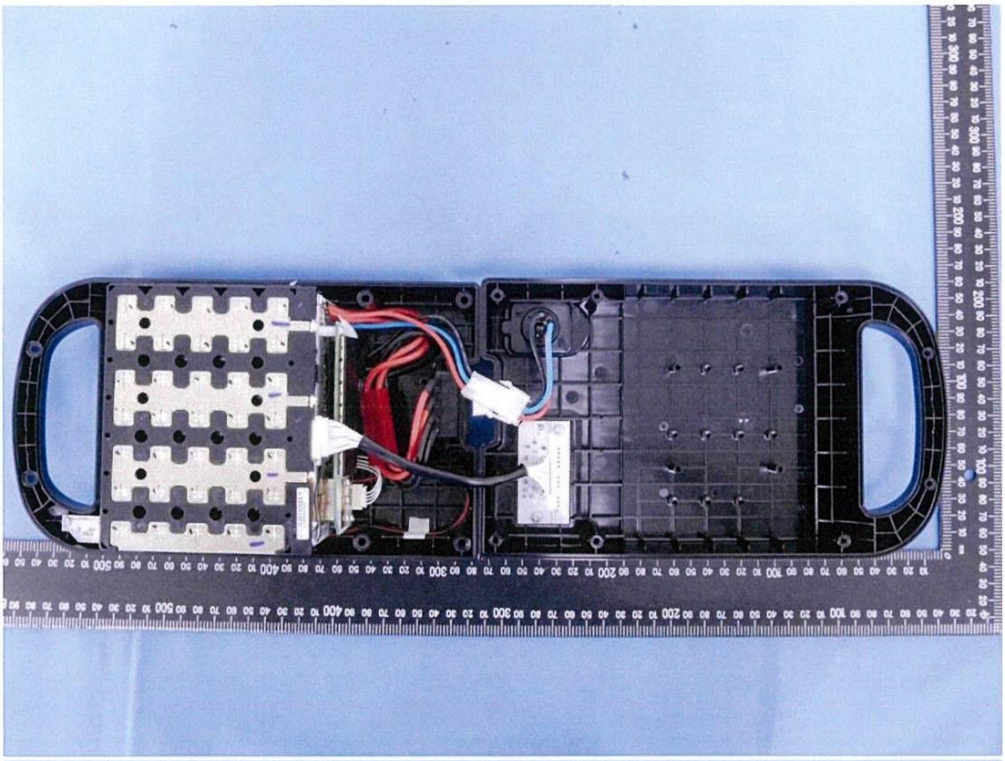
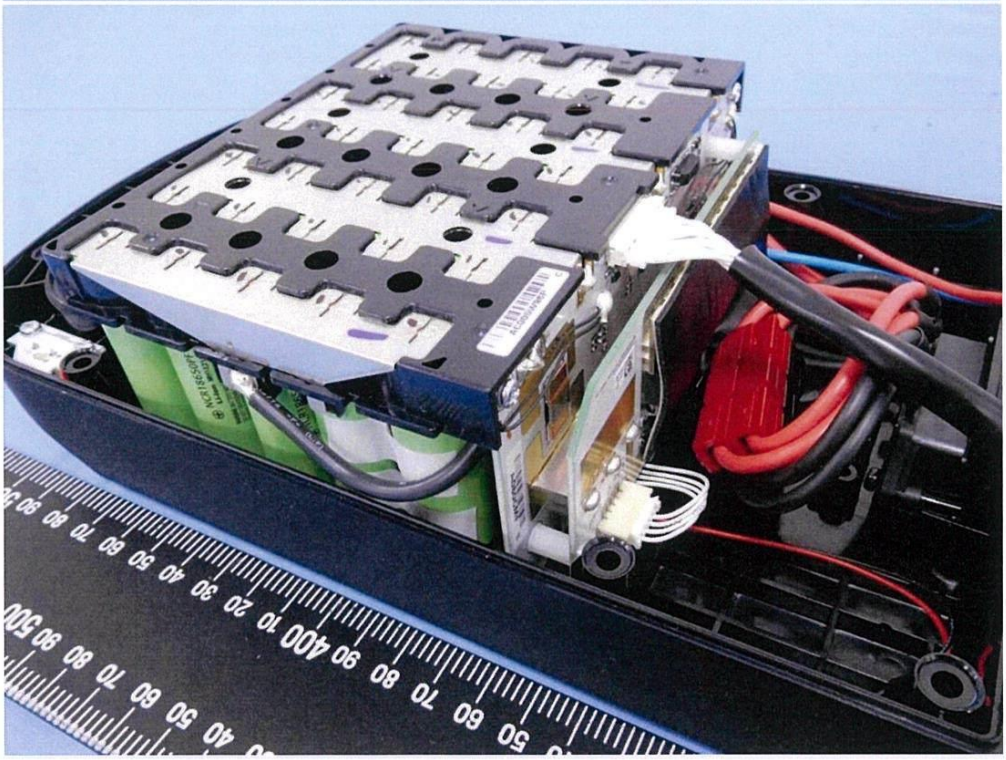
Product: Rechargeable Li-Ion Battery

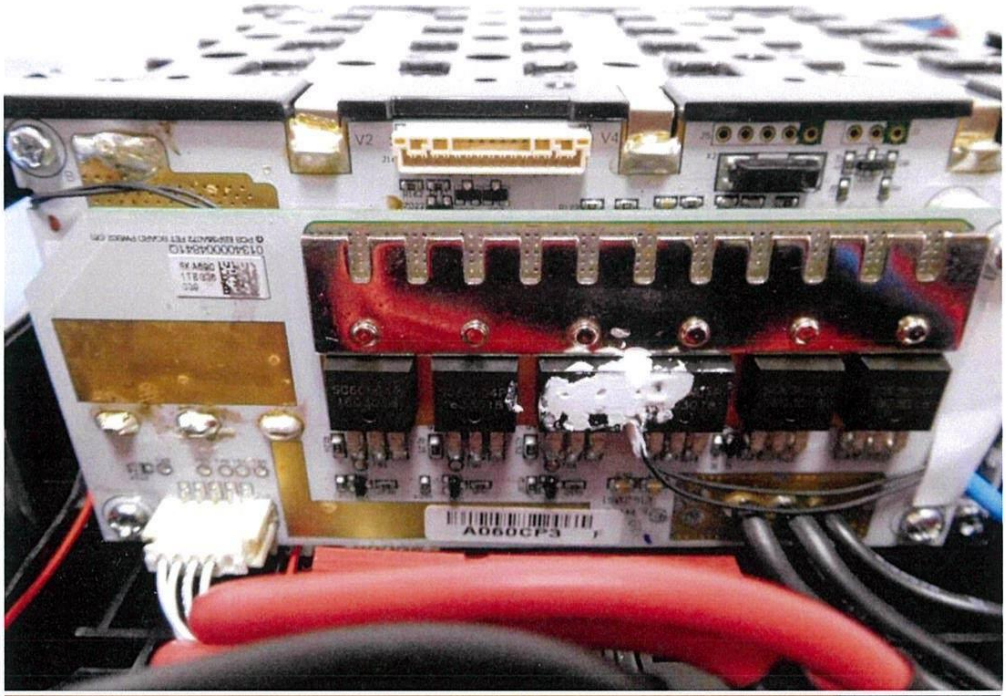
Type Designation: KLB7S5P

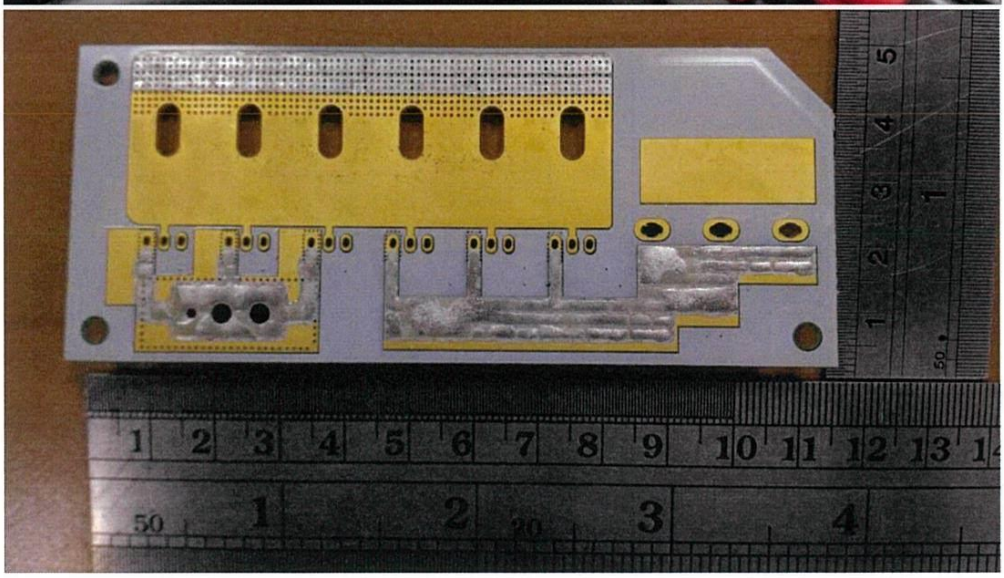




Product: Rechargeable Li-Ion Battery

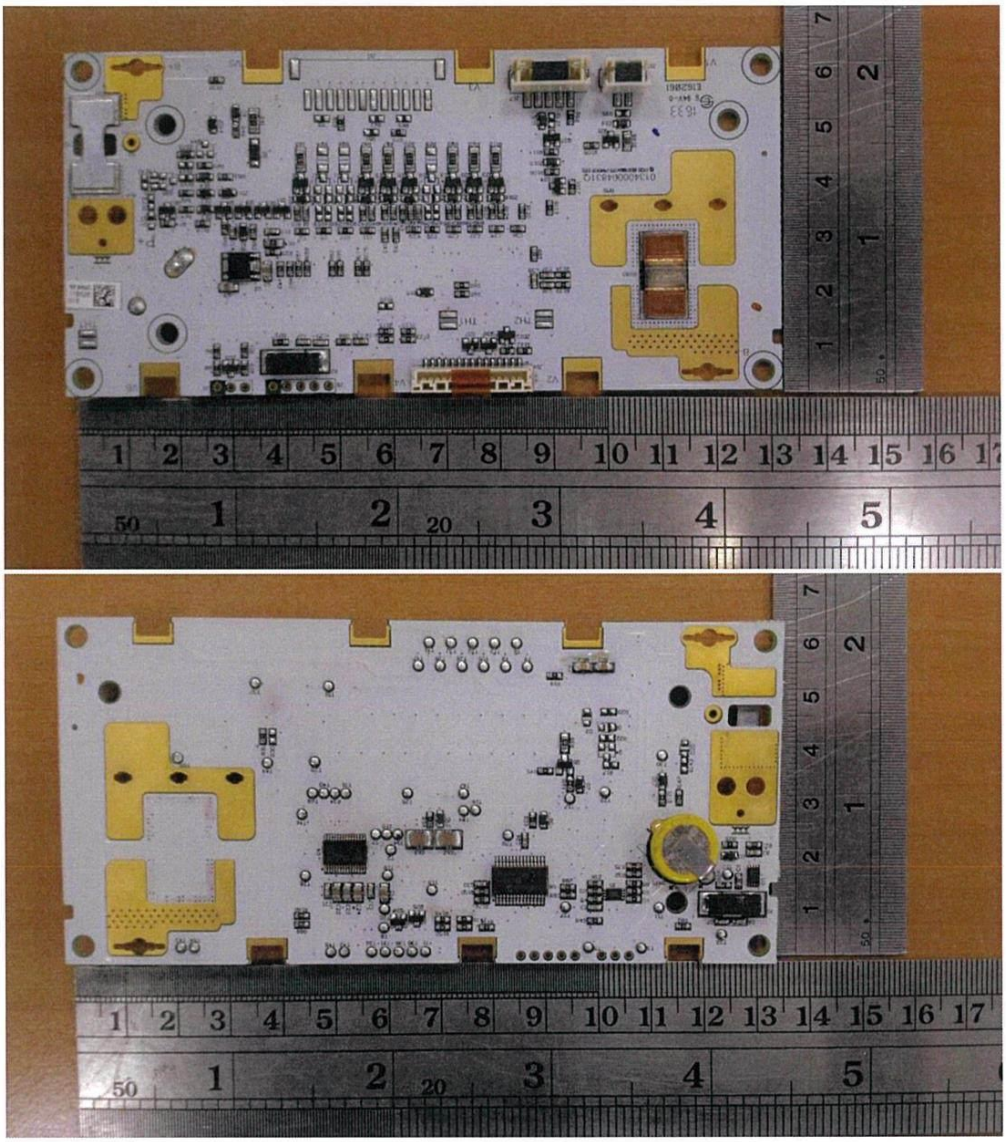
Type Designation: KLB7S5P





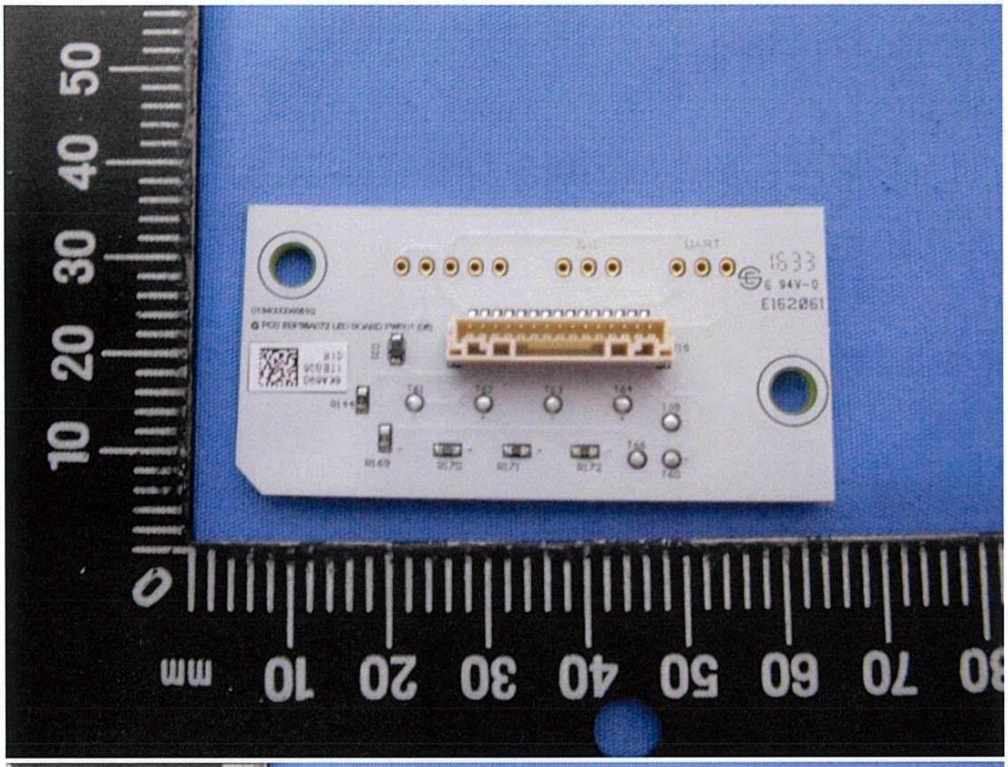
Product: Rechargeable Li-Ion Battery

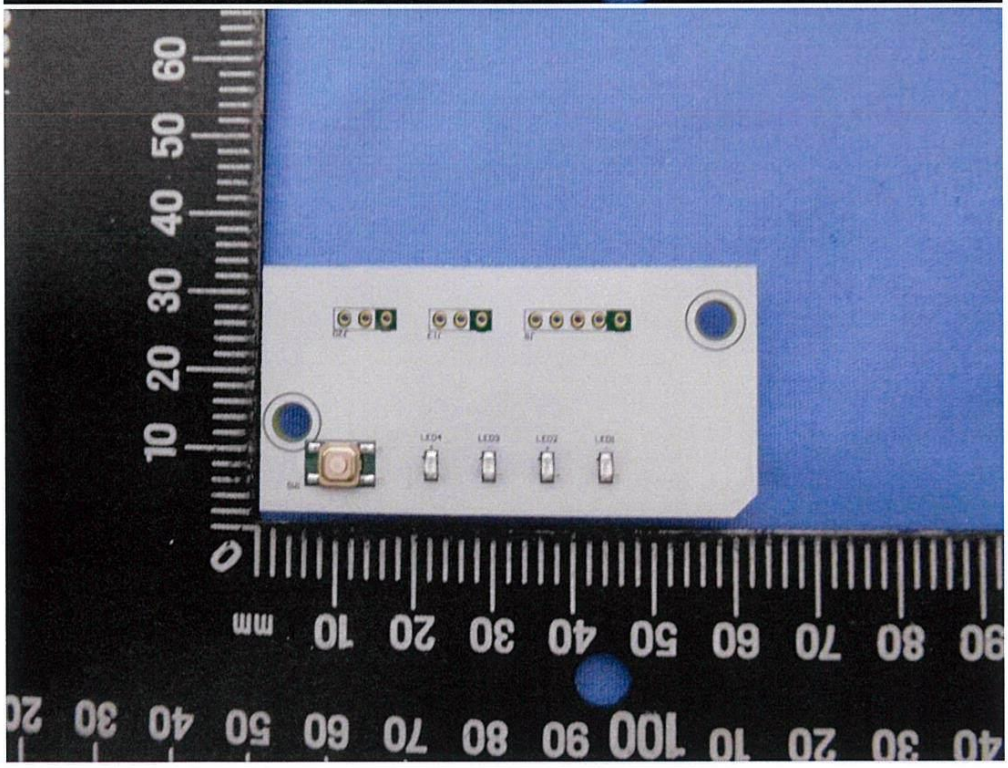
Type Designation: KLB7S5P



Product: Rechargeable Li-Ion Battery

Type Designation: KLB7S5P





Prüfbericht-Nr.: *Test Report No.:*	**10057050 001**	**Auftrags-Nr.:** *Order No.:*	**114054072**	Seite 1 von 15 *Page 1 of 15*
Kunden-Referenz-Nr.: *Client Reference No.:*	N/A	**Auftragsdatum:** *Order date:*	Jul. 20, 2016	
Auftraggeber: *Client:*	Karma Medical Products Co., Ltd. No. 2363, Sec. 2, University Rd. Min-Hsiung Shiang, Chia-yi 621 Taiwan			
Prüfgegenstand: *Test item:*	See following pages			
Bezeichnung / Typ-Nr.: *Identification / Type No.:*	See following pages			
Auftrags-Inhalt: *Order content:*	Service of UN 38.3 test report			
Prüfgrundlage: *Test specification:*	**UN Manual of Tests and Criteria (Sixth revised edition), Part III, sub-section 38.3**			

Wareneingangsdatum: *Date of receipt:*	See following pages	See appendix to this report for photo documentation
Prüfmuster-Nr.: *Test sample No.:*	A000426090-001 to -015	
Prüfzeitraum: *Testing period:*	See following pages	
Ort der Prüfung: *Place of testing:*	See following pages	
Prüflaboratorium: *Testing laboratory:*	TÜV Rheinland Taiwan Ltd.	
Prüfergebnis*: *Test result*:*	Pass	

geprüft von / *tested by:*			**kontrolliert von** / *reviewed by:*		
Nov. 14, 2016	Bruce Tsai / Sr. Project Manager		Nov. 14, 2016	Paul Lin / Project Manager	
Datum *Date*	**Name / Stellung** *Name / Position*	**Unterschrift** *Signature*	**Datum** *Date*	**Name / Stellung** *Name / Position*	**Unterschrift** *Signature*

Sonstiges / *Other:*

Zustand des Prüfgegenstandes bei Anlieferung: *Condition of the test item at delivery:*	Prüfmuster vollständig und unbeschädigt *Test item complete and undamaged*

* Legende:	1 = sehr gut	2 = gut	3 = befriedigend	4 = ausreichend	5 = mangelhaft
	P(ass) = entspricht o.g. Prüfgrundlage(n)		F(ail) = entspricht nicht o.g. Prüfgrundlage(n)	N/A = nicht anwendbar	N/T = nicht getestet
Legend:	*1 = very good*	*2 = good*	*3 = satisfactory*	*4 = sufficient*	*5 = poor*
	P(ass) = passed a.m. test specification(s)		*F(ail) = failed a.m. test specification(s)*	*N/A = not applicable*	*N/T = not tested*

Test item description .....:	Rechargeable Li-Ion Battery
Trade Mark .....:	Karma
Manufacturer.....:	STL Technology Co., Ltd. No. 1, West 15th Street K.E.P.Z. Kaohsiung 806, Taiwan
Model/Type reference .....:	KLB7S5P
Ratings .....:	DC 25.2V, Capacity: 11.5Ah

List of Attachments (including a total number of pages in each attachment):

- Photo Documentation

Total number of pages in each attachment is indicated in each individual attachment.

Summary of testing:	**Testing location:**
Tests performed (name of test and test clause): [x] 38.3.4.1 Test T.1: Altitude simulation [x] 38.3.4.2 Test T.2: Thermal Test [x] 38.3.4.3 Test T.3: Vibration [x] 38.3.4.4 Test T.4: Shock [x] 38.3.4.5 Test T.5: External short circuit [x] 38.3.4.6 Test T-6: Impact / crush [x] 38.3.4.6 Test T-7: Overcharge [ ] 38.3.4.8 Test T-8: Forced discharge	All tests as described in Test Case and Measurement Sections were performed at the laboratory described as below: TÜV Rheinland Taiwan Ltd., Taichung Laboratory No. 9, Ln. 36, Sec. 3, Minsheng Rd., Daya District, Taichung City, 428 Taiwan

Copy of marking plate:

trademark provide on the equipment enclosure

Rechargeable Li-Ion Battery
SPEC : 25.2V/11.5Ah/290Wh. KLB7S5P (7ICR19/66-5)

FOR YOUR SAFETY, BEFORE YOU USE THE BATTERY, BE SURE TO READ THE OWNER'S MANUAL, LABELS ON THE BATTERY, AND THE FOLLOWING WARNINGS:

Before each use of the battery, inspect its appearance. If there's any crack or damage, do not use it. Please contact the dealer about the damage.
Charge the Li-ion battery only with the charger designated by Karma.
Use the battery only at the ambient temp. of 0℃ to + 60℃.
Do not charge the battery when the ambient temp. is below 10℃.
Do not throw, disassemble, puncture and crash the battery.
Do not modify the battery.
Do not heat up or burn the battery.
Do not immerse the battery in any liquid.

Pin-No	Name
1	V+
2	V-
3	NC

Made in Taiwan

Test item particulars ..... :	☐ Lithium metal ☒ Lithium ion ☐ button ☐ cell ☒ battery ☐ component cell ☐ Large ☐ Small cell ☐ Large ☒ Small battery ☐ Single cell battery ☐ battery assembly
Weight of cell or battery ..... :	Approx. 2.53 kg
Lithium equivalent content ..... :	[ ] ≤ 500 g [ ] more than 500 g
Nominal energy ..... :	[X] ≤ 6200 Wh [ ] more than 6200 Wh
Number of series connected cells ..... :	7
EODV ..... :	See General product information for details
Testing ..... :	
Date of receipt of test item ..... :	Sep. 19, 2016
Date (s) of performance of tests ..... :	Sep. 22, 2016 to Nov. 11, 2016

General remarks:

The test results presented in this report relate only to the object tested.
This report shall not be reproduced, except in full, without the written approval of the Issuing testing laboratory.
"(See Enclosure #)" refers to additional information appended to the report.
"(See appended table)" refers to a table appended to the report.

Throughout this report a point is used as the decimal separator.

Abbreviations used in the report:

ND: No disassembly	NT: No excessive temperature rise
NF: No fire	NV: No venting
NL: No leakage	NVD: 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.
NM: No mass loss	
NR: No rupture	

General product information:

- The equipment under test (EUT) is a rechargeable Li-ion battery pack which is constructed with 7 series 5 parallel certified cells, and has overcharge, over-discharge, over current and abnormal temperature detection.

Features of battery pack

Item	Specification	Remark
Rated Voltage (Vdc):	25.2	
Rated capacity (Ah):	11.5	
Cut-off voltage (Vdc):	17.5	
Standard charge voltage (Vdc):	28.7±0.3	
Maximum charge voltage (Vdc):	29.4	
Standard charge current (A):	5±0.3	
Maximum charge current (A):	< 6	
Standard discharge current (A):	14.5	
Maximum discharge current (A):	≤ 25	
Discharge current (0,2 I_t A) (A):	2.3	
Upper limit charging voltage per cell (Vdc):	4.25	

Additional Information:

- The battery cell has also been tested and found in compliance with the requirements of **UN Manual of Tests and Criteria (Fifth revised edition + Amendment 1), Part III, sub-section 38.3**. The test report is issued by Panasonic Group, SANYO Electric Co., Ltd. The following test was conducted additionally: T-6 Impact test.
- The top enclosure and bottom enclosure are secured together by screws.

Other comments:

- Pre-production sample without serial number

Clause	Requirement + Test	Result - Remark	Verdict
38.3.3	**TEST METHODS AND REQUIREMENTS**		P
	Pre-discharge and pre-cycling	See supplementary information in following appended tables for details.	P
38.3.4	**Procedure**		P
38.3.4.1	Test T-1: Altitude		P
	Cells or batteries are stored at a pressure of 11.6 kPa or less for at least 6 h at ambient temperature (20 ± 5 °C).	Test according to required.	P
	Results: no mass loss, no leakage, no venting, no disassembly, no rupture and no fire during this test. 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.	See appended Table T.1. NM, NL, NV, ND, NR, NF, NVD.	P
38.3.4.2	Test T-2: Thermal cycling		P
	Cells or batteries previously subjected to altitude test.	Test according to required.	P
	Cells or batteries are stored for at least 6 h at a test temperature of 72 ± 2C°, followed by storage for at least 6 h at a test temperature of - 40 ± 2C°. Maximum time for transfer is 30 minutes. This procedure is executed 10 times.	Test according to required.	P
	For large cells or batteries the duration of exposure to the test temperatures is at least 12 h instead of 6 h.	Not large batteries.	N/A
	Storage for at least 24 h at ambient temperature (20 ± 5 °C).	Test according to required.	P
	Results: no mass loss, no leakage, no venting, no disassembly, no rupture and no fire during this test. 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.	See appended Table T.2. NM, NL, NV, ND, NR, NF, NVD.	P
38.3.4.3	Test T-3: Vibration		P
	Cells or batteries previously subjected to thermal cycling test	Test according to required.	P
	Cells or batteries are subjected to sinusoidal vibration during transport.	Test according to required.	P
	Cycle is repeated 12 times for a total of 3 h for each of three mutually perpendicular mounting positions. One of the directions is perpendicular to the terminal face.	Test according to required.	P
	Results: no mass loss, no leakage, no venting, no disassembly, no rupture and no fire during this test. 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.	See appended Table T.3. NM, NL, NV, ND, NR, NF, NVD.	P

Clause	Requirement + Test	Result - Remark	Verdict
38.3.4.4	Test T-4: Shock		P
	Cells or batteries previously subjected to vibration test.	Test according to required.	P
	Each cell or battery is subjected to three shocks in each direction of three mutually perpendicular mounting positions of the cell or battery for a total of 18 shocks.	Test according to required.	P
	Results: no mass loss, no leakage, no venting, no disassembly, no rupture and no fire during this test. 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.	See appended Table T.4. NM, NL, NV, ND, NR, NF, NVD.	P
38.3.4.5	Test T-5: External short-circuit		P
	Cells or batteries previously subjected to shock test.	Test according to required.	P
	Each cell or battery is heated and stabilized at an external case temperature of 57 ± 4 °C. This period of time depends on the size and design of the cell or battery and is assessed and documented. If this assessment is not feasible, the exposure time shall be at least 6 hours for small cells and small batteries, and 12 hours for large cells and large batteries.	Test according to required.	P
	Then the cell or battery at 57 ± 4 °C is subjected to a short-circuit condition with a total external resistance of less than 0.1 ohm. Short-circuit condition is continued for at least 1 h after the cell or battery external case temperature has returned to 57 ± 4°C, or in the case of the large batteries, has decreased by half of the maximum temperature increase observed during the test and remains below that value.	See appended Table T.5.	P
	The short circuit and cooling down phases is conducted at least at ambient temperature.		P
	The test sample is observed for a further 6 h.	Test according to required.	P
	Results: The external temperature dose not exceed 170 °C, no rupture, no disassembly and no fire during this test and within the 6 h of observation.	See appended Table T.5. NT, ND, NR, NF.	P
38.3.4.6	Test T-6: Impact / crush	See below.	P
	The test is conducted using test cells or component cells that have not been previously subjected to other transport tests.	Test according to required.	P
	Each test cell or component cell shall be subjected to one impact / crush only.	Test according to required.	P

Clause	Requirement + Test	Result - Remark	Verdict
	Cylindrical cells not less than 18.0 mm in diameter is tested with impact test procedure. *NOTE: Diameter here refers to the design parameter (for example the diameter of 18 650 cells is 18.0 mm).*	Test according to required.	P
	Test cell or component cell is placed on a flat smooth surface. A stainless steel bar with a diameter of 15.8 mm ± 0.1 mm and a length of at least 60 mm or of the longest dimension of the cell, whichever is greater, is placed across the centre of the test sample. A mass of 9.1 kg ± 0.1 kg is dropped from a height of 61 cm ± 2.5 cm at the intersection of the bar and the test sample using a vertical sliding track or channel. The vertical track is oriented 90 degrees from the horizontal supporting surface.		P
	The test sample is impacted with its longitudinal axis parallel to the flat surface and perpendicular to the longitudinal axis of the steel bar lying across the centre of the test sample.		P
	Prismatic, pouch, coin/button cells and cylindrical cells less than 18.0 mm in diameter is tested with crush test procedure. *NOTE: Diameter here refers to the design parameter (for example the diameter of 18 650 cells is 18.0 mm).*		N/A
	A cell or component cell is crushed between two flat surfaces. The crushing is to be gradual with a speed of approximately 1,5 cm/s at the first point of contact.		N/A
	A prismatic or pouch cell shall be crushed by applying the force to the widest side. A button/coin cell shall be crushed by applying the force on its flat surfaces. For cylindrical cells, the crush force shall be applied perpendicular to the longitudinal axis.		N/A
	The crushing is to be continued until one of the three conditions below is reached: - the applied force reaches 13 kN ± 0.78 kN; - the voltage of the cell drops by at least 100 mV; - the cell is deformed by 50 % or more of its original thickness. As soon as one of the above conditions has been obtained, the pressure shall be released.		N/A
	The test sample is observed for a further 6 h.	Test according to required.	P
	Results: The external temperature dose not exceed 170 °C, no disassembly and no fire during this test and within the 6 h of observation.	See appended Table T.6. NT, NE, NF.	P
38.3.4.7	Test T-7: Overcharge		P

Clause	Requirement + Test	Result - Remark	Verdict
	The charge current of the battery or a single cell rechargeable battery is twice the manufacturer's recommended maximum continuous charge current.	Test according to required.	P
	The manufacturer's recommended charge voltage is not more than 18 V, the minimum voltage of the test is the lesser of two times the maximum charge voltage of the battery or 22 V.		N/A
	The manufacturer's recommended charge voltage is more than 18 V. The voltage of the test is not less than 1.2 times the maximum charge voltage.	Test according to required.	P
	The test is conducted at ambient temperature. The charging condition is maintained for at least 24 h.	Test according to required.	P
	The test sample is observed for a further 7 days.	Test according to required.	P
	Results: no disassembly and no fire during this test and within the 7 days of observation.	See appended Table T.7. NE, NF.	P
38.3.4.8	Test T-8: Forced discharge	Evaluated in the separate test report of the cell. See General product information - Additional Information for details.	N/A
	Each cell is forced discharged at ambient temperature by connecting it in series with a 12 V direct current power supply at an initial current equal to the maximum continuous discharge current specified by the manufacturer. Time interval for discharging equals to rated capacity divided by the initial test current.		N/A
	The test sample is observed for a further 7 days.		N/A
	Results: no disassembly and no fire during this test, nor within the 7 days of observation.	See appended Table T.8. NE, NF.	N/A

Clause	Requirement + Test	Result - Remark	Verdict

T.1	**TABLE: Altitude**							P
Sample No.	Precondition	Open circuit voltage before test (V)	Mass before test (g)	Open circuit voltage after test (V)	Mass after test (g)	Mass loss (%)	Mass loss limit (%)	Results
1	A	28.64	2530	28.64	2530	0	0.1	P
2	A	28.70	2530	28.70	2530	0	0.1	P
3	A	28.64	2530	28.64	2530	0	0.1	P
4	A	28.60	2530	28.60	2530	0	0.1	P
5	B	28.61	2530	28.61	2530	0	0.1	P
6	B	28.62	2530	28.62	2530	0	0.1	P
7	B	28.64	2530	28.64	2530	0	0.1	P
8	B	28.62	2530	28.62	2530	0	0.1	P

Supplementary information:

1. Precondition:
   A = test sample at first cycle, in fully charged states.
   B = test sample after 50 cycle, in fully charged states
   C = test sample after 25 cycle, in fully charged states

T.2	**TABLE: Thermal cycling**							P
Sample No.	Precondition	Open circuit voltage before test (V)	Mass before test (g)	Open circuit voltage after test (V)	Mass after test (g)	Mass loss (%)	Mass loss limit (%)	Results
1	A	28.64	2530	27.68	2530	0	0.1	P
2	A	28.70	2530	27.50	2530	0	0.1	P
3	A	28.64	2530	27.60	2530	0	0.1	P
4	A	28.60	2530	27.62	2530	0	0.1	P
5	B	28.61	2530	27.60	2530	0	0.1	P
6	B	28.62	2530	27.60	2530	0	0.1	P
7	B	28.64	2530	27.62	2530	0	0.1	P
8	B	28.62	2530	27.62	2530	0	0.1	P

Clause	Requirement + Test	Result - Remark	Verdict

Supplementary information:
1. Precondition:
   A = test sample at first cycle, in fully charged states.
   B = test sample after 50 cycle, in fully charged states
   C = test sample after 25 cycle, in fully charged states

T.3	**TABLE: Vibration**							P
Sample No.	Precondition	Open circuit voltage before test (V)	Mass before test (g)	Open circuit voltage after test (V)	Mass after test (g)	Mass loss (%)	Mass loss limit (%)	Results
1	A	27.68	2530	27.68	2530	0	0.1	P
2	A	27.50	2530	27.50	2530	0	0.1	P
3	A	27.60	2530	27.60	2530	0	0.1	P
4	A	27.62	2530	27.62	2530	0	0.1	P
5	B	27.60	2530	27.60	2530	0	0.1	P
6	B	27.60	2530	27.60	2530	0	0.1	P
7	B	27.62	2530	27.62	2530	0	0.1	P
8	B	27.62	2530	27.62	2530	0	0.1	P

Supplementary information:
1. Precondition:
   A = test sample at first cycle, in fully charged states.
   B = test sample after 50 cycle, in fully charged states
   C = test sample after 25 cycle, in fully charged states

T.4	**TABLE: Shock**							P
Sample No.	Precondition	Open circuit voltage before test (V)	Mass before test (g)	Open circuit voltage after test (V)	Mass after test (g)	Mass loss (%)	Mass loss limit (%)	Results
1	A	27.68	2530	27.68	2530	0	0.1	P
2	A	27.50	2530	27.50	2530	0	0.1	P
3	A	27.60	2530	27.60	2530	0	0.1	P
4	A	27.62	2530	27.62	2530	0	0.1	P
5	B	27.60	2530	27.60	2530	0	0.1	P
6	B	27.60	2530	27.60	2530	0	0.1	P
7	B	27.62	2530	27.62	2530	0	0.1	P

Clause	Requirement + Test	Result - Remark	Verdict

8	B	27.62	2530	27.62	2530	0	0.1	P

Supplementary information:

1. Precondition:
   A = test sample at first cycle, in fully charged states.
   B = test sample after 50 cycle, in fully charged states
   C = test sample after 25 cycle, in fully charged states

T.5	**TABLE: External short-circuit**					P
Sample No.	Precondition	Open circuit voltage before test (V)	Open circuit voltage after test (V)	Maximum case temperature (°C)	Total external resistance (mΩ)	Results
1	A	27.68	27.68	56.5	76.6	P
2	A	27.50	27.50	57.9	71.9	P
3	A	27.60	27.60	57.5	75.4	P
4	A	27.62	27.62	56.9	75.1	P
5	B	27.60	27.60	58.2	76.6	P
6	B	27.60	27.60	58.9	71.9	P
7	B	27.62	27.62	58.5	75.4	P
8	B	27.62	27.62	58.0	75.1	P

Supplementary information:

1. Precondition:
   A = test sample at first cycle, in fully charged states.
   B = test sample after 50 cycle, in fully charged states
   C = test sample after 25 cycle, in fully charged states
2. Pirior to short circuit condition, the case temperature of cell is reached to a steady state temperature of 58.0 °C, and this condition is continued for six additional hours. Then the cell or battery at temperature as mentioned above is subjected to a short-circuit condition.
3. The short circuit and cooling down phases was conducted at ambient temperature of 23.4 °C.
4. Equipment protective device operated, unit shut down immediately after subject to this test.

T.6a	**TABLE: Impact**		P
Sample No.	Open circuit voltage before test (V)	Maximum case temperature (°C)	Results
Cell: Panasonic, type: NCR18650PF			
1	3.68	106.2	P

Clause	Requirement + Test	Result - Remark	Verdict
2	3.69	115.9	P
3	3.67	116.2	P
4	3.67	116.4	P
5	3.67	105.9	P

Supplementary information:
1. Precondition: test sample at first cycle, at 50% of the design rated capacity
2. Batteries are leakage after subject to this test.

T.6b	**TABLE: Crush**						N/A
Sample No.	Open circuit voltage before test (V)	Voltage drop of the cell (mV)	Applied force (kN)	Thickness before test (mm)	Thickness after test (mm)	Maximum case temperature (°C)	Results

Supplementary information:
1. Precondition: test sample at first cycle, at 50% of the design rated capacity

T.7	**TABLE: Overcharge**					P
Sample No.	Precondition	Open circuit voltage before test (V)	Maximum charging current (A)	Maximum charging voltage (V)	Total charging time (h)	Results
1	A	28.86	12	35.3	24	P
2	A	28.70	12	35.3	24	P
3	A	27.96	12	35.3	24	P
4	A	28.76	12	35.3	24	P
5	B	28.60	12	35.3	24	P
6	B	28.84	12	35.3	24	P
7	B	28.80	12	35.3	24	P
8	B	28.62	12	35.3	24	P

Clause	Requirement + Test	Result - Remark	Verdict

Supplementary information:

1. Precondition:
   A = test sample at first cycle, in fully charged states.
   B = test sample after 50 cycle, in fully charged states
   C = test sample after 25 cycle, in fully charged states
2. Equipment protective device operated, battery can't be charged after apply to the maximum charge voltage as mentioned above.

T.8	**TABLE: Forced discharge**				N/A
Sample No.	Precondition	Open circuit voltage before test (V)	Measured reverse charging current (mA)	Total time for reversed charging application (min)	Results
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					

Supplementary information:

1. Precondition:
   A = test sample at first cycle, in fully discharged states.
   B = test sample after 50 cycle, in fully discharged states

Clause	Requirement + Test	Result - Remark	Verdict

List of test equipment used:

ID#	Type	Model	Calib. until
04-2005-0408	HYBRID RECORDER	DX220	09/03/2017
04-2010-0627	DC Source	DSP-060-02	-
04-2012-0727	Digital Precision Multimeter	DM4040	09/03/2017
04-2013-0817	Shock Tester	Shock-2	01/12/2016
04-2013-0818	Thermal Cycle Chamber	GCT-150-45	14/01/2017
04-2013-0820	Altitude Chamber	A-1 (MC-24	20/10/2017
04-2013-0822	Impact Tester	IB-5	04/11/2018
04-2013-0823	Charger	CTE-MCF-17	19/11/2016
04-2013-0824	Explosion-Proof Cabinet	GPO-1200	-
04-2013-0826	Vibration Tester	VS-300V	12/01/2017
04-2014-0835	Temperature Abuse Oven	RHD-602WP	14/06/2017
04-2014-0853	Dial Caliper	ZA-500-196	12/10/2017
04-2014-0869	Measurement Tape	TOP 5.5M	14/09/2017
04-2015-0891	Electronic Weigher Scale	AJM-30	14/06/2017

- End of Test report -

Product: Rechargeable Li-Ion Battery

Type Designation: KLB7S5P