



报告编号: Q11E11Z11001



Inspection Report

Product Name: Lithium-ion dynamic battery

Product Model: CA180FI

Inspected Unit: CALB

Inspection Type: Mandatory Inspection

**North coach quality supervision & inspection
qualification testing laboratory**

NOTES

1. Report has no "Test report professional seal" or test unit's official seal has no effect.
2. Copy report does not re-affix "inspection report professional seal" or test unit's official seal has no effect.
3. Report has no effect without supervisor, auditing, authorizing offer.
4. Altered report is invalid.
5. If there is no objection with this inspection report, please notice this inspection center to accept in written form.
6. Sending samples inspection is only responsible for samples.

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Inspection Report

Sample name	Lithium-ion dynamic battery	Trademark	
Specification	CA100	Inspection type	Mandatory inspection
Entrust unit	China Aviation Lithium Battery (Luoyang) Co. Ltd	Manufacture	China Aviation Lithium Battery (Luoyang) Co. Ltd
Sending sample person	Zhiyong Zhang	Sending sample date	2011-8-18
Sample amount	24pcs cells 8 battery clusters	Manufacture date	
Inspection basis	QC/T 743-2006<Lithium-ion battery for electric vehicle>	Inspection items	According to QC/T 743-2006<Lithium-ion battery for electric vehicle>standard, 32 items all together, specific items, see appendix.
Inspection conclusion	<p>Upon inspection, those CA100 lithium battery are tested for 32 items according to QC/T 743-2006<Lithium-ion battery for electric vehicle>, there are 32 conformant items, 0 non-conformant items.</p> <p style="text-align: right;">Date: 2012-4-10</p>		
Notes	<p>(1) Source of project: mandatory inspection;</p> <p>(2) Testing object description and appearance photos are listed in Appendix A;</p> <p>(3) Testing curve is illustrated in Appendix B;</p> <p>(4) Testing photos are showed in Appendix C.</p>		

Authorizing: Ding

Auditing: Wang zhong

Supervisor: Gao hongbo

Inspection Report

Chart1 Cell inspection findings

Supervision & inspection qualification testing laboratory

Total 18 page

Page 2

Inspection findings of cell

NO	Inspection item	Standard requirements	Inspection results	Compliance judgment
1	Appearance	Appearance must have no deformation, crack, surface shall be flat, dry, no damage, no pollutants, marks shall be clear and correct.	Appearance have no deformation, crack, surfaces are all flat, dry, have no damage, no pollutants, marks are all clear and correct	Fit
2	Polarity	Terminal polarity shall be correct. Have positive, negative marks.	Polarities are consistent with the symbol marked, all have clear marks of positive, negative	Fit
3	Dimensions(mm)	It shall meet the technology conditions provided by manufacture. 142*67*219(mm)	142*67*219(mm)	Fit
4	Quality(Kg)	It shall meet the technology conditions provided by manufacture. 3.3Kg	3.3Kg	Fit
5	20°C discharging performance	At 20°C±5°C, discharging cell @1I ₃ (A) until discharging cut-off voltage reaches to 2.5V. Discharging capacity shall be not less than nominal capacity, meanwhile, not larger than 110% of nominal capacity.	101.14Ah(96.0% of nominal capacity)	Fit
6	minus 20°C discharging performance	At - 20°C±2°C, after storing cell for 20h, discharging it @1I ₃ (A) until discharging cut-off voltage reaches to 2.0V. Discharging capacity shall be no less than 70% of nominal capacity.	95.95Ah(96.0% of nominal capacity)	Fit
7	55°C discharging performance	At 55°C±2°C, after storing cell for 5h, discharging it @1I ₃ (A) until discharging cut-off voltage reaches to 2.5V. Discharging capacity shall be no less than 90% of nominal capacity.	109.47Ah(109.5% of nominal capacity)	Fit

8	20°C rate discharging performance	At 20°C±5°C, discharging cell @4.5I ₃ (A) until discharging cut-off voltage reaches to 2.5V. Discharging capacity shall be not less than 80% of nominal capacity.	99.24Ah(99.2% of nominal capacity)	Fit
9	Charge retention and capacity recovery performance at room temperature	At 20°C±5°C, after storing for 28d, discharging it @1I ₃ (A) until discharging cut-off voltage reaches to 2.5V. Discharging capacity shall be not less than 80% of nominal capacity, capacity recovery performance shall less than 90% nominal capacity.	Retention performance: 99.56Ah(99.6% of nominal capacity) recovery performance:102.43Ah (102.4% of nominal capacity)	Fit
10	Charge retention and capacity recovery performance at high temperature	After storing for 7h at 55°C±2°C, place it at 20°C±5°C for 5h, discharging it @1I ₃ (A) until discharging cut-off voltage reaches to 2.5V. Discharging capacity shall be not less than 80% of nominal capacity, capacity recovery performance shall less than 90% nominal capacity.	Retention performance: 99.64Ah(99.6% of nominal capacity) recovery performance:101.83Ah (101.8% of nominal capacity)	Fit

Inspection Report

NO	Inspection item	Standard requirements	Inspection results	Compliance judgment
11	Over-discharging test	After charging, at $20^{\circ}\text{C}\pm 5^{\circ}\text{C}$, discharging it @1I ₃ (A) until it's voltage reaches to 0V. It has no explosion, no fire, no leakage.	Cell has no explosion, no fire, no leakage	Fit
12	Over-charging test	After charging, discharging it @1I ₃ (A) until it's voltage reaches to 5V or charging time reaches to 90mins(stop testing as long as one condition is reached)	Cell has o explosion, no fire	Fit
13	Short-circuit test	After charging, let cell external short-circuit for 10mins, resistance of external circuit shall less than 5mΩ, cell shall have no explosion, no fire.	Cell has o explosion, no fire	Fit
14	Dropping test	After charging, at $20^{\circ}\text{C}\pm 5^{\circ}\text{C}$, drop it from the height of 1.5m to hardwood flooring with the thickness of 20mm, each face of the cell is dropped one time. Cell has no explosion, no fire, no leakage.	Cell has no explosion, no fire, no leakage	Fit
15	Heating test	After charging, place cell in constant temperature box of $85^{\circ}\text{C}\pm 2^{\circ}\text{C}$, Cell has no explosion, no fire, no leakage.	Cell has no explosion, no fire	Fit
16	Extrusion test	Testing in accordance with the following conditions, cell has no explosion, no fire, no leakage:1)Extrusion direction: press perpendicularly to plate;2)Extrusion area: less than 20C m ² ;3)Extrusion degree: until shell is cracked or short-circuit (cell's voltage turns to 0V)	Cell has no explosion, no fire	
17	Nail puncture test	After charging, use high temperature steel nail of $\Phi 3\text{mm}\sim\Phi 8\text{mm}$, with the speed of 10mm/s~40mm/s, puncture it perpendicularly to plate (steel nail remains inside of the cell). Cell has no explosion, no fire.	Cell has no explosion, no fire	Fit
18	Life-cycle	After cell is fully charged, at $20^{\circ}\text{C}\pm 2^{\circ}\text{C}$, discharging it @1I ₃ (A) until discharging capacity reaches to 80%. Then charge it @1I ₃ (A) until 3.65V. Charge it at constant 3.65V	Capacity after 500 times of cycling: 100.17Ah (100.2% of nominal capacity)	Fit

		<p>until current reduces to $0.1 I_3$, stand it for 1h. Repeat that steps for 24 times. Check capacity, if capacity is less than 80% of nominal one, then stop testing, life-cycle time shall be not less than 500times.</p>		
19	Storage	<p>After cell is fully charged, at $20^{\circ}\text{C}\pm 5^{\circ}\text{C}$, discharging it @ $1I_3$ (A) for 2h, store it for 90d, fully charge it, discharging it @ $1I_3$ (A) until discharging cut-off voltage reaches to 2.0V. Discharging capacity shall be no less than 95% of nominal capacity.</p>	104.05Ah(104.1% of nominal capacity)	Fit

Inspection Report

Supervision & inspection qualification testing laboratory

Total 18 page

Page 4

Inspection findings of battery module

NO	Inspection item	Standard requirements	Inspection results	Compliance judgment		
1	Appearance	No deformation or flaw on the shell, smooth, dry, No trauma or dirt on the surface, regularly arranged, clearly marked, reliably connected	No deformation or flaw on the shell, smooth, dry, No trauma or dirt on the surface, regularly arranged, clearly marked, reliably connected	Fit		
2	polarity	Polarity of the terminal is correct. Mark of the pole is clear.	Polarity of the terminal is correct. Mark of the pole is clear.	Fit		
3	Dimension	It shall meet the technology conditions provided by manufacture:142*670*219(mm)	142*670*219(mm)	Fit		
4	Quality	It shall meet the technology conditions provided by manufacture: 33.2Kg	33.2kg	Fit		
5	Discharge performance	Discharge the module in current of $1I_3$ (A) in $20\pm 5^\circ\text{C}$, until the module voltage reaches to $n*2.5\text{V}$ or cell voltage reaches 2.0V. Discharging capacity shall be not less than nominal capacity, meanwhile, not larger than 110% of nominal capacity..	104.07Ah(104.1% of nominal capacity)	Fit		
6	Simple simulated condition	The number of batteries withstanding impulse shall be not less than 4.		Battery module withstanding 4 impulses.		
			Operating status		Current A	Step time min
		1	constant-current discharge		$1I_3$	18
		2	constant-current discharge		$9I_3$	1
		3	shelving		0	30
4	constant-current discharge	$1I_3$	18			

		5	constant-current discharge	9 ₃	1		
		6	shelving	0	30		
		7	constant-current discharge	1 ₃	18		
		8	constant-current discharge	9 ₃	1		
		9	shelving	0	30		
		10	constant-current discharge	1 ₃	18		
		11	constant-current discharge	9 ₃	1		

Inspection Report

Supervision & inspection qualification testing laboratory

Total 18 page

Page 5

NO	Inspection item	Standard requirements	Inspection results	Compliance judgment
7	Vibration endurance test	Fasten battery module on vibration test-bed. Testing in accordance with the following conditions:1) discharging current: 1I ₃ (A);2) vibration direction: up and down single vibration;3) vibration frequency: 10Hz~55Hz;4) Maximum accelerated speed: 30m/s ² ;5) sweep cycle: 10 times6) vibration time: 2h. During vibration test, phenomena of discharging current transmutation, abnormal voltage, shell transformation, electrolyte leakage are not allowed, and reliable connection, flawless structure should be retained, installation looseness is not allowed.	Phenomena of discharging current transmutation, abnormal voltage, shell transformation, electrolyte leakage are not incurred. Reliable connection, flawless structure are retained, and no installation looseness.	Fit
8	Over-discharging test	After charging, at 20°C±5°C, discharging batteries @ 1I ₃ (A) (if has electric protective circuit, then remove it temporarily) until voltage reaches to 0V. Batteries shall have no explosion, no fire, no leakage.	No explosion, no fire, no leakage	Fit
9	Over-charging test	After charging, charging batteries @ 3I ₃ (A) current until batteries' voltage reaches to 5V or charging time reaches to 90mins(stop the test as long as one condition is met). Batteries shall have no explosion, no fire, no leakage.	No explosion, no fire, no leakage	Fit
10	short-circuit test	After charging, let batteries outside short-circuit for 10mins. Electric resistance of Outside circuit should be less than 5mΩ. Batteries shall have no explosion, no fire, no leakage.	No explosion, no fire, no leakage	Fit
11	heating test	After charging, place batteries in constant-temperature box of 85°C±2°C, and keep it warm for 120mins. Batteries shall have no explosion, no fire, no leakage.	No explosion, no fire, no leakage	Fit

12	Extrusion	<p>After charging, test in accordance with the following conditions.</p> <p>Extrusion sheet: one side is flat, the other side is sketch plate. Dimensions of it are:300mm*150mm.</p> <p>a) Extrusion direction: pressing perpendicular to batteries' monomer arranged direction.</p> <p>b) Degree of extrusion: pressing until the size of batteries reach to 85% of original dimensions, maintaining for 5mins, then pressing batteries until the sizes of them reach to 50% of original dimensions.</p> <p>During the test procedure, batteries shall have no explosion, no fire.</p>	<p>No Explosion Fire</p> <p>No</p>	Fit
13	Nail puncture	<p>After charging, using high-temperature steel nail with $\Phi 3\text{mm} \sim \Phi 8\text{mm}$, at the speed of $10\text{mm/s} \sim 40\text{mm/s}$, perpendicular to plate, at least 3 batteries(nail remains inside of batteries). Batteries shall have no explosion or no fire.</p>	<p>No Explosion Fire</p> <p>No</p>	Fit

Inspection Report

Appendix A Testing object

A1 Sample description

Source of battery: CALB

Cell: Type: energy model; **Main composition of positive material:** LiFePO₄; **Nominal capacity:** 100Ah; **Weight:** 3.3kg; **Dimensions:** 142*67*219(mm). **Charging upper-limit voltage:** 3.6V, **Discharging lower-limit voltage:** 2.5V.

Battery module: Nominal capacity: 100Ah; **Dimensions:** 142*67*219(mm); **Weight:**33.2kg; Battery module is composed of 10 pcs of cells. In the safety testing, battery module is composed of 5 pcs of cells.

A2 Sample appearance

Cell appearance photo A2-1, module appearance photoA2-2

Photo A2-1



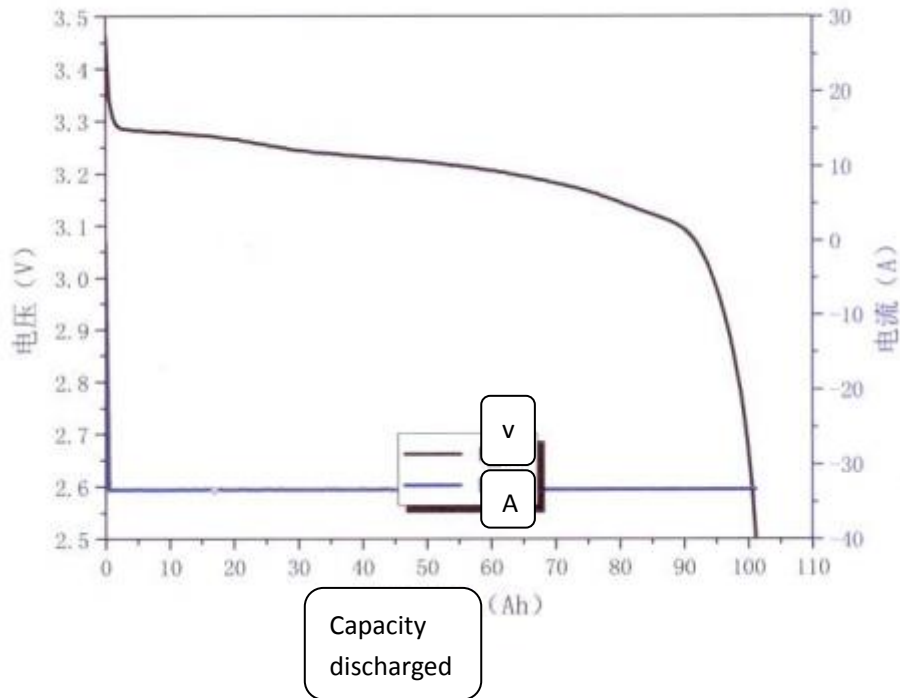
PhotoA2-2



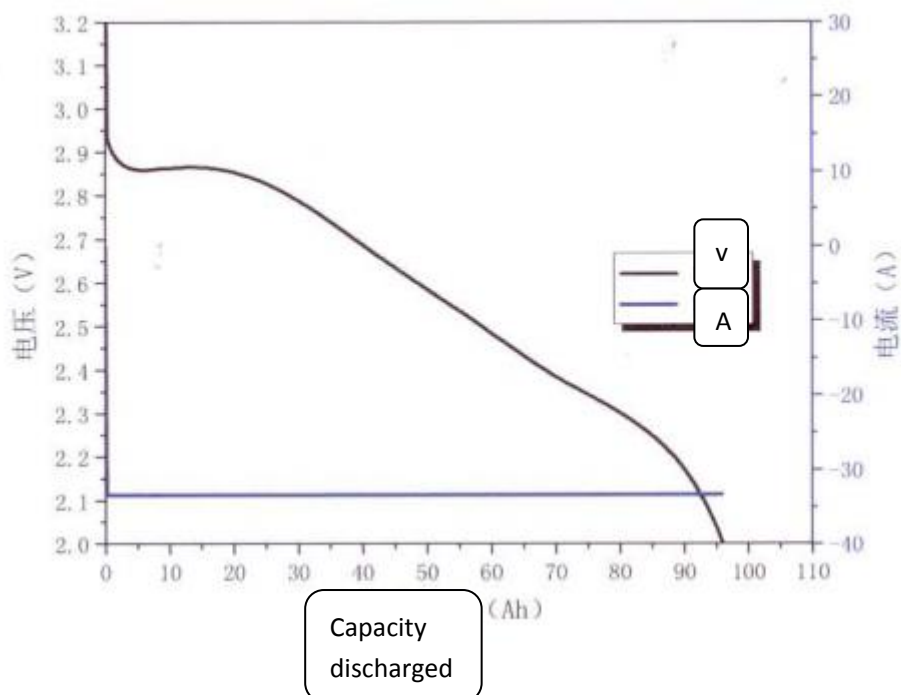
Inspection Report

Appendix B Testing curve

B1 Cell's discharging curve at normal temperature

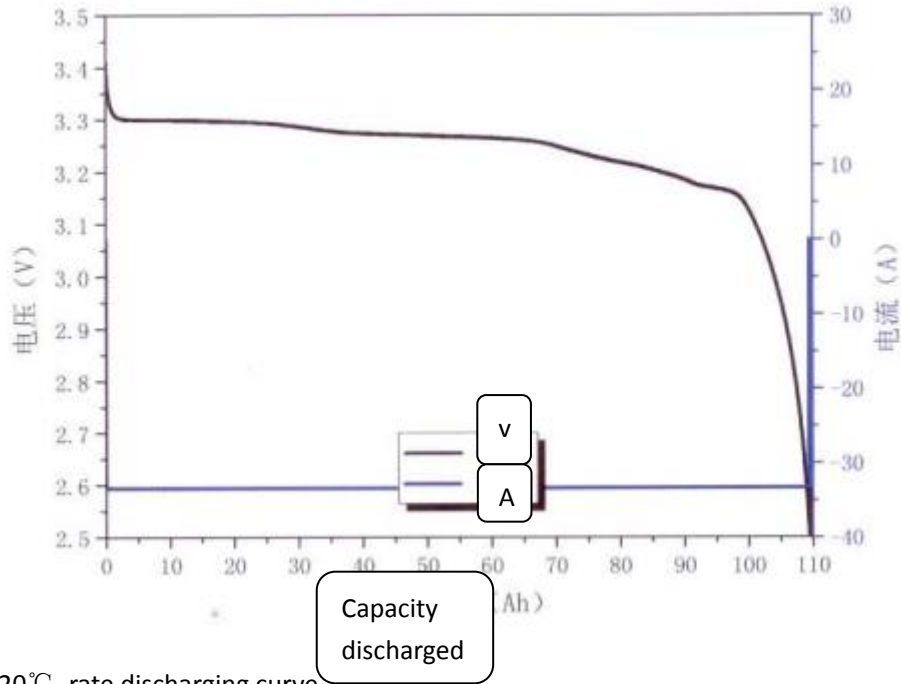


B2 Cell's discharging curve at low temperature

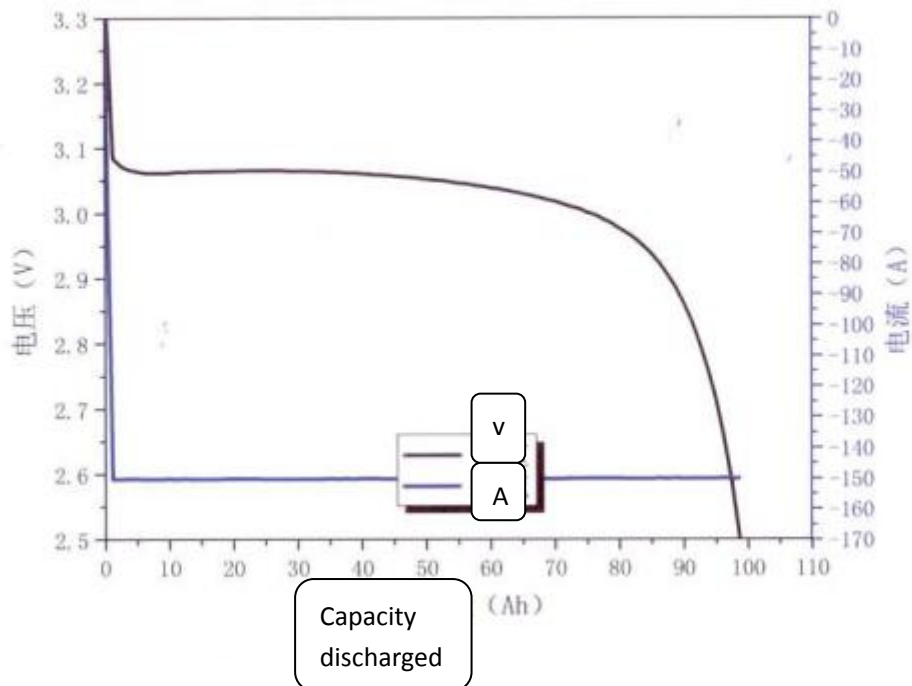


Inspection Report

B3 Cell's discharging curve at high temperature

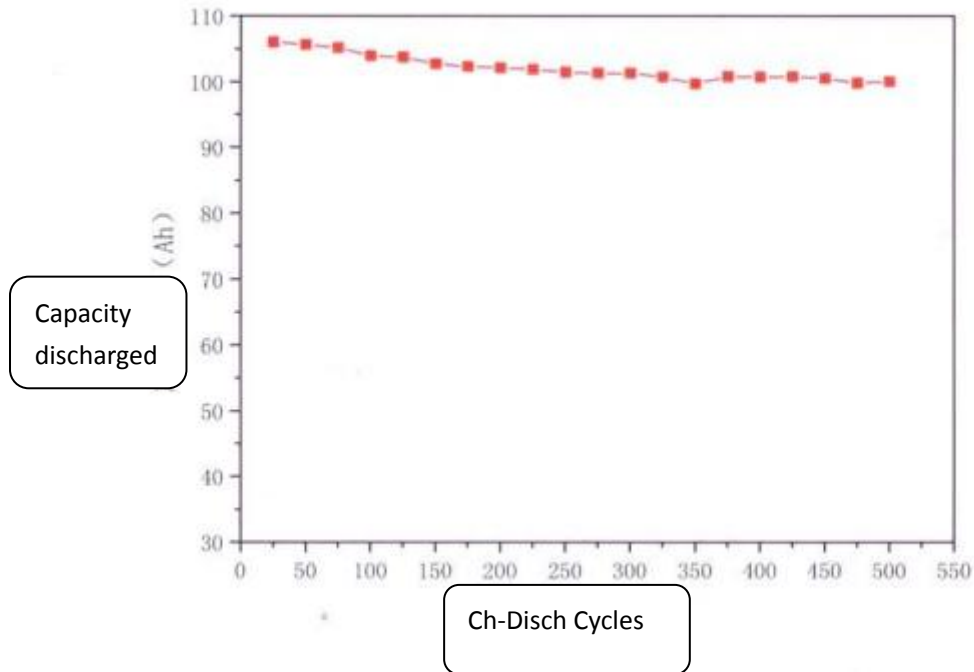


B4 Cell's 20°C rate discharging curve

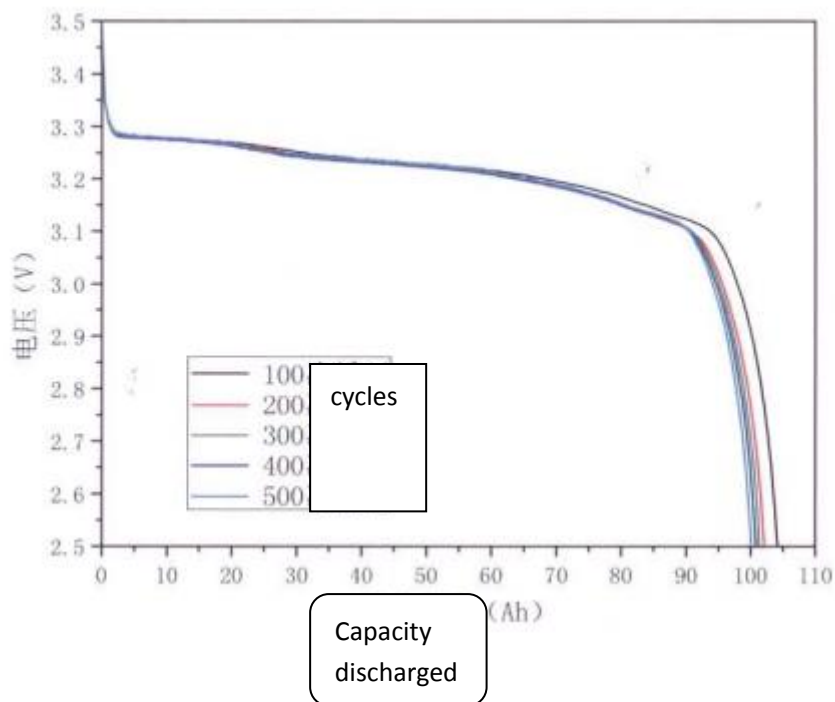


Inspection Report

B5 Cell's life-cycle curve

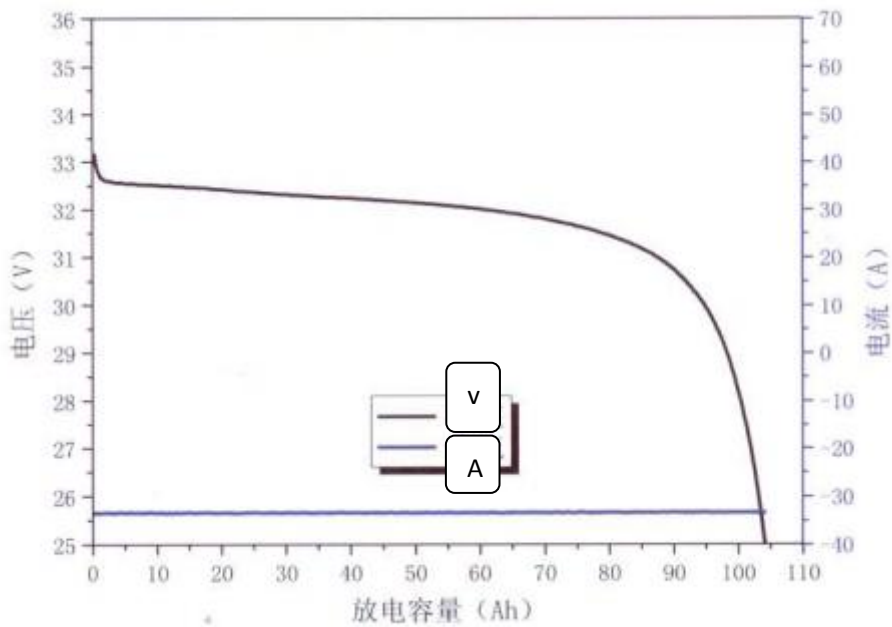
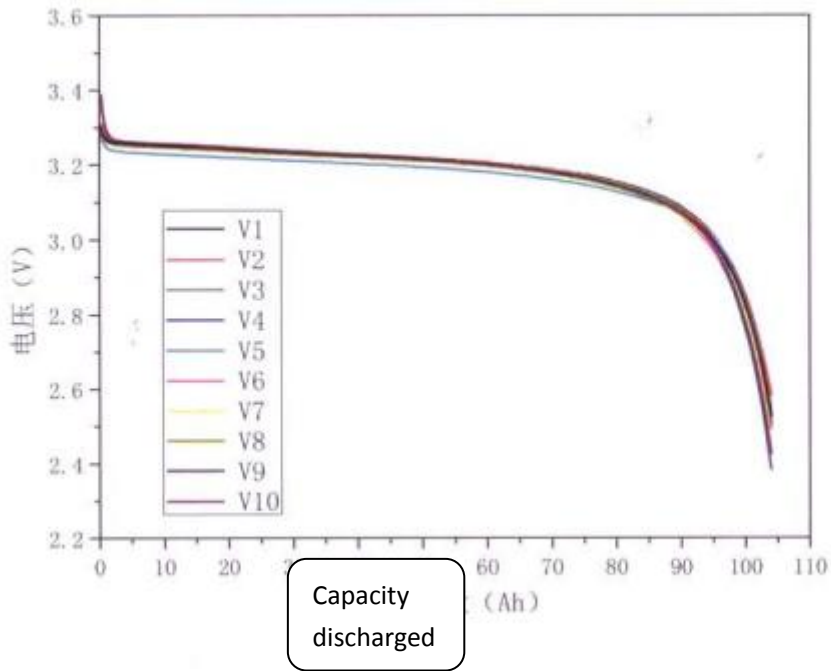


B6 Cell's discharging curve during life-cycle inspection



Inspection Report

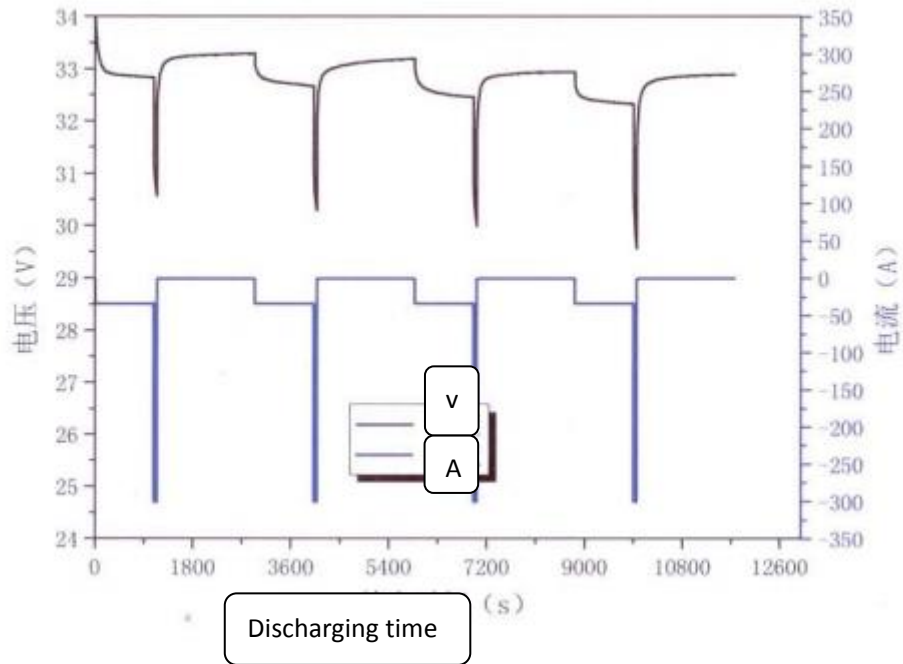
B7 Battery module's discharging curve at normal temperature



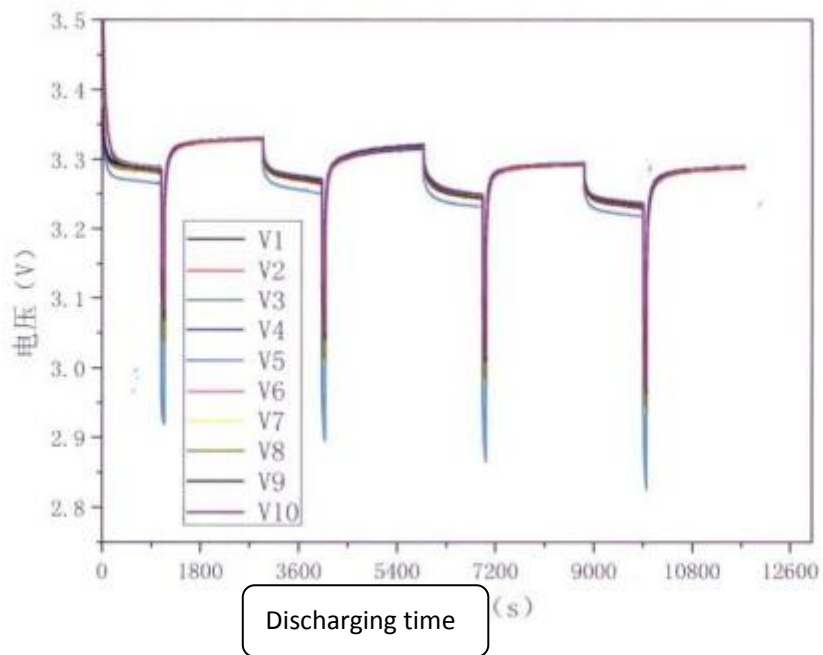
B8 Cell's voltage curve corresponding to battery module's discharging testing at normal temperature

Inspection Report

B9 Module simple simulation operation state curve



B10 Cell's voltage curve corresponding to module simple simulation operation state testing



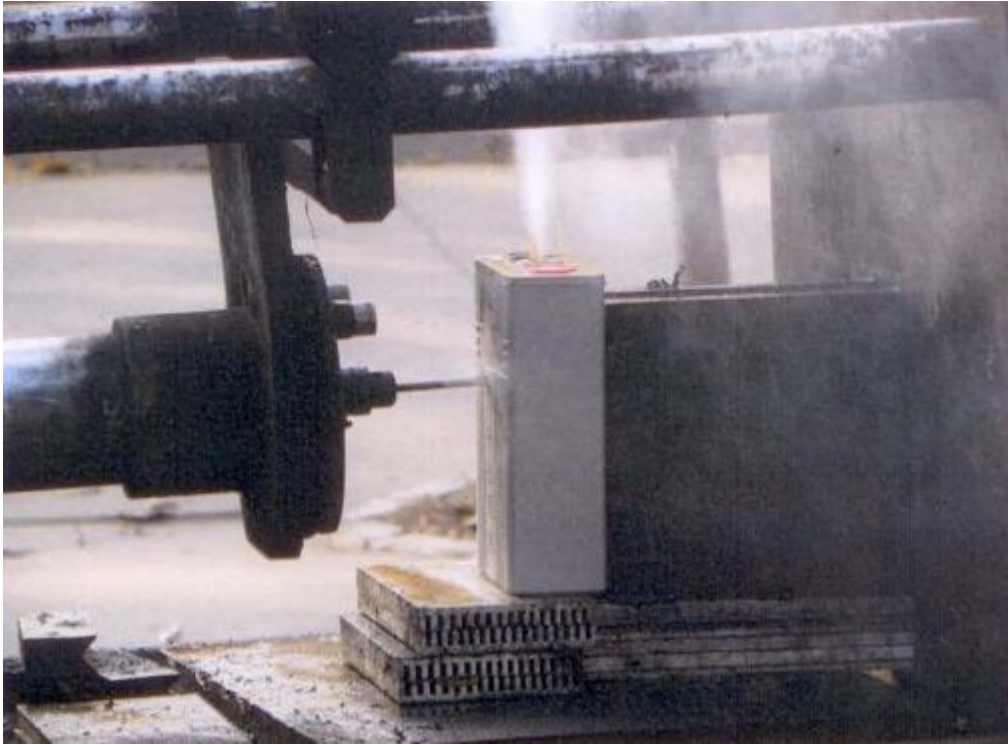
Inspection Report

Appendix C Testing photos

C1 Cell's extrusion test



C2 Cell's nail puncture test



State Coach Quality

Report NO: QU11E11ZH1001

Inspection Report

Supervision & inspection qualification testing laboratory

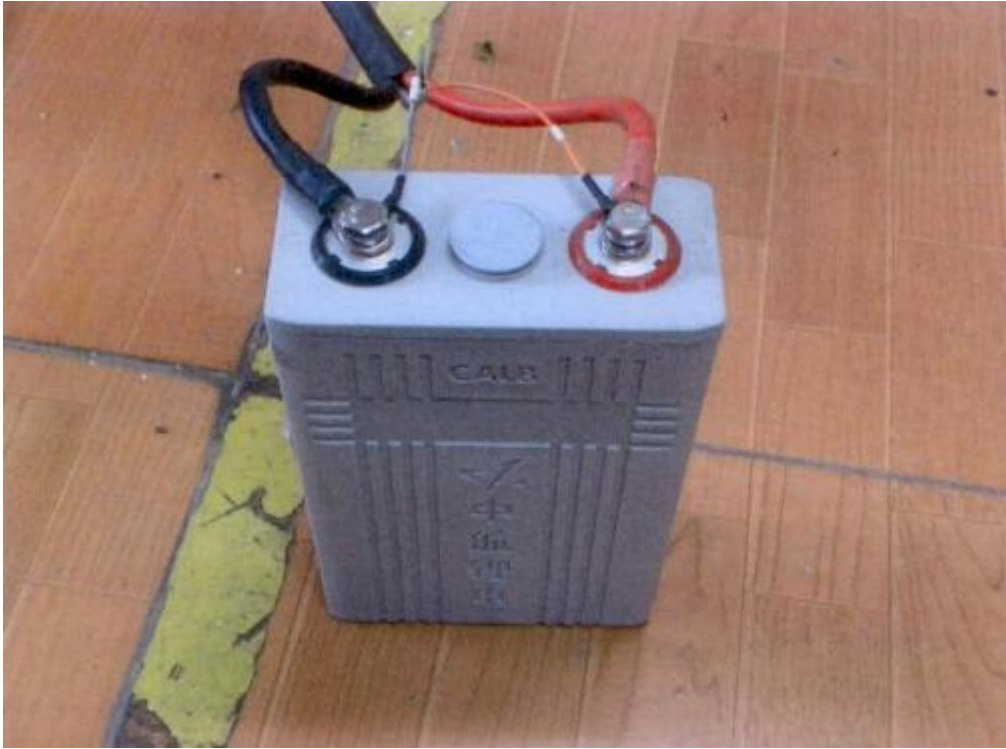
Total 18 page

Page 13

C3 Cell's short-circuit test



C4 Cell's over-charging test



State Coach Quality

Report NO: QU11E11ZH1001

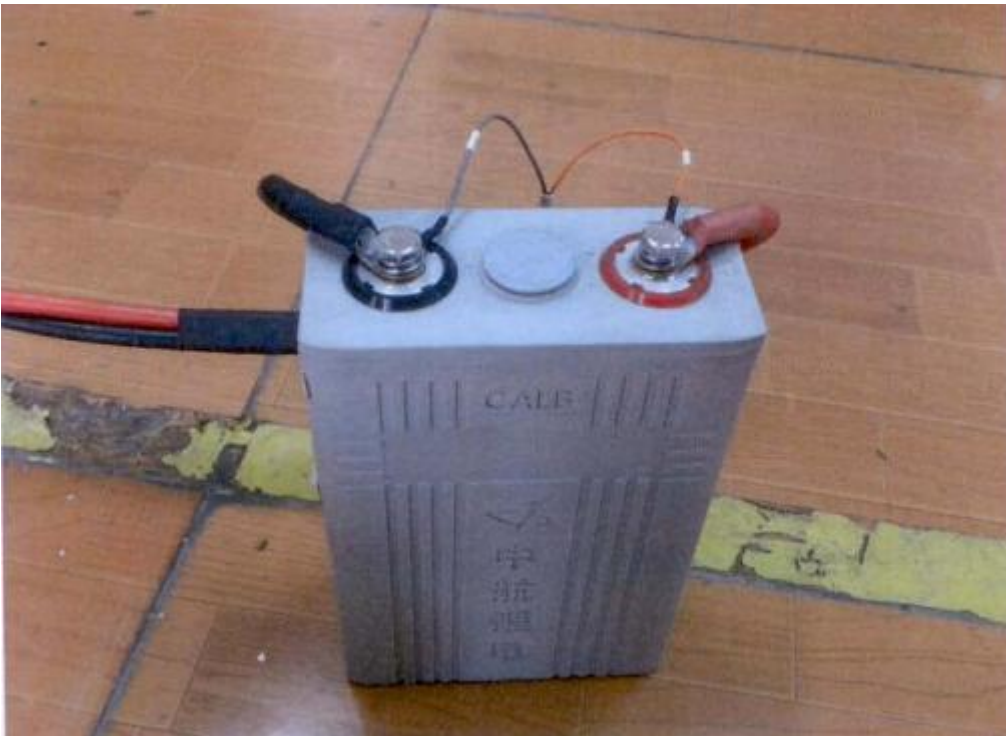
Inspection Report

Supervision & inspection qualification testing laboratory

Total 18 page

Page 14

C5 Cell's over-discharging test



C6 Cell's dropping test



State Coach Quality

Report NO: QU11E11ZH1001

Inspection Report

Supervision & inspection qualification testing laboratory

Total 18page

Page 15

C7 Cell's heating test



C8 Battery module's over-charging test



State Coach Quality

Report NO: QU11E11ZH1001

Inspection Report

Supervision & inspection qualification testing laboratory

Total 18 page

Page 16

C9 Battery module's over-discharging test



C10 Battery module's short-circuit test



State Coach Quality

Report NO: QU11E11ZH1001

Inspection Report

Supervision & inspection qualification testing laboratory

Total 18page

Page 17

C11 Battery module's heating test



C12 Battery module's extrusion test



State Coach Quality

Report NO: QU11E11ZH1001

Inspection Report

Supervision & inspection qualification testing laboratory

Total 18 page

Page 18

C13 Battery module's nail puncture test

