

Prüfungszusammenfassung

für Lithiumzellen oder -batterien gemäß Unterabschnitt 38.3 des UN-Prüfhandbuchs

Hinweis zu Transportvorschriften (SV188)

Die im Folgenden aufgeführte Lithiumbatterie/Lithiumzelle ist für den erleichterten Gefahrgutversand gemäß **Sonderverordnung 188 ADR** qualifiziert.



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Certification

UN38-3-CR2032-01-15

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 / HEAD ENGINEER

Signature

T. Kimura

Mar. 18, 2015



Test

T.1: Altitude simulation**Test procedure**

Test cells shall be stored at a pressure of 11.6 kPa or less for at least six hours at ambient temperature (20 ± 5 °C).

Criteria

There is no mass loss, no leakage, no venting, no disassembly, no rupture and no fire. The open circuit voltage of each test cell after testing is not less than 90% of its voltage immediately prior to this procedure. (Undischarged status only)

*1: Voltage change[%]= $V_2/V_1 \times 100$

*2: Mass loss[%]= $(M_1-M_2)/M_1 \times 100$

Status

Undischarged

Number of test specimen: 10

Test result

No.		1	2	3	4	5	6	7	8	9	10
Initial	Voltage(V_1) [V]	3.269	3.259	3.267	3.265	3.261	3.271	3.261	3.257	3.257	3.262
	Mass(M_1) [g]	2.990	2.969	2.965	2.974	2.963	2.992	2.954	2.943	2.971	2.996
After Test	Voltage(V_2) [V]	3.269	3.258	3.267	3.265	3.261	3.270	3.261	3.258	3.257	3.261
	Voltage change ^{*1} [%]	100	100	100	100	100	100	100	100	100	100
	Mass(M_2) [g]	2.990	2.969	2.965	2.974	2.963	2.992	2.954	2.943	2.971	2.996
	Mass loss ^{*2} [%]	0	0	0	0	0	0	0	0	0	0
	Leakage	No	No	No	No	No	No	No	No	No	No
	Venting	No	No	No	No	No	No	No	No	No	No
	Disassembly	No	No	No	No	No	No	No	No	No	No
	Rupture	No	No	No	No	No	No	No	No	No	No
	Fire	No	No	No	No	No	No	No	No	No	No

Status

Fully discharged

Number of test specimen: 10

Test result

No.		1	2	3	4	5	6	7	8	9	10
Initial	Voltage(V_1) [V]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Mass(M_1) [g]	2.963	2.951	2.987	3.004	2.978	2.981	2.997	2.953	2.993	2.988
After Test	Voltage(V_2) [V]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Voltage change ^{*1} [%]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Mass(M_2) [g]	2.963	2.951	2.987	3.004	2.978	2.981	2.997	2.953	2.993	2.988
	Mass loss ^{*2} [%]	0	0	0	0	0	0	0	0	0	0
	Leakage	No	No	No	No	No	No	No	No	No	No
	Venting	No	No	No	No	No	No	No	No	No	No
	Disassembly	No	No	No	No	No	No	No	No	No	No
	Rupture	No	No	No	No	No	No	No	No	No	No
	Fire	No	No	No	No	No	No	No	No	No	No

N/A: Not Applicable



Test

T.2: Thermal test**Test procedure**

Test cells are to be stored for at least six hours at a test temperature equal to $75 \pm 2 \text{ }^\circ\text{C}$, 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 10 times, after which all test cells are to be stored for 24 hours at ambient

Criteria

There is no mass loss, no leakage, no venting, no disassembly, no rupture and no fire. The open circuit voltage of each test cell after testing is not less than 90% of its voltage immediately prior to this procedure. (Undischarged status only)

*1: Voltage change[%]= $V_2/V_1 \times 100$

*2: Mass loss[%]= $(M_1-M_2)/M_1 \times 100$

Status

Undischarged

Number of test specimen: 10

Test result

No.		1	2	3	4	5	6	7	8	9	10
Initial	Voltage(V_1) [V]	3.269	3.258	3.267	3.265	3.261	3.270	3.261	3.258	3.257	3.261
	Mass(M_1) [g]	2.990	2.969	2.965	2.974	2.963	2.992	2.954	2.943	2.971	2.996
After Test	Voltage(V_2) [V]	3.269	3.262	3.267	3.266	3.263	3.272	3.265	3.262	3.261	3.264
	Voltage change ^{*1} [%]	100	100	100	100	100	100	100	100	100	100
	Mass(M_2) [g]	2.989	2.969	2.964	2.974	2.963	2.992	2.954	2.943	2.971	2.996
	Mass loss ^{*2} [%]	0	0	0	0	0	0	0	0	0	0
	Leakage	No	No	No	No	No	No	No	No	No	No
	Venting	No	No	No	No	No	No	No	No	No	No
	Disassembly	No	No	No	No	No	No	No	No	No	No
	Rupture	No	No	No	No	No	No	No	No	No	No
	Fire	No	No	No	No	No	No	No	No	No	No

Status

Fully discharged

Number of test specimen: 10

Test result

No.		1	2	3	4	5	6	7	8	9	10
Initial	Voltage(V_1) [V]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Mass(M_1) [g]	2.963	2.951	2.987	3.004	2.978	2.981	2.997	2.953	2.993	2.988
After Test	Voltage(V_2) [V]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Voltage change ^{*1} [%]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Mass(M_2) [g]	2.963	2.951	2.987	3.004	2.978	2.981	2.997	2.953	2.993	2.988
	Mass loss ^{*2} [%]	0	0	0	0	0	0	0	0	0	0
	Leakage	No	No	No	No	No	No	No	No	No	No
	Venting	No	No	No	No	No	No	No	No	No	No
	Disassembly	No	No	No	No	No	No	No	No	No	No
	Rupture	No	No	No	No	No	No	No	No	No	No
	Fire	No	No	No	No	No	No	No	No	No	No

N/A: Not Applicable



Test

T.3: Vibration**Test procedure**

Cells 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.

The logarithmic frequency sweep is as follows: from 7 Hz a peak acceleration of 1 g_n 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 g_n occurs (approximately 50 Hz). A peak acceleration of 8 g_n is then maintained until the frequency is increased to 200 Hz.

Criteria

There is no mass loss, no leakage, no venting, no disassembly, no rupture and no fire.

The open circuit voltage of each test cell after testing is not less than 90% of its voltage immediately prior to this procedure. (Undischarged status only)

*1: Voltage change[%]= $V_2/V_1 \times 100$

*2: Mass loss[%]= $(M_1-M_2)/M_1 \times 100$

Status Undischarged

Number of test specimen: 10

Test result

No.		1	2	3	4	5	6	7	8	9	10
Initial	Voltage(V ₁) [V]	3.269	3.262	3.267	3.266	3.263	3.272	3.265	3.262	3.261	3.264
	Mass(M ₁) [g]	2.989	2.969	2.964	2.974	2.963	2.992	2.954	2.943	2.971	2.996
After Test	Voltage(V ₂) [V]	3.285	3.279	3.284	3.284	3.281	3.288	3.283	3.280	3.280	3.281
	Voltage change ^{*1} [%]	100	101	101	101	101	100	101	101	101	101
	Mass(M ₂) [g]	2.989	2.969	2.964	2.974	2.963	2.992	2.954	2.943	2.971	2.996
	Mass loss ^{*2} [%]	0	0	0	0	0	0	0	0	0	0
	Leakage	No	No	No	No	No	No	No	No	No	No
	Venting	No	No	No	No	No	No	No	No	No	No
	Disassembly	No	No	No	No	No	No	No	No	No	No
	Rupture	No	No	No	No	No	No	No	No	No	No
	Fire	No	No	No	No	No	No	No	No	No	No

Status Fully discharged

Number of test specimen: 10

Test result

No.		1	2	3	4	5	6	7	8	9	10
Initial	Voltage(V ₁) [V]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Mass(M ₁) [g]	2.963	2.951	2.987	3.004	2.978	2.981	2.997	2.953	2.993	2.988
After Test	Voltage(V ₂) [V]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Voltage change ^{*1} [%]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Mass(M ₂) [g]	2.963	2.951	2.987	3.004	2.978	2.981	2.997	2.953	2.993	2.988
	Mass loss ^{*2} [%]	0	0	0	0	0	0	0	0	0	0
	Leakage	No	No	No	No	No	No	No	No	No	No
	Venting	No	No	No	No	No	No	No	No	No	No
	Disassembly	No	No	No	No	No	No	No	No	No	No
	Rupture	No	No	No	No	No	No	No	No	No	No
	Fire	No	No	No	No	No	No	No	No	No	No

N/A: Not Applicable



Test	T.4: Shock										
Test procedure											
<p>Test cells 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 shall be subjected to a half-sine shock of peak acceleration of 150 g_n and pulse duration of 6 milliseconds. Each cell 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 for a total of 18 shocks.</p>											
Criteria											
<p>There is no mass loss, no leakage, no venting, no disassembly, no rupture and no fire. The open circuit voltage of each test cell after testing is not less than 90% of its voltage immediately prior to this procedure. (Undischarged status only)</p>											
*1: Voltage change[%]= $V_2/V_1 \times 100$											
*2: Mass loss[%]= $(M_1-M_2)/M_1 \times 100$											
Status	Undischarged										Number of test specimen: 10
Test result											
No.		1	2	3	4	5	6	7	8	9	10
Initial	Voltage(V ₁) [V]	3.285	3.279	3.284	3.284	3.281	3.288	3.283	3.280	3.280	3.281
	Mass(M ₁) [g]	2.989	2.969	2.964	2.974	2.963	2.992	2.954	2.943	2.971	2.996
After Test	Voltage(V ₂) [V]	3.290	3.281	3.287	3.288	3.285	3.291	3.286	3.281	3.284	3.284
	Voltage change ¹ [%]	100	100	100	100	100	100	100	100	100	100
	Mass(M ₂) [g]	2.989	2.969	2.964	2.974	2.963	2.992	2.954	2.943	2.971	2.996
	Mass loss ² [%]	0	0	0	0	0	0	0	0	0	0
	Leakage	No	No	No	No	No	No	No	No	No	No
	Venting	No	No	No	No	No	No	No	No	No	No
	Disassembly	No	No	No	No	No	No	No	No	No	No
	Rupture	No	No	No	No	No	No	No	No	No	No
Fire	No	No	No	No	No	No	No	No	No	No	
Status	Fully discharged										Number of test specimen: 10
Test result											
No.		1	2	3	4	5	6	7	8	9	10
Initial	Voltage(V ₁) [V]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Mass(M ₁) [g]	2.963	2.951	2.987	3.004	2.978	2.981	2.997	2.953	2.993	2.988
After Test	Voltage(V ₂) [V]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Voltage change ¹ [%]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Mass(M ₂) [g]	2.963	2.951	2.987	3.004	2.978	2.981	2.997	2.953	2.993	2.988
	Mass loss ² [%]	0	0	0	0	0	0	0	0	0	0
	Leakage	No	No	No	No	No	No	No	No	No	No
	Venting	No	No	No	No	No	No	No	No	No	No
	Disassembly	No	No	No	No	No	No	No	No	No	No
	Rupture	No	No	No	No	No	No	No	No	No	No
Fire	No	No	No	No	No	No	No	No	No	No	
N/A: Not Applicable											



Test	T.5: External short circuit										
Test procedure											
The cell to be tested shall be temperature stabilized so that its external case temperature reaches 55 ± 2 °C and then the cell 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 external case temperature has returned to 55 ± 2 °C. The cell must be observed for a further six hours for the test to be concluded.											
Criteria											
Cells' external temperature does not exceed 170 °C and there is no disassembly, no rupture and no fire within six hours of this test.											
Status	Undischarged										Number of test specimen: 10
Test result											
No.		1	2	3	4	5	6	7	8	9	10
Initial	Voltage [V]	3.290	3.281	3.287	3.288	3.285	3.291	3.286	3.281	3.284	3.284
	Mass [g]	2.989	2.969	2.964	2.974	2.963	2.992	2.954	2.943	2.971	2.996
Max. Temperature [°C]		59.3	60.8	60.7	62.5	63.9	61.4	61.0	63.4	61.7	59.3
After Test	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	No	No	No	No	No	No	No	No	No	No
	Rupture	No	No	No	No	No	No	No	No	No	No
	Fire	No	No	No	No	No	No	No	No	No	No
Status	Fully discharged										Number of test specimen: 10
Test result											
No.		1	2	3	4	5	6	7	8	9	10
Initial	Voltage [V]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Mass [g]	2.963	2.951	2.987	3.004	2.978	2.981	2.997	2.953	2.993	2.988
Max. Temperature [°C]		54.6	54.6	54.3	54.2	54.4	54.8	53.8	54.2	54.6	55.2
After Test	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	No	No	No	No	No	No	No	No	No	No
	Rupture	No	No	No	No	No	No	No	No	No	No
	Fire	No	No	No	No	No	No	No	No	No	No
N/A: Not Applicable											



Test	T.6: Impact										
Test procedure											
<p>The test sample cell is to be placed on a flat surface. A 15.8 mm diameter bar is to be placed across the centre of the sample. A 9.1 kg mass is to be dropped from a height of 61 ± 2.5 cm onto the sample.</p> <p>A cylindrical or prismatic cell is to be impacted with its longitudinal axis parallel to the flat surface and perpendicular to the longitudinal axis of the 15.8 mm diameter curved surface lying across the centre of the test sample. A prismatic cell is also to be rotated 90 degrees around its longitudinal axis so that both the wide and narrow sides will be subjected to the impact. Each sample is to be subjected to only a single impact. Separate samples are to be</p>											
Criteria											
Cells' external temperature does not exceed 170 °C and there is no disassembly and no fire within six hours of this test.											
Status	Undischarged										Number of test specimen: 5
Test result											
No.		1	2	3	4	5	6	7	8	9	10
Initial	Voltage [V]	3.262	3.263	3.257	3.253	3.268	-	-	-	-	-
	Mass [g]	2.972	2.970	2.966	2.961	2.987	-	-	-	-	-
Max. Temperature [°C]		90°C>	90°C>	90°C>	90°C>	90°C>	-	-	-	-	-
After Test	Leakage	N/A	N/A	N/A	N/A	N/A	-	-	-	-	-
	Venting	N/A	N/A	N/A	N/A	N/A	-	-	-	-	-
	Disassembly	No	No	No	No	No	-	-	-	-	-
	Rupture	N/A	N/A	N/A	N/A	N/A	-	-	-	-	-
	Fire	No	No	No	No	No	-	-	-	-	-
Status	Fully discharged										Number of test specimen: 5
Test result											
No.		1	2	3	4	5	6	7	8	9	10
Initial	Voltage [V]	N/A	N/A	N/A	N/A	N/A	-	-	-	-	-
	Mass [g]	2.974	2.963	2.979	2.986	2.978	-	-	-	-	-
Max. Temperature [°C]		90°C>	90°C>	90°C>	90°C>	90°C>	-	-	-	-	-
After Test	Leakage	N/A	N/A	N/A	N/A	N/A	-	-	-	-	-
	Venting	N/A	N/A	N/A	N/A	N/A	-	-	-	-	-
	Disassembly	No	No	No	No	No	-	-	-	-	-
	Rupture	N/A	N/A	N/A	N/A	N/A	-	-	-	-	-
	Fire	No	No	No	No	No	-	-	-	-	-
N/A: Not Applicable											



Test	T.8: Forced discharge																																																																																																					
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</p>																																																																																																						
Criteria																																																																																																						
There is no disassembly and no fire within seven days of the test.																																																																																																						
Status																																																																																																						
Fully discharged						Number of test specimen: 10																																																																																																
Test result																																																																																																						
<table border="1"> <thead> <tr> <th>No.</th> <th></th> <th>1</th> <th>2</th> <th>3</th> <th>4</th> <th>5</th> <th>6</th> <th>7</th> <th>8</th> <th>9</th> <th>10</th> </tr> </thead> <tbody> <tr> <td rowspan="2">Initial</td> <td>Voltage [V]</td> <td>N/A</td> <td>N/A</td> <td>N/A</td> <td>N/A</td> <td>N/A</td> <td>N/A</td> <td>N/A</td> <td>N/A</td> <td>N/A</td> <td>N/A</td> </tr> <tr> <td>Mass [g]</td> <td>N/A</td> <td>N/A</td> <td>N/A</td> <td>N/A</td> <td>N/A</td> <td>N/A</td> <td>N/A</td> <td>N/A</td> <td>N/A</td> <td>N/A</td> </tr> <tr> <td rowspan="5">After Test</td> <td>Leakage</td> <td>N/A</td> <td>N/A</td> <td>N/A</td> <td>N/A</td> <td>N/A</td> <td>N/A</td> <td>N/A</td> <td>N/A</td> <td>N/A</td> <td>N/A</td> </tr> <tr> <td>Venting</td> <td>N/A</td> <td>N/A</td> <td>N/A</td> <td>N/A</td> <td>N/A</td> <td>N/A</td> <td>N/A</td> <td>N/A</td> <td>N/A</td> <td>N/A</td> </tr> <tr> <td>Disassembly</td> <td>No</td> <td>No</td> <td>No</td> <td>No</td> <td>No</td> <td>No</td> <td>No</td> <td>No</td> <td>No</td> <td>No</td> </tr> <tr> <td>Rupture</td> <td>N/A</td> <td>N/A</td> <td>N/A</td> <td>N/A</td> <td>N/A</td> <td>N/A</td> <td>N/A</td> <td>N/A</td> <td>N/A</td> <td>N/A</td> </tr> <tr> <td>Fire</td> <td>No</td> <td>No</td> <td>No</td> <td>No</td> <td>No</td> <td>No</td> <td>No</td> <td>No</td> <td>No</td> <td>No</td> </tr> </tbody> </table>												No.		1	2	3	4	5	6	7	8	9	10	Initial	Voltage [V]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Mass [g]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	After Test	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	No	No	No	No	No	No	No	No	No	No	Rupture	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Fire	No	No	No	No	No	No	No	No	No	No
No.		1	2	3	4	5	6	7	8	9	10																																																																																											
Initial	Voltage [V]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A																																																																																											
	Mass [g]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A																																																																																											
After Test	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	No	No	No	No	No	No	No	No	No	No																																																																																											
	Rupture	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A																																																																																											
	Fire	No	No	No	No	No	No	No	No	No	No																																																																																											
N/A: Not Applicable																																																																																																						

