

# Principal Dry Battery Systems

## Typical Characteristics

|                                              | <b>Nickel-Metal Hydride (NiMH)</b>                  | <b>Zinc Chloride (Zn/MnO<sub>2</sub>)</b>                              | <b>Alkaline Manganese Dioxide (Zn/MnO<sub>2</sub>)</b> | <b>Lithium (Li/FeS<sub>2</sub>)</b>   | <b>Silver Oxide (Zn/Ag<sub>2</sub>O)</b>                    | <b>Zinc Air (ZnO<sub>2</sub>)</b>       | <b>Lithium Coin (Li/MnO<sub>2</sub>)</b>        | <b>Lithium (Li/MnO<sub>2</sub>)</b>             |
|----------------------------------------------|-----------------------------------------------------|------------------------------------------------------------------------|--------------------------------------------------------|---------------------------------------|-------------------------------------------------------------|-----------------------------------------|-------------------------------------------------|-------------------------------------------------|
| <b>Electrochemical System</b>                | Nickel-Metal Hydride                                | Zinc-Manganese Dioxide                                                 | Zinc-Alkaline Manganese Dioxide                        | Lithium-Iron Disulfide                | Zinc-Silver Oxide                                           | Zinc-Oxygen                             | Lithium Manganese Dioxide                       | Lithium Manganese Dioxide                       |
| <b>Voltage per Cell</b>                      | 1.2                                                 | 1.5                                                                    | 1.5                                                    | 1.5                                   | 1.5                                                         | 1.4                                     | 3.0                                             | 3.0                                             |
| <b>Negative Electrode</b>                    | Metal Hydride                                       | Zinc                                                                   | Zinc                                                   | Lithium Metal                         | Zinc                                                        | Zinc                                    | Lithium Metal                                   | Lithium Metal                                   |
| <b>Positive Electrode</b>                    | Nickel Hydroxide                                    | Manganese Dioxide                                                      | Manganese Dioxide                                      | Iron Disulfide                        | Silver Oxide                                                | Oxygen                                  | Manganese Dioxide                               | Manganese Dioxide                               |
| <b>Electrolyte</b>                           | 20% to 40% weight % solution of potassium hydroxide | Aqueous solution of zinc chloride (may contain some ammonium chloride) | Aqueous solution of potassium hydroxide                | Lithium Salt in organic solvent       | Aqueous solution of potassium hydroxide or sodium hydroxide | Aqueous solution of potassium hydroxide | Lithium Salt in organic solvent                 | Lithium Salt in organic solvent                 |
| <b>Recharge</b>                              | Yes                                                 | No                                                                     | No                                                     | No                                    | No                                                          | No                                      | No                                              | No                                              |
| <b>Overall Reaction Equations</b>            | $MH + NiOOH \rightarrow M - Ni(OH)_2$               | $Zn + 2MnO_2 + 2H_2O + ZnCl_2 \rightarrow 2MnOOH + 2Zn(OH)Cl$          | $3MnO_2 + 2Zn \rightarrow Mn_3O_4 + 2ZnO$              | $4Li + FeS_2 \rightarrow 2Li_2S + Fe$ | $Zn + Ag_2O \rightarrow ZnO + 2Ag$                          | $2Zn + O_2 \rightarrow 2ZnO$            | $Li + Mn^{IV}O_2 \rightarrow Mn^{III}O_2(Li^+)$ | $Li + Mn^{IV}O_2 \rightarrow Mn^{III}O_2(Li^+)$ |
| <b>Typical Commercial Service Capacities</b> | 850 mAh to 2500 mAh                                 | Several Hundred mAh to 38 Ah                                           | 30 mAh to 24 Ah                                        | 25 mAh to 3000 mAh                    | 5 mAh to 200 mAh                                            | 90 mAh to 620 mAh                       | 30 mAh to 620 mAh                               | 800 mAh to 1500 mAh                             |

This document contains typical characteristics for Energizer/Eveready batteries in production at the time of preparation. Since the characteristics of batteries are sometimes modified, please visit [www.energizer.com](http://www.energizer.com) for current information. None of the information constitutes a representation or warranty by Energizer concerning the specific performance or characteristics of any battery.

# Principal Dry Battery Systems

## Typical Characteristics

|                                                  | <b>Nickel-Metal Hydride</b><br>(NiMH)       | <b>Zinc Chloride</b><br>(Zn/MnO <sub>2</sub> ) | <b>Alkaline Manganese Dioxide</b><br>(Zn/MnO <sub>2</sub> ) | <b>Lithium</b><br>(Li/FeS <sub>2</sub> ) | <b>Silver Oxide</b><br>(Zn/Ag <sub>2</sub> O) | <b>Zinc Air</b><br>(ZnO <sub>2</sub> ) | <b>Lithium Coin</b><br>(Li/MnO <sub>2</sub> ) | <b>Lithium</b><br>(Li/MnO <sub>2</sub> ) |
|--------------------------------------------------|---------------------------------------------|------------------------------------------------|-------------------------------------------------------------|------------------------------------------|-----------------------------------------------|----------------------------------------|-----------------------------------------------|------------------------------------------|
| <b>Discharge Curve (shape)</b>                   | Flat                                        | Sloping                                        | Sloping                                                     | Flat                                     | Flat                                          | Flat                                   | Flat                                          | Flat                                     |
| <b>Temperature Range (storage)</b>               | -20°C to 30°C<br>(-4°F to 86°F)             | -40°C to 50°C<br>(-40°F to 120°F)              | -40°C to 50°C<br>(-40°F to 120°F)                           | -40°C to 60°C<br>(-40°F to 140°F)        | -40°C to 60°C<br>(-40°F to 140°F)             | 10°C to 30°C<br>(40% to 70%RH)         | -40°C to 60°C<br>(-40°F to 140°F)             | -40°C to 60°C<br>(-40°F to 140°F)        |
| <b>Temperature Range (operating)</b>             | Discharge<br>0°C to 50°C<br>(32°F to 122°F) | -18°C to 55°C<br>(0°F to 130°F)                | -18°C to 55°C<br>(0°F to 130°F)                             | -40°C to 60°C<br>(-40°F to 140°F)        | -10°C to 55°C<br>(14°F to 130°F)              | -10°C to 55°C<br>(14°F to 130°F)       | -40°C to 60°C<br>(-40°F to 140°F)             | -40°C to 60°C<br>(-40°F to 140°F)        |
| <b>Effect of Temperature on Service Capacity</b> | Fair Low Temperature                        | Poor Low Temperature                           | Good Low Temperature                                        | Excellent Low Temperature                | Good Low Temperature                          | Good Low Temperature                   | Excellent Low Temperature                     | Excellent Low Temperature                |
| <b>Shelf Life at 20°C</b>                        | 2 to 5 Years                                | 1 to 3 Years                                   | 5 to 10 Years                                               | 12 to 20 Years                           | 3 to 7 Years                                  | 3 Years                                | 5 to 8 Years                                  | 10 Years                                 |

This document contains typical characteristics for Energizer/Eveready batteries in production at the time of preparation. Since the characteristics of batteries are sometimes modified, please visit [www.energizer.com](http://www.energizer.com) for current information. None of the information constitutes a representation or warranty by Energizer concerning the specific performance or characteristics of any battery.