Revision of the Ministerial Ordinance for Determining Technical Standards for Electrical Appliances
(Lithium Ion Secondary Batteries)

Attached Table 9　Lithium ion secondary batteries
1.　Basic design
(1) Insulation and wiring
a) The insulation　resistance between the positive terminal and a metal surface (excluding electrical contact surfaces and electrical parts having the same potential as the electrode potential of the battery) exposed to outside the battery, and which, as mounted on the equipment, may be touched by a human, shall be 5 MΩ or more at 500 VDC.
b) Internal wiring and its insulation shall sufficiently withstand anticipated maximum current, maximum voltage, and maximum temperature.
c) Equipment having connection terminals shall be wired to maintain an appropriate clearance and creepage distance between terminals.

(2) Inner pressure reduction mechanism
a) Battery cases and cells shall be designed with a gas release mechanism, or shall be designed to reduce excessive internal pressure when the equipment reaches a value or rate set so as to protect against explosion or fire.
b) If support material is used to fix cells within the battery case, the type of support material and method of fixing cells shall not inhibit pressure relief, and the battery shall not induce overheating during normal use of the battery.

(3) Temperature ~~or~~ and current management
The battery shall be designed so that abnormal temperature-rise conditions are prevented. Provided that this does not apply if a current limiter is installed outside the battery to control abnormal temperature-rise during charging and discharging within a safety level.

(4) Terminal contacts
a) The battery shall be marked positive (+) or negative (-) for terminals on its external surface or be designed with no fear of misconnection.
b) Batteries having a terminal contact plate shall be sized and shaped to ensure the flow of maximum current anticipated.
c) Batteries having a terminal contact plate shall be designed so that the surface of the terminal contact plate will be a conductive material with good mechanical strength and corrosion resistance.　Moreover, the terminal contact plate shall be arranged to minimize the risk of short circuits. .

(5) Assembly of cells into a battery
Batteries made of series connected cell blocks shall be designed so that cells are assembled to make the cell blocks the same capacity, and cell polarity reversal is prevented. Provided that this does not apply to the battery controlled by itself or the equipment as cell polarity reversal is prevented.

2.　Intended use
In the tests mentioned below, the number and test ambient temperature of cells or batteries to be tested shall be as per Annex Table 1-1.　Provided that these tests can be handled by using an equivalent or severer test method.　Moreover, if the battery structure has been partially modified and the test results before the change can be used instead, no further tests are required on that particular part.

(1) Continuous charging at constant voltage
Cells charged under the conditions specified in Annex Table 1-2 (hereafter called "the charged cells") shall not fire, explode, or leak after being charged at constant voltage for 28 days.

(2) Vibration
Cells and batteries charged under the conditions specified in Annex Table 1-2 (hereafter called "the charged cells or batteries") shall not fire, explode, or leak when tested under the following test conditions:

a) A simple harmonic motion with an amplitude of 0.76 mm and a total maximum excursion of 1.52 mm shall be applied to the charged cells.

b) The frequency shall be increased at a rate of 1 Hz/minute from 10 Hz and reduced at a rate of 1 Hz/minute after it reaches 55 Hz, and then it shall be ensured that the frequency has reached 10 Hz.

c) The entire range of frequency (10 Hz to 55 Hz) shall be tested for 90 ± 5 minutes in each of the three mutually perpendicular directions of vibration (X, Y, and Z axes).

d) The vibration shall be applied in each of mutually perpendicular direction (X, Y, an Z axes) in the sequence specified below according to conditions a) to c)　Provided that the order of steps 2 to 4 can be changed.

Step 1: Ensure that the measured voltages of charged cells or batteries are the voltages after charging.

From steps 2 to 4: Apply vibration as specified in Table 1.

Step 5: Leave the charged cells or batteries for one hour, and then conduct a visual inspection.

Table 1　Conditions for vibration testing

Step	Direction of vibration	Range of frequency	Vibration time (min)	Storage time (h)	Visual inspection
1	－	－	－	－	Conduct inspection before the test.
2	X-axis direction	10Hz～55Hz	90±5	－	－
3	Y-axis direction	10Hz～55Hz	90±5	－	－
4	Z-axis direction	10Hz～55Hz	90±5	－	－

5	—	—	—	1	Conduct inspection after the test.

(3) Battery enclosure test at high ambient temperature
A battery charged under conditions specified in Annex Table 1-2 (hereafter called "the charged battery") shall be left in an air circulating oven at 70 ± 2°C for seven hours. Then the battery shall be removed from the air circulating oven and the temperature of the battery case shall be returned back to 20 ± 5°C. At that time, said case shall not undergo deformation that exposes the internal contents.

(4) Temperature cycling
Charged cells or batteries shall not fire, explode, or leak when tested under the following test conditions:
a) The charged cells or batteries shall be left in a thermostatic oven.
b) The inner temperature of the thermostatic oven, the time it is to be left as is, and the test procedure shall be as follows:

Step 1:Leave the charged cells or batteries at 75 ± 2°C for four hours.

Step 2: Change the temperature to 20 ± 5°C within 30 minutes and left the equipment for at least two hours.

Step 3: Change the temperature to – (minus) 20 ± 2°C within 30 minutes and the equipment shall be left for four hours.

Step 4: Change the temperature to 20 ± 5°C within 30 minutes and left the equipment for at least two hours.

Step 5: Steps 1 to 4 repeat another four times.

Step 6: Store the charged cells at 20 ± 5°C for seven days, and then conduct a visual inspection.

3. Reasonably foreseeable misuse
In tests specified below, the number and test ambient temperature of cells or batteries to be tested shall be as per Annex Table 1-1. Provided that these tests can be conducted by using an equivalent or severer test method. Moreover, if the battery structure has been partially modified and the test results before the change can be used instead, no further tests are required on that particular part.

(1) External short circuit
Shall conform to a) and b) below.

a) The charged cell shall be left at an ambient temperature of 55 ± 5°C. With the positive and negative terminals short-circuited via connection to a total external resistance of 80 ± 20 mΩ, the battery shall be left for 24 hours or until the difference between the surface temperature of the charged cell and the ambient temperature becomes not more than 20%

of the maximum difference (whichever is the sooner), and the battery shall not fire or explode.

b) The charged battery shall be left at an ambient temperature of 20 ± 5°C. With the positive and negative terminals short-circuited via connection to a total external resistance of 80 ± 20 mΩ, the battery shall be left for 24 hours or until the difference between the temperature of the battery container and the ambient temperature becomes not more than 20% of the maximum difference (whichever is the sooner ; if the battery incorporates a protective device or protective circuit and the current has stopped, then for one hour after the current stopped), and the battery shall not fire or explode.

(2) Free fall
When the charged cell or battery is dropped three times from a level of 1,000 mm onto a concrete floor in a random direction, the battery shall not fire or explode. Provided that this does not apply to charged batteries weighing more than 7 kg.

(3) Mechanical shock (crash hazard)
Charged cells and batteries shall not fire, explode, or leak when tested under the following test conditions:
a) The charged cell or battery shall be secured to on an impact testing machine by means of a rigid mount. Then shock of the equal magnitude shall be applied to the battery in each of three mutually perpendicular directions (X, Y, and Z axes).
b) The shock applied to the charged cell or battery shall be accelerated so that the minimum average acceleration will be 735 m/s^2 during the first 3 ms. The peak acceleration shall be between 1,228 m/s^2 and 1,716 m/s^2.

(4) Thermal abuse
The charged cell at 20 ± 5°C shall be placed in a gravity or circulating air-convention oven. The oven temperature shall then be increased to 130 ± 2°C at a rate of 5 ± 2°C/min., left for 10 minutes, and then the battery shall not fire or explode.

(5) Crushing of cells
The charged cells shall not fire or explode when tested under the following test conditions:
a) A charged cell shall be placed between two flat surfaces and a force of 13 ± 1 kN shall be applied by a crushing apparatus.
b) The force shall be released when any of the following occurs: (1) the maximum force is applied, (2) an abrupt voltage drop of one-third of the original voltage has been obtained, or (3) there is 10% deformation of the battery height.
c) Force shall be applied to charged cells so that the longitudinal axis of the cells becomes parallel with the flat surface of the crushing apparatus For charged cells that are prismatic (hereafter called "the prismatic cells"), a similar test shall be performed by rotating a cell 90°around its longitudinal axis and it shall be ensured that force is applied to both the wide and narrow sides of the prismatic cells. At that time, one sample shall receive force in a single direction.

(6) Low pressure
A charged cell shall be placed in a vacuum chamber, the chamber shall be closed, and then the chamber shall be gradually reduced to a pressure equal to or less than 11.6 kPa. After being kept in that pressure of the value in the vacuum chamber for six hours, the cell shall not fire, explode, or leak.

(7) Overcharge

The cell discharged under the conditions specified in Annex Table 1-2 (including cells equipped with a protective device for use in equipment or batteries; hereafter called "the discharged cells") shall be provided. Then by using a power supply of not less than 10V, the battery shall be energized until it reaches 250% of the rated capacity or the test voltage with the designed charging current, and the battery shall not fire or explode.

(8) Forced discharge
When polarity reversely charged at 1 ItA for 90 minutes, the discharged cell shall not fire or explode.

(9) Cell protection against a high charging rate
The discharged cells shall not fire or explode when charged at a current three times the designed charging current, thereby fully charging it, or when a protective device used in the equipment or battery cuts off the charge current.

(10)Forced internal short circuit of cells
The winding core of a charged cell (except for those whose electrolyte is not liquid) shall not fire when tested according to the test procedure specified below. Note that each test shall use a new sample.

Step 1: At an ambient temperature of 20 ± 5°C and the dew point of -25°C or below, the sample charged cell shall be dismantled and the winding core shall be removed from the charged cell enclosure. Then a small L-shaped piece of metallic nickel (0.2-mm high by 0.1-mm wide, with each side 1-mm long) shall be inserted between the positive active material and negative active material as laid out in Table 2. If uncoated current collector of positive electrode is faced an active material coated negative electrode, said position shall be tested as well. Provided that, if inserting a small piece of metallic nickel as laid out in Table 2 makes the test difficult, then it is permissible to use a pressing jig as shown in Table 2, laid out so that pressure can be applied with the winding core in contact with the center of the inserted part of the small piece of metallic nickel.

Step 2: After inserting the small piece, the winding core shall be reassembled to its original form, and sealed into a bag without permeability of electrolyte vapors. The time period between dismantling of the charged cell and closing of the bag shall be within 30 minutes.

Step 3: The closed bag containing the winding core shall be stored for 45 ± 15 minutes at each the highest test temperature and the lowest test temperature specified in Annex Table 1-2. Then the winding core shall be taken out from the bag.

Step 4: Immediately after taking out the winding core from the bag, a pressing jig as shown in Table 2 shall touch on the winding core, where said small piece of metallic nickel is inserted, and the pressing jig shall be lowered at a rate of 0.1mm/second at the highest and the lowest test temperatures specified in Annex Table 1-2.

Step 5: The lowering of the pressing jig shall be stopped when a voltage drop of over 50 mV is obtained or the pressure reaches 800 N (whichever occurs earlier). Provided that, for prismatic cells, the lowering of the pressing jig shall be stopped when the pressure reaches 400 N.

Step 6: The test shall be conducted from steps 1 to 5 until five samples prove to have undergone a voltage drop. Provided that there is a maximum number of ten test samples.

Table ~~1~~ 2　Position of insertion in forced internal short circuit test and usage of pressing jig

Position of the insertion : between the positive active material and negative active material	An L-shaped angle shall be placed in the windup direction 20 mm from the edge coated with positive active material on the external circumference of the electrode and between the positive active substance in the middle of the widthwise direction on one hand, and the separator on the other.　If some aluminum foil is exposed from the part coated with positive active material , the exposed part of aluminum foil shall be removed at the boundary.　For prismatic cells, however, the L-shaped angle shall be placed in the windup direction at the center of the plane between the positive active material or negative active material at the external circumference on one hand, and the separator on the other.
Position of the insertion : between the uncoated current collector of positive electrode and the active material coated negative electrode	If there is a plane where the exposed portion of aluminum foil at the external circumference opposes the negative active material, an L-shaped angle shall be placed in the windup direction 1 mm from the edge coated with positive active material at the external circumference of the electrode and between the exposed aluminum foil in the middle of the widthwise direction on one hand, and the separator on the other.　However, for cylindrical cells containing some portion of exposed aluminum foil, a 10-mm exposed portion of aluminum foil shall be left at the boundary and the rest shall be removed.
Pressing jig	A 10-mm square pillar shall be covered with nitrile rubber 2-mm thick on the contact surface.　For prismatic cells, a piece of acrylic resin of 5 mm by 5 mm and 2-mm thick shall be attached on the contact surface.

(11) Function of the overcharge protection of batteries
When tested at an ambient temperature of 20 ± 5°C by using any method specified below, the cell block in the battery shall not exceed the upper limited charging voltage specified in Annex Table 1-2.

a) For batteries made of a one cell block, the voltage applied to the cell block during charging shall be measured.
b) For batteries consisting of a series of two pieces or more of cell blocks, it shall be charged while measuring the voltage of each cell block and at the same time, one cell block shall forcibly be discharged and the voltages of the other cell blocks shall gradually be measured.

c) For batteries consisting of a series of connection of two pieces or more of cell blocks, a voltage exceeding the upper limited charging voltage specified in Annex Table 1-2 shall be applied to the cell block while measuring the voltage of each cell block.　When the charging stops, the voltage shall be measured.

(12) Free fall of appliance
The charged batteries shall not undergo short-circuiting when tested under the conditions specified below.
At an ambient temperature of 20 ± 5°C, according to the appliance specified in the left field of Table 3, the charged battery shall be installed in appliance to be used, and shall be dropped once onto a concrete floor or iron plate in a direction considered to most likely affect the battery in a negative manner Otherwise, an equivalent load shall be applied to said battery. However, this does not apply to portable appliance including battery weighing more than 7 kg or desktop appliance (excluding for appliance that may be carried around) weighing more than 5 kg including battery.

Table 3 Heights in free fall testing

<table>
<tr><td>Equipment tested</td><td colspan="2">Height in drop testing</td></tr>
<tr><td>Portable appliance weighing not more than 7 kg and desktop appliance weighing not more than 5 kg within the scope of JIS C 6950 (2006) (excluding such appliance that may be portable)</td><td colspan="2">Drop height specified in JIS C 6950 (2006), 4.2.6</td></tr>
<tr><td>Portable appliance weighing not more than 7 kg within the scope of JIS C 6065 (2007)</td><td colspan="2">Drop height specified in JIS C 6050 (2006), 12.1.4</td></tr>
<tr><td rowspan="2">Portable appliance and desktop appliance other than mentioned above (excluding for such appliance that may be carried portable)</td><td>Portable appliance</td><td>1000mm</td></tr>
<tr><td>Desktop appliance (excluding such appliance that may be portable)</td><td>750mm</td></tr>
</table>

4. Labeling
Labeling shall be provided as specified in Annex Table 2.

Remarks: The codes used in this table shall have the following meanings:

V: volt
MΩ: megohm
mm: millimeter
Hz: Hertz
min: minute
h: hour
° C: degree of temperature
%: percent
mΩ: milliohm
kg: kilogram
ms: millisecond
m/s²: meter per square second
kN: kiloneuton
A: ampere

mV: millivolt

Annex table 1　Test conditions for lithium ion secondary cells and batteries

Table 1　Test item, charge temperature, test temperature, and quantity tested

Test item	Cell			Battery		
	Charge temperature	Test temperature	Quantity tested	Charge temperature	Test temperature	Quantity tested
Continuous low-rate charging	20±5 ℃	Highest test temperature	5	—	—	—
Vibration	20±5 ℃	20±5 ℃	5	20±5 ℃	20±5 ℃	5
Battery enclosure test at high ambient temperature	—	—	—	20±5 ℃	70±2 ℃	3
Temperature cycling	20±5 ℃	—	5	20±5 ℃	—	5
External short circuit	Highest test temperature	55±5 ℃	5	Highest test temperature	20±5 ℃	5
	Lowest test temperature	55±5 ℃	5	Lowest test temperature	20±5 ℃	5
Free fall	20±5 ℃	20±5 ℃	3	20±5 ℃	20±5 ℃	3
Mechanical shock (crash hazard)	20±5 ℃	20±5 ℃	5	20±5 ℃	20±5 ℃	5
Thermal abuse	Highest test temperature	130±2 ℃	5	—	—	—
	Lowest test temperature	130±2 ℃	5	—	—	—
Crushing of cells	Highest test temperature	Highest test temperature	5 Provided that, for prismatic cells, five are to be tested for wide sides and five for narrow sides.	—	—	—
	Lowest test temperature	Lowest test temperature	5 Provided that, for prismatic cells, five are to be			

			tested for wide sides and five for narrow sides.	—	—	—
Low pressure	20±5 ℃	—	3	—	—	—
Overcharge	—	Highest test temperature	5	—	—	—
	—	Lowest test temperature	5	—	—	—
Forced discharge	—	Highest test temperature	5	—	—	—
	—	Lowest test temperature	5	—	—	—
Cell protection against a high charging rate	—	Highest test temperature	5	—	—	—
	—	Lowest test temperature	5	—	—	—
Forced internal short circuit of cells	Highest test temperature	Highest test temperature	5	—	—	—
	Lowest test temperature	Lowest test temperature	5	—	—	—
Function of the overcharge protection of batteries	—	—	—	—	20±5 ℃	1
Free fall of appliance	—	—	—	20±5 ℃	20±5 ℃	3

Table 2　Charge procedure for testing

Charge procedure	When a test is to be conducted on a cell or battery charged at a charge temperature of 20 ± 5°C, the cell or the battery shall be charged to a fully charged state by using the designed method at an ambient temperature of 20 ± 5°C.　Other tests

	on cells shall be conducted by using cells which, unless otherwise specified, are stabilized for a period of one to four hours at the highest and the lowest test temperatures specified below, and then tested at the upper limited charging voltage and the maximum charging current until the current reaches 0.05 ItA when controlled for constant-voltage charging. Tests on batteries shall be conducted by using charged batteries at an ambient temperature at the highest and the lowest test temperatures specified below until the batteries reach the design fully charged state of the batteries or equipment. Provided that, prior to charging, cells and batteries shall be used after having been discharged to a designed final voltage, at an ambient temperature of 20 ± 5°C and at a constant current of 0.2 ItA.
Upper limited charging voltage	4.25V
Maximum charging current	Designed value
Highest test temperature	45℃
Lowest test temperature	10℃

Remarks
1. ItA shall be expressed in the following formula [see IEC 61434 (1996)]: ItA = C5Ah/1 h.
2. Supporting documents complying with the procedure specified in JIS C 8714 (2007), Supplement B shall be stored.
3. If an upper limited charging voltage having a value other than listed in Table 2 is newly used, one shall store supporting documents regarding voltage changes complying with the procedure specified in JIS C 8714 (2007), Supplement B, and use said value as the upper limited charging voltage.
4. When a highest or a lowest test temperature having a value other than listed in Table 2 is newly used, supporting documents regarding temperature changes shall be stored complying with said procedure and said value can be stored as the highest or lowest test temperature according to JIS C 8714 (2007), Supplement B, "Procedure of the decision of new charging condition and the adoption of new model."

Annex table 2 Method of labeling electrical appliances

Electrical appliance	Method of labeling	
	Item to be indicated	Method of labeling
Lithium ion secondary batteries	1. Rated voltage (batteries) 2. Rated capacity (batteries)	A method shall be used to provide labeling on a surface where it can easily be seen but not easily faded. This may be omitted if such surface labeling proves difficult, and another method can be utilized to provide labeling that will not easily fade on the surface where it is easy to see.

Supplementary rules
[Date of enforcement]
Article 1　This ministerial ordinance will come into effect on the date of enforcement (November 20, 2008) of the Law for Revising Part of the Electrical Appliance and Material Safety Law (Law No. 116 of 2007).

[Transitory measures]
Article 2　Regulations (11) and (12) of Attached Table 9-3 of the Ministerial Ordinance for Determining Technical Standards for Electrical Appliances revised according to said ministerial ordinance will not be applied for three years after the date this ministerial ordinance came into effect.

2.　For three years after the date of enforcement of this ministerial ordinance, Annex Tables 1-1 and 1-2 of Attached Table 9 of the Ministerial Ordinance for Determining Technical Standards for Electrical Appliances revised according to said ministerial ordinance may be applied under the test conditions specified in Attached Tables 1 and 2 in the Supplementary Rules.　Provided that, this shall not apply to (1), (4), or (5) of Attached Table 9-3 regarding Lithium Ion Secondary Cells and Batteries for Portable Electronic Applications and Others.

Attached Table 1 in the Supplementary Rules

Test item	Cell			Battery		
	Charge temperature	Test temperature	Quantity tested	Charge temperature	Test temperature	Quantity tested
Continuous low-rate charging	20±5 ℃	20±5 ℃	5	—	—	—
External short circuit	20±5 ℃	55±5 ℃	5	20±5 ℃	20±5 ℃	5
Thermal abuse	20±5 ℃	130±2 ℃	5	—	—	—
Crushing of cells	20±5 ℃	20±5 ℃	5 Provided that, for prismatic cells, five are to be tested for wide sides and five for narrow sides.	—	—	—
Overcharge	—	20±5 ℃	5	—	—	—
Forced discharge	—	20±5 ℃	5	—	—	—
Cell protection against a high	—	20±5 ℃	5	—	—	—

charging rate						

Attached Table 2 in the Supplementary Rules

Charge procedure	For the purpose of this standard, unless otherwise specified, tests shall be conducted by using cells and batteries charged to a fully charged state by using a designed method at an ambient temperature of 20 ± 5°C. Provided that, prior to charging, cells and batteries shall be used after having been discharged to a designed final voltage, at an ambient temperature of 20 ± 5°C and at a constant current of 0.2 ItA. Note: 1. ItA shall be expressed in the following formula [see IEC 61434 (1996)]: ItA = C5Ah/1 h.