Button cells in digital calipers and the like

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Abstract

This article explains the difference between silver and alkaline cells in digital calipers and the like.

1. Introduction

Figure 1: Various instruments with similar battery requirements.

Electronics has found its way into a range of measuring instruments, some examples are shown in Figure 1.

Without exception, these and others that I have purchased over the years have all be supplied with alkaline cells, most of them LR44.

Everyone who has used them has experienced the flashing display syndrome not long after a new alkaline cell is installed, especially in lower temperatures.

Have you ever wondered why?

2. Instrument requirements

These instruments typically detect low battery voltage and flash the display to signal the condition.

In measuring several instruments, it seems that the threshold for low battery detection is between 1.42 and 1.45V, all instruments tested worked fine on 1.45V.

Now the alkaline cells usually sold with the instruments have a nominal voltage at room temperature of 1.50V when new (ie fully charged).

So, a voltage sag of just 0.3% is sufficient to trigger the low voltage detector!

3. Alkaline (manganese dioxide) cell performance

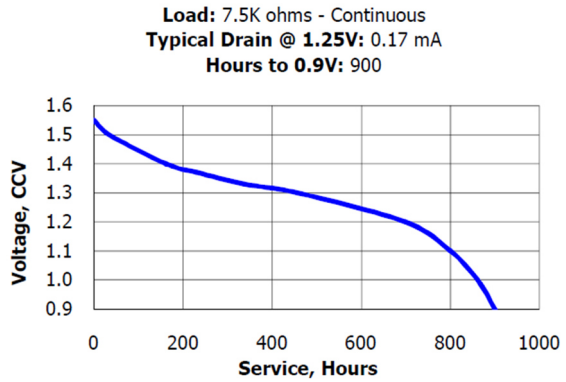

Figure 2: Typical discharge characteristic of alkaline cell.

Figure 2 is from Eveready's alkaline A76 (LR44 equivalent) cell with a load of 7k5Ω. The service time to 1.45V is about 100h, at an average current of around 0.2mA for a service capacity of 20mAh to 1.45V.

So, though these cells are rated for a nominal 150mAh, that rating is to 0.9V and you will not get near that from these instruments. The problem is that terminal voltage sags moderately quickly from the very start of discharge.

4. Silver oxide cell performance

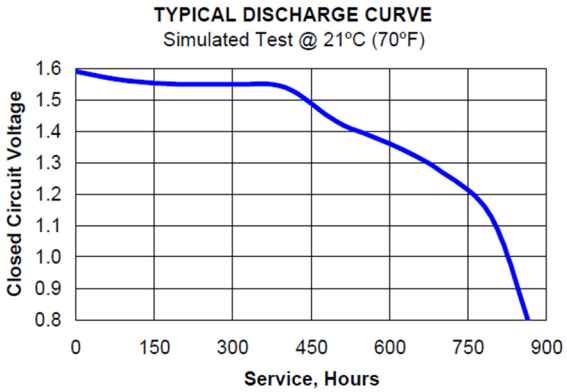

Figure 3: Typical discharge characteristic of Silver oxide cell.

Figure 3 is from Eveready's silver oxide EPX76 (SR44 equivalent) cell with a load of 6k5Ω. The service time to 1.45V is about 500h, at an average current of around 0.2mA for a service capacity of 100mAh to 1.45V (or about five times the capacity of the LR44).

Though the load current in this case is a little higher, it is clear that the silver oxide battery terminal voltage does not sag much at all until it has reached half of its 0.9V capacity.

The silver oxide cell delivers substantially higher capacity for the instruments than an alkaline cell.

5. Costs

The increased capacity doesn't come at no cost. Main street prices (DSE) in Australia are EPX76 $8 and A76 $4/2 ($2ea), so the silver oxide cell is four times the price for five times the capacity so the cost per hour of use is a little lower with the convenience of longer interval between battery changes.

Batteries can be bought for much better prices, but one sees batteries at unbelievable prices and it is doubtful that the cheapest batteries on eBay are good value. Be careful of eBay sellers who often describe alkaline cells with the SR44 designation, as you can see they are not equivalent.

I usually pay about $0.40 for LR44 and closer to $2 for SR44 from a reputable manufacturer (eg Maxell).

6. Changes

Version	Date	Description
1.01	20/11/2012	Initial.
1.02	27/06/2016	Converted to Word
1.03		