

# GP Batteries

## Product Specification

Model No.: 450DK

Document Number: ZQS2007

Revision: 00

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## 1. SCOPE

This specification governs the performance of the following GP Nickel Cadmium Cylindrical Cell and its stack-up batteries which constitute less than 20 unit cells.

Cell Size: D

The data involving nominal voltage and the approximate weight of the stack-up batteries shall be equal to the value of the unit cell multiplied by the number of cells in the battery. For example, a stack-up battery consists of three unit cells:

Nominal Voltage of unit cell = 1.2V

Thus, nominal voltage of stack-up battery = 1.2V x 3 = 3.6V

## 2. RATINGS

| Description                 | Unit   | Specification   | Conditions   |
|-----------------------------|--------|---|--|
| Nominal Voltage             | V      | 1.2   | Unit cell  |
| Typical Capacity            | mAh    | 4,950   | Standard Charge / Discharge  |
| Minimum Capacity            | mAh    | 4,500   | Standard Charge / Discharge  |
| Standard Charge             | mA     | 450 (0.1C)  | $T_a = 0 \sim 45^\circ\text{C}$<br>(see Note 1)  |
|                             | hr     | 14  |  |
| Fast Charge                 | mA     | 2,500(0.5C) ~ 4,500<br>(1C)<br>with charge<br>termination control | - $\Delta V = 10 \sim 20\text{mV/ cell}$<br>Timer cutoff = 110% nominal<br>input<br>Temp. cutoff = 40 ~ 50°C |
|                             | hr     | 2.2 approx.<br>(see Note 2)                                       |  |
| Trickle Charge              | mA     | 255 (0.05C) ~<br>450 (0.1C)                                       | $T_a = 0 \sim 70^\circ\text{C}$  |
| Discharge Cut-off Voltage   | V/cell | 1.0   | Unit cell  |
| Maximum Discharging Current | A      | 22.5 (5C)   | $T_a = -20 \sim 50^\circ\text{C}$  |
| Storage Temperature         | °C     | -20 ~ 60 °C ( $\leq 1$ wk)<br>-20 ~ 35 °C (more<br>than 1 wk)     | Discharged state, open circuit<br>Humidity 65 +/- 20%  |
| Typical Weight              | g      | 130g  | Unit cell  |

### 3. PERFORMANCE

Before proceed the following tests, the cells should be discharged at 0.2C to 1.0V cutoff. Unless otherwise stated, tests should be done within one month of delivery under the following conditions :

Ambient Temperature,  $T_a$  :  $20 \pm 5^\circ\text{C}$

Relative Humidity :  $65 \pm 20\%RH$

Notes : Standard Charge / Discharge Condition

Charge : 450mA (0.1C) x 14hrs

Discharge : 900mA (0.2C) to 1.0V/cell

| Test                       | Unit             | Specification             | Conditions   | Remarks                    |
|----------------------------|------------------|---------------------------|--|----------------------------|
| Capacity                   | mAh              | $\geq 4,500$              | Standard Charge / Discharge  | Up to 3 cycles are allowed |
| Open Circuit Voltage (OCV) | V/cell           | $\geq 1.25$               | Within 1hr after standard charge   | Unit cell                  |
| Internal Impedance (Ri)    | m $\Omega$ /cell | Average: 8<br>Range: 5~10 | Upon fully charge at 1kHz  | Unit cell                  |
| High Rate Discharge (1C)   | min              | $\geq 54$                 | Standard Charge, rest time within 15 mins  |                            |
| High Rate Discharge (5C)   | min              | $\geq 9.6$                | Standard Charge, rest time within 15 mins  |                            |
| Overcharge                 | N/A              | No leakage nor explosion. | 450mA (0.1C) Charge for 1yr  |                            |
| Charge Retention           | mAh              | $\geq 3,600$              | Standard Charge, Storage: 28 days, Standard Discharge  |                            |
| IEC Cycle Life Test        | Cycle            | $\geq 500$                | IEC60285 (1999) 4.4.1  | (see Note 3)               |
| Accelerated Cycle Life     | Cycle            | $\geq 400$                | Charge: 2,250mA (0.5C) x 2.4 hours<br>Discharge: 2,250mA (0.5C) to 1V/cell<br>End of life: 80% of nominal capacity |                            |

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| Test                 | Unit | Specification  | Conditions   | Remarks                |
|----------------------|------|--|--|------------------------|
| Leakage              | N/A  | No leakage nor deformation.  | After battery is fully discharged, battery is placed under load (e.g. resistor, but not include current generator). The battery should be monitored for a period up to two months.             | Load current 0.1C max. |
| Short Circuit        | N/A  | Leakage & deformation may occur, but no explosion is allowed.                                | After standard charge, short circuit for 1hr. (leading wire = 3.1mm <sup>2</sup> x 65mm)   |                        |
| Vibration Resistance | N/A  | $\Delta V < 0.02V/\text{cell}$<br>$\Delta R_i$ (Internal impedance) $< 5m\Omega/\text{cell}$ | Charge at 0.1C for 14hrs, and then leave for 24hrs, check battery before / after vibration<br>Amplitude: 1.5mm<br>Vibration: 3000CPM (any direction for 60mins)                                | Unit cell              |
| Impact Resistance    | N/A  | $\Delta V < 0.02V/\text{cell}$<br>$\Delta R_i$ (Internal impedance) $< 5m\Omega/\text{cell}$ | Charge at 0.1C for 14hrs, and then leave for 24hrs, check battery before / after drop<br>Height: 50cm<br>Thickness of the wooden board: 30mm<br>Direction is not specified<br>Test for 3 times | Unit cell              |

## 4. CONFIGURATIONS, DIMENSIONS AND MARKINGS

Please refer to its Data Sheet.

## 5. EXTERNAL APPEARANCE

The cell / battery shall be free from cracks, scars, breakage, rust, discoloration, leakage and deformation.

## 6. WARRANTY

One year limited warranty against workmanship and material defects.

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## 7. CAUTION

1. Reverse charging is not acceptable.
2. Charge before use, although the cells / batteries are delivered in a charged state.
3. Do not charge / discharge with more than the specified current.
4. Do not short circuit the cell / battery. Permanent damage to the cell / battery may result.
5. Do not incinerate or mutilate the cell / battery.
6. Do not solder directly to the cell / battery.
7. The life expectancy may be reduced if the cell / battery is subjected to adverse conditions like: extreme temperature, deep cycling, excessive overcharge / overdischarge.
8. Store the cell / battery uncharged in a cool dry place. Always discharge the cell / battery before bulk storage or shipment.

- Notes : 1.  $T_a$ : Ambient Temperature  
2. Approximate charge time from discharged state, for reference only.  
3. IEC60285(1999) 4.4.1 Cycle Life Test :

| Cycle No. | Charge             | Rest      | Discharge          |
|-----------|--------------------|-----------|--------------------|
| 1         | 0.1C x 16hrs       | none      | 0.25C x 2hrs20mins |
| 2 - 48    | 0.25C x 3hrs10mins | none      | 0.25C x 2hrs20mins |
| 49        | 0.25C x 3hrs10mins | none      | 0.25C to 1.0V/cell |
| 50        | 0.1C x 16hrs       | 1- 4hr(s) | 0.2C to 1.0V/cell  |

Cycle 1 to 50 shall be repeated until the discharge duration on any 50th cycle becomes less than 3hrs