

**IEC SYSTEM FOR MUTUAL RECOGNITION OF TEST CERTIFICATES FOR ELECTRICAL EQUIPMENT (IECEE)
CB SCHEME**

CB TEST CERTIFICATE

Product

Rechargeable Li-ion Cell

Name and address of the applicant

SAMSUNG SDI CO LTD
467 BEONYEONG-RO, SEOBUK-GU, CHEONAN-SI,
CHUNGCHEONGNAM-DO 31086, KOREA

Name and address of the manufacturer

SAMSUNG SDI CO LTD
467 BEONYEONG-RO, SEOBUK-GU, CHEONAN-SI,
CHUNGCHEONGNAM-DO 31086, KOREA

Name and address of the factory

Note: When more than one factory, please report on page 2

SAMSUNG SDI CO LTD
467 BEONYEONG-RO SEOBUK-GU CHEONAN-SI,
CHUNGCHEONGNAM-DO 31086
KOREA

☒ Additional Information on page 2

Ratings and principal characteristics

3.6Vdc, 4000mAh

Samsung SDI

Trademark (if any)

Type of Customer's Testing Facility (CTF) Stage used

Model / Type Ref.

INR21700-40T++, INR22/71
See Page 2

Additional information (if necessary may also be reported on page 2)

Additionally evaluated to EN 62133-2:2017

☐ Additional Information on page 2

A sample of the product was tested and found to be in conformity with

IEC 62133(ed.2)

As shown in the Test Report Ref. No. which forms part of this Certificate

BA-4788140273-A-1 issued on 2017-11-08

This CB Test Certificate is issued by the National Certification Body



UL (US), 333 Pfingsten Rd IL 60062, Northbrook, USA

UL (Denko), Borupvang 5A DK-2750 Ballerup, DENMARK

UL (JP), Marunouchi Trust Tower Main Building 6F, 1-8-3 Marunouchi, Chiyoda-ku, Tokyo 100-0005, JAPAN

UL (CA), 7 Underwriters Road, Toronto, M1R 3B4 Ontario, CANADA

For full legal entity names see www.ul.com/ncbnames

Date: 2017-11-14

Signature:

Jan-Erik Storgaard



Ref. Certif. No.

DK-68150-UL

Model Details:

INR21700-40T++ (++ These cells may have optional alphanumeric characters or blank not related safety)

Factories:

SAMSUNG SDI ENERGY MALAYSIA SDN.BHD
LOT 635 & 660 KAWASAN PERINDUSTRIAN TUANKU JAAFAR 71450 SUNGAI GADUT, NEGERI SEMBILAN
DARUL KHUSUS
MALAYSIA

SAMSUNG (TIANJIN) BATTERY CO., LTD.
YAT-SEN SCIENTIFIC INDUSTRIAL PARK, WUQING DISTRICT, TIANJIN
P.R. CHINA

Additional information (if necessary)



☐ UL (US), 333 Pfingsten Rd IL 60062, Northbrook, USA

☒ UL (Demko), Borupvang 5A DK-2750 Ballerup, DENMARK

☐ UL (JP), Marunouchi Trust Tower Main Building 6F, 1-8-3 Marunouchi, Chiyoda-ku, Tokyo 100-0005, JAPAN

☐ UL (CA), 7 Underwriters Road, Toronto, M1R 3B4 Ontario, CANADA

For full legal entity names see www.ul.com/ncbnames

Date: 2017-11-14

Signature:

Jan-Erik Storgaard



Test Report issued under the responsibility of:



TEST REPORT IEC 62133-2 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 – Part 2: Lithium systems	
Report Number	BA-4788140273-A-1
Date of issue	2017-11-08
Total number of pages	24
Name of Testing Laboratory preparing the Report	Underwriters Laboratories Taiwan Co., Ltd.
Applicant's name	SAMSUNG SDI CO LTD
Address	467 BEONYEONG-RO, SEOBUK-GU, CHEONAN-SI, CHUNGCHONGNAM-DO 31086, KOREA
Test specification:	
Standard	IEC 62133-2:2017
Test procedure	CB Scheme
Non-standard test method	N/A
Test Report Form No	IEC62133_2A
Test Report Form(s) Originator	DEKRA
Master TRF	Dated 2017-08-10
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General disclaimer: 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 CB Testing Laboratory. The authenticity of this Test Report and its contents can be verified by contacting the NCB, responsible for this Test Report.	

Test item description	Rechargeable Li-ion Cell	
Trade Mark	Samsung SDI	
Manufacturer	SAME AS APPLICANT	
Model/Type reference	INR21700-40T++ / INR22/71 (++ These cells may have optional alphanumeric characters or blank not related safety)	
Ratings	3.6Vdc, 4000mAh	
Responsible Testing Laboratory (as applicable), testing procedure and testing location(s):		
☒ CB Testing Laboratory:	Underwriters Laboratories Taiwan Co., Ltd	
Testing location/ address	1F., No.2, Wenming 1st St., Guishan, Taoyuan City 333, Taiwan 1st Fl, 260 Da-Yeh Road, Peitou, Taipei City, Taiwan	
Tested by (name, function, signature).....:	SooJin Kim / Project Handler	
Approved by (name, function, signature)....:	MyungAh Lim/ Project Reviewer	
Testing procedure: CTF Stage 1:		
Testing location/ address		
Tested by (name, function, signature).....:		
Approved by (name, function, signature)....:		
Testing procedure: CTF Stage 2:		
Testing location/ address		
Tested by (name + signature).....:		
Witnessed by (name, function, signature)..:		
Approved by (name, function, signature)....:		
Testing procedure: CTF Stage 3:		
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):

National Differences (0 pages)

Enclosures (8 pages)

Summary of testing:**Tests performed (name of test and test clause):**

7.2.1 Continuous charge

7.3.9 Forced internal short

Testing location:Underwriters Laboratories Taiwan Co., Ltd.
260 Da-Yeh Road 112 Peitou Taipei City,
CHINESE TAIPEI

7.3.1 External short-circuit

7.3.3 Free fall

7.3.4 Thermal abuse

7.3.5 Crush

7.3.7 Forced discharge

7.3.9 Forced internal short

Underwriters Laboratories Taiwan Co., Ltd.

1F., No.2, Wenming 1st St., Guishan, Taoyuan City
333, Taiwan**Summary of compliance with National Differences (List of countries addressed):**

No National Differences.

☒ **The product fulfils the requirements of EN 62133-2:2017.**

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.

Product Label			
Rechargeable Li-ion Cell		Samsung SDI Co Ltd	
Model Code	INR21700-40T++ / INR22/71	Rating	3.6Vdc, 4000mAh
Batch No	6R9A09A55205	Rank	A
Q'ty	200 EA	Date	YYYY/MM/DD
Remark	고객 요구사항 기입		
Tracking No	Barcode(6R9A09A55205A001)		

Test item particulars	
Classification of installation and use..... : N/A	
Supply Connection : N/A	
Recommend charging method declared by the manufacturer : CC/CV	
Discharge current (0,2 It A) : 800mA	
Specified final voltage : 2.5Vdc	
Upper limit charging voltage per cell..... : 4.25Vdc	
Maximum charging current..... : 6000mA	
Charging temperature upper limit..... : 50degC	
Charging temperature lower limit..... : 0degC	
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 : 2017-09-06	
Date (s) of performance of tests..... : 2017-09-25 to 2017-11-06	
General remarks:	
"(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.	
Manufacturer's Declaration per sub-clause 4.2.5 of IEC60068-2-1:	
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	☒ Yes ☐ 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, CHUNGCHONGNAM-DO 31086 KOREA 2. SAMSUNG SDI ENERGY MALAYSIA SDN.BHD LOT 635 & 660 KAWASAN PERINDUSTRIAN TUANKU JAAFAR 71450 SUNGAI GADUT, NEGERI SEMBILAN DARUL KHUSUS MALAYSIA 3. SAMSUNG (TIANJIN) BATTERY CO., LTD. YAT-SEN SCIENTIFIC INDUSTRIAL PARK, WUQING DISTRICT,TIANJIN, P.R. CHINA
General product information and other remarks: The suffix, ++ of the model name is not related safety. This cell consists of Positive Electrode, Negative Electrode, Separator, Electrolyte and is covered by Stainless Steel. This cell is also investigated to UL 1642. The product was investigated to the following additional standards: EN 62133-2:2017. Model difference The model, INR22/71 is additional marking requirement for IEC 62133-2.	

IEC 62133-2			
Clause	Requirement + Test	Result - Remark	Verdict
4	PARAMETER MEASUREMENT TOLERANCES		
	Parameter measurement tolerances		P
5	GENERAL SAFETY CONSIDERATIONS		
5.1	General		P
	Cells and batteries so designed and constructed that they are safe under conditions of both intended use and reasonably foreseeable misuse		P
5.2	Insulation and wiring	Only applicable for battery packs evaluation.	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 clearance and creepage 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 and current management	Only applicable for battery packs evaluation.	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 specified chargers are designed to maintain charging within the temperature, voltage and current limits specified		N/A
5.5	Terminal contacts	Only applicable for battery packs evaluation.	N/A

IEC 62133-2			
Clause	Requirement + Test	Result - Remark	Verdict
	The size and shape of the terminal contacts ensure that they can carry the maximum anticipated current		N/A
	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-circuit		N/A
5.6	Assembly of cells into batteries	Only applicable for battery packs evaluation.	N/A
5.6.1	General		N/A
	Each battery have an independent control and protection for current, voltage, temperature and any other parameter required for safety and to maintain the cells within their operating region		N/A
	This protection may be provided external to the battery such as within the charger or the end devices		N/A
	If protection is external to the battery, the manufacturer of the battery provide this safety relevant information to the external device manufacturer for implementation		N/A
	If there is more than one battery housed in a single battery case, each battery have protective circuitry that can maintain the cells within their operating regions		N/A
	Manufacturers of cells specify 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 circuitry to prevent operation of cells outside the limits specified by the cell manufacturer		N/A
	Protective circuit components added as appropriate and consideration given to the end-device application		N/A
	The manufacturer of the battery provide a safety analysis of the battery safety circuitry with a test report including a fault analysis of the protection circuit under both charging and discharging conditions confirming the compliance		N/A
5.6.2	Design recommendation		N/A
	For the battery consisting of a single cell or a single cellblock, it is recommended that the charging voltage of the cell does not exceed the upper limit of the charging voltage specified in Table 2		N/A

IEC 62133-2			
Clause	Requirement + Test	Result - Remark	Verdict
	For the battery consisting of series-connected plural single cells or series-connected plural cellblocks, it is recommended that the voltages of any one of the single cells or single cellblocks does not exceed the upper limit of the charging voltage, specified in Table 2, 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, it is recommended that charging is stopped when the upper limit of the charging voltage 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
	For batteries consisting of series-connected cells or cell blocks, nominal charge voltage not be counted as an overcharge protection		N/A
	For batteries consisting of series-connected cells or cell blocks, cells have closely matched capacities, be of the same design, be of the same chemistry and be from the same manufacturer		N/A
	It is recommended that the cells and cell blocks not discharged beyond the cell manufacturer's specified final voltage		N/A
	For batteries consisting of series-connected cells or cell blocks, cell balancing circuitry incorporated into the battery management system		N/A
5.6.3	Mechanical protection for cells and components of batteries		N/A
	Mechanical protection for cells, cell connections and control circuits within the battery provided to prevent damage as a result of intended use and reasonably foreseeable misuse		N/A
	The mechanical protection can be provided by the battery case or it can be provided by the end product enclosure for those batteries intended for building into an end product		N/A
	The battery case and compartments housing cells designed to accommodate cell dimensional tolerances during charging and discharging as recommended by the cell manufacturer		N/A
	For batteries intended for building into a portable end product, testing with the battery installed within the end product considered when conducting mechanical tests		N/A
5.7	Quality plan	ISO9001 Certificate provided separately.	P

IEC 62133-2			
Clause	Requirement + Test	Result - Remark	Verdict
	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		
5.8	Battery safety components		N/A
	According annex F		N/A

6	TYPE TEST AND SAMPLE SIZE		
	Tests are made with the number of cells or batteries specified in Table 1 using cells or batteries that are not more than six months old		P
	Coin cells with resistance $\leq 3 \Omega$ (measured according annex D) are tested according table 1		N/A
	Unless otherwise specified, tests are carried out in an ambient temperature of $20^\circ\text{C} \pm 5^\circ\text{C}$		P
	The safety analysis of 5.6.1 identify those components of the protection circuit that are critical for short-circuit, overcharge and overdischarge protection		N/A
	When conducting the short-circuit test, consideration given to the simulation of any single fault condition that is likely to occur in the protecting circuit that would affect the short-circuit test		N/A

7	SPECIFIC REQUIREMENTS AND TESTS		
7.1	Charging procedure for test purposes		P
7.1.1	First procedure		P
	This charging procedure applies to subclauses other than those specified in 7.1.2		P
	Unless otherwise stated in this document, the charging procedure for test purposes is carried out in an ambient temperature of $20^\circ\text{C} \pm 5^\circ\text{C}$, using the method declared by the manufacturer		P
	Prior to charging, the battery have been discharged at $20^\circ\text{C} \pm 5^\circ\text{C}$ at a constant current of 0,2 It A down to a specified final voltage		P
7.1.2	Second procedure		P
	This charging procedure applies only to 7.3.1, 7.3.4, 7.3.5, and 7.3.9		P
	After stabilization for 1 h and 4 h, respectively, at ambient temperature of highest test temperature and lowest test temperature, as specified in Table 2, cells are charged by using the upper limit charging voltage and maximum charging current, until the charging current is reduced to 0,05 It A, using a constant voltage charging method		P

IEC 62133-2			
Clause	Requirement + Test	Result - Remark	Verdict
7.2	Intended use		
7.2.1	Continuous charging at constant voltage (cells)		P
	Fully charged cells are subjected for 7 days to a charge using the charging method for current and standard voltage specified by the cell manufacturer		P
	Results: No fire. No explosion. No leakage.....:	(See appended table 7.2.1)	P
7.2.2	Case stress at high ambient temperature (battery)	Only applicable for battery packs evaluation.	N/A
	Oven temperature (°C).....:		—
	Results: No physical distortion of the battery case resulting in exposure of internal protective components and cells		N/A
7.3	Reasonably foreseeable misuse		
7.3.1	External short-circuit (cell)		p
	The cells were tested until one of the following occurred:		p
	- 24 hours elapsed; or		N/A
	- The case temperature declined by 20 % of the maximum temperature rise		P
	Results: No fire. No explosion.....:	(See appended table 7.3.1)	P
7.3.2	External short-circuit (battery)		N/A
	The batteries were tested until one of the following occurred:		N/A
	- 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
	A single fault in the discharge protection circuit conducted on one to four (depending upon the protection circuit) of the five samples before conducting the short-circuit test		N/A
	A single fault applies to protective component parts such as MOSFET, fuse, thermostat or positive temperature coefficient (PTC) thermistor		N/A
	Results: No fire. No explosion.....:	(See appended table 7.3.2)	N/A
7.3.3	Free fall		P
	Results: No fire. No explosion		P
7.3.4	Thermal abuse (cells)		P
	Oven temperature (°C).....:	130	—

IEC 62133-2			
Clause	Requirement + Test	Result - Remark	Verdict
	Results: No fire. No explosion		P
7.3.5	Crush (cells)		P
	The crushing force was released upon:		P
	- The maximum force of 13 kN $\pm$ 0,78 kN has been applied; or		P
	- An abrupt voltage drop of one-third of the original voltage has been obtained		N/A
	Results: No fire. No explosion..... :	(See appended table 7.3.5)	P
7.3.6	Over-charging of battery	Only applicable for battery packs evaluation.	N/A
	The supply voltage which is:		N/A
	- 1,4 times the upper limit charging voltage presented in Table A.1 (but not to exceed 6,0 V) for single cell/cell block batteries or		N/A
	- 1,2 times the upper limit charging voltage resented in Table A.1 per cell for series connected multi-cell batteries, and		N/A
	- Sufficient to maintain a current of 2,0 It A throughout the duration of the test or until the supply voltage is reached		N/A
	Test was continued until the temperature of the outer casing:		N/A
	- 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 appended table 7.3.6)	N/A
7.3.7	Forced discharge (cells)		P
	If the discharge voltage reaches the negative value of upper limit charging voltage within the testing duration, the voltage is maintained at the negative value of the upper limit charging voltage by reducing the current for the remainder of the testing duration		N/A
	If the discharge voltage does not reach the negative value of upper limit charging voltage within the testing duration, the test is terminated at the end of the testing duration		P
	Results: No fire. No explosion..... :	(See appended table 7.3.7)	P
7.3.8	Mechanical tests (batteries)		N/A
7.3.8.1	Vibration		N/A
	Results: No fire, no explosion, no rupture, no leakage or venting. :	(See appended table 7.3.8.1)	N/A
7.3.8.2	Mechanical shock		N/A

IEC 62133-2			
Clause	Requirement + Test	Result - Remark	Verdict
	Results: No leakage, no venting, no rupture, no explosion and no fire	(See appended table 7.3.8.2)	N/A
7.3.9	Design evaluation – Forced internal short-circuit (cells)		P
	The cells complied with national requirement for	France, Japan, Korea, Switzerland	—
	The pressing was stopped upon:		P
	- 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		P
	Results: No fire	(See appended table 7.3.9)	P

8	INFORMATION FOR SAFETY		
8.1	General		P
	Manufacturers of secondary cells ensure that information is provided about current, voltage and temperature limits of their products	Refer to enclosure ID 03	P
	Manufacturers of batteries ensure 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
	As appropriate, any information relating to hazard avoidance resulting from a system analysis provided to the end user		N/A
	Do not allow children to replace batteries without adult supervision		N/A
8.2	Small cell and battery safety information		P
	The following warning language is to be provided with the information packaged with the small cells and batteries or equipment using them:		N/A
	- Keep small cells and batteries which are considered swallowable out of the reach of children		N/A
	- Swallowing may lead to burns, perforation of soft tissue, and death. Severe burns can occur within 2 h of ingestion		N/A
	- In case of ingestion of a cell or battery, seek medical assistance promptly		N/A
9	MARKING		
9.1	Cell marking		P

IEC 62133-2			
Clause	Requirement + Test	Result - Remark	Verdict
	Cells marked as specified in IEC 61960, except coin cells		P
	Coin cells whose external surface area is too small to accommodate the markings on the cells show the designation and polarity		N/A
	By agreement between the cell manufacturer and the battery and/or end product manufacturer, component cells used in the manufacture of a battery need not be marked		N/A
9.2	Battery marking		N/A
	Batteries marked as specified in IEC 61960, except for coin batteries		N/A
	Coin batteries whose external surface area is too small to accommodate the markings on the batteries show the designation and polarity. Batteries also marked with an appropriate caution statement		N/A
	Terminals have clear polarity marking on the external surface of the battery		N/A
	Batteries with keyed external connectors designed for connection to specific end products need not be marked with polarity markings if the design of the external connector prevents reverse polarity connections		
9.3	Caution for ingestion of small cells and batteries	Not a small cell and battery	N/A
	Coin cells and batteries identified as small batteries according to 8.2 include a caution statement regarding the hazards of ingestion in accordance with 8.2		N/A
	When small cells and batteries are intended for direct sale in consumer-replaceable applications, caution for ingestion given on the immediate package		N/A
9.4	Other information	Refer to enclosure ID 03	P
	Storage and disposal instructions		P
	Recommended charging instructions		P
10	PACKAGING AND TRANSPORT		
	Packaging for coin cells not small enough to fit within the limits of the ingestion gauge of Figure 3		N/A
	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	Refer to enclosure ID 04	P
ANNEX A	CHARGING AND DISCHARGING RANGE OF SECONDARY LITHIUM ION CELLS FOR SAFE USE		

IEC 62133-2			
Clause	Requirement + Test	Result - Remark	Verdict
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		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		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		P
A.4.3.1	General		P
A.4.3.2	Explanation of safety viewpoint		P
A.4.3.3	Safety considerations when specifying charging conditions in the high temperature range		P
A.4.3.4	Safety considerations when specifying a new upper limit in the high temperature range		P
A.4.4	Low temperature range		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 the low temperature range		P
A.4.4.4	Safety considerations when specifying a new lower limit in the low temperature range		P
A.4.5	Scope of the application of charging current		P
A.4.6	Consideration of discharge		P
A.4.6.1	General		P
A.4.6.2	Final discharge voltage and explanation of safety viewpoint		P
A.4.6.3	Discharge current and temperature range		P
A.4.6.4	Scope of application of the discharging current		P
A.5	Sample preparation		P
A.5.1	General		P

IEC 62133-2			
Clause	Requirement + Test	Result - Remark	Verdict
A.5.2	Insertion procedure for nickel particle to generate internal short		P
A.5.3	Disassembly of charged cell		P
A.5.4	Shape of nickel particle		P
A.5.5	Insertion of nickel particle in cylindrical cell		P
A.5.5.1	Insertion of nickel particle in winding core		P
A.5.5.2	Marking the position of the nickel particle on both ends of the winding core of the separator		P
A.5.6	Insertion of nickel particle in prismatic cell		N/A
A.6	Experimental procedure of the forced internal short-circuit test		P
A.6.1	Material and tools for preparation of nickel particle		P
A.6.2	Example of a nickel particle preparation procedure		P
A.6.3	Positioning (or placement) of a nickel particle		P
A.6.4	Damaged separator precaution		P
A.6.5	Caution for rewinding separator and electrode		P
A.6.6	Insulation film for preventing short-circuit		P
A.6.7	Caution when disassembling a cell		P
A.6.8	Protective equipment for safety		P
A.6.9	Caution in the case of fire during disassembling		P
A.6.10	Caution for the disassembling process and pressing the electrode core		P
A.6.11	Recommended specifications for the pressing device		P
ANNEX B	RECOMMENDATIONS TO EQUIPMENT MANUFACTURERS AND BATTERY ASSEMBLERS		N/A
ANNEX C	RECOMMENDATIONS TO THE END-USERS		N/A
ANNEX D	MEASUREMENT OF THE INTERNAL AC RESISTANCE FOR COIN CELLS		N/A
D.1	General		N/A
D.2	Method		N/A
	A sample size of three coin cells is required for this measurement	(See appended table D.2)	N/A
	Coin cells with an internal resistance of less than or equal to 3 Ω are subjected to the testing according to Clause 6 and Table 1		N/A
	Coin cells with an internal resistance greater than 3 Ω require no further testing		N/A

IEC 62133-2			
Clause	Requirement + Test	Result - Remark	Verdict
ANNEX E	PACKAGING AND TRANSPORT		N/A
ANNEX F	COMPONENT STANDARDS REFERENCES		N/A

IEC 62133-2			
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⁾
Cells					
- Case	--	--	Stainless Steel	--	--
- Electrolyte	--	--	Ethylene carbonate, ethyl methyl carbonate, fluorobenzene, di-methyl carbonate	--	--
- Separator	--	--	PE, PP, PP/PE/PP - SJ72-00XXXX# coated by ceramic	--	--
- Cathode	--	--	Lithium Nickel Cobalt Aluminium Oxide	--	--
- Anode	--	--	Carbon and PVDF or SBR	--	--
Supplementary information: ¹⁾ Provided evidence ensures the agreed level of compliance. See OD-CB2039.					

- X denotes a single alphanumeric character which is 0 thru 9 or A thru Z.

IEC 62133-2			
Clause	Requirement + Test	Result - Remark	Verdict

7.2.1	TABLE: Continuous charging at constant voltage (cells)				P
Sample no.	Recommended charging voltage Vc (Vdc)	Recommended charging current I _{rec} (A)	OCV before test (Vdc)	Results	
1143928-39	4.2	2.0	4.154	A	
1143928-40	4.2	2.0	4.155	A	
1143928-41	4.2	2.0	4.153	A	
1143928-42	4.2	2.0	4.155	A	
1143928-43	4.2	2.0	4.155	A	
Supplementary information: - No fire or explosion - No leakage - Others (please explain)					

7.3.1	TABLE: External short-circuit (cell)					P
Sample no.	Ambient T (°C)	OCV before test (Vdc)	Resistance of circuit (mΩ)	Maximum case temperature rise ΔT (K)	Results	
Samples charged at charging temperature upper limit: 55degC*						
1143928-21	55.1	4.15	81.43	53.5	A	
1143928-22	55.1	4.15	81.79	50.8	A	
1143928-23	55.1	4.15	79.84	51.8	A	
1143928-24	55.0	4.15	80.12	30.2	A	
1143928-25	55.0	4.14	82.46	56.9	A	
Samples charged at charging temperature lower limit: -5degC*						
1143928-26	55.2	4.14	81.43	30.6	A	
1143928-27	55.2	4.14	81.79	11.8	A	
1143928-28	55.1	4.14	79.84	53.5	A	
1143928-29	55.1	4.15	80.12	56.6	A	
1143928-30	55.1	4.14	82.46	55.5	A	
Supplementary information:						
A- No fire or explosion						
B- Others (please explain)						
* Preconditioning was conducted 55/-5degC as more severe condition.						

IEC 62133-2						
Clause	Requirement + Test			Result - Remark		Verdict
7.3.2	TABLE: External short-circuit (battery)					N/A
Sample no.	Ambient T (°C)	OCV before test (Vdc)	Resistance of circuit (mΩ)	Maximum case temperature rise ΔT (K)	Component single fault condition	Results
Supplementary information:						
- No fire or explosion						
- Others (please explain)						

7.3.5	TABLE: Crush (cells)				P
Sample no.	OCV before test (Vdc)	OCV at removal of crushing force (Vdc)	Maximum force applied to the cell during crush (kN)	Results	
Samples charged at charging temperature upper limit: 55degC*					
1143928-11	4.15	4.15	12796	A	
1143928-12	4.15	4.15	13054	A	
1143928-13	4.15	4.15	13186	A	
1143928-14	4.15	4.15	13270	A	
1143928-15	4.15	4.15	12640	A	
Samples charged at charging temperature lower limit: -5degC*					
1143928-16	4.14	4.14	12793	A	
1143928-17	4.14	4.14	13109	A	
1143928-18	4.14	4.14	12968	A	
1143928-19	4.14	4.14	13603	A	
1143928-20	4.14	4.14	13279	A	
Supplementary information: A- No fire or explosion B- Others (please explain) * Preconditioning was conducted 55/-5degC as more severe condition.					

IEC 62133-2			
Clause	Requirement + Test	Result - Remark	Verdict

7.3.6	TABLE: Over-charging of battery			N/A
Constant charging current (A)				—
Supply voltage (Vdc)				—
Sample no.	OCV before charging (Vdc)	Total charging time (minute)	Maximum outer case temperature (°C)	Results
Supplementary information: - No fire or explosion - Others (please explain)				

7.3.7	TABLE: Forced discharge (cells)			P
Sample no.	OCV before application of reverse charge (Vdc)	Measured reverse charge I_t (A)	Lower limit discharge voltage (Vdc)	Results
1143928-31	2.83	4.00	2.5	A
1143928-32	2.83	4.00	2.5	A
1143928-33	2.85	4.00	2.5	A
1143928-34	2.87	4.00	2.5	A
1143928-35	2.84	4.00	2.5	A
Supplementary information: A- No fire or explosion B- Others (please explain)				

7.3.8.1	TABLE: Vibration				N/A
Sample no.	OCV before test (Vdc)	OCV after test (Vdc)	Mass before test (g)	Mass after test (g)	Results
Supplementary information: - No fire or explosion - No rupture - No leakage - No venting - Others (please explain)					

IEC 62133-2					
Clause	Requirement + Test			Result - Remark	Verdict
7.3.8.2	TABLE: Mechanical shock				N/A
Sample no.	OCV before test (Vdc)	OCV after test (Vdc)	Mass before test (g)	Mass after test (g)	Results
Supplementary information: - No fire or explosion - No rupture - No leakage - No venting - Others (please explain)					

7.3.9	TABLE: Forced internal short circuit (cells)				P
Sample no.	Chamber ambient T (°C)	OCV before test (Vdc)	Particle location ¹⁾	Maximum applied pressure (N)	Results
Samples charged at charging temperature upper limit: 55degC*					
1143928-44	55.0	4.178	1	800	A
1143928-45	55.0	4.169	1	800	A
1143928-46	55.0	4.181	1	800	A
1143928-47	55.0	4.174	1	800	A
1143928-48	55.0	4.173	1	800	A
Samples charged at charging temperature lower limit: -5degC					
1143928-49	0.0	4.168	1	800	A
1143928-50	0.0	4.168	1	800	A
1143928-51	0.0	4.166	1	800	A
1143928-52	0.0	4.165	1	800	A
1143928-53	0.0	4.166	1	800	A
Supplementary information: ¹⁾ Identify one of the following: 1: Nickel particle inserted between positive and negative (active material) coated area. 2: Nickel particle inserted between positive aluminium foil and negative active material coated area. A - No fire or explosion B - Others (please explain) * Preconditioning was conducted 55 as more severe condition.					

IEC 62133-2				
Clause	Requirement + Test		Result - Remark	Verdict
D.2	TABLE: Internal AC resistance for coin cells			N/A
Sample no.	Ambient T (°C)	Store time (h)	Resistance Rac (Ω)	Results ¹⁾
Supplementary information: ¹⁾ Coin cells with internal resistance less than or equal to 3 Ω , see test result on corresponding tables				

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

Enclosure

Supplement ID	Description
01	Overview of Rechargeable Lithium ion Cell , Model : INR21700-40T++
02	Specification Sheet
03	Safety instruction
04	Package information

ID 01



ID 02

IMPORTANT TEST PARAMETERS:	
CELL:	
Cell Manufacturer	Samsung SDI Co Ltd
Cell Model	INR21700-40T++
Cell Type	Rechargeable Lithium Ion Cylindrical
PTC or other current/ thermal protection	N/A
Capacity	4000mAh
Standard Charging Current	2000mA
Standard Full Charging Voltage	4.2Vdc
End of Charging Current	200mA
Maximum Charging Current	6000mA
Maximum Charging Voltage	20Vdc
Standard Discharging Current	800 mA
End Point Voltage	2.5 Vdc
Maximum Discharge Current	35000mA
Charging Temperature Range	0~50°C
Discharging Temperature Range	-20~75°C
Upper Limit Charging Voltage	4.25Vdc
Upper charging Temp limit(T3)	50°C
Lower charging Temp limit(T2)	0°C

ID 03-1

Handling precaution and prohibitions of lithium ion rechargeable cells and batteries

Inaccurate handling of lithium ion and lithium ion polymer rechargeable battery may cause leakage, heat, smoke, an explosion, or fire.

This could cause deterioration of performance or failure. Please be sure to follow instructions carefully.

1.1 Storage

Store the battery at low temperature (below 25°C is recommended), low humidity, no dust and no corrosive gas atmosphere.

1.2 Safety precaution and prohibitions

To assure product safety, describe the following precautions in the instruction manual of the application.

[Danger!]**■ Electrical misuseage**

Use stipulated charger.

Use or charge the battery only in the stipulated application.

Don't charge the battery by an electric outlet directly or a cigarette lighter charger.

Don't charge the battery reversely.

■ Environmental misuseage

Don't leave the battery near the fire or a heated source.

Don't throw the battery into the fire.

Don't leave, charge or use the battery in a car or similar place where inside of temperature may be over 60°C.

Don't immerse, throw, wet the battery in water / sea water.

■ others

Don't fold the battery cased with laminated film such as pouch and polymer.

Don't store the battery in a pocket or a bag together with metallic objects such as keys, necklaces, hairpins, coins, or screws.

Don't short circuit (+) and (-) terminals with metallic object intentionally.

Don't pierce the battery with a sharp object such as a needle, screw drivers.

Don't heat partial area of the battery with heated objects such as soldering iron.

Don't hit with heavy objects such as a hammer, weight.

Don't step on the battery and throw or drop the battery on the hard floor to avoid mechanical shock.

Don't disassemble the battery or modify the battery design including electric circuit.

Don't solder on the battery directly.

Don't use seriously scared or deformed battery.

Don't put the battery into a microwave oven, dryer or high-pressure container.

ID 03-2

Don't use or assemble the battery with other makers' batteries, different types and/or models of batteries such as dry batteries, nickel-metal hydride batteries, or nickel-cadmium batteries.

Don't use or assemble old and new batteries together.

[Warning!]

Stop charging the battery if charging isn't completed within the specified time.

Stop using the battery if the battery becomes abnormally hot, or, discoloration, deformation, or abnormal conditions is detected during use, charge, or storage.

Keep away from fire immediately when leakage or foul odors are detected. If liquid leaks onto your skin or cloths, wash well with fresh water immediately.

If liquid leaking from the battery gets into your eyes, don't rub your eyes and wash them with clean water and go to see a doctor immediately.

If the terminals of the battery become dirty, wipe with a dry cloth before using the battery.

The battery can be used within the following temperature ranges. Don't exceed these ranges.

The operating temperature is based on the cell surface temperature in hottest position in pack.

Charge temperature ranges : 0℃ ~ 50℃

Discharge Temperature ranges : -20℃ ~ 75℃

Store the battery at temperature below 60℃

Cover terminals with proper insulating tape before disposal.

[Caution!]**■ Electrical misuseage**

Battery must be charged with constant current-constant voltage (CC/CV).

Charge current must be controlled by specified value in cell specification.

Cut-off voltage of charging must be less than 4.2 + 0.05V

Charger must stop charging battery by detecting either charging time or current specified in cell's specification.

Discharge current must be controlled by specified value in cell's specification.

Cut-off voltage of full discharging and recharging must be over 2.5V.

■ others

Keep the battery away from babies and children to avoid any accidents such as swallow.

If younger children use the battery, their guardians should explain the proper handling method and precaution before using.

Before using the battery, be sure to read the user's manual and precaution of it's handling.

Before using charger, be sure to read the user's manual of the charger.

ID 03-3

Before installing and removing the battery from application, be sure to read user's manual of the application.

Replace the battery when using time of battery becomes much shorter than usual.

Cover terminals with insulating tape before proper disposal.

If the battery is needed to be stored for an long period, battery should be removed from the application and stored in a place where humidity and temperature are low.

While the battery is charged, used and stored, keep it away from object materials with static electric chargers.

Safety handling procedure for the transporter**■ Quarantine**

Packages that are crushed, punctured or torn open to reveal contents should not be transported. Such packages should be isolated until the shipper has been consulted, provided instructions and, if appropriate, arranged to have the product inspected and repacked.

■ Spilled product

In the event that damage to packaging results in the release of cells or batteries, the spilled products should be promptly collected and segregated and the shipper should contact for instructions.

Design of positioning the battery pack in application and charger

To prevent the deterioration of the battery performance caused by heat, battery shall be positioned away from the area where heat is generated in the application and the charger.

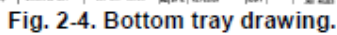
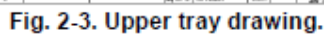
Design of the battery pack

Be sure adopting proper safe device such as PTC specified type or model in Cell Specification. If you intend to adopt different safety device which is not specified in Cell Specification, please contact Samsung SDI to investigate any potential safety problem.

Be sure designing 2nd protective devices such as PCM at the same time to protect cell just in case one protective device is fault.

Please contact following offices when you need any help including safety concerns.

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