

## TECHNICAL INFORMATION

### Manganese Dioxide Lithium Primary Battery

CR1/2 6·L

FDK CORPORATION

FDK ENERGY CO., LTD.

**The data in this document are for descriptive purposes only and are not intended to make or imply any guarantee or warranty.**

1. Service out-put (Load characteristics)

Continuous discharge, E.P.V. = 2.0V Temp. :  $20 \pm 2^\circ\text{C}$

Load	
1k $\Omega$	3k $\Omega$
350 hours	1000 hours

Average of 5 batteries

2. Service out-put (Temperature characteristics)

1k $\Omega$  continuous discharge, E.P.V. = 2.0V

Temperature		
-20 $^\circ\text{C}$	20 $^\circ\text{C}$	60 $^\circ\text{C}$
254 hours	350 hours	317 hours

Average of 5 batteries

3. Storage characteristics at high temperature (70 $^\circ\text{C}$ , ordinary humidity)

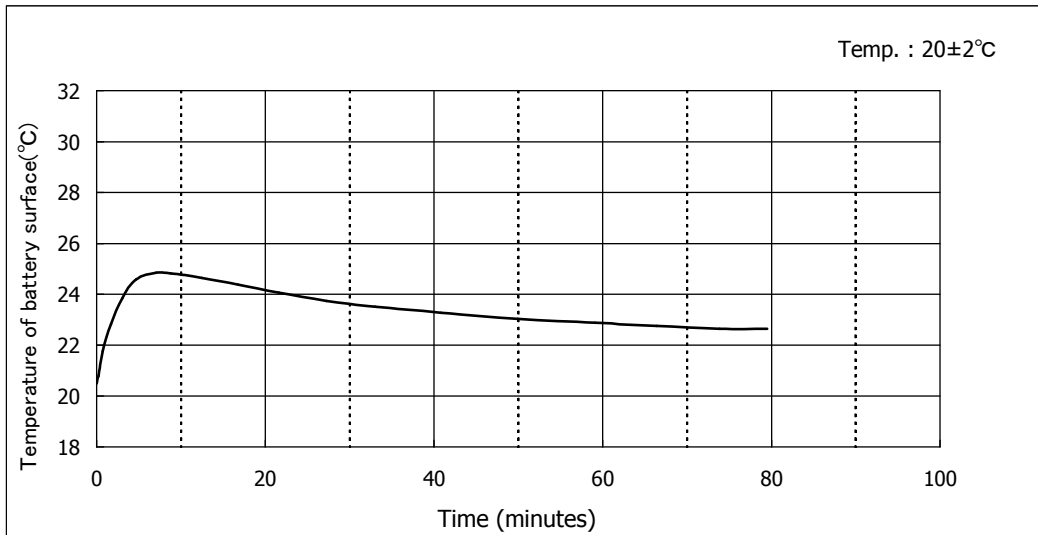
Item	Storage periods		
	Initial	After 40 days	After 80 days
Off-load-voltage (V)	3.20	3.25	3.25
Internal resistance ( $\Omega$ )	5.5	9.5	10.5
Leakage (pcs)	----	0	0
Service out-put at 3k $\Omega$ continuous discharge (hours) E.P.V. = 2.0V	1000	980	960

Test temp. :  $20 \pm 2^\circ\text{C}$ , Average of 5 batteries

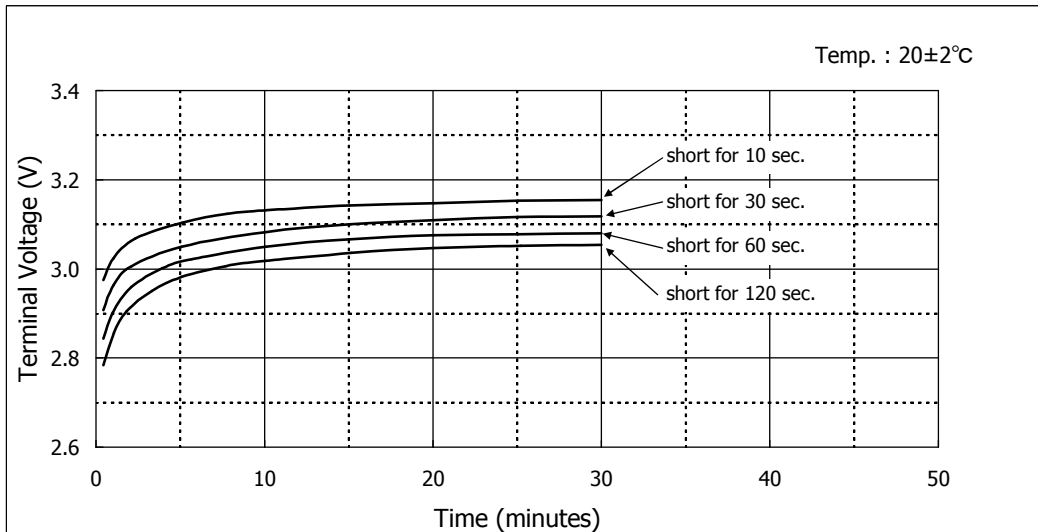
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4. Short circuit characteristics for single cell

(1) Temperature of battery surface



(2) Change of off-load voltage after short circuit



(3) Shape, Dimension, Appearance

No change is recognized for 80 minutes. (Temp. : 20±2°C)

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5. Over-discharge characteristics

Test temp. :  $20 \pm 2^{\circ}\text{C}$

Test method	Test result
The discharge is further continued for 20 days at $1\text{k}\Omega$ load after the voltage has become less than the end-point voltage (2.0V)	Appearance : No change

10 batteries are tested.

6. Charge characteristics

Test temp. :  $20 \pm 2^{\circ}\text{C}$

Charge current	Charging time	Test result
1.25 mA	24 hours	Appearance : No change

10 batteries are tested.

7. Heat shock test

Range of temperature :  $-10 \sim +60^{\circ}\text{C}$ , Time : each for 1 hour

Item	Initial	After 100 cycles
Off-load-voltage (V)	3.20	3.24
Internal resistance ( $\Omega$ )	5.5	8.9
Leakage (pcs)	---	0

Measuring temp. :  $20 \pm 2^{\circ}\text{C}$ , Average of 10 batteries

Measurement of internal resistance is done by 1kHz alternating current.

Leakage proof is done by visual check.

8. Vibration test

Amplitude : 1.5mm, Frequency : 10 ~ 55Hz

Time : X, Y, Z direction, each for 90 minutes

Item	Initial	After test
Off-load-voltage (V)	3.20	3.20
Internal resistance ( $\Omega$ )	5.5	5.5
Leakage (pcs)	---	0

Average of 10 batteries

Measurement of internal resistance is done by 1kHz alternating current.

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Table 1. Testing items and results for safety

No.	Testing Items	Number of Samples	Battery condition	Temp. °C	Duration hours	Testing conditions	Requirement Note 1)	Results
1	Internal Short circuit	5	Undercharged	Ambient	----	A nail, whose diameter is 2.5mm and length is 40~70mm, is to be drilled and penetrated through center of the battery.	NE NF	0/5
2	External Short circuit	5	Undercharged	Ambient	24	Resistance for short circuit : below 0.02 Ω	NE NF	0/5
3	Free fall	5	Undercharged	Ambient	----	Height : 1.9m (on to concrete floor) Number of times : randomly 10 times	NV·NE·NF	0/5
4	Vibration	5	Undercharged	Ambient	1.5	Amplitude : 0.8mm, Frequency : 10~55~10Hz (1Hz/min : 2 (X-Y) mutually perpendicular directions for 90 minutes, respectively)	NV NE NF	0/5
5	Shock	5	Undercharged	Ambient	----	Shock : 150G 6msec Number of times : 5 times respectively, in 2(X-Y) Mutually perpendicular directions	NV NE NF	0/5
6	Heating	5	Undercharged	100 70	5 720	In a oven In a oven	NE·NF NV·NE·NF	0/5
		5	Undercharged	----	18	Thermal shock : -40°C(1Hr) ⇔ 85°C(1Hr) 9cycles	NV·NE·NF	0/5
7	Charge	5	Undercharged	Ambient	24	Charging up to 3% of nominal capacity	NE·NF	0/5

Note 1) : Requirement)  
 NE = No explosion  
 NF = No fire  
 NV = No venting