% after 3-12 weeks at 20°C (68°F). Beyond 20 weeks, at 20°C (68°F), fresh capacity maintenance drops to 0-10%. It is therefore very important to keep the tab seal in place until usage.

Temperature:

The temperature range in which these batteries can be used in a continuous mode is -10°C to 55°C. At high temperatures, however, the batteries will lose water rapidly and this loss will limit the length of service.



Applications:

"Air Cell" batteries are especially effective in high to medium drain applications that will use the batteries capacity within a few weeks after opening the seal. Applications falling within this usage time will achieve the high energy density advantage: the highest capacity-to-volume ratio for any miniature battery system. Hearing aids and pagers are typical devices which fit this usage time parameter.

This reference manual contains general information on all Energizer/Eveready batteries within the Zinc Air chemical system in production at the time of preparation of the manual. Since the characteristics of individual batteries are sometimes modified, persons and businesses that are considering the use of a particular battery should contact the nearest Energizer Sales Office for current information. None of the information in the manual constitutes a representation or warranty by Eveready Battery Company, Inc. concerning the specific performance or characteristics of any of the batteries or devices.