



**THUNDER SKY BATTERY LIMITED**

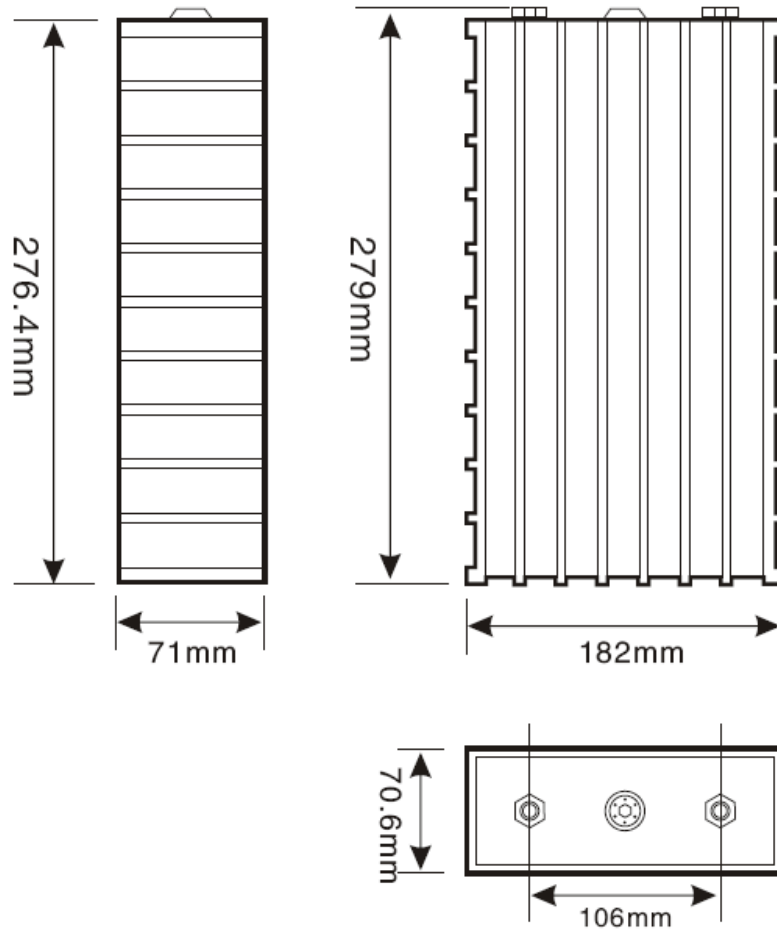
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# TS-LFP160AH TEST REPORT



## TS-LFP160AH mechanical dimensions



## TS-LFP160AH electrical specification

標稱容量 Nominal Capacity	160Ah	
工作電壓 Operation Voltage	充電 (Charge)	4.25V
	放電 (Discharge)	2.5V
最大充電電流 Max Charge Current	≤3CA	
最大放電電流 Max Discharge Current	恒電流 (Constant Current)	≤ 3CA
	脈衝式 (Impulse Current)	≤ 20CA
標準充放電電流 Standard Charge/ Discharge Current	0.5CA	

## TS-LFP160AH electrical specification

循環壽命 Cycle Life	(80DOD%)	≥3000Times
	(70DOD%)	≥5000Times
殼體耐溫性 Temperature Durability Of Case	≤200°C	
適應環境 Operating Temperature	充電 (Charge)	-45°C~85°C
	放電 (Discharge)	-45°C~85°C
自放電率(月) Self-discharge Rate	≤3% (Monthly)	
單體電池重量 Weight	5.6kg ± 100g	

<http://www.yttrium-power.com/>

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**2nd Floor, 3 Barclays Court Ave**  
**St Peter Port, Guernsey GY1 6AW**  
**The Channel Islands, Europe**  
**EMAIL: info(at)gigawavelink.com**

**Auto88 - EV & Power Solutions**  
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**CZ-10219 Czech Republic, European Union**  
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Job No. L-1200

**Thunder Sky Energy Group  
Thunder Sky model TS-LFP160AHA  
Specifications of Li-Ion Starting-Up Power Battery For Fuel Car  
TS-LFP160AHA Test  
Test Report**

**PRODUCTS TESTED:** Ten cells were received as listed in Check-in sheet.

**DATES TESTED:** Testing was performed from 11-Apr-08 through 18-Sept-08.

**TEST PROCEDURE:** Test per Specifications of Li-Ion Starting-Up Power Battery For Fuel Car, 28-Mar-08, received from S. Lu.

**DATA AND OBSERVATIONS:**


Nominal Capacity Test at 25°C:	All samples tested exceeded the manufacturers published rate
Maximum Charge Current:	All samples tested accepted the manufacturers published rate
Maximum DCH Current, constant:	All samples tested discharged at the manufacturers published rate
Maximum DCH Current, 10 pulses:	All samples tested discharged at the manufacturers published rate
Nominal Capacity Test at -25°C:	All samples tested discharged at the manufacturers published rate
Nominal Capacity Test at 75°C:	All samples tested discharged at the manufacturers published rate

Requested by: Steve Lu  
Thunder Sky Energy Group  
Thunder Sky Industrial Base, No. 3 Industrial Zone  
Lisonglang Village, Gongming Town  
Bao'an Dist. Shenzhen, P.R.C.  
POST CODE 5181016

Equipment used: Firing Circuits High Voltage Cyclor  
Firing Circuits High Rate Discharge/Charger  
Freezer No. 7  
Precision Scientific Oven

Date samples received: 18-Mar-08  
Condition: Good  
Acquisition Plan: A

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Prepared by:   
Joseph Badger  
President

9/18/2008



## Battery Check-in Inspection

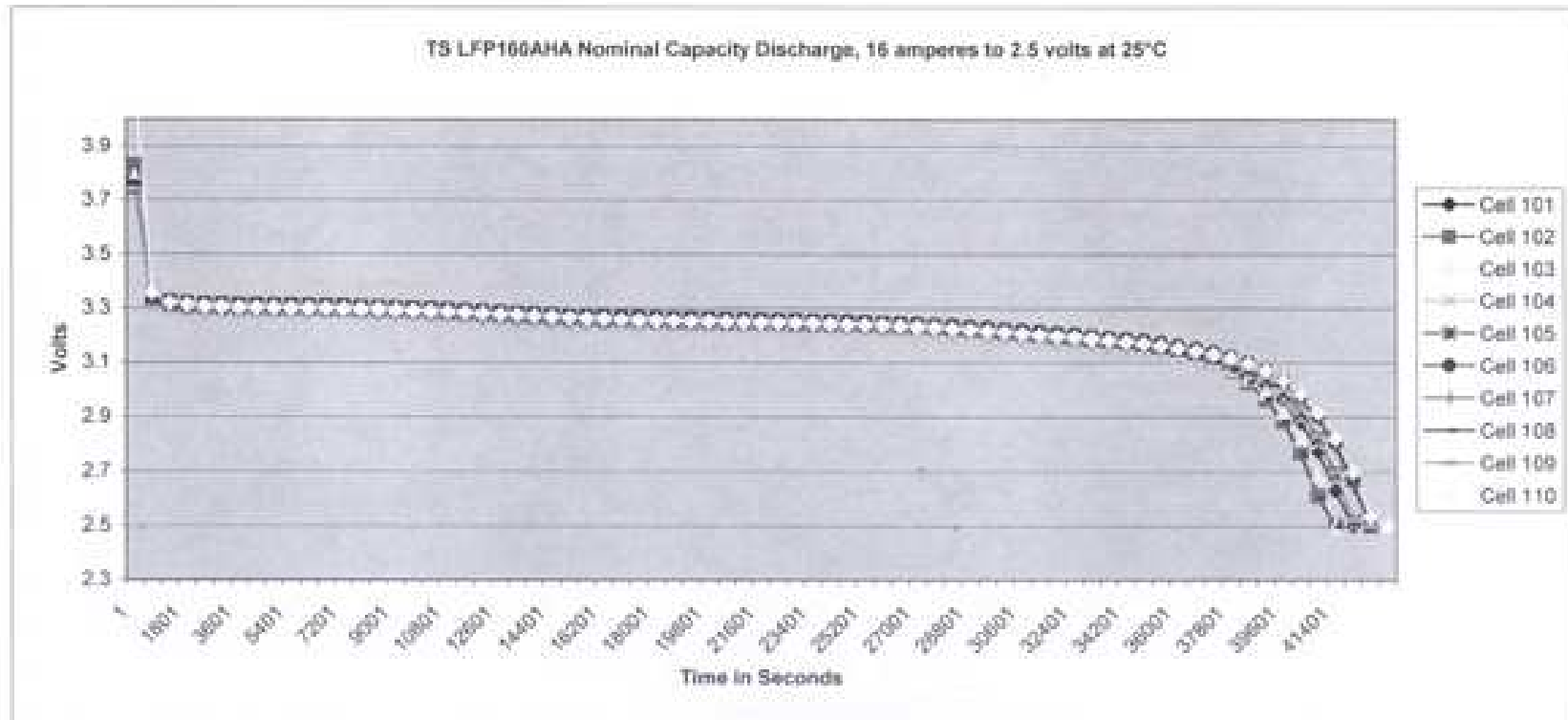
Job No.	Check-in Date	Acquisition Plan	Date Received
L-1200	28-Mar-08	A	18-Mar-08

Battery No.	Mfg.	Brand	Group Size/ Part No.	OCV	Weight	Date Code	Condition
101	Thunder Sky	Thunder Sky	TS-LFP160AHA	3.31	12.55	080308-F16113	Good
102	Thunder Sky	Thunder Sky	TS-LFP160AHA	3.31	12.50	080308-F16112	Good
103	Thunder Sky	Thunder Sky	TS-LFP160AHA	3.31	12.55	080308-F16123	Good
104	Thunder Sky	Thunder Sky	TS-LFP160AHA	3.31	12.55	080308-F16125	Good
105	Thunder Sky	Thunder Sky	TS-LFP160AHA	3.31	12.55	080308-F16136	Good
106	Thunder Sky	Thunder Sky	TS-LFP160AHA	3.31	12.50	080308-F16122	Good
107	Thunder Sky	Thunder Sky	TS-LFP160AHA	3.31	12.50	080308-F16134	Good
108	Thunder Sky	Thunder Sky	TS-LFP160AHA	3.31	12.50	080308-F16127	Good
109	Thunder Sky	Thunder Sky	TS-LFP160AHA	3.31	12.45	080308-F16129	Good
110	Thunder Sky	Thunder Sky	TS-LFP160AHA	3.31	12.50	080308-F16126	Good

L-1200  
11-Apr-08

Thunder Sky model TS-LFP160AHA

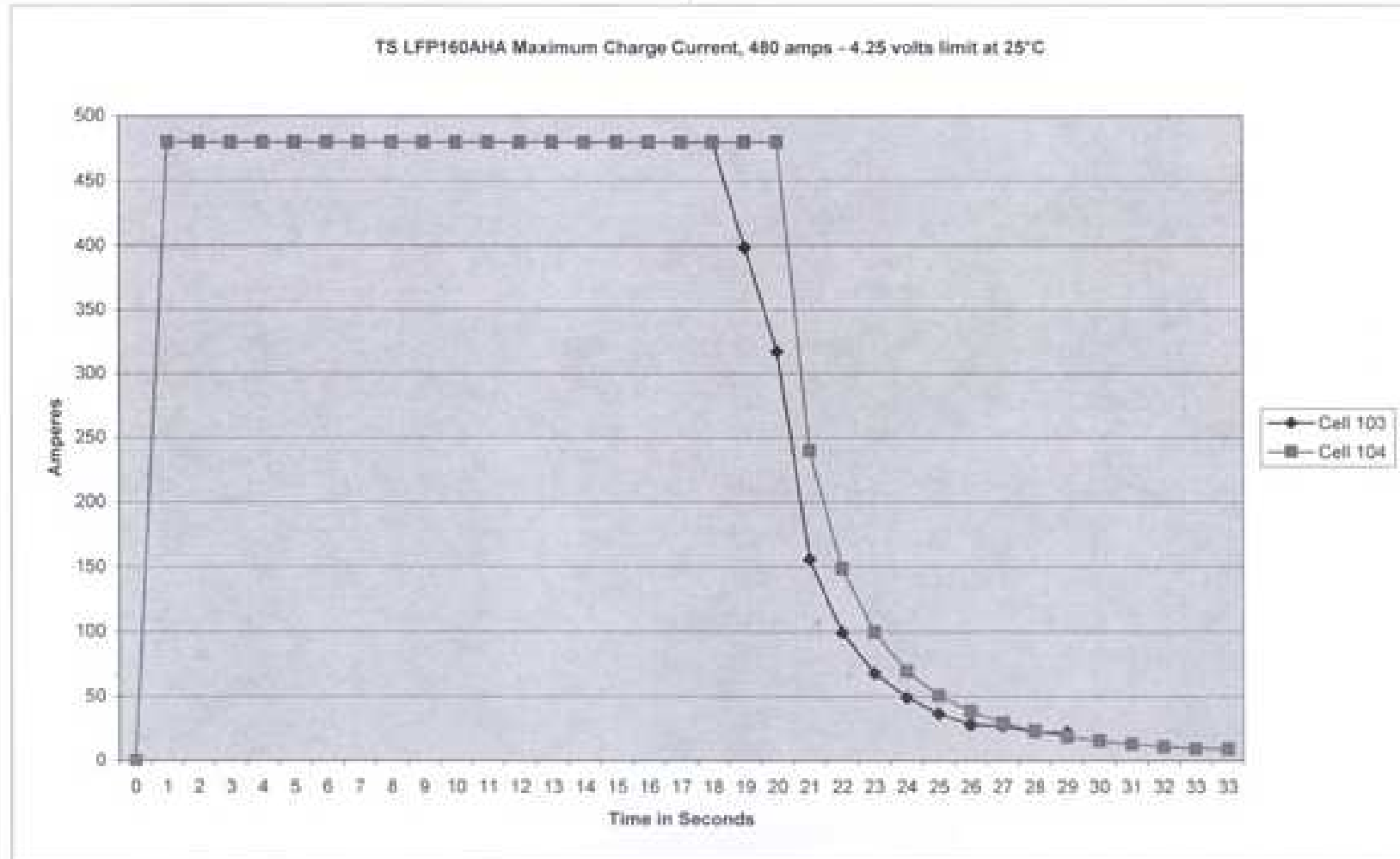
Cell #	OCV	Dch Rate amps	Time to 2.5v minutes	Rated Time minutes	File Name
101	3.79	16.0	696.5	600	101-10H
102	3.83	16.0	685.2	600	102-10H
103	3.79	16.0	689.8	600	103-10H
104	3.74	16.0	700.1	600	104-10H
105	3.75	16.0	700.8	600	105-10H
106	3.75	16.0	709.6	600	106-10H
107	3.75	16.0	707.9	600	107-10H
108	3.75	16.0	685.2	600	108-10H
109	3.74	16.0	701.2	600	109-10H
110	4.17	16.0	711.7	600	110-10H



L-1200  
11-Sep-08

Thunder Sky model TS-LFP160AHA

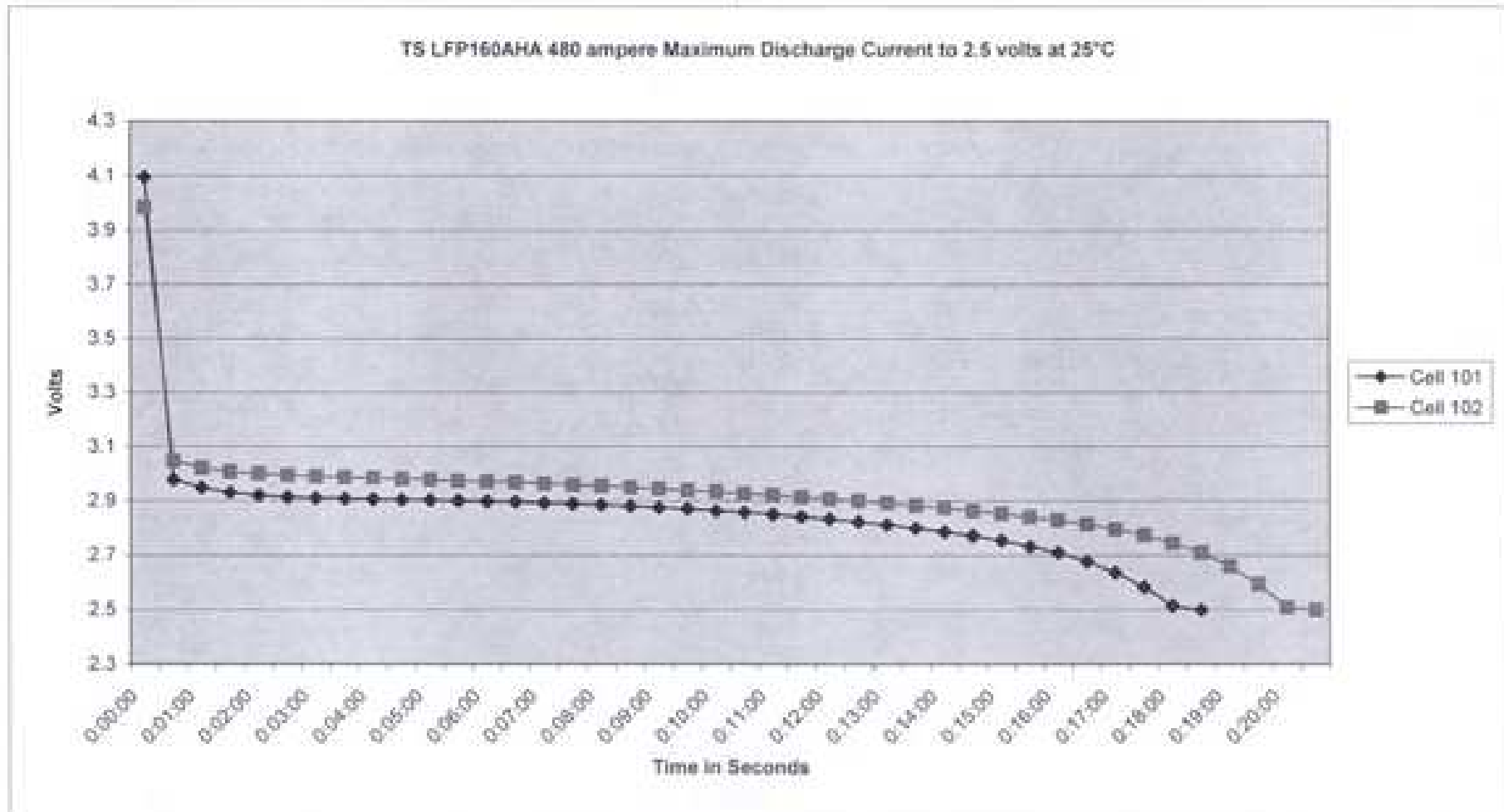
Cell #	OCV	Chg Rate amps	Voltage Limit	File Name
103	2.65	480.0	4.25	103-MAXX-CHA
104	2.60	480.0	4.25	104-MAXX-CHA



L-1200  
18-Apr-08

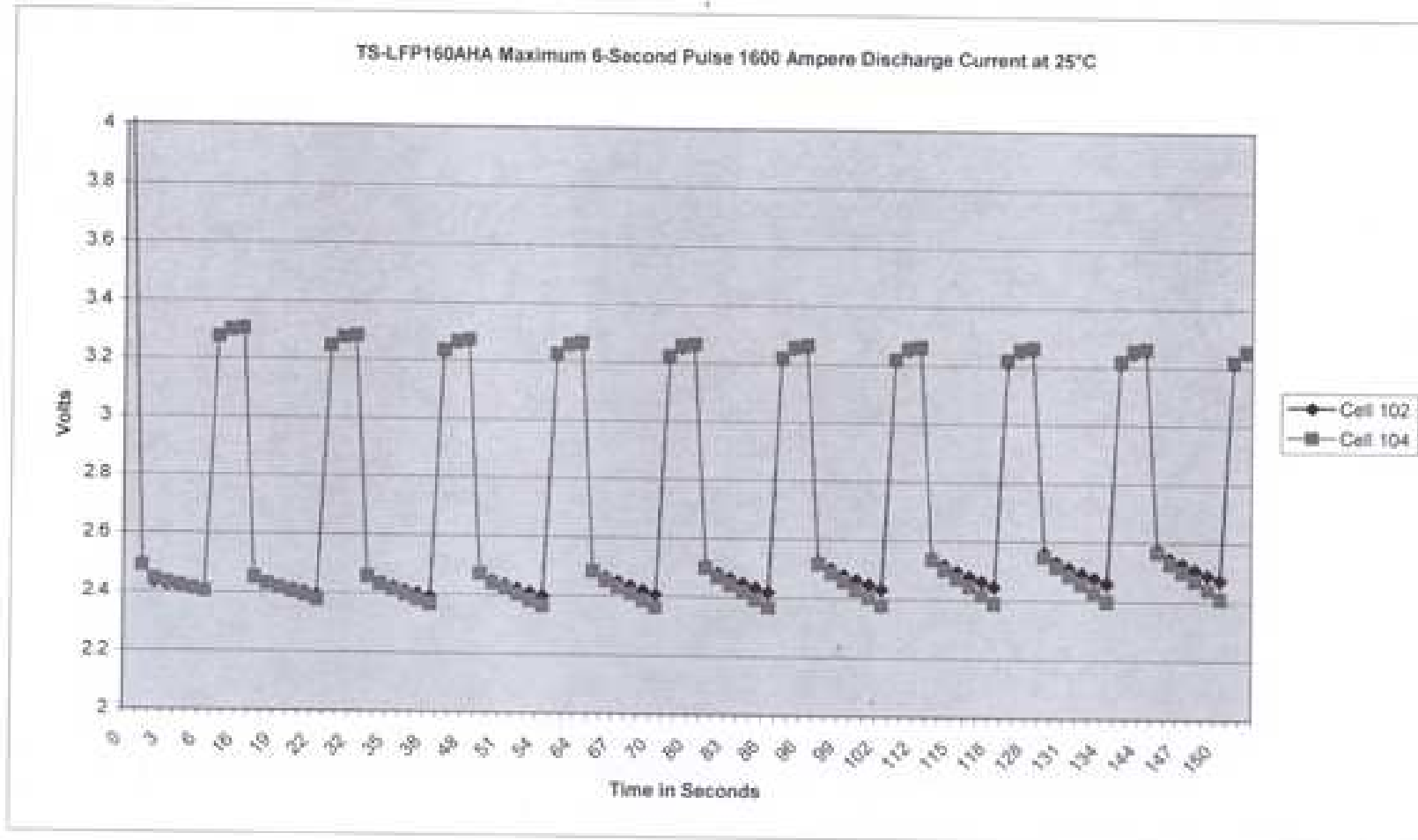
Thunder Sky model TS-LFP160AHA

Cell #	OCV	Dch Rate amps	Time to 2.5v minutes	File Name
101	4.10	480.0	18.07	101-MAXD
102	3.99	480.0	20.03	102-MAXD



L-1200  
19-Aug-08

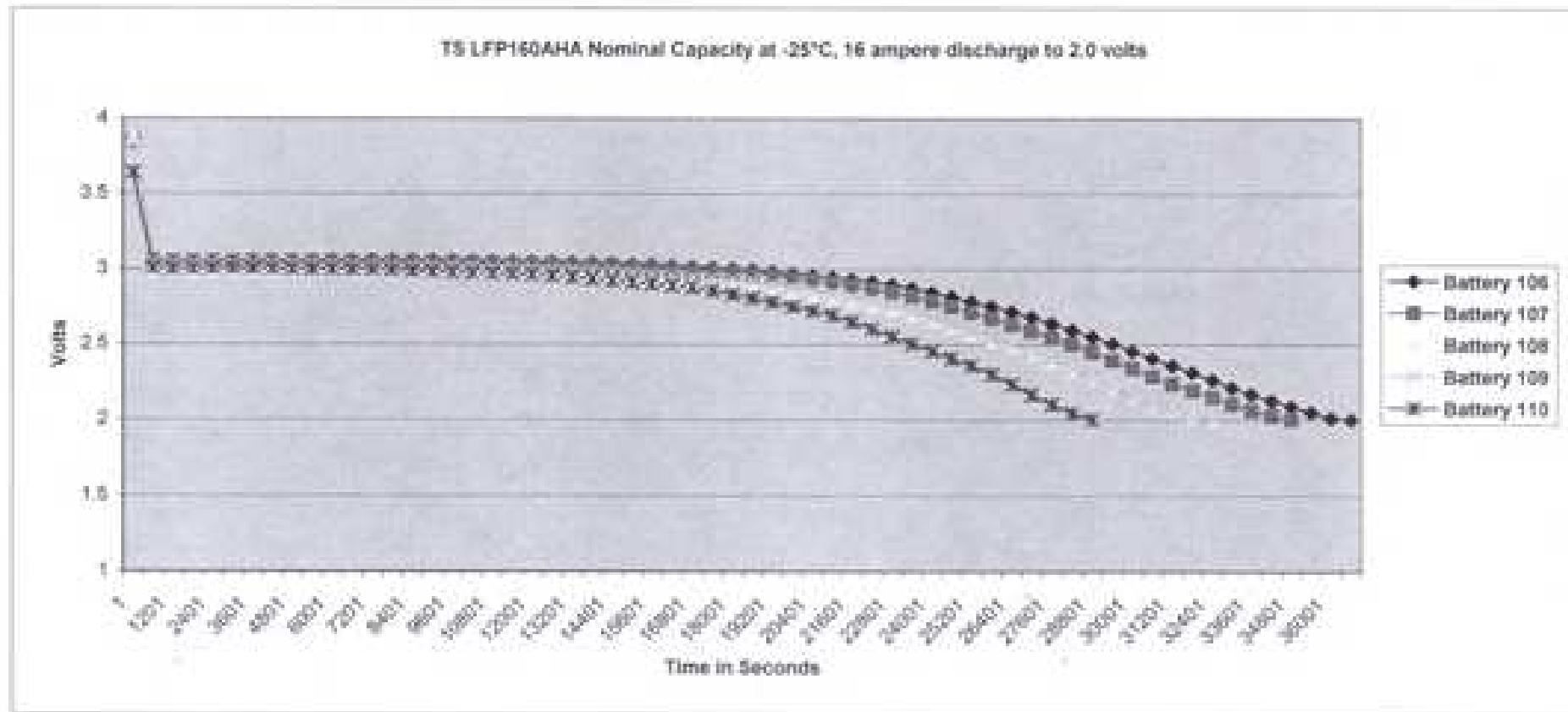
Cell #	OCV	Dch Rate amps	Number of 6 sec Pulses	File Name
102	4.097	1600.0	10	102-PulseDch
104	4.082	1600.0	10	104-PulseDch



L-1200  
18-Apr-08

Thunder Sky model TS-LFP160AHA

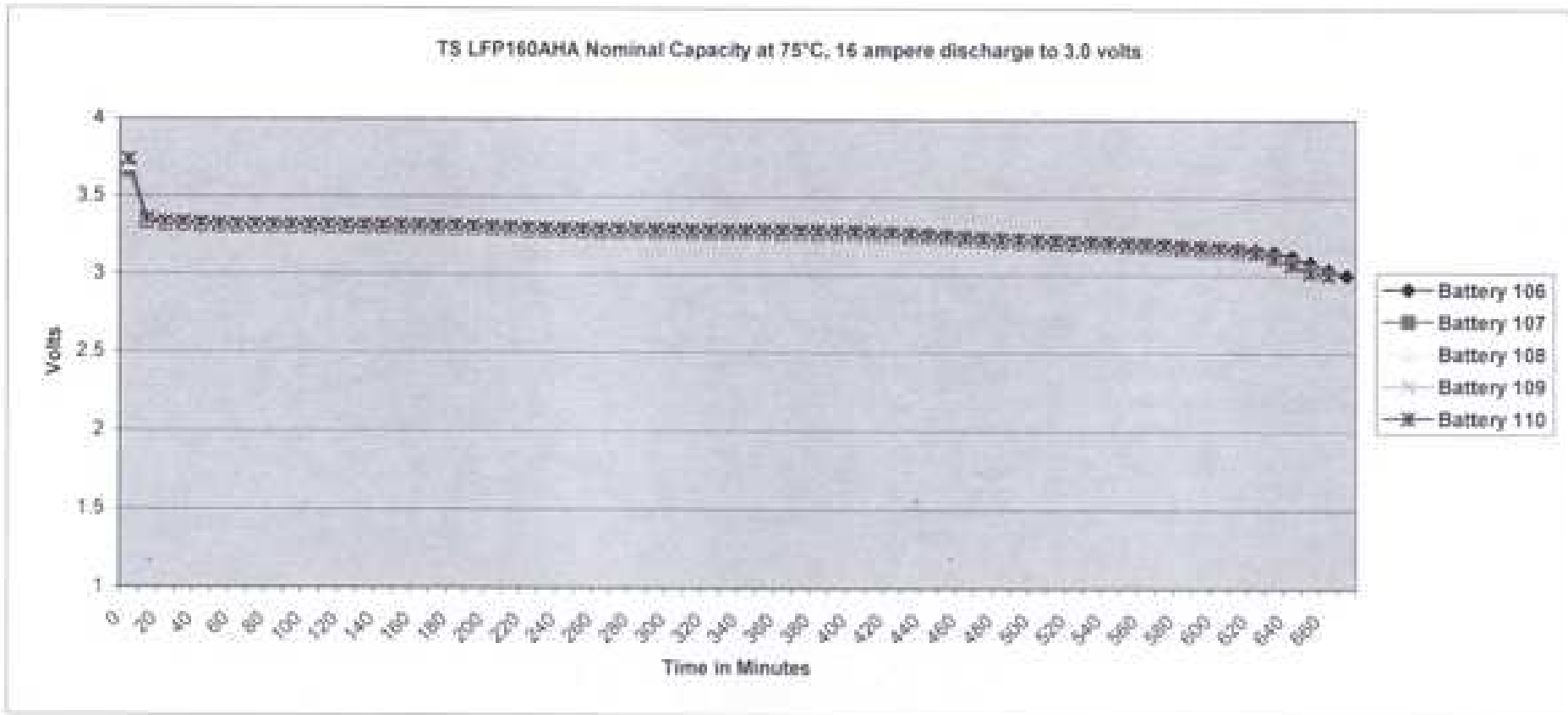
Cell #	OCV	Dch Rate amps	Temperature °C	Time to 2 v minutes	File Name
106	3.88	16.0	-25	601.9	106- -25C
107	3.89	16.0	-25	576.9	107- -25C
108	3.82	16.0	-25	535.8	108- -25C
109	3.88	16.0	-25	534.8	109- -25C
110	3.72	16.0	-25	509.4	110- -25C



L-1200  
11-Sep-08

Thunder Sky model TS-LFP160AHA

Cell #	OCV	Dch Rate amps	Temperature °C	Time to 2 v minutes	File Name
106	3.695	16.0	75	666.05	106-75C
107	3.661	16.0	75	655.61	107-75C
108	3.709	16.0	75	652.93	108-75C
109	3.807	16.0	75	654.46	109-75C
110	4.083	16.0	75	652.48	110-75C





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Job No. L-1200

**ThunderSky**  
**T1, T3, T4 and**  
**SAND2005-3123 (3.1,3.2,3.4,4.2,5.1,5.2,5.3)**  
**Abuse Testing**  
**Test Report**

**PRODUCTS TESTED:** Nine (9) ThunderSky 160 Ahr modules were received in good condition on 18-Mar-08:

Module	Mfr./Brand	Part No.	OCV	Weight (lb)	Date Code
120	ThunderSky	TS-LFP 160AHA	3.31	12.50	080308-F16120
121	ThunderSky	TS-LFP 160AHA	3.31	12.55	080308-F16121
122	ThunderSky	TS-LFP 160AHA	3.31	12.50	080308-F16137
123	ThunderSky	TS-LFP 160AHA	3.31	12.50	080308-F16117
124	ThunderSky	TS-LFP 160AHA	3.31	12.50	080308-F16130
125	ThunderSky	TS-LFP 160AHA	3.31	12.30	080308-F16116
126	ThunderSky	TS-LFP 160AHA	3.31	12.50	080308-F16114
127	ThunderSky	TS-LFP 160AHA	3.31	12.50	080308-F16138
128	ThunderSky	TS-LFP 160AHA	3.30	12.50	080308-F16135

**DATES TESTED:** Testing was performed from 15-Sept-08 through 14-Oct-08.

**TEST PROCEDURE:** See Test Program & Results.


**DATA AND OBSERVATIONS:** See Test Program & Results.

Testing was outsourced.

Requested by: Steve Lu  
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 POST CODE 5181016

Acquisition Plan: A

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Prepared by:   
 Joseph Badger  
 President 10/14/2008

## 2.0 PROGRAM

### 2.1 UN Altitude

#### 2.1.1 Test Requirements

In accordance with the recommendations given forth by the Transport of Dangerous Goods, Manual of Test and Criteria, Section 38.3.4.1; Test 1; Altitude Simulation.

#### 2.1.2 Test Procedure

Module 124 was stored at a pressure of 11.6 kPa for a minimum of six (6) hours at an ambient temperature ( $20 \pm 5^{\circ}\text{C}$ ).

#### 2.1.3 Test Results

Module 124 did not have a mass or voltage loss. It did not leak, vent disassemble, rupture or catch fire as a result of the testing. There was no visible damage.

### 2.2 UN Vibration

#### 2.2.1 Test Requirements

In accordance with the recommendations given forth by the Transport of Dangerous Goods, Manual of Test and Criteria, Section 38.3.4.3; Test 3; Vibration.

#### 2.2.2 Test Procedure

Module 125 was fastened to the shaker head and subjected to a sinusoidal sweep between 7 Hz and 200 Hz and back to 7 Hz, traversed in fifteen (15) minutes. This cycle was repeated twelve (12) times for a total of three (3) hours in each mutually perpendicular axis.

#### 2.2.3 Test Results

Module 125 did not have a mass or voltage loss. It did not leak, vent, disassemble, rupture or catch fire as a result of the testing. There was no additional visible damage.

### 2.3 UN Shock

#### 2.3.1 Test Requirements

In accordance with the recommendations given forth by the Transport of Dangerous Goods, Manual of Test and Criteria, Section 38.3.4.4; Test 4; Shock.

#### 2.3.2 Test Procedure

Module 126 was fastened to the drop tower and subjected to a half sine shock with a peak acceleration of 150 g and pulse duration of six (6) milliseconds. The UUT received three (3) shocks in the positive and negative directions in each of three (3) orthogonal axes for a total of eighteen (18) shocks.

### **2.3.3 Test Results**

Module 126 did not have a mass or voltage loss. It did not leak, vent, disassemble, rupture or catch fire as a result of the testing. There was no additional visible damage.

## **2.4 Short circuit**

### **2.4.1 Test Requirements**

Test was performed in accordance with SAND2005-3123 section 5.2.

### **2.4.2 Test Procedure**

Module 123 was subjected to a hard short for ten (10) minutes or until other conditions occurred that prevented the completion of the test. A five (5) milliohm conductor was used to achieve the short. Data acquisition was continued for an additional two (2) hours after the short was removed.

### **2.4.3 Test Results**

During the test, the positive lead on the module began to glow red, causing the unit to catch fire. The short was then disconnected and the module casing continued to melt.

## **2.5 Overcharge**

### **2.5.1 Test Requirements**

Test was performed in accordance with SAND2005-3123 section 5.1.

### **2.5.2 Test Procedure**

Module 121 was overcharged at a constant current of 32 amps until it reached 200% SOC, which was approximately five (5) hours. Data acquisition was continued for an additional two (2) hours after charging had been stopped.

### **2.5.3 Test Results**

Close to the end of the charge cycle, a quarter inch hole formed on the module and the unit began to vent. Prior to this, the module began to swell and its temperature reached approximately 77 degrees Celsius.

## **2.6 Discharge**

### **2.6.1 Test Requirements**

Test was performed in accordance with SAND2005-3123 section 5.3.

### **2.6.2 Test Procedure**

Module 120 was discharged at a rate of C/1 for one and a half (1.5) hours or until the unit had achieved voltage reversal for fifteen (15) minutes. Data acquisition was continued for an additional two (2) hours after the discharge was completed.

### **2.6.3 Test Results**

The discharge was removed before 1.5 hours was reached because the module achieved voltage reversal for fifteen (15) minutes. The module swelled but there was no fire, venting, or explosion.

## **2.7 Water Immersion**

### **2.7.1 Test Requirements**

Test was performed in accordance with SAND2005-3123 section 3.4.

### **2.7.2 Test Procedure**

Module 127 was completely immersed in salt water (nominal composition of seawater and at 25°C) for a minimum of two hours or until all visible reactions had stopped.

### **2.7.3 Test Results**

No visible reaction occurred when the module was immersed in the salt water. A voltage loss was measured post test and some oxidation was observed on the positive and negative terminals.

## **2.8 Crush**

### **2.8.1 Test Requirements**

Test was performed in accordance with SAND2005-3123 section 3.1.

### **2.8.2 Test Procedure**

Module 122 was crushed between a flat platen and a textured platen. The textured platen had semicircular intruders with a 75mm radius at 30mm apart. The module was then crushed at a displacement 15% its height and held for five (5) minutes. The module was then crushed 50% its height or at a force 1000 times it's mass and held for five (5) minutes.

### **2.8.3 Test Results**

The module was crushed and no fire or explosion occurred as a result.

## **2.9 Nail Penetration**

### **2.9.1 Test Requirements**

Test was performed in accordance with SAND2005-3123 section 3.2.

### **2.9.2 Test Procedure**

Module 128 was penetrated with a 20mm mild steel (conductive) pointed rod that was electrically isolated from the unit. The rate of penetration was eight (8) cm/sec. until a displacement of 100mm was achieved.

### **2.9.3 Test Results**

Module 128 vented upon penetration but did not catch fire or explode.

**- The END -**