PURE ENERGY.

30 Pollard Street Richmond Hill, Ontario L4B 1C3 TEL: (905) 707-9577 FAX: (905) 707-7435 www.pureenergybattery.com

### DATA SHEET OF PURE ENERGY XL RECHARGEABLE ALKALINE CELLS

Cell Size	AA				
Open Circuit Voltage		1.57 V			
Internal Resistance of Fresh cells		approx. 0.150 Ω			
Initial Typical	30 mA to 0.9 V	2000			
Capacity <sup>1)</sup> , mAh	125 mA to 0.9 V	1750			
	300 mA to 0.8 V	1400			
	500 mA to 0.8 V	1200			
	1000 mA to 0.8 V	900			
Dimensions	Height, in.	1.975			
	Height, mm	50.2			
	Diameter, inch	0.553			
	Diameter, mm	14.0			
Average Weight, g	22				
Charging	Voltage Limit, V	1.65 <u>+</u> 0.05 V			
(Pulse/Taper) <sup>2)</sup>		(for taper charge)			
		1.75/1.65V			
		(for pulse charge)			
	Max. Charge	1 A			
	Current, A/cell				
Operating Temperat	$-20^{\circ}$ C to $+60^{\circ}$ C				
Storage	Recommended	$+ 15^{\circ}C \text{ to } + 35^{\circ}C$			
Temperature	Tested	Up to 70°C			
Shelf life of Fresh C	5 to 7 years				
Cycle Life <sup>4)</sup>	50 to 500 +				
<ol> <li>Aged cells may require intermittent discharge, which is the typical consumer use, to achieve typical capacity.</li> <li>Pulse Charge of XL RAM requires intelligent charger with a special</li> </ol>					
<ul><li>charging algorithm. Contact PEB for details.</li><li>3) Capacity from cells will be lower at lower temperatures</li></ul>					

4) Cycle life will strongly depend on factors such as rate of discharge, end point (cut -off) voltage and depth of discharge

# **Cell Construction**



Fig. 1: Cross Sectional View of an AA Cell

### Chemistry

- $MnO_2 + H_2O + e^- \le MnOOH + OH^-$
- $Zn + 2 OH^{-} \ll ZnO + H_2O + 2e^{-}$
- $Zn + 2 MnO_2 + H_2O \iff ZnO + 2 MnOOH$
- Aqueous potassium hydroxide solution

Additional design considerations:

 Cells also have 'anti-fade' additives to promote rechargeability, catalysts to manage internal gas pressure, a semi-permeable membrane separator to prevent internal shorting and are limited to the 'one-electron' capacity of MnO<sub>2</sub>.

### Discharge



Fig. 2: Normalized Discharge Voltage Curves for AA Cells to Estimate Available Capacity at Various Drain Rates.

### Charge



Fig. 3: Typical Charge Curves for Fast Pulse Charge of XL RECHARGEABLE ALKALINE AA Cells.

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# **Deep Discharge Cycling**



Fig. 4a: Deep Discharge Cycling Comparison of RECHARGEABLE ALKALINE AA Cells on the IEC AudioPlayer Test (10 ohm load, approx. 100-125mA).



Fig. 4b: Total Service Time on Deep Discharge Cycling of RECHARGEABLE ALKALINE AA Cells on the IEC AudioPlayer Test (10 ohm load, approx. 100-125mA).



Fig. 4c: Deep Discharge Voltage Cycle Life of XL RECHARGEABLE ALKALINE AA Cells on the IEC AudioPlayer Test (10 ohm load, approx. 100-125mA).

## **Effect of Depth of Discharge**



Fig.5: Performance Range of XL RECHARGEABLE ALKALINE AA Cells as Function of Depth of Discharge on Cycling, Full Recharge after each Shallow Discharge.

### **Effect of Temperature**



Fig.6: Effect of Temperature on Capacity of XL RECHARGEABLE ALKALINE Cells.

#### **Self-Discharge Comparison**

Capacity Loss	PE- XL	Orig. RAM <sup>TM</sup>	NiCd	NiMH
20°C/month	<1%	1%	20%	25%
45°C/month	3%	5%	60%	80%
65°C/month	10%	20%	100%	100%
Shelf Life	7 yrs.	5 yrs.	charge prior to use	charge prior to use