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Certification

C190111-9

model name : CR2032			
<input checked="" type="checkbox"/> Lithium metal cell or battery		<input type="checkbox"/> Lithium-ion cell or battery	
Lithium content		Watt-hour rating	
<input checked="" type="checkbox"/> cell	<input type="checkbox"/> battery(pack)	<input type="checkbox"/> cell	<input type="checkbox"/> battery(pack)
<input checked="" type="checkbox"/> $\leq 0.3g$	<input type="checkbox"/> $\leq 0.3g$	<input type="checkbox"/> $\leq 2.7Wh$	<input type="checkbox"/> $\leq 2.7Wh$
<input type="checkbox"/> $\leq 1g$	<input type="checkbox"/> $\leq 2g$	<input type="checkbox"/> $\leq 20Wh$	<input type="checkbox"/> $\leq 100Wh$
<input type="checkbox"/> $> 1g$	<input type="checkbox"/> $> 2g$	<input type="checkbox"/> $> 20Wh$	<input type="checkbox"/> $> 100Wh$
		Nominal Voltage	V
		Rated Capacity	mAh

Transport tests and results

Test number	Designation	Results	Remarks
T-1	Altitude	Accepted	
T-2	Thermal cycling	Accepted	
T-3	Vibration	Accepted	
T-4	Shock	Accepted	
T-5	External short circuit	Accepted	
T-6	Crush	Accepted	
T-7	Overcharge	Not applicable	for rechargeable battery only
T-8	Forced Discharge	Accepted	

We certify that above results are confirmed in accordance with the Manual of Tests and Criteria of the UN Recommendations on the Transport of Dangerous Goods(5th revised edition Amendment2), Part III, sub-section 38.3

Name / Title of Signatory

Takashi Kimura / Senior Manager, MD Design Dept.




Signature

January 11, 2019




Test No.	C-1804-1										
Test	T.1: Altitude simulation										
Item (Status)	CR2032 (Undischarged)					Approved by	Checked by	Prepared by			
Place	Safety test house			Equipment No.	P-23-01		Type	Li content			
Number of test specimen		10					Cell or Battery	0.07 g			
Performed by		Koya Nakatani									
Time and temperature	Test time	Start	2018/4/5 9:15		Finish	2018/4/5 15:15					
	Temperature		20.3°C			20.5°C					
	Observe time	Start	2018/4/5 15:15		Finish	2018/4/5 16:16					
	Temperature		20.3°C			20.3°C					
Test procedure											
Test cells and batteries shall be stored at a pressure of 11.6 kPa or less for at least 6 hours at ambient temperature (20 ± 5 °C).											
Requirements											
There is no leakage (no mass loss), no venting, no disassembly, no rupture and no fire. The open circuit voltage of each test cell or battery after testing is not less than 90% of its voltage immediately prior to this procedure.											
Test result											
No.		1	2	3	4	5	6	7	8	9	10
Lot No.		18-03	18-03	18-03	18-03	18-03	18-03	18-03	18-03	18-03	18-03
Test condition		Test time 6 hr Pressure: Less than 11.6kPa									
Voltage	Pre-test(V ₁) [V]	3.271	3.266	3.261	3.256	3.264	3.269	3.255	3.264	3.267	3.271
	After-test(V ₂) [V]	3.262	3.253	3.239	3.270	3.234	3.257	3.258	3.258	3.263	3.250
	Change rate*1 [%]	100	100	99	100	99	100	100	100	100	99
Mass	Pre-test(M ₁) [g]	2.978	2.973	2.977	2.990	3.002	2.980	2.973	2.958	2.974	2.975
	After-test(M ₂) [g]	2.978	2.973	2.977	2.990	3.002	2.980	2.973	2.958	2.974	2.975
	Mass loss*2 [%]	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
After-test Status	Leakage	N.L.	N.L.	N.L.	N.L.	N.L.	N.L.	N.L.	N.L.	N.L.	N.L.
	Venting	N.V.	N.V.	N.V.	N.V.	N.V.	N.V.	N.V.	N.V.	N.V.	N.V.
	Disassembly	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
	Rupture	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
	Fire	N.F.	N.F.	N.F.	N.F.	N.F.	N.F.	N.F.	N.F.	N.F.	N.F.
*1: Change rate[%]=V ₂ /V ₁ x 100 Limit Change rate: 90%		*2: Mass loss[%]=(M ₁ -M ₂)/M ₁ x 100									
		Mass M of cell or battery					Mass loss limit				
		M < 1g					0.5%				
		1g ≤ M ≤ 75g					0.2%				
		M > 75g					0.1%				

Test No.	C-1804-1										
Test	T.1: Altitude simulation										
Item (Status)	CR2032 (Fully discharged)					Approved by	Checked by	Prepared by			
Place	Safety test house			Equipment No.	P-23-01		Type	Li content			
Number of test specimen		10					Cell or Battery	0.07 g			
Performed by		Koya Nakatani									
Time and temperature	Test time	Start	2018/4/5 9:15		Finish	2018/4/5 15:15					
	Temperature		20.3°C			20.5°C					
	Observe time	Start	2018/4/5 15:15		Finish	2018/4/5 16:16					
	Temperature		20.3°C			20.3°C					
Test procedure											
Test cells and batteries shall be stored at a pressure of 11.6 kPa or less for at least 6 hours at ambient temperature (20 ± 5 °C).											
Requirements											
There is no leakage (no mass loss), no venting, no disassembly, no rupture and no fire.											
Test result											
No.		1	2	3	4	5	6	7	8	9	10
Lot No.		18-03	18-03	18-03	18-03	18-03	18-03	18-03	18-03	18-03	18-03
Test condition		Test time 6 hr Pressure: Less than 11.6kPa									
Voltage	Pre-test(V ₁) [V]	-	-	-	-	-	-	-	-	-	-
	After-test(V ₂) [V]	-	-	-	-	-	-	-	-	-	-
	Change rate ^{*1} [%]	-	-	-	-	-	-	-	-	-	-
Mass	Pre-test(M ₁) [g]	2.997	2.964	2.982	3.002	2.970	2.944	2.995	3.005	2.989	2.982
	After-test(M ₂) [g]	2.997	2.964	2.982	3.002	2.970	2.944	2.995	3.005	2.989	2.982
	Mass loss ^{*2} [%]	-0.01	0.00	0.00	0.01	0.00	-0.01	0.00	0.00	0.00	0.00
After-test Status	Leakage	N.L.	N.L.	N.L.	N.L.	N.L.	N.L.	N.L.	N.L.	N.L.	N.L.
	Venting	N.V.	N.V.	N.V.	N.V.	N.V.	N.V.	N.V.	N.V.	N.V.	N.V.
	Disassembly	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
	Rupture	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
	Fire	N.F.	N.F.	N.F.	N.F.	N.F.	N.F.	N.F.	N.F.	N.F.	N.F.
*1: Change rate[%]=V ₂ /V ₁ x 100 Limit Change rate: 90%		*2: Mass loss[%]=(M ₁ -M ₂)/M ₁ x 100									
		Mass M of cell or battery					Mass loss limit				
		M < 1g					0.5%				
		1g ≤ M ≤ 75g					0.2%				
		M > 75g					0.1%				

Test No.	C-1804-1										
Test	T.2: Thermal test										
Item (Status)	CR2032 (Undischarged)				Approved by 		Checked by 		Prepared by 		
	Place	Safety test house		Equipment No.	A-02-01		Type	Li content			
Number of test specimen		10					Cell or Battery		0.07g		
Performed by		Koya Nakatani									
Time and temperature	Test time	Start	2018/4/6 13:00		Finish	2018/4/11 18:00					
	Temperature		-			-					
	Observe time	Start	2018/4/11 18:00		Finish	2018/4/12 18:45					
	Temperature		21.2°C			21.2°C					
Test procedure											
<p>Test cells and batteries are to be stored for at least 6 hours at a test temperature equal to $72 \pm 2^\circ\text{C}$, followed by storage for at least 6 hours at a test temperature equal to $-40 \pm 2^\circ\text{C}$. The maximum time interval between test temperature extremes is 30 minutes. This procedure is to be repeated until 10 total cycles are complete, after which all test cells and batteries are to be stored for 24 hours at ambient temperature ($20 \pm 5^\circ\text{C}$).</p>											
Requirements											
<p>There is no leakage (no mass loss), no venting, no disassembly, no rupture and no fire. The open circuit voltage of each test cell or battery after testing is not less than 90% of its voltage immediately prior to this procedure.</p>											
Test result											
No.		1	2	3	4	5	6	7	8	9	10
Lot No.		18-03	18-03	18-03	18-03	18-03	18-03	18-03	18-03	18-03	18-03
Test condition		Setting temperature: $72^\circ\text{C}/-40^\circ\text{C}$ Setting time: 6h Setting cycle:10									
Voltage	Pre-test(V_1) [V]	3.264	3.260	3.262	3.268	3.264	3.271	3.254	3.270	3.272	3.266
	After-test(V_2) [V]	3.265	3.261	3.264	3.263	3.265	3.271	3.265	3.267	3.264	3.264
	Change rate*1 [%]	100	100	100	100	100	100	100	100	100	100
Mass	Pre-test(M_1) [g]	2.973	2.976	2.998	2.952	2.978	2.961	2.989	2.973	2.987	2.992
	After-test(M_2) [g]	2.973	2.976	2.998	2.952	2.978	2.962	2.989	2.973	2.987	2.992
	Mass loss*2 [%]	0.00	0.00	0.01	0.00	0.00	-0.01	0.00	0.00	0.00	0.00
After-test Status	Leakage	N.L.	N.L.	N.L.	N.L.	N.L.	N.L.	N.L.	N.L.	N.L.	N.L.
	Venting	N.V.	N.V.	N.V.	N.V.	N.V.	N.V.	N.V.	N.V.	N.V.	N.V.
	Disassembly	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
	Rupture	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
	Fire	N.F.	N.F.	N.F.	N.F.	N.F.	N.F.	N.F.	N.F.	N.F.	N.F.
*1: Change rate[%]= $V_2/V_1 \times 100$ Limit Change rate: 90%		*2: Mass loss[%]= $(M_1-M_2)/M_1 \times 100$									
		Mass M of cell or battery					Mass loss limit				
		M < 1g					0.5%				
		1g ≤ M ≤ 75g					0.2%				
		M > 75g					0.1%				

Test No.	C-1804-1										
Test	T.2: Thermal test										
Item (Status)	CR2032 (Fully discharged)					Approved by	Checked by	Prepared by			
											
Place	Safety test house			Equipment No.	A-02-01		Type	Li content			
Number of test specimen		10					Cell or Battery	0.07 g			
Performed by		Koya Nakatani									
Time and temperature	Test time	Start	2018/4/6 13:00		Finish	2018/4/11 18:00					
	Temperature		-			-					
	Observe time	Start	2018/4/11 18:00		Finish	2018/4/12 18:45					
	Temperature		21.2°C			21.2°C					
Test procedure											
<p>Test cells and batteries are to be stored for at least 6 hours at a test temperature equal to $72 \pm 2 \text{ }^\circ\text{C}$, followed by storage for at least six hours at a test temperature equal to $-40 \pm 2 \text{ }^\circ\text{C}$. The maximum time interval between test temperature extremes is 30 minutes. This procedure is to be repeated until 10 total cycles are complete, after which all test cells and batteries are to be stored for 24 hours at ambient temperature ($20 \pm 5 \text{ }^\circ\text{C}$).</p>											
Requirements											
There is no leakage (no mass loss), no venting, no disassembly, no rupture and no fire.											
Test result											
No.		1	2	3	4	5	6	7	8	9	10
Lot No.		18-03	18-03	18-03	18-03	18-03	18-03	18-03	18-03	18-03	18-03
Test condition		Setting temperature: $72^\circ\text{C}/-40^\circ\text{C}$ Setting time: 6h Setting cycle:10									
Voltage	Pre-test(V_1) [V]	-	-	-	-	-	-	-	-	-	-
	After-test(V_2) [V]	-	-	-	-	-	-	-	-	-	-
	Change rate ^{*1} [%]	-	-	-	-	-	-	-	-	-	-
Mass	Pre-test(M_1) [g]	2.992	2.984	2.994	2.951	2.998	2.949	2.985	2.987	2.956	2.989
	After-test(M_2) [g]	2.992	2.984	2.994	2.951	2.997	2.949	2.985	2.987	2.956	2.989
	Mass loss ^{*2} [%]	0.00	0.00	-0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.00
After-test Status	Leakage	N.L.	N.L.	N.L.	N.L.	N.L.	N.L.	N.L.	N.L.	N.L.	N.L.
	Venting	N.V.	N.V.	N.V.	N.V.	N.V.	N.V.	N.V.	N.V.	N.V.	N.V.
	Disassembly	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
	Rupture	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
	Fire	N.F.	N.F.	N.F.	N.F.	N.F.	N.F.	N.F.	N.F.	N.F.	N.F.
*1: Change rate[%]= $V_2/V_1 \times 100$ Limit Change rate: 90%		*2: Mass loss[%]= $(M_1-M_2)/M_1 \times 100$									
		Mass M of cell or battery					Mass loss limit				
		M < 1g					0.5%				
		1g ≤ M ≤ 75g					0.2%				
		M > 75g					0.1%				

Test No.	C-1804-1										
Test	T.3: Vibration										
Item (Status)	CR2032 (Undischarged)					Approved by	Checked by	Prepared by			
Place	Safety test house		Equipment No.	A-07-01		Type	Li content				
Number of test specimen		10					Cell or Battery	0.07 g			
Performed by		Koya Nakatani									
Time and temperature	Test time	Start	2018/4/16 9:00		Finish	2018/4/16 18:00					
	Temperature		21.3°C			21.2°C					
	Observe time	Start	2018/4/16 18:00		Finish	2018/4/16 18:45					
	Temperature		20.9°C			21.2°C					
Test procedure											
<p>Cells and batteries are firmly secured to the platform of the vibration machine without distorting the cells in such a manner as to faithfully transmit the vibration. The vibration shall be a sinusoidal waveform with a logarithmic sweep between 7 Hz and 200 Hz and back to 7 Hz traversed in 15 minutes. This cycle shall be repeated 12 times for a total of 3 hours for each of three mutually perpendicular mounting positions of the cell. One of the directions of vibration must be perpendicular to the terminal face.</p> <p>The logarithmic frequency sweep is as follows: from 7 Hz a peak acceleration of 1 gn is maintained until 18 Hz is reached. The amplitude is then maintained at 0.8 mm (1.6 mm total excursion) and the frequency increased until a peak acceleration of 8 gn occurs (approximately 50 Hz). A peak acceleration of 8 gn is then maintained until the frequency is increased to 200 Hz.</p>											
Requirements											
<p>There is no leakage (no mass loss), no venting, no disassembly, no rupture and no fire.</p> <p>The open circuit voltage of each test cell or battery after testing is not less than 90% of its voltage immediately prior to this procedure.</p>											
Test result											
No.		1	2	3	4	5	6	7	8	9	10
Lot No.		18-03	18-03	18-03	18-03	18-03	18-03	18-03	18-03	18-03	18-03
Test condition		Vibration : 7Hz -200Hz-7Hz Test time: 3 hours for each direction(x, y, z); total 9 hours									
Voltage	Pre-test(V ₁) [V]	3.267	3.268	3.267	3.264	3.267	3.259	3.265	3.262	3.269	3.268
	After-test(V ₂) [V]	3.265	3.282	3.284	3.263	3.277	3.244	3.280	3.283	3.281	3.283
	Change rate*1 [%]	100	100	101	100	100	100	100	101	100	100
Mass	Pre-test(M ₁) [g]	2.964	2.971	2.970	2.968	2.975	2.975	2.979	3.009	2.982	2.980
	After-test(M ₂) [g]	2.963	2.970	2.970	2.968	2.975	2.975	2.979	3.009	2.982	2.980
	Mass loss*2 [%]	0.00	0.01	0.00	0.00	-0.01	0.00	0.01	0.00	0.00	0.01
After-test Status	Leakage	N.L.	N.L.	N.L.	N.L.	N.L.	N.L.	N.L.	N.L.	N.L.	N.L.
	Venting	N.V.	N.V.	N.V.	N.V.	N.V.	N.V.	N.V.	N.V.	N.V.	N.V.
	Disassembly	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
	Rupture	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
	Fire	N.F.	N.F.	N.F.	N.F.	N.F.	N.F.	N.F.	N.F.	N.F.	N.F.
*1: Change rate[%]=V ₂ /V ₁ x 100 Limit Change rate: 90%		*2: Mass loss[%]=(M ₁ -M ₂)/M ₁ x 100									
		Mass M of cell or battery					Mass loss limit				
		M < 1g					0.5%				
		1g ≤ M ≤ 75g					0.2%				
		M > 75g					0.1%				




Test No.	C-1804-1										
Test	T.3: Vibration										
Item (Status)	CR2032 (Fully discharged)					Approved by	Checked by	Prepared by			
											
Place	Safety test house		Equipment No.	A-07-01		Type	Li content				
Number of test specimen		10					Cell or Battery	0.07 g			
Performed by		Koya Nakatani									
Time and temperature	Test time	Start	2018/4/16 9:00		Finish	2018/4/16 18:00					
	Temperature		21.3°C			21.2°C					
	Observe time	Start	2018/4/16 18:00		Finish	2018/4/16 18:45					
	Temperature		20.9°C			21.2°C					
Test procedure											
<p>Cells and batteries are firmly secured to the platform of the vibration machine without distorting the cells in such a manner as to faithfully transmit the vibration. The vibration shall be a sinusoidal waveform with a logarithmic sweep between 7 Hz and 200 Hz and back to 7 Hz traversed in 15 minutes. This cycle shall be repeated 12 times for a total of 3 hours for each of three mutually perpendicular mounting positions of the cell. One of the directions of vibration must be perpendicular to the terminal face.</p> <p>The logarithmic frequency sweep is as follows: from 7 Hz a peak acceleration of 1 gn is maintained until 18 Hz is reached. The amplitude is then maintained at 0.8 mm (1.6 mm total excursion) and the frequency increased until a peak acceleration of 8 gn occurs (approximately 50 Hz). A peak acceleration of 8 gn is then maintained until the frequency is increased to 200 Hz.</p>											
Requirements											
There is no leakage (no mass loss), no venting, no disassembly, no rupture and no fire.											
Test result											
No.		1	2	3	4	5	6	7	8	9	10
Lot No.		18-03	18-03	18-03	18-03	18-03	18-03	18-03	18-03	18-03	18-03
Test condition		Vibration : 7Hz -200Hz-7Hz Test time: 3 hours for each direction(x, y, z); total 9 hours									
Voltage	Pre-test(V ₁) [V]	-	-	-	-	-	-	-	-	-	-
	After-test(V ₂) [V]	-	-	-	-	-	-	-	-	-	-
	Change rate ^{*1} [%]	-	-	-	-	-	-	-	-	-	-
Mass	Pre-test(M ₁) [g]	2.964	2.974	2.949	2.984	2.984	2.983	2.964	2.964	2.994	2.995
	After-test(M ₂) [g]	2.964	2.974	2.949	2.984	2.984	2.983	2.964	2.964	2.994	2.995
	Mass loss ^{*2} [%]	0.00	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.01
After-test Status	Leakage	N.L.	N.L.	N.L.	N.L.	N.L.	N.L.	N.L.	N.L.	N.L.	N.L.
	Venting	N.V.	N.V.	N.V.	N.V.	N.V.	N.V.	N.V.	N.V.	N.V.	N.V.
	Disassembly	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
	Rupture	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
	Fire	N.F.	N.F.	N.F.	N.F.	N.F.	N.F.	N.F.	N.F.	N.F.	N.F.
*1: Change rate[%]=V ₂ /V ₁ x 100 Limit Change rate: 90%		*2: Mass loss[%]=(M ₁ -M ₂)/M ₁ x 100									
		Mass M of cell or battery					Mass loss limit				
		M < 1g					0.5%				
		1g ≤ M ≤ 75g					0.2%				
		M > 75g					0.1%				




Test No.	C-1804-1										
Test	T.4: Shock										
Item (Status)	CR2032 (Undischarged)					Approved by	Checked by	Prepared by			
Place	Safety test house			Equipment No.	A-08-01		Type	Li content			
Number of test specimen		10					Cell or Battery	0.07 g			
Performed by		Koya Nakatani									
Time and temperature	Test time	Start	2018/4/17 9:30		Finish	2018/4/17 10:30					
	Temperature		23.1°C			23.1°C					
	Observe time	Start	2018/4/17 10:30		Finish	2018/4/17 11:00					
	Temperature		23.0°C			23.0°C					
Test procedure											
<p>Test cells and batteries shall be secured to the testing machine by means of a rigid mount which will support all mounting surfaces of each test battery. Each cell or battery shall be subjected to a half-sine shock of peak acceleration of 150 gn and pulse duration of 6 milliseconds. Each cell or battery shall be subjected to three shocks in the positive direction followed by three shocks in the negative direction of three mutually perpendicular mounting positions of the cell or battery for a total of 18 shocks.</p>											
Requirements											
<p>There is no leakage (no mass loss), no venting, no disassembly, no rupture and no fire. The open circuit voltage of each test cell or battery after testing is not less than 90% of its voltage immediately prior to this procedure.</p>											
Test result											
No.		1	2	3	4	5	6	7	8	9	10
Lot No.		18-03	18-03	18-03	18-03	18-03	18-03	18-03	18-03	18-03	18-03
Test condition		Peak acceleration: 150 gn Pulse duration: 6 ms									
Voltage	Pre-test(V ₁) [V]	3.279	3.285	3.282	3.279	3.278	3.286	3.278	3.283	3.280	3.278
	After-test(V ₂) [V]	3.288	3.290	3.284	3.285	3.286	3.281	3.284	3.281	3.285	3.285
	Change rate ^{*1} [%]	100	100	100	100	100	100	100	100	100	100
Mass	Pre-test(M ₁) [g]	2.983	2.974	2.972	2.966	2.957	2.967	2.958	2.984	2.971	2.976
	After-test(M ₂) [g]	2.983	2.974	2.972	2.966	2.957	2.967	2.958	2.984	2.971	2.976
	Mass loss ^{*2} [%]	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00
After-test Status	Leakage	N.L.	N.L.	N.L.	N.L.	N.L.	N.L.	N.L.	N.L.	N.L.	N.L.
	Venting	N.V.	N.V.	N.V.	N.V.	N.V.	N.V.	N.V.	N.V.	N.V.	N.V.
	Disassembly	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
	Rupture	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
	Fire	N.F.	N.F.	N.F.	N.F.	N.F.	N.F.	N.F.	N.F.	N.F.	N.F.
*1: Change rate[%]=V ₂ /V ₁ x 100 Limit Change rate: 90%		*2: Mass loss[%]=(M ₁ -M ₂)/M ₁ x 100									
		Mass M of cell or battery					Mass loss limit				
		M < 1g					0.5%				
		1g ≤ M ≤ 75g					0.2%				
		M > 75g					0.1%				

Test No.	C-1804-1										
Test	T.4: Shock										
Item (Status)	CR2032 (Fully discharged)					Approved by	Checked by	Prepared by			
Place	Safety test house		Equipment No.	A-08-01		Type	Li content				
Number of test specimen	10					Cell or Battery	0.07 g				
Performed by	Koya Nakatani										
Time and temperature	Test time	Start	2018/4/17 9:30		Finish	2018/4/17 10:30					
	Temperature		23.1°C			23.1°C					
	Observe time	Start	2018/4/17 10:30		Finish	2018/4/17 11:00					
	Temperature		23.0°C			23.0°C					
Test procedure											
<p>Test cells and batteries shall be secured to the testing machine by means of a rigid mount which will support all mounting surfaces of each test battery. Each cell or battery shall be subjected to a half-sine shock of peak acceleration of 150 gn and pulse duration of 6 milliseconds. Each cell or battery shall be subjected to three shocks in the positive direction followed by three shocks in the negative direction of three mutually perpendicular mounting positions of the cell or battery for a total of 18 shocks.</p>											
Requirements											
There is no leakage (no mass loss), no venting, no disassembly, no rupture and no fire.											
Test result											
No.		1	2	3	4	5	6	7	8	9	10
Lot No.		18-03	18-03	18-03	18-03	18-03	18-03	18-03	18-03	18-03	18-03
Test condition		Peak acceleration: 150 gn Pulse duration: 6 ms									
Voltage	Pre-test(V ₁) [V]	-	-	-	-	-	-	-	-	-	-
	After-test(V ₂) [V]	-	-	-	-	-	-	-	-	-	-
	Change rate ^{*1} [%]	-	-	-	-	-	-	-	-	-	-
Mass	Pre-test(M ₁) [g]	2.999	3.005	2.951	2.949	2.954	2.960	2.994	2.969	2.979	2.989
	After-test(M ₂) [g]	2.999	3.005	2.951	2.949	2.954	2.960	2.993	2.969	2.979	2.989
	Mass loss ^{*2} [%]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00
After-test Status	Leakage	N.L.	N.L.	N.L.	N.L.	N.L.	N.L.	N.L.	N.L.	N.L.	N.L.
	Venting	N.V.	N.V.	N.V.	N.V.	N.V.	N.V.	N.V.	N.V.	N.V.	N.V.
	Disassembly	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
	Rupture	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
	Fire	N.F.	N.F.	N.F.	N.F.	N.F.	N.F.	N.F.	N.F.	N.F.	N.F.
*1: Change rate[%]=V ₂ /V ₁ x 100 Limit Change rate: 90%		*2: Mass loss[%]=(M ₁ -M ₂)/M ₁ x 100									
		Mass M of cell or battery					Mass loss limit				
		M < 1g					0.5%				
		1g ≤ M ≤ 75g					0.2%				
		M > 75g					0.1%				

Test No.	C-1804-1										
Test	T.5: External short circuit										
Item (Status)	CR2032 (Undischarged)					Approved by	Checked by	Prepared by			
Place	Safety test house		Equipment No.	A-02-30		Type	Li content				
Number of test specimen	10					Cell or Battery	0.07 g				
Performed by	Koya Nakatani										
Time and temperature	Test time	Start	2018/4/18 9:00		Finish	2018/4/18 16:00					
	Temperature		22.2°C			21.8°C					
	Observe time	Start	2018/4/18 16:00		Finish	2018/4/18 22:15					
	Temperature		21.7°C			21.8°C					
Test procedure											
<p>The cell or battery to be tested shall be temperature stabilized so that its external case temperature reaches 55 ± 2 °C and then the cell or battery shall be subjected to a short circuit condition with a total external resistance of less than 0.1 ohm at 55 ± 2 °C. This short circuit condition is continued for at least one hour after the cell or battery external case temperature has returned to 55 ± 2 °C. The cell or battery must be observed for a further six hours for the test to be concluded.</p>											
Requirements											
Cells and batteries meet this requirement if their external temperature does not exceed 170 °C and there is no disassembly, no rupture and no fire within six hours of this test.											
Test result											
No.	1	2	3	4	5	6	7	8	9	10	
Lot No.	18-03	18-03	18-03	18-03	18-03	18-03	18-03	18-03	18-03	18-03	
Test condition	Setting Temperature of chamber: 55°C Resistance: Less than 0.1ohm										
Voltage	Pre-test [V]	3.284	3.289	3.285	3.285	3.283	3.283	3.286	3.288	3.290	3.285
Mass	Pre-test [g]	2.980	2.979	2.954	2.948	2.956	2.964	2.953	2.967	2.975	2.972
Max. Temperature (°C)		60.1	60.8	60.8	60.5	61.5	61.0	60.7	61.8	62.0	61.0
After-test Status	Leakage	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Venting	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Disassembly	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
	Rupture	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
	Fire	N.F.	N.F.	N.F.	N.F.	N.F.	N.F.	N.F.	N.F.	N.F.	N.F.

Test No.	C-1804-1										
Test	T.5: External short circuit										
Item (Status)	CR2032 (Fully discharged)					Approved by	Checked by	Prepared by			
Place	Safety test house		Equipment No.	A-02-30		Type	Li content				
Number of test specimen		10					Cell or Battery	0.07 g			
Performed by		Koya Nakatani									
Time and temperature	Test time	Start	2018/4/18 9:00		Finish	2018/4/18 16:00					
	Temperature		22.2°C			21.8°C					
	Observe time	Start	2018/4/18 16:00		Finish	2018/4/18 22:15					
	Temperature		21.7°C			21.8°C					
Test procedure											
<p>The cell or battery to be tested shall be temperature stabilized so that its external case temperature reaches 55 ± 2 °C and then the cell or battery shall be subjected to a short circuit condition with a total external resistance of less than 0.1 ohm at 55 ± 2 °C. This short circuit condition is continued for at least one hour after the cell or battery external case temperature has returned to 55 ± 2 °C. The cell or battery must be observed for a further six hours for the test to be concluded.</p>											
Requirements											
Cells and batteries meet this requirement if their external temperature does not exceed 170 °C and there is no disassembly, no rupture and no fire within six hours of this test.											
Test result											
No.		1	2	3	4	5	6	7	8	9	10
Lot No.		18-03	18-03	18-03	18-03	18-03	18-03	18-03	18-03	18-03	18-03
Test condition		Setting Temperature of chamber: 55°C Resistance: Less than 0.1ohm									
Voltage	Pre-test(V ₁) [V]	-	-	-	-	-	-	-	-	-	-
Mass	Pre-test(M ₁) [g]	3.004	2.989	2.992	2.991	2.978	2.984	2.978	2.951	2.967	2.964
Max. Temperature (°C)		54.8	54.6	54.8	54.7	54.7	54.8	54.8	54.8	54.9	54.8
After-test Status	Leakage	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Venting	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Disassembly	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
	Rupture	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
	Fire	N.F.	N.F.	N.F.	N.F.	N.F.	N.F.	N.F.	N.F.	N.F.	N.F.

Test	T.6: Crush										
Item (Status)	CR2032					Approved by	Checked by	Prepared by			
	(Undischarged)										
Place	Safety test house					Nominal Voltage		Rated Capacity			
Number of test specimen		5					3.0V		220mAh		
Performed by		Atsushi Yamano									
Time and temperature	Test time	Start	2013/12/1 13:30			Finish	2013/12/1 14:00				
	Temperature		21.0°C				20.5°C				
	Observe time	Start	2013/12/1 14:00			Finish	2013/12/2 18:15				
	Temperature		20.5°C				19.5°C				
Test procedure A cell or component cell is to be crushed between two flat surfaces. The crushing is to be gradual with a speed of approximately 1.5 cm/s at the first point of contact. The crushing is to be continued until the first of the three options below is reached. (a) The applied force reaches 13 kN ± 0.78 kN; (b) The voltage of the cell drops by at least 100 mV; or (c) The cell is deformed by 50% or more of its original thickness. Once the maximum pressure has been obtained, the voltage drops by 100 mV or more, or the cell is deformed by at least 50% of its original thickness, the pressure shall be released. A prismatic or pouch cell shall be crushed by applying the force to the widest side. A button/coin cell shall be crushed by applying the force on its flat surfaces. For cylindrical cells, the crush force shall be applied perpendicular to the longitudinal axis. Each test cell or component cell is to be subjected to one crush only. The test sample shall be observed for a further 6 h. The test shall be conducted using test cells or component cells that have not previously been subjected to other tests.											
Requirements Cells and batteries meet this requirement if their external temperature does not exceed 170 °C and there is no disassembly and no fire within six hours of this test.											
Test result											
No.		1	2	3	4	5	6	7	8	9	10
Lot No.		131102	131102	131102	131102	131102	/	/	/	/	/
Test condition		Crushing speed: 1.5cm/s Ram diameter: 32 mm Pressure: 13KN (17 Mpa) Direction of the force : Widest side									
Force	Peak (kN)	15.000	15.000	15.000	15.000	15.000	/	/	/	/	/
Voltage	Pre-test(V ₁) [V]	3.269	3.267	3.261	3.259	3.257	/	/	/	/	/
	After-test(V ₂) [V]	3.257	3.260	3.251	3.251	3.248	/	/	/	/	/
	Drop*1 [V]	0.012	0.007	0.010	0.008	0.009	/	/	/	/	/
Mass	Pre-test [g]	-	-	-	-	-	/	/	/	/	/
Thick-ness	Pre-test(T ₁) [mm]	3.184	3.187	3.191	3.188	3.191	/	/	/	/	/
	After-test(T ₂) [mm]	3.196	3.194	3.205	3.191	3.261	/	/	/	/	/
	Change rate*2 [%]	100%	100%	100%	100%	102%	/	/	/	/	/
Max. Temperature (°C)		30°C<	30°C<	30°C<	30°C<	30°C<	/	/	/	/	/
After-test Status	Leakage	N/A	N/A	N/A	N/A	N/A	/	/	/	/	/
	Venting	N/A	N/A	N/A	N/A	N/A	/	/	/	/	/
	Disassembly	N.D.	N.D.	N.D.	N.D.	N.D.	/	/	/	/	/
	Rupture	N/A	N/A	N/A	N/A	N/A	/	/	/	/	/
	Fire	N.F.	N.F.	N.F.	N.F.	N.F.	/	/	/	/	/
		*1: Drop*1 [V]=V ₁ -V ₂					*2: Change rate[%]=T ₂ /T ₁ x 100				

Test	T.6: Crush										
Item (Status)	CR2032 (Fully discharged)					Approved by	Checked by	Prepared by			
											
Place	Safety test house					Nominal Voltage		Rated Capacity			
Number of test specimen		5					3.0V		220mAh		
Performed by		Atsushi Yamano									
Time and temperature	Test time	Start	2013/12/1 13:30			Finish	2013/12/1 14:00				
	Temperature		21.0°C				20.5°C				
	Observe time	Start	2013/12/1 14:00			Finish	2013/12/2 18:15				
	Temperature		20.5°C				19.5°C				
Test procedure A cell or component cell is to be crushed between two flat surfaces. The crushing is to be gradual with a speed of approximately 1.5 cm/s at the first point of contact. The crushing is to be continued until the first of the three options below is reached. (a) The applied force reaches 13 kN ± 0.78 kN; (b) The voltage of the cell drops by at least 100 mV; or (c) The cell is deformed by 50% or more of its original thickness. Once the maximum pressure has been obtained, the voltage drops by 100 mV or more, or the cell is deformed by at least 50% of its original thickness, the pressure shall be released. A prismatic or pouch cell shall be crushed by applying the force to the widest side. A button/coin cell shall be crushed by applying the force on its flat surfaces. For cylindrical cells, the crush force shall be applied perpendicular to the longitudinal axis. Each test cell or component cell is to be subjected to one crush only. The test sample shall be observed for a further 6 h. The test shall be conducted using test cells or component cells that have not previously been subjected to other tests.											
Requirements Cells and batteries meet this requirement if their external temperature does not exceed 170 °C and there is no disassembly and no fire within six hours of this test.											
Test result											
No.		1	2	3	4	5	6	7	8	9	10
Lot No.		131102	131102	131102	131102	131102	/	/	/	/	/
Test condition		Crushing speed: 1.5cm/s Ram diameter: 32 mm Pressure: 13KN (17 Mpa) Direction of the force : Widest side									
Force	Peak (kN)	15.000	15.000	15.000	15.000	15.000	/	/	/	/	/
Voltage	Pre-test(V ₁) [V]	2.810	2.769	2.796	2.816	2.826	/	/	/	/	/
	After-test(V ₂) [V]	2.795	2.757	2.786	2.804	2.809	/	/	/	/	/
	Drop*1 [V]	0.015	0.012	0.010	0.012	0.017	/	/	/	/	/
Mass	Pre-test [g]	-	-	-	-	-	/	/	/	/	/
Thick-ness	Pre-test(T ₁) [mm]	3.195	3.189	3.194	3.192	3.186	/	/	/	/	/
	After-test(T ₂) [mm]	3.199	3.195	3.198	3.199	3.210	/	/	/	/	/
	Change rate*2 [%]	100%	100%	100%	100%	101%	/	/	/	/	/
Max. Temperature (°C)		30°C <	30°C <	30°C <	30°C <	30°C <	/	/	/	/	/
After-test Status	Leakage	N/A	N/A	N/A	N/A	N/A	/	/	/	/	/
	Venting	N/A	N/A	N/A	N/A	N/A	/	/	/	/	/
	Disassembly	N.D.	N.D.	N.D.	N.D.	N.D.	/	/	/	/	/
	Rupture	N/A	N/A	N/A	N/A	N/A	/	/	/	/	/
	Fire	N.F.	N.F.	N.F.	N.F.	N.F.	/	/	/	/	/
		*1: Drop*1 [V]=V ₁ -V ₂					*2: Change rate[%]=T ₂ /T ₁ x 100				

Test No.	C-1804-1										
Test	T.8: Forced discharge										
Item (Status)	CR2032 (Fully discharged)					Approved by	Checked by	Prepared by			
Place	Safety test house		Equipment No.	E-07-27		Type	Li content				
Number of test specimen		10					Cell or Battery	0.07 g			
Performed by		Koya Nakatani									
Time and temperature	Test time	Start	2018/4/16		9:00	Finish	2018/4/17		7:00		
	Temperature		21.2°C					21.3°C			
	Observe time	Start	2018/4/17		10:00	Finish	2018/4/24		10:00		
	Temperature		21.2°C					21.0°C			
Test procedure											
<p>Each cell shall be forced discharged at ambient temperature by connecting it in series with a 12 V D.C. power supply at an initial current equal to the maximum discharge current specified by the manufacturer.</p> <p>The specified discharge current is to be obtained by connecting a resistive load of the appropriate size and rating in series with the test cell. Each cell shall be forced discharged for a time interval (in hours) equal to its rated capacity divided by the initial test current(in Ampere).</p>											
Requirements											
Test result											
No.		1	2	3	4	5	6	7	8	9	10
Lot No.		18-03	18-03	18-03	18-03	18-03	18-03	18-03	18-03	18-03	18-03
Test condition		Discharge current: 10mA Forced discharge time: 22h									
Voltage	Pre-test [V]	-	-	-	-	-	-	-	-	-	-
Mass	Pre-test [g]	-	-	-	-	-	-	-	-	-	-
After-test Status	Leakage	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Venting	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Disassembly	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
	Rupture	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Fire	N.F.	N.F.	N.F.	N.F.	N.F.	N.F.	N.F.	N.F.	N.F.	N.F.