

# TEST REPORT

1. No : CU15-00409

2. Client

- o Name : SAMSUNG SDI Co., Ltd.
- o Address : 508, Sungsung-dong, Seobuk-gu, Cheonan-si, Chungcheongnam-do, KOREA
- o Date of Receipt : Jul. 27, 2015
- o Date of Issued : Aug. 11, 2015

3. Use of Report : Submission

4. Test Sample : Rechargeable Lithium-ion Battery Pack



Model Name	PA2R29-03-H01
Nominal voltage	36.0 V
Rated capacity	5 200 mAh
Wh Capacity	187.2 Wh
Weight	1 420 g

(#1~#4 : Fresh cell 100 % SOC, #5~#8 : 50 Cycled cell 100% SOC)

5. Method : Manual of Tests and Criteria UN38.3 (5th), Amendment 1 & Amendment 2  
IATA Dangerous Goods Regulations 56th Edition

6. Test Results :

Refer to the attached sheets

Affirmation	Tested By Name : Jin Hyeok, Kim 	Technical Manager Name : Jin Sung, Park 
<small>Our report apply only to the standards or procedures identified and to the sample(s) tested unless otherwise specified. The test results are not indicative of representative of the qualities of the qualities of the lot from which the sample was taken or of apparently identical or similar products.</small>		

Korea Conformity Laboratories

President

Kim, kyungsik



Address : 153-803 199, Gasan Digital 1-ro, Geumcheon-Gu, Seoul, Korea 82-2-2102-2500

Result Inquiry : Electric & Electronic Team 82-2-2102-2795

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## 6. Test Results

Test Item	Acceptance criteria	Test Result	
T1: Altitude Simulation	<ul style="list-style-type: none"> <li>- No leakage</li> <li>- No venting</li> <li>- No disassembly</li> <li>- No rupture</li> <li>- No fire</li> <li>- OCV &gt; 90% of initial</li> </ul>	#1	Pass
		#2	Pass
		#3	Pass
		#4	Pass
		#5	Pass
		#6	Pass
		#7	Pass
		#8	Pass
T2: Thermal Test	<ul style="list-style-type: none"> <li>- No leakage</li> <li>- No venting</li> <li>- No disassembly</li> <li>- No rupture</li> <li>- No fire</li> <li>- OCV &gt; 90% of initial</li> </ul>	#1	Pass
		#2	Pass
		#3	Pass
		#4	Pass
		#5	Pass
		#6	Pass
		#7	Pass
		#8	Pass
T3: Vibration Test	<ul style="list-style-type: none"> <li>- No leakage</li> <li>- No venting</li> <li>- No disassembly</li> <li>- No rupture</li> <li>- No fire</li> <li>- OCV &gt; 90% of initial</li> </ul>	#1	Pass
		#2	Pass
		#3	Pass
		#4	Pass
		#5	Pass
		#6	Pass
		#7	Pass
		#8	Pass

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T4:Shock Test	<ul style="list-style-type: none"> <li>- No leakage</li> <li>- No venting</li> <li>- No disassembly</li> <li>- No rupture</li> <li>- No fire</li> <li>- OCV &gt; 90% of initial</li> </ul>	#1	Pass
		#2	Pass
		#3	Pass
		#4	Pass
		#5	Pass
		#6	Pass
		#7	Pass
		#8	Pass
T5:External Short Circuit	<ul style="list-style-type: none"> <li>- No disassembly</li> <li>- No rupture</li> <li>- No fire</li> <li>- External temperature &lt; 170°C</li> </ul>	#1	Pass
		#2	Pass
		#3	Pass
		#4	Pass
		#5	Pass
		#6	Pass
		#7	Pass
		#8	Pass
T7:Overcharge	<ul style="list-style-type: none"> <li>- No disassembly</li> <li>- No fire</li> </ul>	#1	Pass
		#2	Pass
		#3	Pass
		#4	Pass
		#5	Pass
		#6	Pass
		#7	Pass
		#8	Pass
Drop Test (Package)	<ul style="list-style-type: none"> <li>-Without damage to cells or batteries contained therein.</li> <li>-Without shifting of the contents so as to allow battery to battery contact.</li> <li>- Without release of contents.</li> </ul>	Pass	

► Test Method

- T1~T7 : Manual of Tests and Criteria UN38.3 (5th), Amendment 1 & Amendment 2
- Drop Test : Dangerous Goods Regulations 56<sup>th</sup> Edition

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## 7. Test Data

T1~T5

	Before Test		T1		T2		T3		T4		T5
	Mass (g)	Open circuit voltage (V)	Mass (g)	Open circuit voltage (V)	Mass (g)	Open circuit voltage (V)	Mass (g)	Open circuit voltage (V)	Mass (g)	Open circuit voltage (V)	Max. Temp. (°C)
1	142536	41.10	142536	41.09	142534	4034	142534	4033	142534	4033	55.6
2	142610	41.10	142610	41.10	142610	4036	142610	4035	142610	4034	55.4
3	142711	41.08	142710	41.08	142710	4034	1427.10	4034	142710	4034	55.4
4	142621	41.08	142621	41.08	142621	4034	1426.21	4034	142621	4034	55.5
5	142546	41.12	142546	41.12	142546	4036	142545	4035	142546	4034	55.0
6	142563	41.09	142563	41.09	142563	4035	1425.63	4034	142563	4034	54.9
7	142472	41.10	142472	41.09	142471	4033	1424.71	4033	1424.70	4033	54.8
8	142545	41.07	142545	41.07	142545	4030	1425.45	4030	1425.43	4030	55.1

T7

	Before Test		T7
	Mass (g)	Open circuit voltage (V)	Max. Temp (°C)
1	1427.22	41.10	24.8
2	1424.74	41.10	24.4
3	1425.49	41.09	24.5
4	1425.53	41.10	24.8
5	1424.53	41.07	24.6
6	1424.46	41.07	24.5
7	1423.32	41.07	24.6
8	1424.01	41.10	24.6

Drop Test(Package)

- Material : Fiberboard Box	
Weight(g)	Before : 9 215 / After : 9 215
1(Top)	no damage, no shifting, no release
2(bottom)	no damage, no shifting, no release
3(Face)	no damage, no shifting, no release
4(Face)	no damage, no shifting, no release
5(corner)	no damage, no shifting, no release

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## 8. Test Condition

### T1. Altitude Simulation

Test cells and batteries shall be stored at a pressure of 11.6 kPa or less for at least six hours at ambient temperature ( $20 \pm 5$  °C).

### T2. Thermal test

Test Temperature(°C)	Test Time(h)
→	0.5
$75 \pm 2$	6
→	0.5
$- 40 \pm 2$	6
10 Cycles	

### T3.Vibration Test

Direction	Frequency	Displacement(Acc.)	Sweep rate	Test Time(h)
X	(7-18) Hz	1 g	7.5 min/Singles Sweep	3
Y	(18-50) Hz	0.8 mm <sub>0-p</sub>		3
Z	(50-200) Hz	8g		3

### T4.Shock Test

Direction	Acceleration(G)	Duration Time(ms)	Wave Form	Repetitive Times	
X	150	6	Half Sine	+	3
				-	3
Y				+	3
				-	3
Z				+	3
				-	3

### T5. External short circuit

The cell or battery to be tested shall be temperature stabilized so that its external case temperature reaches  $55 \pm 2$ °C and then the cell or battery shall be subjected to a short circuit condition with a total external resistance of less than 0.1 ohm at  $55 \pm 2$  °C. This short circuit condition is continued for at least one hour after the cell or battery external case temperature has returned to  $55 \pm 2$ °C. The cell or battery must be observed for a further six hours for the test to be concluded.

# TEST REPORT

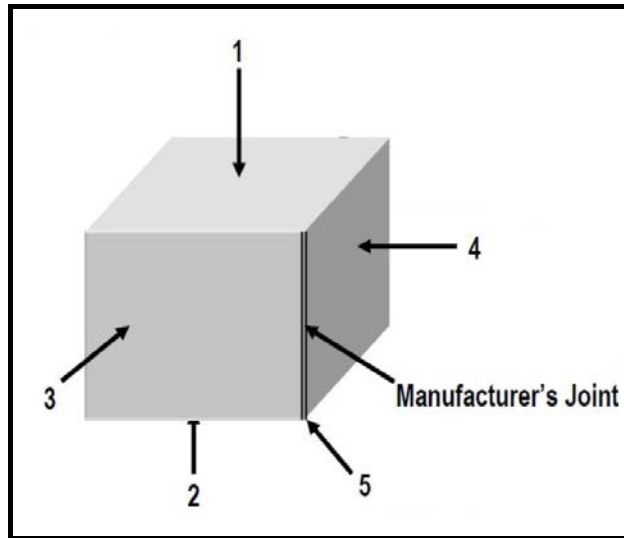
No : CU15-00409

## T7. Overcharge

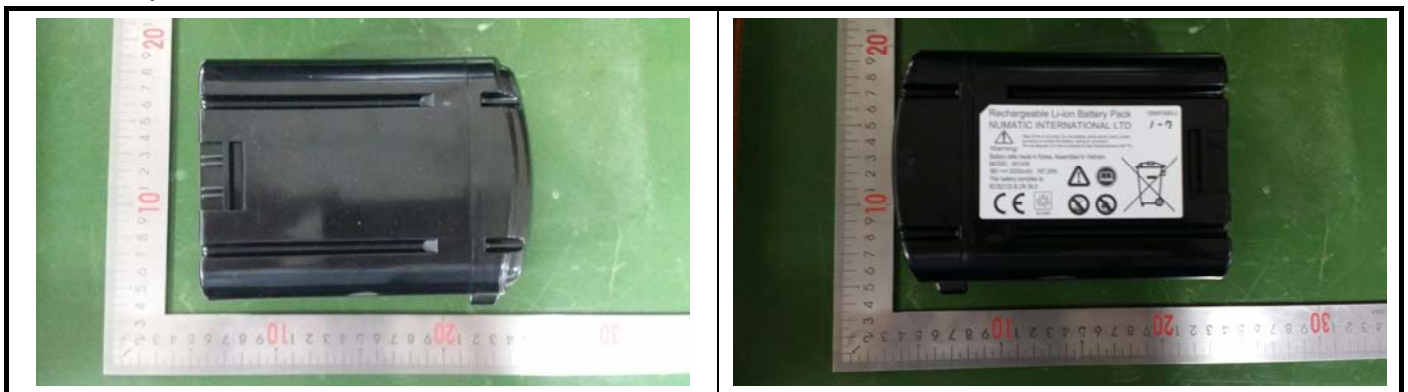
Test Voltage (V)	Test Current (A)	Test Time (h)
50.4	9	24

Drop Test

- Drop Height : 1.2 m



## 9. Test Sample



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## 10. Test Scene



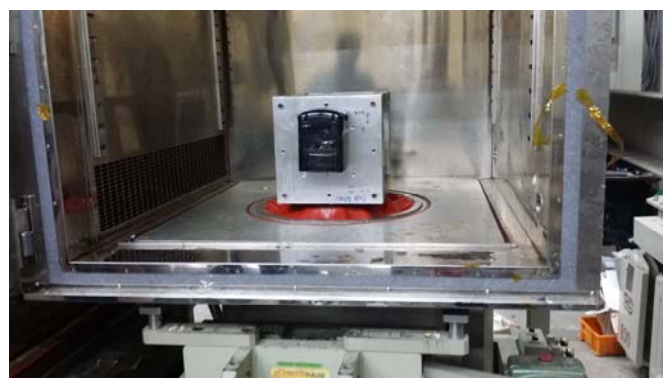
T1. Altitude Simulation



T2. Thermal test



T3.Vibration Test



T4.Shock Test



T5. External short circuit



T7. Overcharge



Drop Test

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## 11. Test Equipment

- T1 : ALTITUDE CHAMBER / KUKJAE ENGINEERING(KOREA)
- T2 : CHAMBER(TSA-71S-A) / ESPEC(JAPAN)
- T3 : VIBRATION TESTER(F-26000) / EMIC(JAPAN)
- T4 : SHOCK TESTER(i240S) / IMV(JAPAN)
- T5 : SAFETY OVEN / HANBAEK(KOREA)
- T7 : MODULE CYCLER(WWSC\_1306) / WOOWON(KOREA)
- DROP TEST : DROP TESTER(DT-125) / GAYNES ENGINEERING INC.

-----End of Report -----