NCT Technology

IEC 62133 TEST REPORT

For

Li-ion Cell

Model: 18650 3.7V 1200mAh

Prepared for:

Prepared by: Shenzhen NCT Testing Technology Co., Ltd.
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Hely Wang

Approved By:
Billy Tu

Shenzhen NCT Testing Technology Co., Ltd. 2008

TEST REPORT
IEC 62133

Secondary cells and batteries containing alkaline or other non-acid electrolytes – Safety requirements for portable sealed secondary cells, and for batteries made from them, for use in portable applications

Report Number..... :	NCT17011279I1-1
Date of issue ..... :	2017-03-31
Total number of pages.....	21pages
Applicant's name ..... :	
Address ..... :	
Test specification:	
Standard..... :	IEC 62133:2012 (Second Edition)
Test procedure..... :	Test Report
Non-standard test method..... :	N/A
Test item description..... :	Li-ion Cell
Trade Mark ..... :	N/A
Manufacturer..... :	Same as applicant
Address ..... :	Same as applicant
Model/Type reference..... :	18650 3.7V 1200mAh
Ratings ..... :	3.7V, 1200mAh, 4.44Wh

Testing procedure and testing location:

Testing Laboratory:

Testing location/ address..... :	Shenzhen NCT Testing Technology Co., Ltd. 1 / F, No. B Building, Mianshang Younger Pioneer Park, Hangcheng Road,Gushu Xixiang Street, Baoan District, Shenzhen, Guangdong, China.
Tested by (name) ..... :	Klaus Peng
Reviewed by (name) ..... :	Hely Wang
Approved by (name)..... :	Billy Tu

List of Attachments:

Appendix 1: 3 pages of Photo Documentation

Summary of testing:

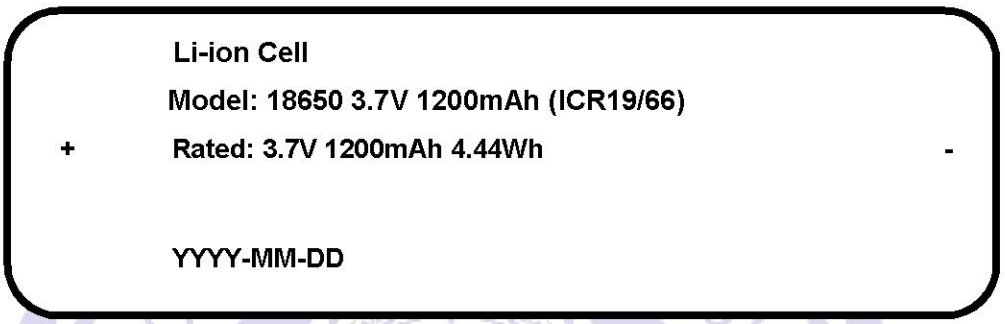
Tests performed (name of test and test clause):	**Testing location:**
Tests are made with the number of samples specified in Table 2 of IEC 62133:2012. cl. 8.2.1 Continuous charging at constant voltage (cells) cl. 8.3.1 External short circuit (cells) cl. 8.3.3 Free fall(cells) cl. 8.3.4 Thermal abuse (cells) cl. 8.3.5 Crush (cells) cl. 8.3.7 Forced discharge(cells) cl. 8.3.8 Transport tests (cells) cl. 8.3.9 Forced internal short circuit (cells) The samples comply with the requirement of IEC 62133:2012 and EN 62133:2013.	Shenzhen NCT Testing Technology Co., Ltd. 1 / F, No. B Building, Mianshang Younger Pioneer Park, Hangcheng Road, Gushu Xixiang Street, Baoan District, Shenzhen, Guangdong, China.

Summary of compliance with National Differences

☒ The product fulfils the requirements of IEC 62133:2012 and EN 62133: 2013

Copy of marking plate

The artwork below may be only a draft. The use of certification marks on a product must be authorized by the respective NCBs that own these marks.



Test item particulars ..... :	
Classification of installation and use ..... :	To be defined in final product
Supply connection..... :	Electrode tab
Recommend charging method declared by the manufacturer ..... :	Charging the battery with 240mA constant current until 4.2V, then constant voltage until charge current reduces to12mA at ambient 20°C±5°C.
Discharge current (0,2 I_t A) ..... :	240mA
Specified final voltage..... :	2.75V
Chemistry ..... :	☐nickel systems..... ☒lithium systems
Recommend of charging limit for lithium system	
Upper limit charging voltage per cell..... :	4.25V
Maximum charging current..... :	1200mA
Charging temperature upper limit ..... :	45°C
Charging temperature lower limit..... :	0°C
Polymer cell electrolyte type ..... :	☐gel polymer ☐solid polymer ☒N/A
Possible test case verdicts:	
- test case does not apply to the test object..... :	N/A
- test object does meet the requirement..... :	P (Pass)
- test object does not meet the requirement..... :	F (Fail)
Testing ..... :	
Date of receipt of test item..... :	2017-03-14
Date (s) of performance of tests ..... :	2017-03-14 to 2017-03-30

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 ☐ comma / ☒ point is used as the decimal separator.

Name and address of factory (ies)..... : Same as applicant

General product information:

The cell consists of the positive electrode plate, negative electrode plate, separator, electrolyte, case. The positive and negative electrode plates are housed in the case in the state being separated by the separator.

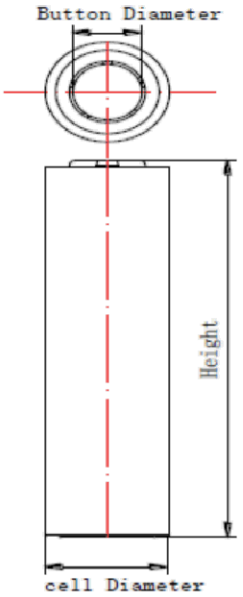
The main features of the cell are shown as below (clause 8.1.1):

Model	Nominal capacity	Nominal voltage	Nominal Charge Current	Nominal Discharge Current	Maximum Charge Current	Maximum Discharge Current	Maximum Charge Voltage	Cut-off Voltage
18650 3.7V 1200mAh (Cell)	1200mAh	3.7V	240mA	240mA	1200mA	1200mA	4.2V	2.75V

The main features of the cell in the battery pack are shown as below (clause 8.1.2):

Model	Upper limit charge voltage	Taper-off current	Lower charge temperature	Upper charge temperature
18650 3.7V 1200mAh (Cell)	4.25V	60mA	0°C	45°C

Construction:(Cell Unit: mm)



Cell diameter(电池直径)	Cell Height(电池高度)	Button diameter(盖帽直径)
mm	mm	mm
18.0±0.5	65.0±0.3	7.5±0.3

IEC 62133: 2012			
Clause	Requirement + Test	Result - Remark	Verdict
4	**Parameter measurement tolerances**		**P**
	Parameter measurement tolerances		P
5	**General safety considerations**		**P**
5.1	General		P
5.2	Insulation and wiring		P
	The insulation resistance between the positive terminal and externally exposed metal surfacesof the battery (excluding electrical contact surfaces)is not less than 5 MΩ	No metal surface exists.	N/A
	Insulation resistance (MΩ) ..... :		—
	Internal wiring and insulation are sufficient to withstand maximum anticipated current, voltage and temperature requirements		P
	Orientation of wiring maintains adequate creepage and clearance distances between conductors		P
	Mechanical integrity of internal connections accommodates reasonably foreseeable misuse		P
5.3	Venting		P
	Battery cases and cells incorporate a pressure relief mechanism or are constructed so that they relieve excessive internal pressure at a value and rate that will preclude rupture, explosion and self-ignition	Explosion-proof safety valve for venting exists.	P
	Encapsulation used to support cells within an outer casing does not cause the battery to overheat during normal operation nor inhibit pressure relief		N/A
5.4	Temperature/voltage/current management		N/A
	Batteries are designed such that abnormal temperature rise conditions are prevented	Cell only.	N/A
	Batteries are designed to be within temperature, voltage and current limits specified by the cell manufacturer		N/A
	Batteries are provided with specifications and charging instructions for equipment manufacturers so that associated chargers are designed to maintain charging within the temperature, voltage and current limits specified		N/A
5.5	Terminal contacts		P
	Terminals have a clear polarity marking on the external surface of the battery	The “+” and “-” polarity explicitly marked on surface of the cell.	P

IEC 62133: 2012			
Clause	Requirement + Test	Result - Remark	Verdict
	The size and shape of the terminal contacts ensure that they can carry the maximum anticipated current	Complied.	P
	External terminal contact surfaces are formed from conductive materials with good mechanical strength and corrosion resistance	Complied.	P
	Terminal contacts are arranged to minimize the risk of short circuits	Complied.	P
5.6	Assembly of cells into batteries		N/A
5.6.1	If there is more than one battery housed in a single battery case, cells used in the assembly of each battery have closely matched capacities, be of the same design, be of the same chemistry and be from the same manufacturer	Cell only.	N/A
	Each battery has an independent control and protection		N/A
	Manufacturers of cells make recommendations about current, voltage and temperature limits so that the battery manufacturer/designer may ensure proper design and assembly		N/A
	Batteries that are designed for the selective discharge of a portion of their series connected cells incorporate separate circuitry to prevent the cell reversal caused by uneven discharges		N/A
	Protective circuit components are added as appropriate and consideration given to the end-device application		N/A
	When testing a battery, the manufacturer of the battery provides a test report confirming the compliance according to this standard		N/A
5.6.2	Design recommendation for lithium systems only		N/A
	For the battery consisting of a single cell or a single cellblock: - Charging voltage of the cell does not exceed the upper limit of the charging voltage specified in Clause 8.1.2, Table 4; or	Cell only.	N/A
	- Charging voltage of the cell does not exceed the different upper limit of the charging voltage determined through Clause 8.1.2, NOTE 1.		N/A

IEC 62133: 2012			
Clause	Requirement + Test	Result - Remark	Verdict
	For the battery consisting of series-connected plural single cells or series-connected plural cellblocks: - The voltages of any one of the single cells or single cellblocks does not exceed the upper limit of the charging voltage, specified in Clause 8.1.2, Table 4, by monitoring the voltage of every single cell or the single cellblocks; or		N/A
	- The voltages of any one of the single cells or single cellblocks does not exceed the different upper limit of the charging voltage, determined through Clause 8.1.2, NOTE 1, by monitoring the voltage of every single cell or the single cellblocks		N/A
	For the battery consisting of series-connected plural single cells or series-connected plural cellblocks: - Charging is stopped when the upper limit of the charging voltage, specified in Clause 8.1.2, Table 4, is exceeded for any one of the single cells or single cellblocks by measuring the voltage of every single cell or the single cellblocks; or		N/A
	- Charging is stopped when the upper limit of the different charging voltage, determined through Clause 8.1.2, NOTE 1, is exceeded for any one of the single cells or single cellblocks by measuring the voltage of every single cell or the single cellblocks		N/A
5.7	Quality plan		P
	The manufacturer prepares and implements a quality plan that defines procedures for the inspection of materials, components, cells and batteries and which covers the whole process of producing each type of cell or battery	Complied. ISO 9001: 2008 certificate provided.	P
6	**Type test conditions**		**P**
	Tests were made with the number of cells or batteries specified in Table 1 for nickel-cadmium and nickel-metal hydride systems and Table 2 for lithium systems, using cells or batteries that are not more than six months old	Complied. Table 2 for Lithium system.	P
	Unless noted otherwise in the test methods, testing was conducted in an ambient of 20°C ±5°C.	Tests are carried out at 20°C ±5°C.	P
7	**Specific requirements and tests (nickel systems)**		**N/A**
7.1	Charging procedure for test purposes	Lithium system.	N/A
7.2	Intended use		N/A
7.2.1	Continuous low-rate charging (cells)		N/A

IEC 62133: 2012			
Clause	Requirement + Test	Result - Remark	Verdict
	Results: No fire. No explosion		N/A
7.2.2	Vibration		N/A
	Results: No fire. No explosion. No leakage	(See Table 7.2.2)	N/A
7.2.3	Moulded case stress at high ambient temperature		N/A
	Oven temperature (°C) .....:		—
	Results: No physical distortion of the battery casing resulting in exposure if internal components		N/A
7.2.4	Temperature cycling		N/A
	Results: No fire. No explosion. No leakage.		N/A
7.3	Reasonably foreseeable misuse		N/A
7.3.1	Incorrect installation cell		N/A
	The test was carried out using: - Four fully charged cells of the same brand, type, size and age connected in series, with one of them reversed; or		N/A
	- A stabilized dc power supply.		N/A
	Results: No fire. No explosion.....:	(See Table 7.3.1)	N/A
7.3.2	External short circuit		N/A
	The cells or batteries were tested until one of the following occurred: - 24 hours elapsed; or		N/A
	- The case temperature declined by 20% of the maximum temperature rise		N/A
	Results: No fire. No explosion.....:	(See Table 7.3.2)	N/A
7.3.3	Free fall		N/A
	Results: No fire. No explosion.		N/A
7.3.4	Mechanical shock (crash hazard)		N/A
	Results: No fire. No explosion. No leakage.		N/A
7.3.5	Thermal abuse		N/A
	Oven temperature (°C) .....:		—
	Results: No fire. No explosion.		N/A
7.3.6	Crushing of cells		N/A
	The crushing force was released upon: - The maximum force of 13 kN± 1 kN has been applied; or		N/A

IEC 62133: 2012			
Clause	Requirement + Test	Result - Remark	Verdict
	- An abrupt voltage drop of one-third of the original voltage has been obtained		N/A
	The cell is prismatic type and a second set of samples was tested, rotated 90° around longitudinal axis compared to the first set		N/A
	Results: No fire. No explosion..... :	(See Table 7.3.6)	N/A
7.3.7	Low pressure		N/A
	Chamber pressure (kPa)..... :		—
	Results: No fire. No explosion. No leakage.		N/A
7.3.8	Overcharge		N/A
	Results: No fire. No explosion..... :	(See Table 7.3.8)	N/A
7.3.9	Forced discharge		N/A
	Results: No fire. No explosion..... :	(See Table 7.3.9)	N/A
8	**Specific requirements and tests (lithium systems)**		**P**
8.1	Charging procedures for test purposes	Complied.	P
8.1.1	First procedure: This charging procedure applied to tests other than those specified in 8.1.2		P
8.1.2	Second procedure: This charging procedure applied to the tests of 8.3.1, 8.3.2, 8.3.4, 8.3.5, and 8.3.9		P
	If a cell's specified upper and/or lower charging temperature exceeds values for the upper and/or lower limit test temperatures of Table 4, the cells were charged at the specified values plus 5 °C for the upper limit and minus 5 °C for the lower limit	Charging temperature range declared by client is: 0-45°C. The upper limit test temperature was 45°C; The lower limit test temperature was -5°C.	P
	A valid rationale was provided to ensure the safety of the cell (see Figure A.1)..... :		P
	For a different upper limit charging voltage (i.e. other than for lithium cobalt oxide systems at 4,25 V), the applied upper limit charging voltage and upper limit charging temperatures were adjusted accordingly		N/A
	A valid rationale was provided to ensure the safety of the cell (see Figure A.1)..... :	4.25V applied.	N/A
8.2	Intended use		P
8.2.1	Continuous charging at constant voltage (cells)	Tested complied.	P
	Results: No fire. No explosion..... :	(See Table 8.2.1)	P

IEC 62133: 2012			
Clause	Requirement + Test	Result - Remark	Verdict
8.2.2	Moulded case stress at high ambient temperature (battery)	Cell only.	N/A
	Oven temperature (°C) ..... :		—
	Results: No physical distortion of the battery casing resulting in exposure of internal components		N/A
8.3	Reasonably foreseeable misuse		P
8.3.1	External short circuit (cell)		P
	The cells were tested until one of the following occurred: - 24 hours elapsed; or		N/A
	- The case temperature declined by 20% of the maximum temperature rise		P
	Results: No fire. No explosion..... :	(See Table 8.3.1)	P
8.3.2	External short circuit (battery)	Cell only.	N/A
	The batteries were tested until one of the following occurred: - 24 hours elapsed; or		N/A
	- The case temperature declined by 20% of the maximum temperature rise		N/A
	In case of rapid decline in short circuit current, the battery pack remained on test for an additional one hour after the current reached a low end steady state condition		N/A
	Results: No fire. No explosion..... :	(See Table 8.3.2)	N/A
8.3.3	Free fall		P
	Results: No fire. No explosion.	No fire. No explosion.	P
8.3.4	Thermal abuse (cells)		P
	The cells were held at 130°C ± 2°C for: - 10 minutes; or	Tested complied.	P
	- 30 minutes for large cells (gross mass of more than 500 g as defined in IEC 62281)	<500g, small cell.	N/A
	Oven temperature (°C) ..... :	130°C	—
	Gross mass of cell (g)..... :	<500g, small cell.	—
	Results: No fire. No explosion.	No fire. No explosion.	P
8.3.5	Crush (cells)		P
	The crushing force was released upon: - The maximum force of 13 kN± 1 kN has been applied; or		N/A

IEC 62133: 2012			
Clause	Requirement + Test	Result - Remark	Verdict
	- An abrupt voltage drop of one-third of the original voltage has been obtained; or		N/A
	- 10% of deformation has occurred compared to the initial dimension	Tested and complied.	P
	Results: No fire. No explosion..... :	(See Table 8.3.5)	P
8.3.6	Over-charging of battery	Cell only	N/A
	Test was continued until the temperature of the outer casing: - Reached steady state conditions (less than 10°C change in 30-minute period); or		N/A
	- Returned to ambient		N/A
	Results: No fire. No explosion..... :	(See Table 8.3.6)	N/A
8.3.7	Forced discharge (cells)		P
	Results: No fire. No explosion..... :	(See Table 8.3.7)	P
8.3.8	Transport tests	Tested complied.	P
	Manufacturer's documentation provided to show compliance with UN Recommendations on Transport of Dangerous Goods	Tested complied.	P
8.3.9	Design evaluation – Forced internal short circuit (cells)	Tested complied.	P
	The cells complied with national requirement for..... :	France, Japan, Republic of Korea and Switzerland.	—
	The pressing was stopped upon: - A voltage drop of 50 mV has been detected; or		N/A
	- The pressing force of 800 N (cylindrical cells) or 400 N (prismatic cells) has been reached	800N for cylindrical cells.	P
	Results: No fire..... :	(See Table 8.3.9)	P
9	**Information for safety**		**P**
	The manufacturer of secondary cells ensures that information is provided about current, voltage and temperature limits of their products.	Information for safety mentioned in manufacturer's specifications.	P
	The manufacturer of batteries ensures that equipment manufacturers and, in the case of direct sales, end-users are provided with information to minimize and mitigate hazards.		N/A
	Systems analyses performed by device manufacturers to ensure that a particular battery design prevents hazards from occurring during use of a product		N/A

IEC 62133: 2012			
Clause	Requirement + Test	Result - Remark	Verdict
	As appropriate, information relating to hazard avoidance resulting from a system analysis is provided to the end user ..... :		N/A
10	**Marking**		**P**
10.1	Cell marking		P
	Cells marked as specified in the applicable cell standards: IEC 61951-1, IEC 61951-2 or IEC 61960.	The cell is marked in accordance with IEC 61960, also see copy of marking plate	P
10.2	Battery marking		N/A
	Batteries marked in accordance with the requirements for the cells from which they are assembled.	Cell only.	N/A
	Batteries marked with an appropriate caution statement.		N/A
10.3	Other information		P
	Storage and disposal instructions marked on or supplied with the battery.	Information for storage instructions mentioned in manufacturer's specifications.	P
	Recommended charging instructions marked on or supplied with the battery.	Information for recommended charging instructions mentioned in manufacturer's specifications.	P
11	**Packaging**		**P**
	The materials and packaging design are chosen so as to prevent the development of unintentional electrical conduction, corrosion of the terminals and ingress of environmental contaminants.		P
Annex A	**Charging range of secondary lithium ion cells for safe use**		**P**
A.1	General		P
A.2	Safety of lithium-ion secondary battery	Complied.	P
A.3	Consideration on charging voltage	Complied.	P
A.3.1	General	Charging voltage is 4.2V.	P
A.3.2	Upper limit charging voltage	4.25V applied.	P
A.3.2.1	General		P
A.3.2.2	Explanation of safety viewpoint		N/A
A.3.2.3	Safety requirements, when different upper limit charging voltage is applied	4.25V applied.	N/A

IEC 62133: 2012			
Clause	Requirement + Test	Result - Remark	Verdict
A.4	Consideration of temperature and charging current		P
A.4.1	General		P
A.4.2	Recommended temperature range	See A.4.2.2.	P
A.4.2.1	General		P
A.4.2.2	Safety consideration when a different recommended temperature range is applied	Charging temperature range declared by client is:0-45°C.	P
A.4.3	High temperature range	Not higher than the temperature range specific in this standard.	N/A
A.4.3.1	General		N/A
A.4.3.2	Explanation of safety viewpoint		N/A
A.4.3.3	Safety considerations when specifying charging conditions in high temperature range		N/A
A.4.3.4	Safety consideration when specifying new upper limit in high temperature range		N/A
A.4.4	Low temperature range	Charging low temperature declared by client is: 0°C.	P
A.4.4.1	General		P
A.4.4.2	Explanation of safety viewpoint		P
A.4.4.3	Safety considerations, when specifying charging conditions in low temperature range		P
A.4.4.4	Safety considerations when specifying a new lower limit in the low temperature range	-5°C applied.	P
A.4.5	Scope of the application of charging current		P
A.5	Sample preparation		P
A.5.1	General		P
A.5.2	Insertion procedure for nickel particle to generate internal short		P
	The insertion procedure carried out at 20°C±5°C and under -25 °C of dew point		P
A.5.3	Disassembly of charged cell		P
A.5.4	Shape of nickel particle		P
A.5.5	Insertion of nickel particle to cylindrical cell		P
A.5.5.1	Insertion of nickel particle to winding core		P
A.5.5.2	Mark the position of nickel particle on the both end of winding core of the separator		P

IEC 62133: 2012			
Clause	Requirement + Test	Result - Remark	Verdict
A.5.6	Insertion of nickel particle to prismatic cell		N/A

5.1 – 5.6	TABLE: Critical components information				
Object/part no.	**Manufacturer/ trademark**	**Type/model**	**Technical data**	**Standard**	**Mark(s) of conformity**
Cell	Xinxiang hongli Power Science and Technology Co., Ltd	18650 3.7V 1200mAh	1200mAh, 3.7V	IEC62133: 2012	Tested with appliance
Electrolyte	Interchangeable	Interchangeable	LiPF6+DMC+EMC+EC	--	Tested with appliance
Positive electrode	Interchangeable	Interchangeable	LiCoO2, PVDF, NMP, Conductive Additive,	--	Tested with Appliance
Negative electrode	Interchangeable	Interchangeable	Graphite, PVDF, Distilled NMP, Conductive Additive,	--	Tested with appliance
Separator	Interchangeable	Interchangeable	Shutdown temperature: 130°C	--	Tested with appliance
Supplementary information: N/A					

8.2.1	TABLE: Continuous charging at constant voltage (cells)			P
Model	**Recommended charging voltage V_c, (Vdc)**	**Recommended charging current I_{rec}, (A)**	**OCV at start of test, (Vdc)**	**Results**
Cell #1	4.20	0.24	4.19	P
Cell #2	4.20	0.24	4.19	P
Cell #3	4.20	0.24	4.19	P
Cell #4	4.20	0.24	4.19	P
Cell #5	4.20	0.24	4.19	P
Supplementary information: - No fire, no explosion, no leakage.				

8.3.1	TABLE: External short circuit (cells)				P
Model	**Ambient, (°C)**	**OCV at start of test, (Vdc)**	**Resistance of circuit, (Ω)**	**Maximum case temperature ~~rise~~ ΔT, (°C)**	**Results**
Samples charged at charging temperature upper limit (45°C)					
Cell #1	24.5	4.22	0.080	138.8	P
Cell #2	24.5	4.22	0.081	140.6	P
Cell #3	24.5	4.21	0.080	133.8	P
Cell #4	24.5	4.22	0.080	120.6	P
Cell #5	24.5	4.22	0.079	142.6	P
Samples charged at charging temperature lower limit (-5°C)					
Cell #6	24.5	4.21	0.079	138.7	P
Cell #7	24.5	4.20	0.081	147.7	P
Cell #8	24.5	4.21	0.080	147.6	P
Cell #9	24.5	4.20	0.080	145.3	P
Cell #10	24.5	4.20	0.082	139.4	P
Supplementary information: - No fire, no explosion.					

8.3.2	TABLE: External short circuit (battery)				N/A
Model	**Ambient, (°C)**	**OCV at start of test, (Vdc)**	**Resistance of circuit, (Ω)**	**Maximum case temperature rise ΔT, (°C)**	**Results**
Samples charged at charging temperature upper limit					
/	/	/	/	/	/
/	/	/	/	/	/
/	/	/	/	/	/
/	/	/	/	/	/
/	/	/	/	/	/
Samples charged at charging temperature lower limit					
/	/	/	/	/	/
/	/	/	/	/	/
/	/	/	/	/	/
/	/	/	/	/	/
/	/	/	/	/	/
Supplementary information: - No fire or explosion					

8.3.5	TABLE: Crush				P
Model	**OCV at start of test, (Vdc)**	**OCV at removal of crushing force, (Vdc)**	**Width/ diameter of cell before crush, (mm)**	**Required deformation for crush, (mm)**	**Results**
Samples charged at charging temperature upper limit (45°C)					
Cell #1	4.22	4.21	18.12	1.812	P
Cell #2	4.22	4.21	18.07	1.807	P
Cell #3	4.21	4.21	18.11	1.811	P
Cell #4	4.21	4.21	18.06	1.806	P
Cell #5	4.22	4.21	18.02	1.802	P
Supplementary information: - No fire, no explosion.					

8.3.6	TABLE: Over-charging of battery	N/A
Constant charging current (A) ..... :	/	—
Supply voltage (Vdc) ..... :	/	—

Model	OCV before charging, (Vdc)	Resistance of circuit, (Ω)	Maximum outer casing temperature, (°C)	Results
/	/	/	/	/
/	/	/	/	/
/	/	/	/	/
/	/	/	/	/
/	/	/	/	/

Supplementary information:

- No fire or explosion

8.3.7	TABLE: Forced discharge (cells)	P

Model	OCV before application of reverse charge, (Vdc)	Measured Reverse charge I_t, (A)	Time for reversed charge, (minutes)	Results
Cell #1	3.11	1.20	90	P
Cell #2	3.09	1.20	90	P
Cell #3	3.09	1.20	90	P
Cell #4	3.10	1.20	90	P
Cell #5	3.09	1.20	90	P

Supplementary information:

- No fire or explosion

8.3.8 T-5	TABLE: External short circuit (cells)				P
Model	**Ambient, (°C)**	**OCV at start of test, (Vdc)**	**Resistance of circuit, (Ω)**	**Maximum case temperature rise ΔT, (°C)**	**Results**
Cell #1	55.0	4.19	0.080	133.4	P
Cell #2	55.0	4.19	0.079	129.4	P
Cell #3	55.0	4.19	0.081	123.9	P
Cell #4	55.0	4.19	0.080	132.9	P
Cell #5	55.0	4.19	0.081	128.6	P
Cell #6	55.0	4.19	0.080	133.1	P
Cell #7	55.0	4.19	0.081	126.4	P
Cell #8	55.0	4.19	0.080	135.7	P
Cell #9	55.0	4.19	0.079	133.2	P
Cell #10	55.0	4.19	0.080	138.1	P
Supplementary information: - No excessive temperature, no rupture, no fire, no explosion.					

8.3.9	TABLE: Forced internal short circuit (cells)				P
Model	**Chamber ambient, (°C)**	**OCV at start of test, (Vdc)**	**Particle location [1)]**	**Maximum applied pressure, (N)**	**Results**
Cell #1	45	4.22	1	800	P
Cell #2	45	4.22	1	800	P
Cell #3	45	4.21	1	800	P
Cell #4	45	4.22	1	800	P
Cell #5	45	4.22	1	800	P
Cell #6	10	4.21	1	800	P
Cell #7	10	4.21	1	800	P
Cell #8	10	4.22	1	800	P
Cell #9	10	4.21	1	800	P
Cell #10	10	4.21	1	800	P
Supplementary information: - No fire					

Appendix 1
Photo Documentation

Details of:	Fig.1–Front view of Cell 18650 3.7V 1200mAh

Details of:	Fig. 2–Back view of Cell 18650 3.7V 1200mAh

---End of Test Report---