TEST REPORT

Reliability Laboratory

Report No.： HE10018/2016
Page： 1 of 14
Date： March 18, 2016

MERITS HEALTH PRODUCTS CO., LTD
NO.18,JINGKE ROAD, T.P.M.T PARK,
NANTUN DISTRICT, TAICHUNG CITY, TAIWAN, R.O.C.

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

Item	Information	Comments
Product Description	7S4P Li-ion Battery Pack	
Battery Manufacturer	Mobile Energy Technology Co., Ltd.	
Model No.	MER-01	
Watt-Hour Rating	274.4 Wh	
Pack Voltage	24 V	
Charging Mode	CC-CV	
Charge Current	5 A	
Charge Voltage	29.4 V	
End of Charge Current	500mA	
Discharging Mode	CC	
Discharge Current	10 A	
End of Discharge Voltage	21 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.
Clause 6.4 Transport tests and Clause 6.5 Misuse tests in IEC 62281 Edition 2.0:2012 Safety of primary and secondary lithium cells and batteries during transport.

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. Clause 6.4 Transport tests and Clause 6.5 Misuse tests in IEC62281 Edition 2.0:2012 Safety of primary and secondary lithium cells and batteries during transport.

Signed for and on behalf of SGS TAIWAN Ltd.

Norman Wu
Asst. Manager

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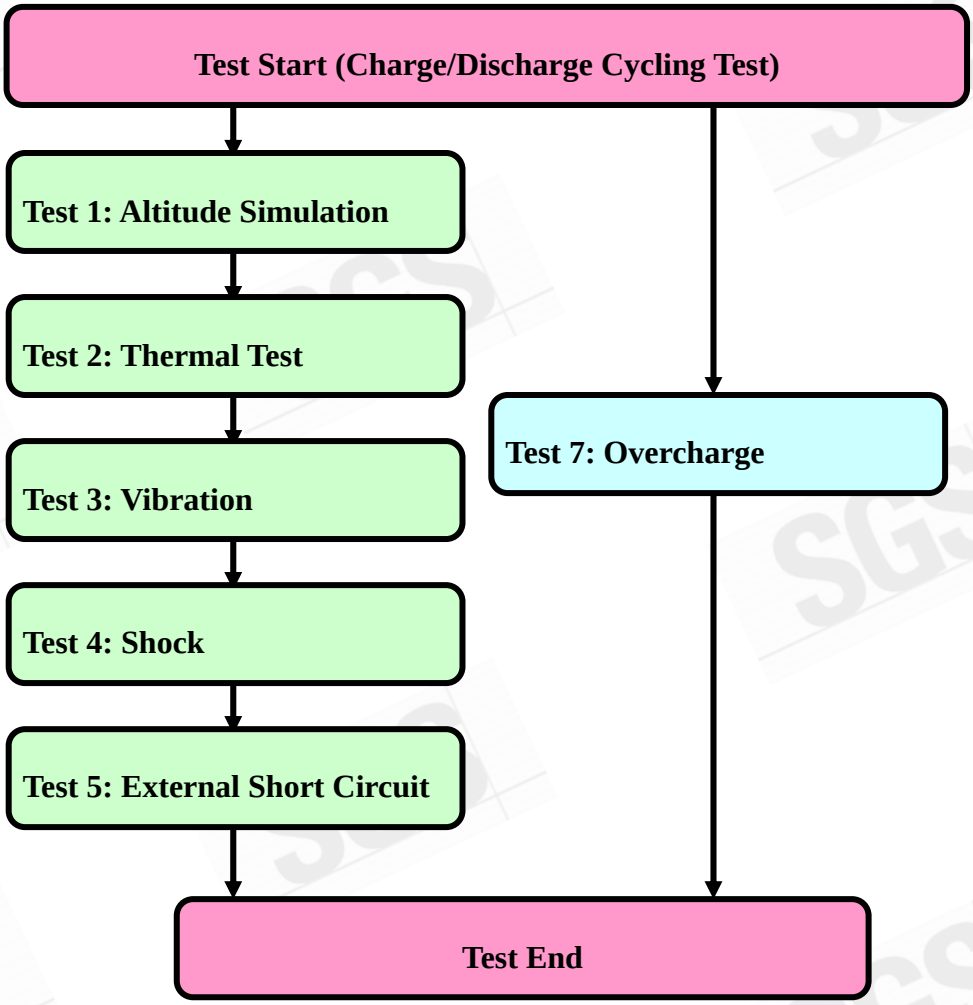
Test Flowchart:



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Date of Tests:

Test Started	Test Completed
Jan. 12 ,2016	Mar. 17 ,2016

Lab Environmental Conditions:

Ambient temperature: (20 ± 5) ℃
Ambient humidity: (50 ± 20) % RH

Sample Condition:

Sample Status	Sample Size	Sample No.
1. First cycle in fully charged status	8 packs	No.1~No.4, No.9~No.12
2. After fifty cycles ending in fully charged status	8 packs	No.5~No.8, No.13~No.16

Test Equipment:

Name	Brand	Model	Serial No.
Vacuum-Temperature Cabinet	YEONG SHIN	DOBL-45	YSCB940280E
Thermal Shock Tester	KSON	TSK-C4T-150+RAMP	4295T
Vibration Test System	UNHOLTZ-DICKIE	SAI60-H560BAC/2/ST	474
Controller	Dactron	LASER	7110357
Control Accelerometer	PCB	353B34	143550
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	MY44061199
Programmable Temperature & Humidity Chamber	Giant Force	GTH-960-40-CP-AR	MAA1410-009
True RMS Multimeter	Fluke	289	19360015
Electronic Precision Balance	Mettler Toledo	MS6002S/01	B116131743
Charge/Discharge Battery Test System	ChenTech	MCF60L4060A	D11139-1
Charge/Discharge Battery Test System	ChenTech	MCF60L4060A	D11139-2
Charge/Discharge Battery Test System	ChenTech	MCF60L4060A	D11139-3
Charge/Discharge Battery Test System	ChenTech	MCF60L4060A	D09174

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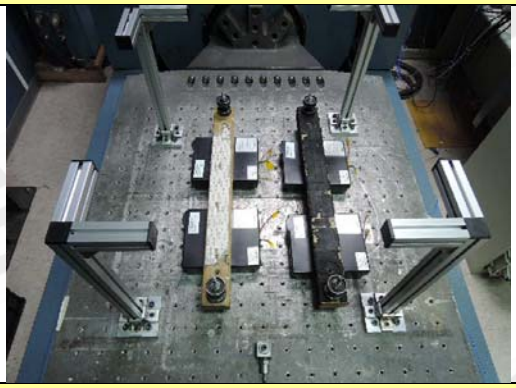
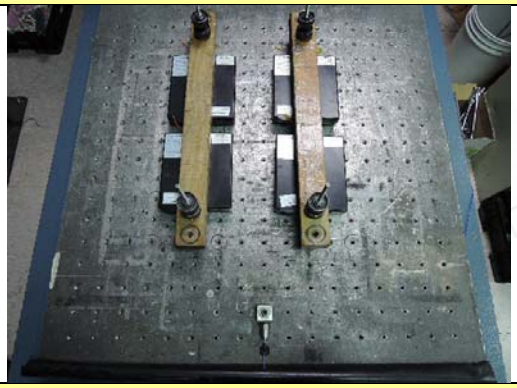
Images:

Appearance of sample MER-01	Appearance of sample MER-01
T1: Altitude Simulation	T2: Thermal Test
	
T3: Vibration Test: X axis	T3: Vibration Test: Y axis

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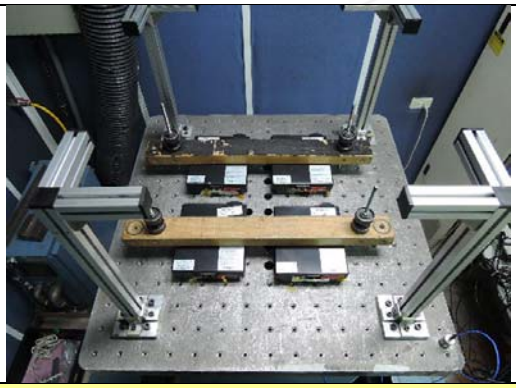
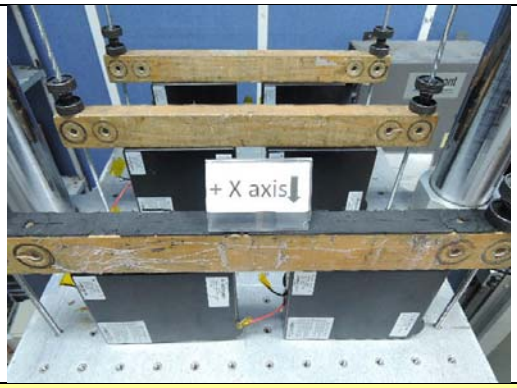
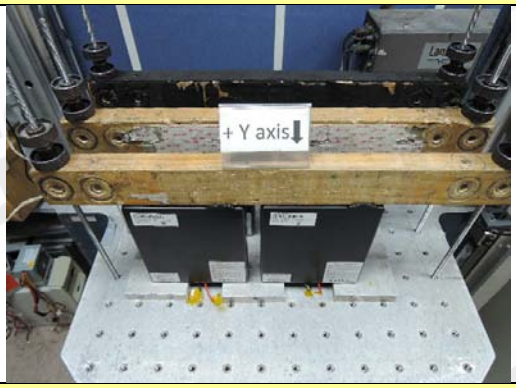
Images--Continued:



T3: Vibration Test: Z axis

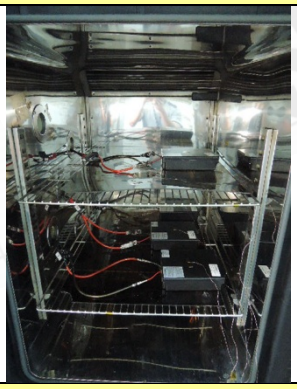


T4: Shock Test: X axis



T4: Shock Test: Y axis

T4: Shock Test: Z axis



T5: External Short Circuit Test

T7: Overcharge Test

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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 ± 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 ± 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 ± 2) °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 °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.: MER-01

Test Item / Sample No.	Weight Measurement Unit:gram				Voltage Measurement Unit:Volt				Appearance Check
	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	1742.75	1742.62	0.01%	Pass	29.025	29.014	99.96%	Pass	Pass
No.2	1751.33	1751.16	0.01%	Pass	29.219	29.201	99.61%	Pass	Pass
No.3	1752.03	1751.89	0.01%	Pass	29.224	29.207	99.61%	Pass	Pass
No.4	1740.56	1740.44	0.01%	Pass	29.196	29.181	99.66%	Pass	Pass
No.5	1740.15	1740.09	0.00%	Pass	29.121	29.115	99.76%	Pass	Pass
No.6	1748.49	1748.44	0.00%	Pass	29.106	29.099	99.76%	Pass	Pass
No.7	1749.66	1749.60	0.00%	Pass	29.131	29.123	99.74%	Pass	Pass
No.8	1740.98	1740.96	0.00%	Pass	29.100	29.092	99.77%	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.: MER-01

Test Item / Sample No.	Weight Measurement Unit:gram				Voltage Measurement Unit:Volt				Appearance Check
	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	1742.62	1741.88	0.04%	Pass	29.014	28.748	99.64%	Pass	Pass
No.2	1751.16	1751.08	0.00%	Pass	29.201	29.086	99.61%	Pass	Pass
No.3	1751.89	1751.45	0.03%	Pass	29.207	29.092	99.61%	Pass	Pass
No.4	1740.44	1740.33	0.01%	Pass	29.181	29.081	99.66%	Pass	Pass
No.5	1740.09	1740.03	0.00%	Pass	29.115	29.045	99.76%	Pass	Pass
No.6	1748.44	1748.22	0.01%	Pass	29.099	29.028	99.76%	Pass	Pass
No.7	1749.60	1749.43	0.01%	Pass	29.123	29.046	99.74%	Pass	Pass
No.8	1740.96	1740.15	0.05%	Pass	29.092	29.025	99.77%	Pass	Pass
Conclusion	Meet the requirement of Test T.2: Thermal test.								
Note									

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Test Result--Continued:

3. Vibration:

Model No.: MER-01

Test Item / Sample No.	Weight Measurement Unit:gram				Voltage Measurement Unit:Volt				Appearance Check
	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 leakage, No venting, No disassembly, No rupture and No fire
No.1	1741.88	1741.84	0.00%	Pass	28.748	28.742	99.98 %	Pass	Pass
No.2	1751.08	1751.08	0.00%	Pass	29.086	29.070	99.94%	Pass	Pass
No.3	1751.45	1751.06	0.02%	Pass	29.092	29.074	99.94%	Pass	Pass
No.4	1740.33	1740.21	0.01%	Pass	29.081	29.064	99.94%	Pass	Pass
No.5	1740.03	1740.02	0.00%	Pass	29.045	29.030	99.95%	Pass	Pass
No.6	1748.22	1748.11	0.01%	Pass	29.028	29.014	99.95%	Pass	Pass
No.7	1749.43	1749.40	0.02%	Pass	29.046	29.032	99.95%	Pass	Pass
No.8	1740.15	1740.10	0.00%	Pass	29.025	29.011	99.95%	Pass	Pass
Conclusion	Meet the requirement of Test T.3: Vibration Test.								
Note									

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Test Result--Continued:

4. Shock:

Model No.: MER-01									
Test Item / Sample No.	Weight Measurement Unit:gram				Voltage Measurement Unit:Volt				Appearance Check
	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	1741.84	1741.75	0.01%	Pass	28.742	28.727	98.95%	Pass	Pass
No.2	1751.08	1751.07	0.00%	Pass	29.070	29.068	99.99%	Pass	Pass
No.3	1751.06	1751.06	0.00%	Pass	29.074	29.074	100.00%	Pass	Pass
No.4	1740.21	1740.20	0.00%	Pass	29.064	29.064	100.00%	Pass	Pass
No.5	1740.02	1740.01	0.00%	Pass	29.030	29.030	100.00%	Pass	Pass
No.6	1748.11	1748.08	0.00%	Pass	29.014	29.014	100.00%	Pass	Pass
No.7	1749.40	1749.06	0.02%	Pass	29.032	29.031	100.00%	Pass	Pass
No.8	1740.10	1740.10	0.00%	Pass	29.011	29.010	100.00%	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.: MER-01			
Test Item / Sample No.	External Temperature Unit:℃		Appearance Check
	Temperature (T_1)	T1 < 170℃?	No disassembly, No rupture and No fire with in six hours
No.1	55.25	Pass	Pass
No.2	54.83	Pass	Pass
No.3	54.70	Pass	Pass
No.4	54.63	Pass	Pass
No.5	54.35	Pass	Pass
No.6	54.33	Pass	Pass
No.7	54.00	Pass	Pass
No.8	54.54	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.: MER-01			
Test Item / Sample No.	Charge Voltage Unit:Volt	Charge Current Unit:Amp	Appearance Check No disassembly and No fire within seven days of the test
No.9	35.28	10	Pass
No.10	35.28	10	Pass
No.11	35.28	10	Pass
No.12	35.28	10	Pass
No.13	35.28	10	Pass
No.14	35.28	10	Pass
No.15	35.28	10	Pass
No.16	35.28	10	Pass
Conclusion	There is no overcharge protection function of battery pack.		

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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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