



***Intec Industries Co., Ltd.***  
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# SPECIFICATION

Type:	Ni-CD Cylindrical Cell
Model No.:	ET-2500D
Prepared:	HML
Approved:	LFX
Date:	July 6, 2011



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1. PREFACE

This specification applies to the Intec Nickel Cadmium Cylindrical batteries or battery packs. Intec reserves the right to alter the product design or amend this specification without prior notice.

2. SCOPE

This specification applies to a Nickel Cadmium cylindrical rechargeable single cell with INTEC designation ET-2500D. This cell is designed for high temperature and permanent charge applications.

3. REFERENCE DOCUMENTS

IEC61951 2003 & IEC62133 2002: Sealed Ni-Cd cylindrical rechargeable single cells.  
 ICEL Testing Procedures.

4. GENERAL ELECTRICAL SPECIFICATION

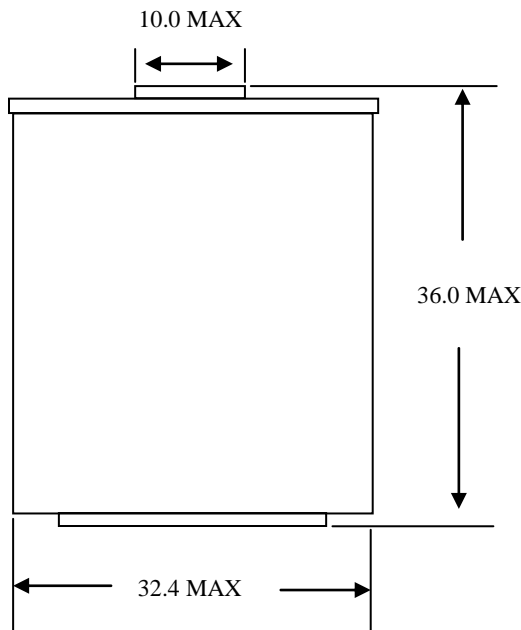
ITEM	SPECIFICATION	UNITS	NOTES
INTEC cell designation	ET-2500D		
Nominal voltage	1.2	Volt	
IEC Rated Capacity	2500	mAh	at C/5
Typical Capacity	2575	mAh	at C/5
Typical Capacity	2250	mAh	at C
Typical impedance	18	mΩ	at 1000 Hz, charged
<b>CHARGE CURRENT</b>			
Standard (16 hours)	250	mA	C/10
Quick (3-4 hrs)	750	mA	C/3 with end of charge
Permanent	125	mA	detection.
Trickle (after quick)	80	mA	
<b>PEAK VOLTAGE IN CHARGE</b>			
Standard	1.50 to 1.55	Volts	
Quick	1.55 to 1.65	Volts	
<b>MAX.DISCHARGE CURRENT</b>			
Continuous	5	A	
Pulse (1 second)	15	A	
<b>TEMPERATURE RANGE</b>			
In standard Charge	+10 to +65	°C	
In Quick Charge	+10 to +55	°C	
In Discharge	-20 to +70	°C	
In recommended Storage.	+5 to +25	°C	
In Extended Storage.	-20 to +60	°C	



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5. GENERAL MECHANICAL SPECIFICATION



**BARE CELL DIMENSIONS(mm)**

Maximum height: 36.0

Maximum diameter: 32.4

Positive contact

Maximum diameter: 10.0

Typical weight: 85 grams

6. CAPACITY

6.1 IEC capacity

IEC Capacity is defined as follows:

- Temperature:  $+20 \pm 5^\circ\text{C}$
- Charge current:  $C/10=250\text{mA}$  constant current
- Charge duration: 16 hours
- Period of rest: 1 to 4 hours
- Discharge current:  $C/5=500\text{ mA}$  constant current

The operating time until the voltage drops to 1.0 volt/cell must not be less than 300 minutes-2 cycles are permitted. The IEC Capacity is then a minimum of 2500 mAh.



## 6.2 AVAILABLE CAPACITY

The following table gives the available capacity of a ET-2500D battery under various charge and discharge conditions. The temperature is  $+20 \pm 5^{\circ}\text{C}$ . Deviation depending on test conditions may be observed.

CHARGE			
Rate	Current (mA)	Duration (hour)	Rest after charge (hour)
0.05C	125	>32	No rest
0.1C	250	16	1

DISCHARGE		
Rate	Current (mA)	Capacity (mAh)
0.2C	500	2575
1.0C	2500	2250
2.0C*	5000	2000

\*Cutoff voltage 0.8 Volts per cell

## 7. CHARGE

### 7.1 Permanent charge

The ET-2500D battery is designed to be permanently charge between  $+15$  to  $+45^{\circ}\text{C}$  with the above mentioned constant current (0.05C).

Occasional temperatures of  $10$  to  $65^{\circ}\text{C}$  are acceptable for short durations only (<1 month).

A “ TRICKLE” charge is designed to follow a “ QUICK” charge.

With low temperature below  $0^{\circ}\text{C}$ , charge voltage must be limited to 1.55 volts per cell.

In case of charge current be regime, or pulse charge, a ET-2500D battery must be charged at a minimum trickle charge rate of 0.033C between the pulses

CHARGE	RATE	CURRENT (mA)	DURATION (hours)	TEMPERATURE ( $^{\circ}\text{C}$ )
Standard	C/10	250	16	+10 to +65
Quick	C/3	800	About 4	+10 to +55
Trickle	C/25	100	Permanent (after quick)	-20 to +70



**8. TEMPERATURE CHARACTERISTICS**

The following table gives the typical available capacity of a ET-2500D battery under the charge conditions:

- Standard Charge: C/10 for 16 hours
- Charge Temperature : +20± 5°C
- Maximum rest after charge: 4 hours at temperature of discharge

Capacities (mAh) are given for a final discharge voltage of 1.0 volt / cell. Deviation depending on test conditions may be observed.

	Discharge Rate C/5=0.2C=500mA	Discharge Rate C/2=0.5C=1250mA	Discharge Rate 1C=2500mA
TEMPERATURE OF DISCHARGE	Capacity %C	Capacity %C	Capacity %C
+65°C	2125 85%	2000 80%	1750 70%
+40°C	2275 91%	2125 85%	1950 78%
+20°C	2575 103%	2500 100%	2250 90%
0°C	2100 84%	1850 75%	1500 60%
-20°C	1750 70%	1500 60%	1250 50%

**9. CHARGE RETENTION**

After a 28 day storage at +20± 5°C, a ET-2500D battery shall retain typically 70% of its initial capacity. The battery is being fully charged initially.

After a 7 day storage at +40± 5°C, a ET-2500D battery shall retain typically 80% of its initial capacity. The battery is being fully charged initially

**10. STORAGE**

Intec recommends to store the battery in a 65%± 5% relative humidity room with the temperature range of +5 to 25°C and a discharged state with open circuit.

An extended storage of -20 to +60°C temperature range with 65%± 20% relative humidity is permitted for short periods or on an intermittent basis.

**11. OVERCHARGE**

After a 28 days continuous charge at 0.05C(125mAh)at 0°C ± 2°C, the capacity at 0.2C discharge rate of a ET-2500D battery at 1.0Volts/cell is typically 2.25Ah.



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## 12. PERMANENT CHARGE ENDURANCE

The permanent charge endurance test shall be performed in three steps according to the conditions specified in table 1.

It consists of:

- a charge efficiency test;
- an ageing period of six months at +70°C;

NOTE – The temperature of 70°C is estimated to simulate four years of permanent charge operation at +40°C.

and

- a final charge efficiency test to check the cell's performance after ageing.

Prior to the test, the cell shall be discharged at 0.2C<sub>5</sub>A at 20°C ± 5°C to a final voltage of 1.0 V and stored for not less than 16 h and not more than 24 h at an ambient temperature of 40°C ± 2°C.

The cell shall then be charged and discharged at constant currents under the conditions specified in table 1 while maintained in an ambient temperature of 40°C ± 2°C or 70°C ± 2°C respectively as appropriate.

The discharge is carried out immediately on completion of charging.

After performing the first charge efficiency test at 40°C, the cell is stored for not less than 16 h and not more than 24 h at an ambient temperature of 70°C ± 2°C.

During the ageing period of six months at 70°C, precautions shall be taken to prevent the cell-case temperature from rising above +75°C, by providing a forced air draught, if necessary\*.

\*NOTE – actual cell temperature, not the ambient temperature, determines cell performance.

The discharge duration of the three cycles at +70°C shall be recorded. Leakage of electrolyte shall not occur during this test.

After completion of the ageing period, the cells shall be stored for not less than 16 h and not more than 24 h at an ambient temperature of 40°C ± 2°C. The three cycles at 40°C of the initial charge efficiency test are then repeated using the conditions specified in table 1. The duration of discharge shall be not less than the minimum specified in table 1.



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Table 1 – permanent charge endurance

Cycle number	Ambient Temperature	Charge	Discharge	Minimum Discharge duration
1	+40°C ± 2°C	0.05 C <sub>5</sub> A for 48 h	0.2 C <sub>5</sub> A to 1.0V	No requirement
2		0.05 C <sub>5</sub> A for 24 h	0.2 C <sub>5</sub> A to 1.0V	3 h 45 min
3		0.05 C <sub>5</sub> A for 24 h	0.2 C <sub>5</sub> A to 1.0V	3 h 45 min
4	+70°C ± 2°C	0.05 C <sub>5</sub> A for 60 days	0.2 C <sub>5</sub> A to 1.0V	No requirement
5		0.05 C <sub>5</sub> A for 60 days	0.2 C <sub>5</sub> A to 1.0V	
6		0.05 C <sub>5</sub> A for 60 days	0.2 C <sub>5</sub> A to 1.0V	
7	+40°C ± 2°C	0.05 C <sub>5</sub> A for 48 h	0.2 C <sub>5</sub> A to 1.0V	No requirement
8		0.05 C <sub>5</sub> A for 24 h	0.2 C <sub>5</sub> A to 1.0V	2 h 30 min
9		0.05 C <sub>5</sub> A for 24 h	0.2 C <sub>5</sub> A to 1.0V	2 h 30 min

An Intec ET-2500D cell shall pass all the testing steps and with result as follows:

Step 2: Minimum discharge duration 4 hours/2000mAh

Step 3: Minimum discharge duration 4 hours/2000mAh

Step 8: Minimum discharge duration 3 hours/1500mAh

Step 9: Minimum discharge duration 3 hours/1500mAh

### 13. CYCLE-LIFE

The cycle-life of a rechargeable battery depends on various parameters such as charge rate, discharge rate, depth of discharge, overcharge temperature, period of rest between charge and discharge and, so on.

The rechargeable battery reaches its end of life when its capacity is 60% of the initial capacity. Typical life of a ET-2500D battery is 4 years with the average operating conditions defined as follows:

Working battery temperature:+40°C.

Permanent charge current:0.05C.

Discharge / month at 0.5C discharge rate.



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#### 14. ICEL TEST PROCEDURE

- Cycle 1: at a cell temperature of 55°C, charge for 48hours at C/16 and then discharge at 0.25C. No minimum duration requirement.
- Cycle 2: at a cell temperature of 55°C, charge for 24hours at C/16 and then discharge at 0.25C. 3hours minimum duration requirement.
- Cycle 3: at a cell temperature of 55°C, charge for 24hours at C/16 and then discharge at 0.25C. 3hours minimum duration requirement.
- Raise cell temperature to 70°C then at a cell temperature of 70°C, charge for 28 days at C/16 and then discharge at 0.25C. No minimum duration requirement.
- Cycle 5: Bring cell temperature down to 55°C, then at a cell temperature of 55°C, charge for 48hours at C/16 and then discharge at 0.25C. No minimum duration requirement.
- Cycle 6: at a cell temperature of 55°C,charge for 24hours at C/16 and then discharge at 0.25C. 3 hours minimum duration requirement.
- Cycle 7: at a cell temperature of 55°C, charge of 24hours at C/16 and then discharge at 0.25C. 3hours minimum duration requirement.

An Intec ET-2500D cell shall pass the above testing with result as follows:

At cycle 2: Minimum discharge duration 3.5hours/2180mAh.

At cycle 3: Minimum discharge duration 3.5hours/2180mAh.

At cycle 6: Minimum discharge duration 3hours/1875mAh.

At cycle 7: Minimum discharge duration 3hours/1875mAh.

#### 15. REFERENCE

Please refer to Intec's Customer Service if there is any question on using batteries.