



Test Report issued under the responsibility of:



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..... : **4359883.50**
Date of issue..... : **2019-11-19**
Total number of pages : **Test report – 26 pages**

Name of Testing Laboratory preparing the Report : **DEKRA Testing and Certification (Shanghai) Ltd., Guangzhou Branch.**

Applicant’s name : **SAMSUNG SDI Co., LTD.**
Address..... : **467, Beonyeong-ro, Seobuk-gu, Cheonan-si, Chungcheongnam-do 31086, Republic of Korea**

Test specification:
Standard : **IEC 62133:2012**
Test procedure : **CB Scheme**
Non-standard test method : **N/A**

Test Report Form No. : **IEC62133C**
Test Report Form(s) Originator : **UL (Demko)**
Master TRF : **2018-07-27**



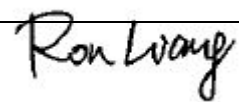
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Test item description :	Rechargeable Lithium-Ion Battery Cell	
Trade Mark :	SAMSUNG	
Manufacturer	SAMSUNG SDI Co., LTD. 467, Beonyeong-ro, Seobuk-gu, Cheonan-si, Chungcheongnam-do 31086, Republic of Korea	
Model/Type reference :	INR21700-50S++ / INR22/71	
Ratings :	3.6 Vdc, 5000 mAh	
Responsible Testing Laboratory (as applicable), testing procedure and testing location(s):		
<input type="checkbox"/>	CB Testing Laboratory:	
Testing location/ address :		
Tested by (name, function, signature) :		
Approved by (name, function, signature) ... :		
<input type="checkbox"/>	Testing procedure: CTF Stage 1:	
Testing location/ address :		
Tested by (name, function, signature) :		
Approved by (name, function, signature) ... :		
<input checked="" type="checkbox"/>	Testing procedure: CTF Stage 2:	
Testing location/ address :		SAMSUNG SDI Co., LTD. 467, Beonyeong-ro, Seobuk-gu, Cheonan-si, Chungcheongnam-do 31086, Republic of Korea
Tested by (name + signature) :		Lian Kim 
Witnessed by (name, function, signature) :		Bruce Lee 
Approved by (name, function, signature) ... :		Ron Liang 
<input type="checkbox"/>	Testing procedure: CTF Stage 3:	
<input type="checkbox"/>	Testing procedure: CTF Stage 4:	
Testing location/ address :		
Tested by (name, function, signature) :		
Witnessed by (name, function, signature) :		
Approved by (name, function, signature) ... :		
Supervised by (name, function, signature) :		

List of Attachments (including a total number of pages in each attachment): N/A	
Summary of testing:	
Tests performed (name of test and test clause): <ul style="list-style-type: none">- 8.2.1 - Continuous charging at constant voltage- 8.3.1 – External Short Circuit- 8.3.3 – Free Fall- 8.3.4 – Thermal Abuse- 8.3.5 – Crush- 8.3.7 – Forced Discharge- 8.3.9 - Forced internal short circuit	Testing location: SAMSUNG SDI Co., LTD. 467, Beonyeong-ro, Seobuk-gu, Cheonan-si, Chungcheongnam-do 31086, Republic of Korea
Summary of compliance with National Differences (List of countries addressed): N/A	
<input checked="" type="checkbox"/> The product fulfils the requirements of EN62133:2013	

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.

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Test item particulars: Rechargeable Lithium-Ion Battery Cell	
Recommend charging method declared by the manufacturer	CC/CV
Discharge current (0,2 k A)	1000 mA
Specified final voltage	2.5 V
Chemistry	<input type="checkbox"/> nickel systems <input checked="" type="checkbox"/> lithium systems
Recommend of charging limit for lithium system	
Upper limit charging voltage per cell	4.25 V
Maximum charging current	6000 mA
Charging temperature upper limit	45 °C
Charging temperature lower limit	0 °C
Polymer cell electrolyte type	<input type="checkbox"/> gel polymer <input type="checkbox"/> solid polymer
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	2019-11-01
Date (s) of performance of tests	2019-11-01 to 2019-11-13
General remarks:	
<p>"(See Enclosure #)" refers to additional information appended to the report. "(See appended table)" refers to a table appended to the report. This report will not be used for social proof function in China market. Throughout this report a <input type="checkbox"/> comma / <input checked="" type="checkbox"/> point is used as the decimal separator.</p> <p>This item is tested and compliance with the following standards: IEC 62133: 2012 (Second Edition) and EN62133: 2013</p>	
Manufacturer's Declaration per sub-clause 4.2.5 of IEC 62133:	
The application for obtaining a CB Test Certificate includes more than one factory location and a declaration from the Manufacturer stating that the sample(s) submitted for evaluation is (are) representative of the products from each factory has been provided	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> Not applicable
When differences exist; they shall be identified in the General product information section.	

Name and address of factory (ies)..... :	1) SAMSUNG SDI CO., LTD. : 467, Beonyeong-ro, Seobuk-gu, Cheonan-si, Chungcheongnam-do 31086, Republic of Korea 2) TIANJIN SAMSUNG SDI CO., LTD. : No.1, Qingling Avenue, Yat-Sen Scientific Industrial Park, Tianjin Economic Technological Development Area, Tianjin 301726 China 3) SAMSUNG SDI ENERGY MALAYSIA SDN.BHD : Lot 635 & 660 Kawasan Perindustrian Tuanku Jaafar 71450 Sungai Gadut, Negeri Sembilan Darul Khusus Malaysia 4) Samsung SDI (Tianjin) Battery Co., Ltd. : South Area of Manufacture Building, No.1, Qingling Avenue, Yat-Sen Scientific Industrial Park, Tianjin Economic Technological Development Area, Tianjin 301726 China
General product information and other remarks: The Rechargeable Lithium-Ion Battery Cell (Model: INR21700-50S++) is only used by battery manufacturer and not intended to be used by end user. IEC code INR22/71 is not marked on the cell. The '+' in the model designation can be optional alphanumeric character "0~9" and "A~Z" according to the end customer, manufacturing site and manufacturing process control or can be blank. The dimension of the Lithium-Ion Rechargeable Battery Cell is Max. 70.62 mm (H), diameter \varnothing 21.25 mm and weight Max. 72.0 g. For 8.1.2, Tests were conducted with charging temp. Upper limit (50 °C) and charging temp. Lower limit (-5 °C) by manufacturer's request.	

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Clause	Requirement + Test	Result - Remark	Verdict
4	Parameter measurement tolerances		
	Parameter measurement tolerances		P
5	General safety considerations		
5.1	General		P
5.2	Insulation and wiring		N/A
	The insulation resistance between the positive terminal and externally exposed metal surfaces of the battery (excluding electrical contact surfaces) is not less than 5 MΩ		N/A
	Insulation resistance (MΩ) :		—
	Internal wiring and insulation are sufficient to withstand maximum anticipated current, voltage and temperature requirements		N/A
	Orientation of wiring maintains adequate creepage and clearance distances between conductors		N/A
	Mechanical integrity of internal connections accommodates reasonably foreseeable misuse		N/A
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	Pressure relief mechanism was incorporated.	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		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		N/A
	Terminals have a clear polarity marking on the external surface of the battery		N/A
	The size and shape of the terminal contacts ensure that they can carry the maximum anticipated current		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	External terminal contact surfaces are formed from conductive materials with good mechanical strength and corrosion resistance		N/A
	Terminal contacts are arranged to minimize the risk of short circuits		N/A
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		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		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
	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

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Clause	Requirement + Test	Result - Remark	Verdict
	- 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	Factories were certified acc. to ISO 9001. 1. Samsung SDI Co., Ltd.: Certificate No. FM639667 Expired: 27/12/2021, by BSI 2. Tianjin Samsung SDI: Certificate No. FM672162 Expired: 21/03/2021, by BSI 3. Samsung SDIEM Certificate No. FM584612 Expired: 30/08/2022, by BSI 4. SAMSUNG (TIANJIN) BATTERY CO., LTD. Certificate No. FM672175 Expired: 26/08/2021, by BSI	P
6	Type test conditions		
	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		P
	Unless noted otherwise in the test methods, testing was conducted in an ambient of 20°C ± 5°C.		P
7	Specific requirements and tests (nickel systems)		
7.1	Charging procedure for test purposes		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
7.2	Intended use		N/A
7.2.1	Continuous low-rate charging (cells)		N/A
	Results: No fire. No explosion	(See Table 7.2.1)	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

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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)		
8.1	Charging procedures for test purposes		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	Test temperature of 50 °C / -5 °C at 4.25 V applied by manufacturer's request.	P
	A valid rationale was provided to ensure the safety of the cell (see Figure A.1)..... :	See the declaration of different upper limit charging voltage & temp of INR21700-50S++	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)..... :		N/A
8.2	Intended use		P
8.2.1	Continuous charging at constant voltage (cells)		P
	Results: No fire. No explosion..... :	(See Table 8.2.1)	P
8.2.2	Moulded case stress at high ambient temperature (battery)		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	Oven temperature (°C)..... :		—
	Results: No physical distortion of the battery casing resulting in exposure if 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)		N/A
	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		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 and explosion	P
8.3.4	Thermal abuse (cells)		P
	The cells were held at 130°C ± 2°C for: - 10 minutes; or		P
	- 30 minutes for large cells (gross mass of more than 500 g as defined in IEC 62281)		N/A
	Oven temperature (°C)..... :	130 °C	—
	Gross mass of cell (g)	72.0 g	—
	Results: 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	The Max. force of 13 kN has been applied	P
	- 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		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	Results: No fire. No explosion..... :	(See Table 8.3.5)	P
8.3.6	Over-charging of battery		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		P
	Manufacturer's documentation provided to show compliance with UN Recommendations on Transport of Dangerous Goods	Reviewed the UN test report of INR21700-50S++	P
8.3.9	Design evaluation – Forced internal short circuit (cells)		P
	The cells complied with national requirement for :	France, Japan, Korea, 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	800 N	P
	Results: No fire :	(See Table 8.3.9)	P
9	Information for safety		
	The manufacturer of secondary cells ensures that information is provided about current, voltage and temperature limits of their products.		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.	Not intended for end-users.	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
	As appropriate, information relating to hazard avoidance resulting from a system analysis is provided to the end user		N/A
10	Marking		
10.1	Cell marking		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	Cells marked as specified in the applicable cell standards: IEC 61951-1, IEC 61951-2 or IEC 61960.	Cells used in the manufacture of the battery and need not to be marked.	N/A
10.2	Battery marking		N/A
	Batteries marked in accordance with the requirements for the cells from which they are assembled.		N/A
	Batteries marked with an appropriate caution statement.		N/A
10.3	Other information		N/A
	Storage and disposal instructions marked on or supplied with the battery.		N/A
	Recommended charging instructions marked on or supplied with the battery.		N/A
11	Packaging		
	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.	Document review, Package drawing in Spec.	P
Annex A	Charging range of secondary lithium ion cells for safe use		
A.1	General		P
A.2	Safety of lithium-ion secondary battery		P
A.3	Consideration on charging voltage		P
A.3.1	General		P
A.3.2	Upper limit charging voltage	4.25 V	P
A.3.2.1	General		P
A.3.2.2	Explanation of safety viewpoint		P
A.3.2.3	Safety requirements, when different upper limit charging voltage is applied		N/A
A.4	Consideration of temperature and charging current		P
A.4.1	General		P
A.4.2	Recommended temperature range		P
A.4.2.1	General		P
A.4.2.2	Safety consideration when a different recommended temperature range is applied		P
A.4.3	High temperature range	45 °C	N/A
A.4.3.1	General		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
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	Tested at 50 °C	N/A
A.4.4	Low temperature range	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	Tested at -5 °C	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
A.5.6	Insertion of nickel particle to prismatic cell		N/A

IEC 62133			
Clause	Requirement + Test	Result - Remark	Verdict

TABLE: Critical components information					P
Object/part no.	Manufacturer/ trademark	Type/model	Technical data	Standard	Mark(s) of conformity ¹⁾
Cell(Li-ion)	Samsung SDI	INR21700-50S++	3.6 V, 5000 mAh	-	-
- Electrolyte	-	-	EC, EMC, DMC, LiPF ₆	IEC 62133	Tested in appliance
- Separator	-	-	PE	IEC 62133	Tested in appliance
- Anode	-	-	Graphite(Carbon)	IEC 62133	Tested in appliance
- Cathode	-	-	LiNiCoAlO ₂	IEC 62133	Tested in appliance

Supplementary information:
¹⁾ Provided evidence ensures the agreed level of compliance. See OD-CB2039.

IEC 62133			
Clause	Requirement + Test	Result - Remark	Verdict

7.2.1	TABLE: Continuous low rate charge (cells)					N/A
Model	Recommended charging method, (CC, CV, or CC/CV)	Recommended charging voltage V_c , (Vdc)	Recommended charging current I_{rec} , (A)	OCV at start of test, (Vdc)	Results	
Supplementary information: <ul style="list-style-type: none"> - No fire or explosion - No leakage - Leakage - Fire - Explosion - Bulge - Others (please explain) 						

7.2.2	TABLE: Vibration			N/A
Model	OCV at start of test, (Vdc)		Results	
Supplementary information: <ul style="list-style-type: none"> - No fire or explosion - No leakage - Leakage - Fire - Explosion - Bulge - Others (please explain) 				

7.3.1	TABLE: Incorrect installation (cells)			N/A
Model	OCV of reversed cell, (Vdc)		Results	
Supplementary information: <ul style="list-style-type: none"> - No fire or explosion - No leakage - Leakage - Fire - Explosion - Bulge - Others (please explain) 				

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Clause	Requirement + Test				Result - Remark	Verdict
7.3.2	TABLE: External short circuit					N/A
Model	Ambient (at 20°C ± 5°C or 55°C ± 5°C)	OCV at start of test, (Vdc)	Resistance of circuit, (Ω)	Maximum case temperature rise ΔT, (°C)	Results	
Supplementary information: - No fire or explosion - No leakage - Leakage - Fire - Explosion - Bulge - Others (please explain)						

7.3.6				TABLE: Crush	N/A
Model	OCV at start of test, (Vdc)	OCV at removal of crushing force, (Vdc)	Results		
Supplementary information: - No fire or explosion - No leakage - Leakage - Fire - Explosion - Bulge - Others (please explain)					

7.3.8				TABLE: Overcharge	N/A
Model	OCV prior to charging, (Vdc)	Maximum charge current, (A)	Time for charging, (hours)	Results	
Supplementary information: - No fire or explosion - No leakage - Leakage - Fire - Explosion - Bulge - Others (please explain)					

IEC 62133			
Clause	Requirement + Test	Result - Remark	Verdict

7.3.9	TABLE: Forced discharge (cells)			N/A
Model	OCV before application of reverse charge, (Vdc)	Measured reverse charge I_t , (A)	Time for reversed charge, (minutes)	Results
Supplementary information: - No fire or explosion - No leakage - Leakage - Fire - Explosion - Bulge - Others (please explain)				

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
INR21700-50S++	4.2	6.0	4.18	A, B
INR21700-50S++	4.2	6.0	4.18	A, B
INR21700-50S++	4.2	6.0	4.18	A, B
INR21700-50S++	4.2	6.0	4.18	A, B
INR21700-50S++	4.2	6.0	4.18	A, B
Supplementary information A- No fire or explosion B - No leakage C - Leakage D - Fire E - Explosion F - Bulge G - Others (please explain)				

IEC 62133			
Clause	Requirement + Test	Result - Remark	Verdict

8.3.1	TABLE: External short circuit (cell)					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 (50 °C)						
INR21700-50S++	23.5 °C	4.21	0.08	56.3	A,B	
INR21700-50S++	23.5 °C	4.21	0.08	59.4	A,B	
INR21700-50S++	23.5 °C	4.21	0.08	58.1	A,B	
INR21700-50S++	23.5 °C	4.21	0.08	61.3	A,B	
INR21700-50S++	23.5 °C	4.21	0.08	58.3	A,B	
Samples charged at charging temperature lower limit (-5 °C)						
INR21700-50S++	23.5 °C	4.19	0.08	49.3	A,B	
INR21700-50S++	23.5 °C	4.19	0.08	56.6	A,B	
INR21700-50S++	23.5 °C	4.19	0.08	50.9	A,B	
INR21700-50S++	23.5 °C	4.19	0.08	58.1	A,B	
INR21700-50S++	23.5 °C	4.19	0.08	57.4	A,B	
Supplementary information:						
A- No fire or explosion						
B - No leakage						
C - Leakage						
D - Fire						
E - Explosion						
F - Bulge						
G - Others (please explain)						

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						

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Clause	Requirement + Test	Result - Remark	Verdict
Supplementary information:			
A- No fire or explosion B - No leakage C - Leakage D - Fire E - Explosion F - Bulge G - Others (please explain)			

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 (50 °C)						
INR21700-50S++	4.21	4.21	-	-	A, B	
INR21700-50S++	4.21	4.21	-	-	A, B	
INR21700-50S++	4.21	4.21	-	-	A, B	
INR21700-50S++	4.21	4.21	-	-	A, B	
INR21700-50S++	4.21	4.21	-	-	A, B	
Samples charged at charging temperature lower limit (-5 °C)						
INR21700-50S++	4.18	4.18	-	-	A, B	
INR21700-50S++	4.18	4.18	-	-	A, B	
INR21700-50S++	4.18	4.18	-	-	A, B	
INR21700-50S++	4.18	4.18	-	-	A, B	
INR21700-50S++	4.18	4.18	-	-	A, B	
Supplementary information: Once the max. force of 13 kN has been applied.						
A- No fire or explosion B - No leakage C - Leakage D - Fire E - Explosion F - Bulge G - Others (please explain)						

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

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Clause	Requirement + Test		Result - Remark	Verdict
Model	OCV before charging, (Vdc)	Resistance of circuit, (Ω)	Maximum outer casing temperature, ($^{\circ}\text{C}$)	Results
Supplementary information:				
A- No fire or explosion B - No leakage C - Leakage D - Fire E - Explosion F - Bulge G - Others (please explain)				

8.3.7	TABLE: Forced discharge (cells)				P
Model	OCV before application of reverse charge, (Vdc)	Measured Reverse charge I_r , (mA)	Time for reversed charge, (minutes)	Results	
INR21700-50S++	2.91	5000	90	A, B	
INR21700-50S++	2.92	5000	90	A, B	
INR21700-50S++	2.91	5000	90	A, B	
INR21700-50S++	2.91	5000	90	A, B	
INR21700-50S++	2.91	5000	90	A, B	
Supplementary information:					
A- No fire or explosion B - No leakage C - Leakage D - Fire E - Explosion F - Bulge G - Others (please explain)					

8.3.9	TABLE: Forced internal short circuit (cells)				P
Model	Chamber ambient, ($^{\circ}\text{C}$)	OCV at start of test, (Vdc)	Particle location ¹⁾	Maximum applied pressure, (N)	Results
INR21700-50S++	-5	4.18	1	800	A
INR21700-50S++	-5	4.18	1	800	A
INR21700-50S++	-5	4.18	1	800	A

IEC 62133					
Clause	Requirement + Test			Result - Remark	Verdict
INR21700-50S++	-5	4.18	1	800	A
INR21700-50S++	-5	4.18	1	800	A
INR21700-50S++	50	4.23	1	800	A
INR21700-50S++	50	4.22	1	800	A
INR21700-50S++	50	4.22	1	800	A
INR21700-50S++	50	4.22	1	800	A
INR21700-50S++	50	4.23	1	800	A
Supplementary information:					
<p>1) Identify one of the following:</p> <p>1: Nickel particle inserted between positive and negative (active material) coated area.</p> <p>2: Nickel particle inserted between positive aluminium foil and negative active material coated area.</p> <p>A- No fire or explosion B - No leakage C - Leakage D - Fire E - Explosion F - Bulge G - Others (please explain)</p>					

List of test equipment used:

A completed list of used test equipment shall be provided in the Test Reports when a Customer's Testing Facility according to CTF stage 1 or CTF stage 2 procedure has been used.

Note: This page may be removed when CTF stage 1 or CTF stage 2 are not used. See also clause 4.8 in OD 2020 for more details.

Clause	Measurement/ testing	Testing/measuring equipment/material used, (equipment ID)	Range used	Last calibration date	Calibration due date
8.1.2	Second procedure	Temperature Controller	-30~200 °C	2018.12.27	2019.12.27
8.2.1	Continuous charging at constant voltage (cells)	Power Supply	5 V, 6 A	2019.03.15	2020.03.15
8.2.2	Mould case stress	Oven	-40~100 °C	2018.12.27	2019.12.27
8.3.1	External short circuit (cell)	Temperature Controller	K1300 °C	2019.02.21	2020.02.21
8.3.2	External short circuit (battery)				
8.3.3	Free fall	Steel Ruler	L1000	2019.03.05	2020.03.05
8.3.4	Thermal abuse (cells)	Temperature Controller	K1300 °C	2019.02.21	2020.02.21
8.3.5	Crushing of Cells [UN38.3]T6	Load battery	3 t	2019.09.19	2020.09.19
8.3.6	Over-charging of battery	Power Supply	50 V, 50 A	2019.05.21	2020.05.21
8.3.7	Forced discharge (cells)				
	[UN38.3]T7 [UN38.3]T8				
8.3.5	Design evaluation – Forced internal short circuit (cells)	Crush tester	0~30000 N	2019.09.19	2020.09.19
8.3.5	Design evaluation – Forced internal short circuit (cells)	DATA acquisition	0~24 V / -40~200 °C	2019.07.02	2020.07.02
All	All	Temp Humidity Recorder	-20 ~ 50 °C 20 ~ 90 %RH	2019.09.05	2020.09.05
All	All	Digital Multimeter	1000 V, 10 A	2018.11.26	2019.11.26
All	All	Termoelectric Temperature Record	(-200 ~ 1370) °C, 0.1 °C, K	2018.11.20	2019.11.20
All	All	Ohmmeter	0 mΩ ~ 300 mΩ / 0 Ω ~ 30 Ω	2018-12-21	2019-12-21

Photographs- front view & Rear view



Photographs- front view & Rear view



(End of report)