

TEST REPORT

Report No. : 10-04-EAT-127-E06-A
Applicant : HY-LINE AG
Address : Gründenstrasse 82, 8247 Flurlingen Schweiz
Commodity : Li-ion Battery Pack
Model : H2B2722
Quantity : 24 pcs
Date of Receipt : Apr. 06, 2010
Date of Testing : May 26, 2010~ Jul. 17, 2010
Ambient Environment : Temp. 25~29°C , R.H. 56~71%
Testing Item : Refer to next page

Testing Laboratory Name : Electronics Testing Center, Taiwan
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Tested by : Wesley Chiou Approved by : Eric Peng
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Contents : Total 26 pages

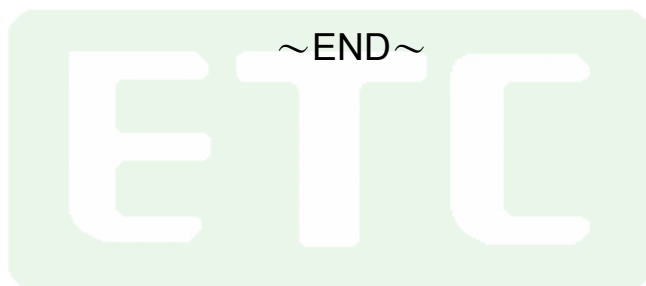
Note: 1. The results of the testing report relate only to the items tested.
2. The testing report shall not be reproduced except in full, without the written approval of ETC.

Testing item :

1. Altitude simulation test
2. Thermal test
3. Vibration test
4. Shock test
5. External short circuit test
6. Overcharge test



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※Pre-condition of samples

Sample No. : #1~#24

Charge : 1.Constant current of 3A until the voltage is up to 8.4V.

2.Constant voltage of 8.4V until the current is down to 0.069A

Discharge : Constant current of 3A until the voltage is down to 6V

Cycles :

Sample No.	Cycles
#1~#4	After 50 th cycles ending in fully charged
#5~#8	After 50 th cycles ending in fully discharged
#9~#12	1 st cycle in fully charged
#13~#16	1 st cycle in fully discharged
#17~#20	After 50 th cycles ending in fully charged
#21~#24	1 st cycle in fully charged



Testing Conditions : According to UN ST/SG/AC.10/11/Rev.4 Section 38.3 and applicant's specification

1. Altitude simulation test

Sample No. : #1~#16

Sample condition : As shown in Fig.1

Pressure : 11.6 kPa

Temperature : 20°C

Duration : 6 hrs.

Requirement : Mass loss did not exceed 0.1%, the voltage of specimen after test is not less than 90% of pre-test voltage(Only for #1~#4, #9~#12), no leakage, no venting, no disassembly, no rupture, no fire

Note : 1. Leakage and venting is deemed to have occurred when the resulting mass loss exceeds 0.1%

2. No disassembly, no rupture, no fire are judged by visual inspection.



Fig.1 : Altitude simulation test

2. Thermal test

Sample No. : #1~#16

Sample condition : As shown in Fig.2

Procedure :

Step	Temperature	Duration
1	75°C	6 hrs
2	75°C → -40°C	<30 min
3	-40°C	6 hrs
4	-40°C → 75°C	<30 min
5	Step 1 to step 4 is as a cycle. Repeat further 9 cycles	
6	Storage at 20°C for 24 hrs after test	

Requirement : Mass loss did not exceed 0.1%, the voltage of specimen after test is not less than 90% of pre-test voltage(Only for #1~#4, #9~#12), no leakage, no venting, no disassembly, no rupture, no fire

Note : 1. Leakage and venting is deemed to have occurred when the resulting mass loss exceeds 0.1%

2. No disassembly, no rupture, no fire are judged by visual inspection.





Fig.2 : Thermal test

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3. Vibration test

Sample No. : #1~#16

Sample condition : As shown in Fig.3

Waveform : Sine wave

Frequency : (7 ~ 200 ~ 7) Hz

Sweep time : 15 min.

Amplitude : 1.6 mm (18~ 50) Hz

Acceleration : 1g (7~ 18) Hz / 8g (50~ 200) Hz

Direction : X, Y, Z (3 axes)

Duration : 3 hrs. / axis

Requirement : Mass loss did not exceed 0.1%, the voltage of specimen after test is not less than 90% of pre-test voltage(Only for #1~#4, #9~#12), no leakage, no venting, no disassembly, no rupture, no fire

Note : 1. Leakage and venting is deemed to have occurred when the resulting mass loss exceeds 0.1%

2. No disassembly, no rupture, no fire are judged by visual inspection.





Fig.3 : Vibration test

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4. Shock test

Sample No. : #1~#16

Sample condition : With fixture (As shown in Fig.4)

Pulse shape : Half-sine pulse

Peak acceleration : 150 g

Duration of pulse : 6 ms

Direction : $\pm X, \pm Y, \pm Z$ (6 directions)

Number of shock : 3 times / direction, total 18 times

Requirement : Mass loss did not exceed 0.1%, the voltage of specimen after test is not less than 90% of pre-test voltage(Only for #1~#4, #9~#12), no leakage, no venting, no disassembly, no rupture, no fire

Note : 1. Leakage and venting is deemed to have occurred when the resulting mass loss exceeds 0.1%

2. No disassembly, no rupture, no fire are judged by visual inspection.

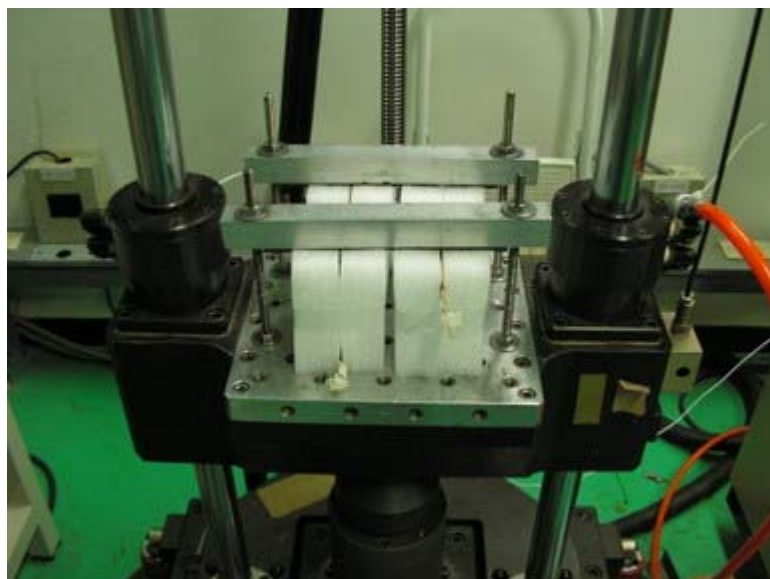


Fig.4 : Shock test

5. External short circuit test

Sample No. : #1~#16

Sample condition : As shown in Fig.5

Temperature : 55°C

External resistance : $< 0.1 \Omega$

Duration : 1 hr after the specimens temperature has returned to 55°C

Requirement : 1. Short-circuited external temperature doesn't exceed 170°C.

2. No disassembly, no rupture, no fire within 6 hours after test

Note : No disassembly, no rupture, no fire are judged by visual inspection.

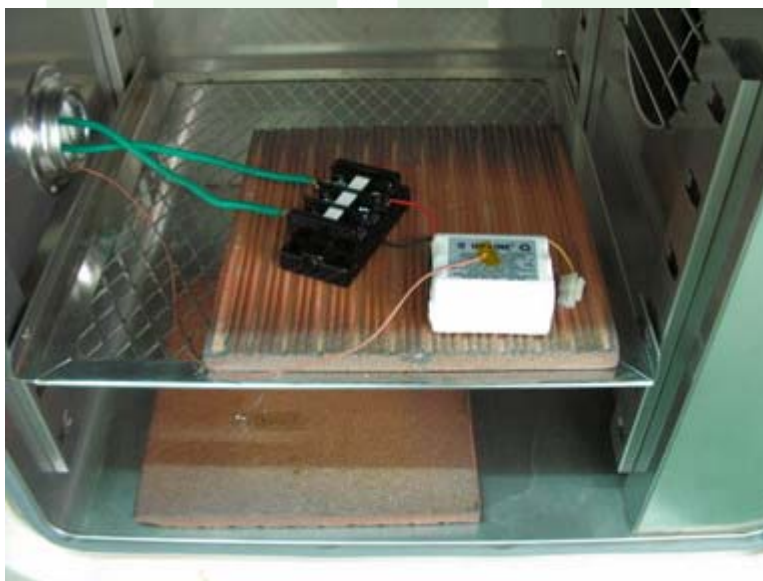


Fig.5 : External short circuit test

6. Overcharge test

Sample No. : #1, #2, #19~#24

Sample condition : As shown in Fig.6

Current : 9.66A

Voltage : 16.8V

Duration : 24 hrs.

Requirement : No fire, no disassembly within 7 days after test

Note : No disassembly, no fire are judged by visual inspection.



Fig.6 : Overcharge test

Testing Equipment :

Name	Model	Cal. Date	Due Date
Multimeter	G.W. GDM-391	Nov. 10, 2009	Nov. 09, 2010
Electronic Balance	SHINKO HJ-33KE	Nov. 16, 2009	Nov. 15, 2010
Climatic and T/H Chamber	ESPEC MZH-11H	May 24, 2010	May 23, 2011
T & H Chamber	WEISS SD/800/70-SA/10	Nov. 11, 2009	Nov. 10, 2010
Vibration Test System	SHINKEN G-5230S	Jul. 01, 2009	Jun. 30, 2010
Shock Tester	KD DP-1200-ST25	Aug. 25, 2009	Aug. 24, 2010
Micro Ohmmeter	VALHALLA SCIENTIFIC 4300B	Feb. 23, 2010	Feb, 22, 2011
H & L Chamber	TABAI MC-710	Dec. 14, 2009	Dec. 13, 2010
Charge/Discharge Battery Tester	MACCOR SERIES 4000	Dec. 29, 2009	Dec. 28, 2010

Testing Result :

1. Altitude simulation test

1.1 Judgment table

Date of testing : Jun. 17, 2010

Measure environment : Temp. 25°C , R.H. 61%

Sample No.	Description
#1~#16	<ol style="list-style-type: none">1. Mass loss did not exceed 0.1%2. The voltage of #1~#4 and #9~#12 after test are not less than 90% of pre-test value3. No leakage4. No venting5. No disassembly6. No rupture7. No fire

Note : 1.The details of mass are shown in 1.2-Mass loss table

2.The details of voltage are shown in 1.3-Voltage table



1.2 Mass loss table

Date of testing : Jun. 15, 2010(Pre-test)/Jun. 17, 2010(Post-test)

Measure environment : Temp. 25°C , R.H. 61%(Pre-test)

Temp. 25°C , R.H. 61%(Post-test)

Sample No.	Pre-test mass (g)	Post-test mass (g)	Mass loss (%)
#1	284.3	284.3	0.00
#2	284.1	284.1	0.00
#3	284.0	284.1	-0.04
#4	284.4	284.4	0.00
#5	284.1	284.2	-0.04
#6	284.2	284.2	0.00
#7	284.1	284.2	-0.04
#8	284.3	284.4	-0.04
#9	284.6	284.6	0.00
#10	284.3	284.3	0.00
#11	284.5	284.5	0.00
#12	284.4	284.4	0.00
#13	284.4	284.4	0.00
#14	284.3	284.3	0.00
#15	284.0	284.1	-0.04
#16	283.8	283.9	-0.04

Note : Mass loss = $(M_{pre} - M_{post}) / M_{pre} \times 100\%$

1.3 Voltage table

Date of testing : Jun. 15, 2010(Pre-test)/Jun. 17, 2010(Post-test)

Measure environment : Temp. 25°C , R.H. 61%(Pre-test)

Temp. 25°C , R.H. 61%(Post-test)

Sample No.	Pre-test voltage (V)	Post-test voltage (V)	Voltage ratio (%)
#1	8.43	8.42	99.88
#2	8.43	8.42	99.88
#3	8.42	8.42	100.00
#4	8.42	8.42	100.00
#9	8.43	8.42	99.88
#10	8.42	8.41	99.88
#11	8.42	8.41	99.88
#12	8.42	8.42	100.00

Note : Voltage ratio = $V_{post} / V_{pre} \times 100\%$



2. Thermal test

2.1 Judgment table

Date of testing : Jun. 28, 2010

Measure environment : Temp. 28°C , R.H. 56%

Sample No.	Description
#1~#16	1. Mass loss did not exceed 0.1% 2. The voltage of #1~#4 and #9~#12 after test are not less than 90% of pre-test value 3. No leakage 4. No venting 5. No disassembly 6. No rupture 7. No fire

Note : 1.The details of mass are shown in 1.2-Mass loss table

2.The details of voltage are shown in 1.3-Voltage table

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2.2 Mass loss table

Date of testing : Jun. 17, 2010(Pre-test)/Jun. 28, 2010(Post-test)

Measure environment : Temp. 25°C , R.H. 61%(Pre-test)

Temp. 28°C , R.H. 56%(Post-test)

Sample No.	Pre-test mass (g)	Post-test mass (g)	Mass loss (%)
#1	284.3	284.2	0.04
#2	284.1	284.0	0.04
#3	284.1	283.9	0.07
#4	284.4	284.3	0.04
#5	284.2	284.1	0.04
#6	284.2	284.0	0.07
#7	284.2	284.0	0.07
#8	284.4	284.3	0.04
#9	284.6	284.4	0.07
#10	284.3	284.2	0.04
#11	284.5	284.4	0.04
#12	284.4	284.3	0.04
#13	284.4	284.3	0.04
#14	284.3	284.2	0.04
#15	284.1	284.0	0.04
#16	283.9	283.7	0.07

Note : Mass loss = $(M_{pre} - M_{post}) / M_{pre} \times 100\%$

2.3 Voltage table

Date of testing : Jun. 17, 2010(Pre-test)/Jun. 28, 2010(Post-test)

Measure environment : Temp. 25°C , R.H. 61%(Pre-test)

Temp. 28°C , R.H. 56%(Post-test)

Sample No.	Pre-test voltage (V)	Post-test voltage (V)	Voltage ratio (%)
#1	8.42	8.35	99.17
#2	8.42	8.35	99.17
#3	8.42	8.34	99.05
#4	8.42	8.35	99.17
#9	8.42	8.34	99.05
#10	8.41	8.35	99.29
#11	8.41	8.35	99.29
#12	8.42	8.34	99.05

Note : Voltage ratio = $V_{post} / V_{pre} \times 100\%$



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3. Vibration test

3.1 Judgment table

Date of testing : Jun. 30, 2010

Measure environment : Temp. 28°C , R.H. 58%

Sample No.	Description
#1~#16	1. Mass loss did not exceed 0.1% 2. The voltage of #1~#4 and #9~#12 after test are not less than 90% of pre-test value 3. No leakage 4. No venting 5. No disassembly 6. No rupture 7. No fire

Note : 1.The details of mass are shown in 1.2-Mass loss table

2.The details of voltage are shown in 1.3-Voltage table

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3.2 Mass loss table

Date of testing : Jun. 28, 2010(Pre-test)/Jun. 30, 2010(Post-test)

Measure environment : Temp. 28°C , R.H. 56%(Pre-test)

Temp. 28°C , R.H. 58%(Post-test)

Sample No.	Pre-test mass (g)	Post-test mass (g)	Mass loss (%)
#1	284.2	284.1	0.04
#2	284.0	284.0	0.00
#3	283.9	283.9	0.00
#4	284.3	284.3	0.00
#5	284.1	284.1	0.00
#6	284.0	284.1	-0.04
#7	284.0	284.1	-0.04
#8	284.3	284.3	0.00
#9	284.4	284.5	-0.04
#10	284.2	284.2	0.00
#11	284.4	284.4	0.00
#12	284.3	284.3	0.00
#13	284.3	284.3	0.00
#14	284.2	284.2	0.00
#15	284.0	284.0	0.00
#16	283.7	283.7	0.00

Note : Mass loss = $(M_{pre} - M_{post}) / M_{pre} \times 100\%$

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3.3 Voltage table

Date of testing : Jun. 28, 2010(Pre-test)/ Jun. 30, 2010(Post-test)

Measure environment : Temp. 28°C , R.H. 56%(Pre-test)

Temp. 28°C , R.H. 58%(Post-test)

Sample No.	Pre-test voltage (V)	Post-test voltage (V)	Voltage ratio (%)
#1	8.35	8.35	100.00
#2	8.35	8.34	99.88
#3	8.34	8.34	100.00
#4	8.35	8.34	99.88
#9	8.34	8.34	100.00
#10	8.35	8.34	99.88
#11	8.35	8.34	99.88
#12	8.34	8.34	100.00

Note : Voltage ratio = $V_{post} / V_{pre} \times 100\%$



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4. Shock test

4.1 Judgment table

Date of testing : Jul. 09, 2010

Measure environment : Temp. 27°C , R.H. 61%

Sample No.	Description
#1~#16	1. Mass loss did not exceed 0.1% 2. The voltage of #1~#4 and #9~#12 after test are not less than 90% of pre-test value 3. No leakage 4. No venting 5. No disassembly 6. No rupture 7. No fire

Note : 1.The details of mass are shown in 1.2-Mass loss table

2.The details of voltage are shown in 1.3-Voltage table

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4.2 Mass loss table

Date of testing : Jul. 08, 2010(Pre-test)/ Jul. 09, 2010(Post-test)

Measure environment : Temp. 27°C , R.H. 59%(Pre-test)

Temp. 27°C , R.H. 61%(Post-test)

Sample No.	Pre-test mass (g)	Post-test mass (g)	Mass loss (%)
#1	284.2	284.2	0.00
#2	284.0	284.0	0.00
#3	284.0	283.9	0.04
#4	284.4	284.4	0.00
#5	284.1	284.1	0.00
#6	284.1	284.2	-0.04
#7	284.1	284.1	0.00
#8	284.3	284.2	0.04
#9	284.5	284.5	0.00
#10	284.2	284.2	0.00
#11	284.4	284.4	0.00
#12	284.4	284.4	0.00
#13	284.4	284.4	0.00
#14	284.2	284.2	0.00
#15	284.0	284.0	0.00
#16	283.8	283.8	0.00

Note : Mass loss = $(M_{pre} - M_{post}) / M_{pre} \times 100\%$

4.3 Voltage table

Date of testing : Jul. 08, 2010(Pre-test)/ Jul. 09, 2010(Post-test)

Measure environment : Temp. 27°C , R.H. 59%(Pre-test)

Temp. 27°C , R.H. 61%(Post-test)

Sample No.	Pre-test voltage (V)	Post-test voltage (V)	Voltage ratio (%)
#1	8.34	8.34	100.00
#2	8.34	8.34	100.00
#3	8.34	8.34	100.00
#4	8.34	8.34	100.00
#9	8.34	8.34	99.95
#10	8.34	8.34	100.00
#11	8.34	8.33	99.88
#12	8.34	8.33	99.88

Note : Voltage ratio = $V_{post} / V_{pre} \times 100\%$



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5. External short circuit test

Date of testing : Jul. 09, 2010

Measure environment : Temp. 27°C , R.H. 61%

Sample No.	Description
#1~#16	1. External temperature didn't exceed 170°C 2. No disassembly 3. No rupture 4. No fire

6. Overcharge test

Date of testing : Jul. 17, 2010

Measure environment : Temp. 25°C , R.H. 62%

Sample No.	Description	Remark
#1	1. No disassembly 2. No fire	The surface of all samples are damaged after test. (Refer to Fig. 7)
#2	1. No disassembly 2. No fire	
#19	1. No disassembly 2. No fire	
#20	1. No disassembly 2. No fire	
#21	1. No disassembly 2. No fire	
#22	1. No disassembly 2. No fire	
#23	1. No disassembly 2. No fire	
#24	1. No disassembly 2. No fire	

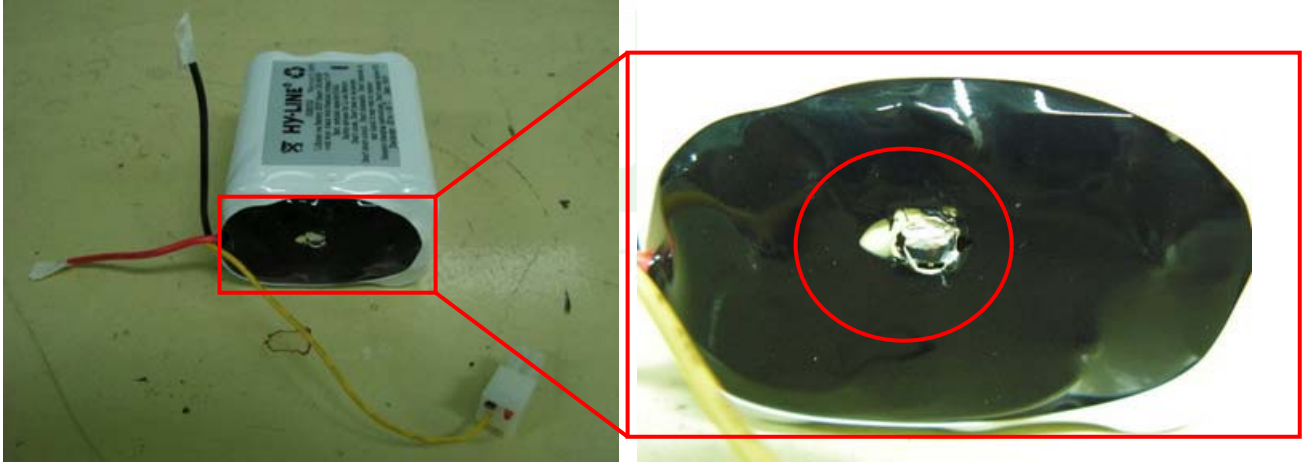


Fig.7 : The illustration of surface damage



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