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| Title: Coin Type Lithium ion Rechargeable Battery | Number: PD1255-080729 |
| Model: <i>Powerdisc 1255</i> | Date: Rev:C |

PRODUCT SPECIFICATIONS OF COIN TYPE LI-ION RECHARGEABLE BATTERY

MODEL: PD1255

PRESENTED TO:

Accepted by :

Date:

Route JD Inc.

Prepared by : Hee-Seok Kim ()

Approved by : Young-Dug Kim ()

Date : 2008.07.29

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1. Preface

This Product Specification describes the requirements of Coin Type Lithium-ion Rechargeable Battery ("Cell") to be supplied to customer by **Route JD Inc.**

2. Description

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| 2.1 Product | Lithium-ion Rechargeable Battery |
| 2.2 Model (Type) | Powerdisc 1255 (PD1255) |

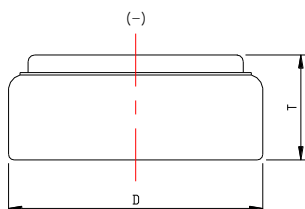
3. Specifications

| Item | Specification | Remark |
|--------------------------------|---------------|-------------------------------------|
| 3.1 Nominal Capacity | 38 mAh | 0.2C rate, 3.0V cut-off |
| 3.2 Minimum Capacity | 35 mAh | 0.2C rate, 3.0V cut-off |
| 3.3 Nominal Voltage | 3.7 V | From 4.20 V to 3.00V |
| 3.4 Charging Method | CC/CV | Constant Current / Constant Voltage |
| 3.5 Charging Current (Std.) | 0.5CA (19mA) | 0 ~ 45°C |
| 3.6 Charging Voltage | 4.2 ± 0.03 V | |
| 3.7 Charging End Condition | 1mA | At CV mode |
| 3.8 Charging Time (Std.) | > 3.0 hours | |
| 3.9 Discharge Current (Std.) | 0.2CA (7.6mA) | - 20 ~ 60°C |
| 3.10 Discharge Current (Max) | 2CA (76mA) | - 20 ~ 60°C |
| 3.11 Discharge Cut-off Voltage | 3.0 V | |
| 3.12 Cell Weight | Approx. 1.6 g | |
| 3.13 Storage Temperature Range | -20 ~ 60°C | For up to one month |
| | -20 ~ 40°C | For up to three month |

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| | -20 ~ 25℃ | For up to one year |
|--|-----------|--------------------|

4. Dimensions (unit : mm)



| Condition | Charge state | T (Thickness) | D (Diameter) |
|----------------------------------|-----------------|------------------|-----------------|
| Fresh cell | Shipping charge | 5.7+0-0.3mm | 11.6 ± 0.2mm |
| | Full charge | 5.8+0-0.3mm | |
| Cycled cell (after 400 cycle) | Full charge | 5.9+0-0.3mm | |

5. Standard Test Conditions

Unless otherwise specified, all tests stated in this Product Specification are conducted at temperature 25 ± 3℃ and humidity 65 ± 20% RH.

6. Electrical Characteristics

6.1 Standard Charge and Discharge Conditions

The "Standard Charge" means charging the Cell with initial charge current 19mA (0.5C) and with a constant voltage 4.20V (± 0.03 V) and a cut off current 1mA at 25℃ for 3.0 hours.

The "Standard Discharge" means discharging the Cell with constant discharge current 7.6mA (0.2C) and with 3.0V cut-off voltage at 25℃.

6.2 Initial Discharge Capacity

The initial capacity measured under the standard test conditions stated in 6.1

Initial Discharge Capacity Typical 38mAh, Minimum 35mAh

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6.3 Initial Internal Impedance

Internal resistance measured at 1KHz after Standard Charge.

$$\text{Initial Internal Impedance} \leq 3\Omega$$

6.4 Cycle Life

Capacity after 400 cycles, measured under the test conditions stated in 6.1.

$$\text{Capacity} \geq 28\text{mAh after 400 cycles}$$

6.5 Temperature Dependence of Discharge Capacity

Relative capacity at each temperature, measured with constant discharge current 8mA (0.2C) with 2.75V cut-off after the Standard Charge shown below.

| Charge Temp. | Discharge Temp. | | | |
|--------------|-----------------|--------|-------|-------|
| 25 °C | -20 °C | -10 °C | 25 °C | 60 °C |
| | >50 % | >70% | 100 % | >95% |

6.6 Discharge Characteristics on Current Load (C-Rate)

Relative capacity at each load, measured with constant discharge current 0.2C, 0.5C, 1.0C, 2C with 3.00V cut-off after Standard Charge shown below.

| Charge Current | Discharge Current | | | |
|-----------------|-------------------|--------|--------|--------|
| Standard Charge | 0.2 CA | 0.5 CA | 1 CA | 2.0 CA |
| | 0.76 mA | 19 mA | 38mA | 76 mA |
| | 100 % | >85 % | > 60 % | > 20% |

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7. Safety Test

| Test Item | Test Method | Criteria |
|------------------------|--|--|
| 7.1 Hot Box Test | A cell is to be heated in a gravity convection oven. The temperature of the oven is to be raised at a rate of $5\pm2^{\circ}\text{C}$ per minute to a temperature of $130\pm2^{\circ}\text{C}$ and remain for 10 minutes at the temperature before the test is discontinued. | No explosion, No fire |
| 7.2 Overcharge Test | Charging the Cell up to 250% of its Nominal capacity at 25°C for 2.5 hours. | No explosion, No fire |
| 7.3 Impact Test | A test cell is to be placed on a flat surface. The bar of 9.1 kg weight and 15.8 mm diameter is dropped from a height of 610 mm onto the cell. | No explosion, No fire |
| 7.4 Short-Circuit Test | A Cell is to be short-circuited by connecting the positive and negative terminals of the battery with copper wire having a maximum resistance load of $100\text{m}\Omega$. | No fire or no explosion, until it is completely discharged |

8. Shipment

The Cell shall be shipped in 30% charged state. (Cell voltage range: 3.7 ~ 3.8 V)

*The remaining capacity before charging shall be changed depending on the storage time and conditions.

9. Warranty

The Warranty of battery is one year from the date of shipment. However, even though the problem occurs within this period, Route JD won't replace a new battery for free as long as the problem is not due to the failure of Route JD manufacturing process or is due to customer's abuse or misuse.

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- Route JD will not be responsible for trouble occurred by handling outside of the precautions in this specification.
- Route JD will not be responsible for trouble occurred by matching electric circuit, battery pack and charger.
- Route JD will be exempt from warrantee any defect cells during assembling after acceptance.

10. Precautions and Safety Instructions

Lithium-Ion rechargeable batteries subject to abusive conditions can cause damage to the battery and/or personal injury. Please read and observe the standard battery precautions below before using utilization.

Note 1. The customer is required to contact Route JD in advance, if and when the customer needs other applications or operating conditions than those described in this document.

Note 2. Route JD will take no responsibility for any accident when the cell is used under other conditions than those described in this Document.

10.1 Precautions and Safety Instructions:

- Do not expose the battery to extreme heat or flame.
- Do not short circuit, over-charge or over-discharge the battery.
- Do not subject the battery to strong mechanical shocks.
- Do not immerse the battery in water or sea water, or get it wet..
- Do not reverse the polarity of the battery for any reason.
- Do not disassemble or modify the battery.
- Do not remove charge/discharge protection circuitry.
- Do not handle or store with metallic like necklaces, coins or hairpins, etc.
- Do not use the battery with conspicuous damage or deformation.
- Do not connect battery to the plug socket or car-cigarette-plug.

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- k. Do not make the direct soldering onto a battery. Weld spot welding lead plate onto a battery.
- l. Do not touch a leaked battery directly.
- m. Do not use for other equipment.
- n. Do not use Lithium-ion battery in mixture.
- o. Do not use or leave the battery under the blazing sun (or in heated car by sunshine).
- p. Keep battery away from children.
- q. Do use the specified charger and observe charging requirement.
- r. Do not drive a nail into the battery, strike it by hammer or tread it.
- s. Do not give battery impact or fling it.

10.2 Battery Operation Instruction:

A. Charging

- a. Charge the battery in a temperature range of 0°C to + 45°C.
- b. Charge the battery at a constant current of 0.5C until 4.20±0.03V per cell is attained. Charge rates greater than 1C are NOT recommended. (C : Rated Capacity of Battery)
- c. Maintain charge voltage at 4.20V per cell for 3.0 hours (recommended for maximum capacity).
 * Use a constant current, constant voltage (CC/CV) lithium-ion (Li+) battery charge controller.
 * Do not continue to charge battery over specified time.

B. Discharging

- a. Recommended cut-off voltage to 3.0V. Recommended maximum discharge rate is 2C at constant current.
- b. For maximum performance, discharge the battery in a temperature range of –20°C to + 45°C.

C. Protection Circuit

Protection circuit can be provided upon request. However, protection circuit may be omitted for most applications without damaging performance and safety. Please consult our engineering staff for technical advice.

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D. Storage Recommendations

a. Storage Temperature and Humidity

- Storage the battery at temperature range $-20 \sim +40^{\circ}\text{C}$, low humidity and no corrosive gas atmosphere.
- No condensation on the battery

b. Long Period Storage

- In case of long period storage (more than 3 months), storage the battery at temperature range of $-20 \sim +25^{\circ}\text{C}$, low humidity, no corrosive gas atmosphere.
- No condensation on the battery

11. Consultation

As to the obscurity, contact the following.

Route JD Inc. Sales & Marketing Division

sales@powercellkorea.com

Tel : +82-70-8611-2100

Fax : +82-41-741-0831

12. Requirement for Safety Assurance

For the sake of safety assurance, please discuss the equipment design, its system and protection circuit of Lithium-ion battery with Route JD in advance.

And consult about the high rate current, rapid charge and special application in the same way.