Test Report issued under the responsibility of:

DEKRA

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. ..... :	4347912.50
Date of issue ..... :	2018-08-10
Total number of pages ..... :	Test report – 24 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 62133-2:2017
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

If this Test Report Form is used by non-IECEE members, the IECEE/IEC logo and the reference to the CB Scheme procedure shall be removed.

This report is not valid as a CB Test Report unless signed by an approved CB Testing Laboratory and appended to a CB Test Certificate issued by an NCB in accordance with IECEE 02.

General disclaimer:

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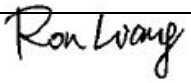
Test item description ..... :	Lithium-Ion Rechargeable Battery Cell
Trade Mark ..... :	SAMSUNG
Manufacturer ..... :	SAMSUNG SDI Co., LTD. 467, Beonyeong-ro, Seobuk-gu, Cheonan-si, Chungcheongnam-do 31086, Republic of Korea
Model/Type reference ..... :	INR18650-35E++ / INR19/66
Ratings ..... :	3.6 Vdc, 3400 mAh

Responsible Testing Laboratory (as applicable), testing procedure and testing location(s):			
☐	**CB Testing Laboratory:**		
Testing location/ address.....:			
Tested by (name, function, signature).....:			
Approved by (name, function, signature)...:			
☐	**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.....:		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	
☐	**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): N/A	
Summary of testing:	
Tests performed (name of test and test clause): - 7.2.1 – Continuous charging at constant voltage - 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 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 ☒ **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.

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Test item particulars.....:	Lithium-Ion Rechargeable Cell
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).....:	680 mA
Specified final voltage.....:	2.5 V
Upper limit charging voltage per cell.....:	4.25 V
Maximum charging current.....:	2000 mA
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.....:	23 July. 2018
Date (s) of performance of tests.....:	23 July. 2018 to 03 Aug. 2018

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.

This item is tested and compliance with the following standards:

IEC 62133-2:2017 and EN 62133-2:2017

Manufacturer's Declaration per sub-clause 4.2.5 of IECEE 02:

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.

4347912.50

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. :DEVELOPING ZONE OF YI XIAN PARK WUQING COUNTY 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 (TIANJIN) BATTERY CO., LTD. YAT-SEN SCIENTIFIC INDUSTRIAL PARK, WUQING DISTRICT, TIANJIN, P.R. CHINA

General product information and other remarks:

The Lithium-Ion Rechargeable Battery Cell (Model: INR18650-35E++) is only used by battery manufacturer and not intended to be used by end user.

IEC code INR19/66 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. 65.25 mm (H), diameter ø 18.5 mm and weight Max. 50.0 g.

For 7.1.2, Tests were conducted with charging temp. Upper limit (50 °C) and charging temp. Lower limit (-5 °C) by manufacturer’s request.

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**		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**		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**		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-circuit		N/A
5.6	**Assembly of cells into batteries**		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

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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**		P

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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	Factories were certified acc. to ISO 9001. 1. Samsung SDI Co., Ltd.: Certificate No. FM639667 Expired: 14/09/2018, by BSI 2. Tianjin Samsung SDI: Certificate No. FM672162 Expired: 21/03/2021, by BSI 3. Samsung SDIEM Certificate No. TS657980-002 Expired: 14/09/2018, by BSI 4. SAMSUNG (TIANJIN) BATTERY CO., LTD. Certificate No. CN16/10380 Expired: 15/09/2018, by SGS	P
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 ≤ 3 Ω (measured according annex D) are tested according table 1		N/A
	Unless otherwise specified, tests are carried out in an ambient temperature of 20 °C ± 5 °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 °C ± 5 °C, using the method declared by the manufacturer		P

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Clause	Requirement + Test	Result - Remark	Verdict
	Prior to charging, the battery have been discharged at 20 °C ± 5 °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
7.2	**Intended use**		P
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)		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**		P
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

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Clause	Requirement + Test	Result - Remark	Verdict
	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 °C	—
	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 ± 0,78 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		N/A
	Results: No fire. No explosion..... :	(See appended table 7.3.5)	P
7.3.6	Over-charging of battery		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

IEC 62133-2			
Clause	Requirement + Test	Result - Remark	Verdict
	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
	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	800 N	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		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	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, 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**		N/A
	The following warning language is to be provided with the information packaged with the small cells and batteries or equipment using them:		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	- 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
	Cells marked as specified in IEC 61960, except coin cells		N/A
	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	Cells used in the manufacture of the battery and need not to be marked.	P
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		N/A
9.3	**Caution for ingestion of small cells and batteries**		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**		P
	Storage and disposal instructions		P
	Recommended charging instructions		P

IEC 62133-2			
Clause	Requirement + Test	Result - Remark	Verdict
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	Document review, Package drawing	P
ANNEX A	**CHARGING AND DISCHARGING 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		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	4.25 V	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
A.4.3.2	Explanation of safety viewpoint		N/A
A.4.3.3	Safety considerations when specifying charging conditions in the high temperature range	Tested at 50 °C	N/A
A.4.3.4	Safety considerations when specifying a new upper limit in the high temperature range		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 the low temperature range	Tested at -5 °C	P
A.4.4.4	Safety considerations when specifying a new lower limit in the low temperature range		P

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

IEC 62133-2			
Clause	Requirement + Test	Result - Remark	Verdict
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
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)]**
Cell(Li-ion)	Samsung SDI	INR18650-35E++	3.6 V, 3400 mAh	-	-
- Electrolyte	-		Ethylene Carbonate, Ethylmethyl Carbonate, Diethyl Carbonate or Ethyl propionate	IEC 62133-2	Tested in appliance
- Separator	-	-	PE or PP/PE/PP	IEC 62133-2	Tested in appliance
- Anode	-	-	Graphite(Carbon)	IEC 62133-2	Tested in appliance
- Cathode	-	-	Lithium Nickel Cobalt Aluminium Oxide ($LiNiCoAlO_2$)	IEC 62133-2	Tested in appliance
Supplementary information: [1)] Provided evidence ensures the agreed level of compliance. See OD-CB2039.					

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} (mA)**	**OCV before test (Vdc)**	**Results**
INR18650-35E++	4.25	1700	4.18	A, B
INR18650-35E++	4.25	1700	4.18	A, B
INR18650-35E++	4.25	1700	4.18	A, B
INR18650-35E++	4.25	1700	4.18	A, B
INR18650-35E++	4.25	1700	4.18	A, B

Supplementary information:

A. No fire or explosion
B. No leakage
C. 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 (50 °C)					
INR18650-35E++	58.0 °C	4.24	0.08	72.1	A
INR18650-35E++	58.0 °C	4.24	0.08	87.8	A
INR18650-35E++	58.0 °C	4.24	0.08	89.3	A
INR18650-35E++	58.0 °C	4.24	0.08	81.7	A
INR18650-35E++	58.0 °C	4.24	0.08	88.8	A
Samples charged at charging temperature lower limit (-5 °C)					
INR18650-35E++	58.0 °C	4.13	0.08	41.9	A
INR18650-35E++	58.0 °C	4.13	0.08	46.0	A
INR18650-35E++	58.0 °C	4.13	0.08	52.2	A
INR18650-35E++	58.0 °C	4.13	0.08	54.5	A
INR18650-35E++	58.0 °C	4.13	0.08	48.4	A

Supplementary information:

A. No fire or explosion
B. Others (please explain)

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**

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

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 (50 °C)				
INR18650-35E++	4.23	4.23	13	A
INR18650-35E++	4.23	4.23	13	A
INR18650-35E++	4.23	4.23	13	A
INR18650-35E++	4.23	4.23	13	A
INR18650-35E++	4.23	4.23	13	A
Samples charged at charging temperature lower limit (-5 °C)				
INR18650-35E++	4.15	4.15	13	A
INR18650-35E++	4.15	4.15	13	A
INR18650-35E++	4.15	4.15	13	A
INR18650-35E++	4.15	4.15	13	A
INR18650-35E++	4.15	4.15	13	A

Supplementary information:

A. No fire or explosion

B. Others (please explain)

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

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

Sample no.	OCV before application of reverse charge (Vdc)	Measured reverse charge I_t (mA)	Lower limit discharge voltage (Vdc)	Results
INR18650-35E++	2.5	3400	-0.8	A
INR18650-35E++	2.5	3400	-0.8	A
INR18650-35E++	2.5	3400	-0.8	A
INR18650-35E++	2.5	3400	-0.8	A
INR18650-35E++	2.5	3400	-0.8	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)

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**

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

Samples charged at charging temperature upper limit					
INR18650-35E++	50	4.184	1	800	A
INR18650-35E++	50	4.185	1	800	A
INR18650-35E++	50	4.184	1	800	A
INR18650-35E++	50	4.185	1	800	A
INR18650-35E++	50	4.185	1	800	A
Samples charged at charging temperature lower limit					
INR18650-35E++	-5	4.151	1	800	A
INR18650-35E++	-5	4.151	1	800	A
INR18650-35E++	-5	4.152	1	800	A
INR18650-35E++	-5	4.151	1	800	A
INR18650-35E++	-5	4.151	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)

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
7.1.2	Second procedure	Temperature Controller	-30~200 ºC	2018.04.24	2019.04.24
7.2.1	Continuous charging at constant voltage (cells)	Power Supply	5 V, 6 A	2018.03.12	2019.03.12
7.2.2	Mould case stress	Oven	-40~75 ºC	2018.02.20	2019.02.20
7.3.1 7.3.2	External short circuit (cell) External short circuit (battery)	Temperature Controller	K1300 ºC	2018.02.02	2019.02.02
7.3.3	Free fall	Steel Ruler	L1000	2018.02.09	2019.02.09
7.3.4	Thermal abuse (cells)	Temperature Controller	K1300 ºC	2018.02.02	2019.02.02
7.3.5	Crushing of Cells [UN38.3] T6	Load battery	3 t	2017.09.22	2018.09.22
7.3.6 7.3.7	Over-charging of battery Forced discharge (cells) [UN38.3] T7 [UN38.3] T8	Power Supply	30 V, 20 A	2018.03.16	2019.03.16
7.3.5 7.3.9	Design evaluation – Forced internal short circuit (cells)	Crush tester	0~30000 N	2017.09.22	2018.09.22
7.3.5 7.3.9	Design evaluation – Forced internal short circuit (cells)	DATA acquisition	0~10 V / -10~400 ºC	2018.06.21	2019.06.21
All	All	Temp Humidity Recorder	-20 ~ 50 ºC, 20 ~ 90 %RH	2017.09.10	2018.09.10
All	All	Digital Multimeter	1000 V, 10 A	2017.11.08	2018.11.08
All	All	Termoelectric Temperature Record	(-200 ~ 1370) ºC, 0.1 ºC, K	2017.11.20	2018.11.20
All	All	Balance	(0 ~ 10000) g, 2 g	2018.02.14	2019.02.14
All	All	Ohmmeter	0 mΩ ~ 300 mΩ / 0 Ω ~ 30 Ω	2017.08.14	2018.08.14

Photographs- front view & Rear view

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