

TEST REPORT

Reliability Laboratory

Report No. : HE40025/2014

Page : 1 of 14

Date : July 14, 2014

TD HITECH ENERGY INC.
3F., NO.25, R&D ROAD 2., SCIENCE-BASED INDUSTRIAL PARK
HSINCHU CITY, TAIWAN

The following merchandise was submitted and identified by the vendor as:

Item	Information	Comments
Product Description	13S6P (18650) Lithium Battery for Pedelec	
Battery Manufacturer	TD HiTech Energy Inc.	
Model No.	ST1306A	
Watt-Hour Rating	814 Wh	
Rated Voltage	47.45 V	
Charging Mode	CC-CV	
Charge Current	14 A	
Charge Voltage	54.6 V	
End of Charge Current	0.795 A	
Discharging Mode	CC	
Discharge Current	29 A	
End of Discharge Voltage	39 V	

We have tested the submitted sample(s) as requested and the following results were obtained:

Test Required : Section 38.3 Lithium metal and lithium ion batteries in UN ST/SG/AC.10/11/Rev.5/Amend.1 Recommendations on the TRANSPORT OF DANGEROUS GOODS Manual of Tests and Criteria.

Conclusion

Submittals samples comply with the requirement of Section 38.3 Lithium metal and lithium ion batteries in UN ST/SG/AC.10/11/Rev.5/Amend.1 Recommendations on the TRANSPORT OF DANGEROUS GOODS Manual of Tests and Criteria Fifth revised edition.

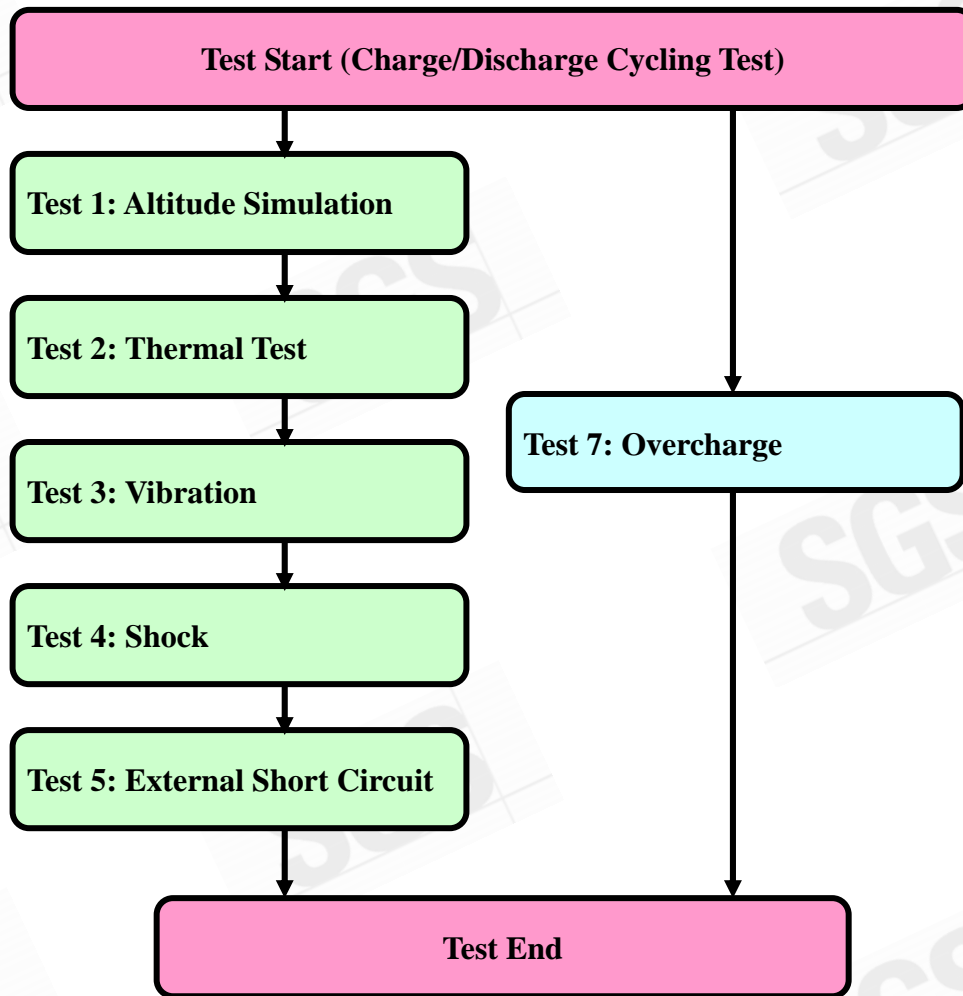
Signed for and on behalf of
SGS TAIWAN Ltd.



Norman Wu
Asst. Manager

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Test Flowchart:



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Date of Tests:

Test Started	Test Completed
May 2, 2014	July 14, 2014

Lab Environmental Conditions:

Ambient temperature: (20 ± 5) °C

Ambient humidity: (55 ± 20) % RH

Sample Condition:







Sample Status	Sample Size	Sample No.
1. First cycle in fully charged status	4 packs	No.1~No.4
2. After fifty cycles ending in fully charged status	4 packs	No.5~No.8

Test Equipment:

Name	Brand	Model	Serial No.
Vacuum-Temperature Cabinet	YEONG SHIN	DOBL-45	YSCB940280E
Thermal Shock Tester	KSON	TSK-C4C-150+RAMP	3727
Vibration Test System	UNHOLTZ-DICKIE	SAI60-H560BAC/2/ST	474
Controller	Dactron	LASER	7110357
Control Accelerometer	PCB	353B34	143549
Shock Test System	LANSMONT	65-81 TTSII	M-13418
Data Acquisition & Analysis System	LANSMONT	103570-2-B	0503-73
ICP Accelerometer	PCB	353B14	79347
Data Acquisition/ Switch Unit	Agilent	34970A	MY44060165
Programmable Temperature & Humidity Chamber	Giant Force	GTH-408-60-CP-AR	MAA1006-002
True RMS Multimeter	Fluke	112	84920196
Vacuum-Temperature Cabinet	YEONG SHIN	DOBL-45	YSCB940280E
Programmable DC Power Supply	Chroma	62024P-80-60	62024PA00589
Charge/Discharge Battery Test System	Chen Tech	MCF60L4060A	D11139-2
Charge/Discharge Battery Test System	Chen Tech	MCF60L4060A	D11139-3

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Images:

	
<p>Appearance of sample: ST1306A</p>	<p>Appearance of sample: ST1306A</p>
	
<p>T1: Altitude Simulation</p>	<p>T2: Thermal Test</p>
	
<p>T3: Vibration Test: X axis</p>	<p>T3: Vibration Test: Y axis</p>

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Images--Continued:



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Test Method/ Specification:

Test T.1: Altitude simulation	
Purpose:	This test simulates air transport under low-pressure conditions.
Test Procedure:	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 ± 5) °C.
Requirement:	Cells and batteries meet this requirement if there is no mass loss, no leakage, no venting, no disassembly, no rupture and no fire and if the open circuit voltage of each test cell or battery after testing is not less than 90% of its voltage immediately prior to this procedure. The requirement relating to voltage is not applicable to test cells and batteries at fully discharged states.

Test T.2: Thermal test	
Purpose:	This test assesses cell and battery seal integrity and internal electrical connections. The test is conducted using rapid and extreme temperature changes.
Test Procedure:	Test cells and batteries are to be stored for at least six hours at a test temperature equal to (72 ± 2) °C, followed by storage for at least six hours at a test temperature equal to (-40 ± 2) °C. The maximum time interval between test temperature extremes is 30 minutes. This procedure is to be repeated 10 times, after which all test cells and batteries are to be stored for 24 hours at ambient temperature (20 ± 5) °C. For large cells and batteries the duration of exposure to the test temperature extremes should be at least 12 hours.
Requirement:	Cells and batteries meet this requirement if there is no mass loss, no leakage, no venting, no disassembly, no rupture and no fire and if the open circuit voltage of each test cell or battery after testing is not less than 90 % of its voltage immediately prior to this procedure. The requirement relating to voltage is not applicable to test cells and batteries at fully discharged states.

Test T.3: Vibration	
Purpose:	This test simulates vibration during transport.
Test Procedure:	Cells and batteries are firmly secured to the platform of the vibration machine without distorting the cells in such a manner as to faithfully transmit the vibration. The vibration shall be a sinusoidal waveform with a logarithmic sweep between 7 Hz and 200 Hz and back to 7 Hz traversed in 15 minutes. This cycle shall be repeated 12 times for a total of 3 hours for each of three mutually perpendicular mounting positions of the cell. One of the directions of vibration must be perpendicular to the terminal face. The logarithmic frequency sweep is as follows: from 7 Hz a peak acceleration of 1 gn is maintained until 18 Hz is reached. The amplitude is then maintained at 0.8 mm (1.6 mm total excursion) and the frequency increased until a peak acceleration of 8 gn occurs (approximately 50 Hz). A peak acceleration of 8 gn is then maintained until the frequency is increased to 200 Hz.
Requirement:	Cells and batteries meet this requirement if there is no mass loss, no leakage, no venting, no disassembly, no rupture and no fire and if the open circuit voltage of each test cell or battery after testing is not less than 90 % of its voltage immediately prior to this procedure. The requirement relating to voltage is not applicable to test cells and batteries at fully discharged states.

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Test Method/ Specification--Continued:

Test T.4: Shock	
Purpose:	This test simulates possible impacts during transport.
Test Procedure:	Test cells and batteries shall be secured to the testing machine by means of a rigid mount which will support all mounting surfaces of each test battery. Each cell or battery shall be subjected to a halfsine shock of peak acceleration of 150 gn and pulse duration of 6 milliseconds. Each cell or battery shall be subjected to three shocks in the positive direction followed by three shocks in the negative direction of three mutually perpendicular mounting positions of the cell or battery for a total of 18 shocks. However, large cells and large batteries shall be subjected to a half-sine shock of peak acceleration of 50 gn and pulse duration of 11 milliseconds. Each cell or battery is subjected to three shocks in the positive direction followed by three shocks in the negative direction of each of three mutually perpendicular mounting positions of the cell for a total of 18 shocks.
Requirement:	Cells and batteries meet this requirement if there is no mass loss, no leakage, no venting, no disassembly, no rupture and no fire and if the open circuit voltage of each test cell or battery after testing is not less than 90% of its voltage immediately prior to this procedure. The requirement relating to voltage is not applicable to test cells and batteries at fully discharged states.

Test T.5: External short circuit	
Purpose:	This test simulates an external short circuit.
Test Procedure:	The cell or battery to be tested shall be temperature stabilized so that its external case temperature reaches $(55 \pm 2) ^\circ\text{C}$ 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 $(55 \pm 2) ^\circ\text{C}$. This short circuit condition is continued for at least one hour after the cell or battery external case temperature has returned to $(55 \pm 2) ^\circ\text{C}$. The cell or battery must be observed for a further six hours for the test to be concluded.
Requirement:	Cells and batteries meet this requirement if their external temperature does not exceed $170 ^\circ\text{C}$ and there is no disassembly, no rupture and no fire within six hours of this test.

Test T.7: Overcharge	
Purpose:	This test evaluates the ability of a rechargeable battery to withstand an overcharge condition.
Test Procedure:	The charge current shall be twice the manufacturer's recommended maximum continuous charge current. The minimum voltage of the test shall be as follows: (a) when the manufacturer's recommended charge voltage is not more than 18 V, the minimum voltage of the test shall be the lesser of two times the maximum charge voltage of the battery or 22 V. (b) when the manufacturer's recommended charge voltage is more than 18 V, the minimum voltage of the test shall be 1.2 times the maximum charge voltage. Tests are to be conducted at ambient temperature. The duration of the test shall be 24 hours.
Requirement:	Rechargeable batteries meet this requirement if there is no disassembly and no fire within seven days of the test.

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Test Result:

1. Altitude Simulation:

Model No.: ST1306A									
Test Item Sample No.	Weight Measurement				Voltage Measurement				Appearance Check
	Unit:gram				Unit:Volt				
	Initial (W ₀)	Final (W ₁)	Mass loss (W ₀ -W ₁)/W ₀	Mass loss < 0.1%?	Initial (V ₀)	Final (V ₁)	(V ₁ /V ₀)	(V ₁ /V ₀) >90%?	No leakage, No venting, No disassembly, No rupture and No fire
No.1	4649.06	4649.01	0.001%	Pass	53.880	53.768	99.792%	Pass	Pass
No.2	4661.87	4661.87	0.000%	Pass	58.856	53.746	91.318%	Pass	Pass
No.3	4661.43	4661.39	0.001%	Pass	53.929	53.820	99.798%	Pass	Pass
No.4	4674.50	4674.49	0.000%	Pass	53.935	53.816	99.779%	Pass	Pass
No.5	4657.20	4657.18	0.000%	Pass	53.748	53.680	99.873%	Pass	Pass
No.6	4648.24	4648.19	0.001%	Pass	53.722	53.665	99.894%	Pass	Pass
No.7	4666.28	4666.24	0.001%	Pass	53.773	53.715	99.892%	Pass	Pass
No.8	4652.12	4652.12	0.000%	Pass	53.900	53.823	99.857%	Pass	Pass
Conclusion	Meet the requirement of Test T.1: Altitude Simulation.								
Note									

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Test Result--Continued:

2. Thermal test:

Model No.: ST1306A									
Test Item Sample No.	Weight Measurement				Voltage Measurement				Appearance Check
	Unit:gram				Unit:Volt				
	Initial (W ₁)	Final (W ₂)	Mass loss (W ₁ -W ₂)/W ₁	Mass loss < 0.1%?	Initial (V ₁)	Final (V ₂)	(V ₂ /V ₁)	(V ₂ /V ₁) >90%?	No leakage, No venting, No disassembly, No rupture and No fire
No.1	4649.01	4648.57	0.009%	Pass	53.768	53.105	98.767%	Pass	Pass
No.2	4661.87	4661.43	0.009%	Pass	53.746	53.111	98.819%	Pass	Pass
No.3	4661.39	4660.95	0.009%	Pass	53.820	53.095	98.653%	Pass	Pass
No.4	4674.49	4674.12	0.008%	Pass	53.816	53.115	98.697%	Pass	Pass
No.5	4657.18	4656.67	0.011%	Pass	53.680	53.186	99.080%	Pass	Pass
No.6	4648.19	4647.99	0.004%	Pass	53.665	53.210	99.152%	Pass	Pass
No.7	4666.24	4666.00	0.005%	Pass	53.715	53.217	99.073%	Pass	Pass
No.8	4652.12	4651.75	0.008%	Pass	53.823	53.231	98.900%	Pass	Pass
Conclusion	Meet the requirement of Test T.2: Thermal test.								
Note									

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Test Result--Continued:

3. Vibration:

Model No.: ST1306A									
Test Item Sample No.	Weight Measurement				Voltage Measurement				Appearance Check No leakage, No venting, No disassembly, No rupture and No fire
	Unit:gram				Unit:Volt				
	Initial (W ₂)	Final (W ₃)	Mass loss (W ₂ -W ₃)/W ₂	Mass loss < 0.1%?	Initial (V ₂)	Final (V ₃)	(V ₃ /V ₂)	(V ₃ /V ₂) >90%?	
No.1	4648.57	4648.55	0.000%	Pass	53.105	53.090	99.972%	Pass	Pass
No.2	4661.43	4661.38	0.001%	Pass	53.111	53.095	99.970%	Pass	Pass
No.3	4660.95	4660.91	0.001%	Pass	53.095	53.080	99.972%	Pass	Pass
No.4	4674.12	4674.07	0.001%	Pass	53.115	53.099	99.970%	Pass	Pass
No.5	4656.67	4656.67	0.000%	Pass	53.186	53.170	99.970%	Pass	Pass
No.6	4647.99	4647.99	0.000%	Pass	53.210	53.192	99.966%	Pass	Pass
No.7	4666.00	4665.94	0.001%	Pass	53.217	53.201	99.970%	Pass	Pass
No.8	4651.75	4651.75	0.000%	Pass	53.231	53.212	99.964%	Pass	Pass
Conclusion	Meet the requirement of Test T.3: Vibration Test.								
Note									

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Test Result--Continued:

4. Shock:

Model No.: ST1306A									
Test Item	Weight Measurement				Voltage Measurement				Appearance Check
	Unit:gram				Unit:Volt				
Sample No.	Initial (W ₃)	Final (W ₄)	Mass loss (W ₃ -W ₄)/W ₃	Mass loss < 0.1%?	Initial (V ₃)	Final (V ₄)	(V ₄ /V ₃)	(V ₄ /V ₃) >90%?	No leakage, No venting, No disassembly, No rupture and No fire
No.1	4657.81	4657.76	0.001%	Pass	52.696	52.692	99.992%	Pass	Pass
No.2	4670.46	4670.39	0.001%	Pass	52.701	52.698	99.994%	Pass	Pass
No.3	4669.67	4669.62	0.001%	Pass	52.635	52.633	99.996%	Pass	Pass
No.4	4682.94	4682.89	0.001%	Pass	52.716	52.714	99.996%	Pass	Pass
No.5	4665.91	4665.81	0.002%	Pass	52.802	52.799	99.994%	Pass	Pass
No.6	4656.87	4656.81	0.001%	Pass	52.804	52.801	99.994%	Pass	Pass
No.7	4671.89	4671.85	0.001%	Pass	52.853	52.850	99.994%	Pass	Pass
No.8	4659.82	4659.75	0.002%	Pass	52.871	52.871	100.000%	Pass	Pass
Conclusion	Meet the requirement of Test T.4: Shock Test.								
Note									

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Test Result--Continued:

5. External Short Circuit:

Model No.: ST1306A			
Test Item	External Temperature		Appearance Check
	Unit: °C		
Sample No.	Temperature (T ₁)	T ₁ < 170°C ?	No disassembly, No rupture and No fire with in six hours
No.1	55.3	Pass	Pass
No.2	55.6	Pass	Pass
No.3	55.6	Pass	Pass
No.4	55.0	Pass	Pass
No.5	55.4	Pass	Pass
No.6	55.7	Pass	Pass
No.7	55.3	Pass	Pass
No.8	55.3	Pass	Pass
Conclusion	Meet the requirement of Test T.5: External short circuit.		
Note			

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Test Result--Continued:

6. Overcharge:

Model No.: ST1306A			
Test Item	Charge Voltage	Charge Current	Appearance Check
Sample No.	Unit: Volt	Unit: Amp	No disassembly and No fire within seven days of the test
No.1	65.52	28	Pass
No.2	65.52	28	Pass
No.3	65.52	28	Pass
No.4	65.52	28	Pass
No.5	65.52	28	Pass
No.6	65.52	28	Pass
No.7	65.52	28	Pass
No.8	65.52	28	Pass
Conclusion	Meet the requirement of Test T.7: Overcharge.		
Note			

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TEST REPORT

Test Summary:

Test Item	Test Result	Note
Test T.1: Altitude simulation	Pass	
Test T.2: Thermal test	Pass	
Test T.3: Vibration	Pass	
Test T.4: Shock	Pass	
Test T.5: External short circuit	Pass	
Test T.7: Overcharge	Pass	

— — — The End of Test Report — — —

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