

# TEST REPORT

UN Manual of Tests and Criteria,  
Part III, Sub-section 38.3,  
Lithium Metal and Lithium ion Batteries

Model : CLH - 20

Test Report Number : CBP211201-02

Dec 01, 2021

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# TEST REPORT UN38.3

TRANSPORT OF DANGEROUS GOODS - Lithium metal and lithium ion batteries

## 1. General Information

• Apparatus.....:	Lithium Thionyl Chloride(Li/SOCl <sub>2</sub> ) Cell
• Type reference.....:	CLH-20 (Spiral D)
• Ratings.....:	3.6V, 14.0Ah
• Mass.....:	Approx. 102g
• Lithium content (for lithium metal).....:	4.5g
• Wh capacity (for lithium ion).....:	N/A
• Battery connection configuration.....:	S1/P1
• Trade Mark.....:	
• Manufacturer.....:	COROS Battery Co., Ltd. 1104 Choongang Royal Office, 13 Seoun-ro, Seocho-gu, Seoul, Republic of Korea Tel) 82-2-588-4008 Website: www.corosbattery.com
• Test Standard.....:	ST/SG/AC.10/11/Rev.6 Recommendations on the Transport of Dangerous Goods : Manual of Tests and Criteria, Part III, Sub-Section 38.3 Lithium metal and lithium ion batteries UNITED NATIONS
• Date(s) of performance of tests.....:	2021-09-01 to 2021-11-30
• Date of receipt of test item.....:	2021-12-01

Tested by	Haneul Park (Project Engineer)	
Witnessed by	SukHee Zang (Technical Manager)	
Approved by	SangSun Park (R&D Director)	

## 2. Technical information

### 2.1. Summary of test Results

No.	Test Items	Criteria	Results
1	Test T.1 : Altitude Simulation	<ul style="list-style-type: none"> <li>- No mass loss, no leakage, no venting, no disassembly, no rupture and no fire.</li> <li>- The open circuit voltage of each cells after testing is not less than 90% of its voltage immediately prior to the procedure</li> </ul>	PASS
2	Test T.2 : Thermal Test	<ul style="list-style-type: none"> <li>- No mass loss, no leakage, no venting, no disassembly, no rupture and no fire.</li> <li>- The open circuit voltage of each cells after testing is not less than 90% of its voltage immediately prior to the procedure</li> </ul>	PASS
3	Test T.3 : Vibration	<ul style="list-style-type: none"> <li>- No mass loss, no leakage, no venting, no disassembly, no rupture and no fire.</li> <li>- The open circuit voltage of each cells after testing is not less than 90% of its voltage immediately prior to the procedure</li> </ul>	PASS
4	Test T.4 : Shock	<ul style="list-style-type: none"> <li>- No mass loss, no leakage, no venting, no disassembly, no rupture and no fire.</li> <li>- The open circuit voltage of each cells after testing is not less than 90% of its voltage immediately prior to the procedure</li> </ul>	PASS
5	Test T.5 : External Short Circuit	<ul style="list-style-type: none"> <li>- Their external temperature does not exceed 170 °C and there is no disassembly, no rupture and no fire within six hours of this test.</li> </ul>	PASS
6	Test T.6 : Impact/Crush	<ul style="list-style-type: none"> <li>- Their external temperature does not exceed 170 °C and there is no disassembly and no fire within six hours of this test.</li> </ul>	PASS
7	Test T.7 : Over Charge	<ul style="list-style-type: none"> <li>- There is no disassembly and no fire within seven days of the test.</li> </ul>	N/A
8	Test T.8 : Forced Discharge	<ul style="list-style-type: none"> <li>- There is no disassembly and no fire within seven days of the test.</li> </ul>	PASS

## 2.2. Test environment

\* Unless specified otherwise in the individual tests shall be conducted under the following ambient conditions.

- Temperature ..... 20°C± 5°C
- Relative Humidity ..... Not specified
- Air Pressure ..... Not specified
- Altitude of test laboratory ..... Not specified

## 2.3. Test Instrument list

No.	Equipment	Maker	Model	Remarks
1	Charge/Discharge MC	Maccor	MC-4300	0~10V/-5~5V Accuracy±0.02% (Voltage & current)
2	DVM	Fluke	289	
3	Balance	AND	CB300	Max weight 300g Accuracy 0.01g
4	Computer	Samsung		
5	Data Logger	Agilent	34970A	
6	Thermal couple		K type	
7	Vacuum Chamber	JISCO	VO-10X	
8	Heating Chamber	Cleanthermo system		
9	Low Temp. Chamber	ESPEC	SH-661	
10	Vibration Test MC	SAMHAN Tech.	SJTA-2000S	
11	Shock Test MC	SAMHAN Tech.	SJTC-300	
12	Impact Test MC	SAMHAN Tech.		
13	Crush Test MC	Media Tech.		
14	External short circuit device	Corosbattery		under 80mΩ
15	DC Power Supply	VuPower	K3005D	

### 3. Test Results

#### 3.1. 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)

#### 3.2. Test Procedure and Requirements

UN 38.3. Lithium metal and Lithium ion batteries			
Clause	Requirement + Test	Result-Remark	Verdict
<b>38.3.3</b>	<b>Assembled battery testing requirements</b>		
38.3.3 (f)	The battery assembly has aggregate lithium content of not more than 500 g (lithium metal type) or with a Watt-hour rating of not more than 6,200 Wh (lithium ion type), and is assembled from batteries that have passed all applicable tests. One assembled battery in a fully charged state is tested under tests T.3, T.4 and T.5, and, in addition, test T.7 in the case of rechargeable battery.		N/A
38.3.3 (g)	Batteries that have passed all applicable tests are electrically connected to form a battery in which the aggregate lithium content is more than 500 g (lithium metal type) or with a Watt-hour rating of more than 6,200 Wh (lithium ion type). The assembled battery is not tested if the assembled battery is of a type that has been verified as preventing: (i) Overcharge; (ii) Short circuits; and (iii) Over discharge between the batteries.		N/A
<b>38.3.4</b>	<b>Transport tests</b>		<b>P</b>
<b>38.3.4.1</b>	<b>Test T-1 : Altitude simulation</b>		<b>P</b>
	<i>Purpose :</i> This test simulates air transport under low-pressure conditions.		P
	<i>Procedure:</i> Test cells and batteries shall be stored at a pressure of 11.6 kPa or less for at least 6 hours at ambient temperature.		P
	<i>Requirement:</i> Cells and batteries meet this requirement if there is no leakage, no venting, no disassembly, no rupture and no fire and if 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. The requirement relating to voltage is not applicable to test cells and batteries at fully discharged states.		P
	<i>Results:</i> no leakage, no venting, no short-circuit, no rupture, no explosion and no fire during this test.	See appended Table 38.3.4.1	P

UN 38.3. Lithium metal and Lithium ion batteries			
Clause	Requirement + Test	Result-Remark	Verdict
38.3.4.2	<b>Test T-2 : Thermal test</b>		P
	<i>Purpose :</i> This test assesses cell and battery seal integrity and internal electrical connections. The test is conducted using rapid and extreme temperature changes.		P
	<i>Procedure:</i> 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 hr 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 hr at ambient temperature. Cells or batteries previously subjected to altitude simulation test.		P
	For large cells or batteries the duration of exposure to the test temperatures is at least 12h instead of 6h.		N/A
	<i>Requirement:</i> Cells and batteries meet this requirement if there is no leakage, no venting, no disassembly, no rupture and no fire and if 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. The requirement relating to voltage is not applicable to test cells and batteries at fully discharged states.		P
	<i>Results:</i> no leakage, no venting, no short-circuit, no rupture, no explosion and no fire during this test.	See appended Table 38.3.4.2	P
38.3.4.3	<b>Test T-3 : Vibration</b>		P
	<i>Purpose :</i> This test simulates vibration during transport.		P
	<i>Procedure:</i> Cells or batteries are subjected to the following sinusoidal vibration with a logarithmic sweep: 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 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. Cells or batteries previously subjected to thermal test		P

UN 38.3. Lithium metal and Lithium ion batteries			
Clause	Requirement + Test	Result-Remark	Verdict
	Large batteries are subjected to the following sinusoidal vibration with a logarithmic sweep: from 7 Hz a peak acceleration of 1 g <sub>n</sub> is maintained until 18 Hz is reached. The amplitude is then maintained at 0.8 mm and the frequency increased until a peak acceleration of 2 g <sub>n</sub> occurs (approximately 25 Hz). A peak acceleration of 2 g <sub>n</sub> is then maintained until the frequency is increased to 200 Hz.		N/A
	Cycle is repeated 12 times for a total of 3 h for each of three mutually perpendicular mounting positions. One of the directions is perpendicular to the terminal face.		P
	<b>Requirement:</b> Cells and batteries meet this requirement if there is no leakage, no venting, no disassembly, no rupture and no fire during the test and after the test and if the open circuit voltage of each test cell or battery directly after testing in its third perpendicular mounting position is not less than 90% of its voltage immediately prior to this procedure. The requirement relating to voltage is not applicable to test cells and batteries at fully discharged states.		P
	<b>Results:</b> no leakage, no venting, no short-circuit, no rupture, no explosion and no fire during this test.	See appended Table 38.3.4.3	P
<b>38.3.4.4</b>	<b>Test T-4 : Shock</b>		P
	<b>Purpose :</b> This test assesses the robustness of cells and batteries against cumulative shocks.		P
	<b>Procedure:</b> Cells or batteries are subjected to three shocks in each direction of three mutually perpendicular mounting positions of the cell or battery for a total of 18 shocks. Cells are subjected to half-sine shock of peak acceleration of 150 g <sub>n</sub> and pulse duration of 6 ms. Cells or batteries previously subjected to vibration test.		P
	As an alternative, large cells are subjected to a half sine shock of peak acceleration of 50 g <sub>n</sub> and pulse duration of 11 ms.		N/A
	Small batteries are subjected to half-sine shock of peak acceleration of the smaller of the following and pulse duration of 6 ms: - 150 g <sub>n</sub> or - $\sqrt{(100850 / \text{mass in kg})}$ g <sub>n</sub>		N/A

UN 38.3. Lithium metal and Lithium ion batteries			
Clause	Requirement + Test	Result-Remark	Verdict
	Large batteries are subjected to half-sine shock of peak acceleration of the smaller of the following and pulse duration of 11 ms: - 50 g <sub>n</sub> or - $\sqrt{30000 / \text{mass in kg}} \text{ g}_n$		N/A
	<b>Requirement:</b> Cells and batteries meet this requirement if there is no leakage, no venting, no disassembly, no rupture and no fire and if 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. The requirement relating to voltage is not applicable to test cells and batteries at fully discharged states.		P
	<b>Results:</b> no leakage, no venting, no short-circuit, no rupture, no explosion and no fire during this test.	See appended Table 38.3.4.4	P
<b>38.3.4.5</b>	<b>Test T-5 : External Short-circuit</b>		<b>P</b>
	<b>Purpose :</b> This test simulates an external short circuit.		P
	<b>Procedure:</b> The cell or battery to be tested shall be heated for a period of time necessary to reach a homogeneous stabilized temperature of 57±4°C, measured on the external case.		P
	Cells or batteries are subjected to a short-circuit condition with a total external resistance of less than 0.1 ohm at 57 ± 4 °C. Short-circuit condition is continued for at least 1 h after the cell or battery external case temperature has returned to 57 ± 4°C, or in the case of the large batteries, has decreased by half of the maximum temperature increase observed during the test and remains below that value. The test sample is observed for a further 6 h. Cells or batteries previously subjected to shock test.		P
	<b>Requirement:</b> 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 during the test and within six hours after the test.		P
	<b>Results:</b> no excessive temperature rise, no rupture, no explosion and no fire during this test and within the 6 h of observation.	See appended Table 38.3.4.5	P

UN 38.3. Lithium metal and Lithium ion batteries			
Clause	Requirement + Test	Result-Remark	Verdict
38.3.4.6	<b>Test T-6 : Impact/Crush</b>		P
	<b>Purpose:</b> These tests simulate mechanical abuse from an impact or crush that may result in an internal short circuit.		P
	The test is conducted using test cells or component cells that have not been previously subjected to other transport tests.		P
	Each test cell or component cell shall be subjected to one impact / crush only.		P
	Cylindrical cells not less than 20.0 mm in diameter are tested with impact test procedure.		P
	<b>Procedure(Impact):</b> The cell is placed on a flat smooth surface. A stainless steel bar with a diameter of $15.8 \pm 0.1$ mm and a length of at least 60 mm or of the longest dimension of the cell, whichever is greater, is placed across the centre of the test sample. A mass of $9.1 \pm 0.1$ kg is dropped from a height of $61 \pm 2.5$ cm at the intersection of the bar and the test sample using a vertical sliding track or channel. The vertical track is oriented 90 degrees from the horizontal supporting surface.		P
	The test sample is impacted with its longitudinal axis parallel to the flat surface and perpendicular to the longitudinal axis of the steel		P
	Prismatic, pouch, coin/button cells and cylindrical cells less than 18.0 mm in diameter are tested with crush test procedure.		N/A
	<b>Procedure(Crush):</b> The cell is 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.		N/A
	The crushing is to be continued until one of the three conditions below is reached: - The applied force reaches $13 \pm 0.78$ kN; - The voltage of the cell drops by at least 100mV; or - The cell is deformed by 50 % or more of its original thickness. As soon as one of the above conditions has been obtained, the pressure shall be released.		N/A
	The test sample shall be observed for a further 6 h.		N/A
	<b>Requirement:</b> Cells and component cells meet this requirement if their external temperature does not exceed 170°C and there is no disassembly and no fire during the test and within six hours after this test		N/A
	<b>Results:</b> no excessive temperature rise, no explosion and no fire during this test and within the 6 h of observation.	See appended Table 38.3.4.6	N/A

UN 38.3. Lithium metal and Lithium ion batteries			
Clause	Requirement + Test	Result-Remark	Verdict
38.3.4.7	<b>Test T-7 : Overcharge</b>		N/A
	<i>Purpose :</i> This test evaluates the ability of a rechargeable battery to withstand an overcharge condition.		N/A
	<i>Procedure:</i> The charge current of the battery is twice the manufacturer's recommended maximum continuous charge current. The manufacturer's recommended charge voltage is not more than 18 V. The minimum voltage of the test is the lesser of two times the maximum charge voltage of the battery or 22 V.		N/A
	The manufacturer's recommended charge voltage is not more than 18 V. The minimum voltage of the test is the lesser of two times the maximum charge voltage of the battery or 22 V.		N/A
	The manufacturer's recommended charge voltage is more than 18 V. The voltage of the test is not less than 1.2 times the maximum charge voltage.		N/A
	<i>Requirement:</i> Rechargeable batteries meet this requirement if there is no disassembly and no fire during the test and within seven days after the test.		N/A
	<i>Results:</i> no explosion and no fire during this test and within the 7 days of observation.		N/A
38.3.4.8.	<b>Test T-8 : Forced discharge</b>		P
	<i>Purpose :</i> This test evaluates the ability of a primary or a rechargeable cell to withstand a forced discharge condition.		P
	<i>Procedure:</i> Each cell is forced discharged at ambient temperature by connecting it in series with a 12 V direct current power supply at an initial current equal to the maximum continuous discharge current specified by the manufacturer. Time interval for discharging equals to rated capacity divided by the initial test current. The test sample is observed for a further 7 days.		P
	<i>Requirement:</i> Primary or rechargeable cells meet this requirement if there is no disassembly and no fire during the test and within seven days after the test.		P
	<i>Results:</i> no explosion and no fire during this test, nor within the 7 days of observation.	See appended Table 38.3.4.8	P

### UN 38.3.4.1. : Altitude Test

Clause	Requirement + Test	Result - Remarks	Verdict
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Sample No.	Pre-condition	OCV before test (V)	Mass before test (g)	OCV after test (V)	Mass after test (g)	Mass loss (%)	Voltage remain (%)	Results
T1 to T5_1	Fresh	3.658	99.21	3.66	99.21	0	0.05	P
T1 to T5_2	Fresh	3.662	98.94	3.664	98.94	0	0.05	P
T1 to T5_3	Fresh	3.658	99.23	3.659	99.23	0	0.03	P
T1 to T5_4	Fresh	3.656	99.44	3.658	99.44	0	0.05	P
T1 to T5_5	Fresh	3.66	99.72	3.662	99.72	0	0.05	P
T1 to T5_6	Fresh	3.663	99.26	3.664	99.26	0	0.03	P
T1 to T5_7	Fresh	3.657	99.43	3.658	99.43	0	0.03	P
T1 to T5_8	Fresh	3.66	99.44	3.662	99.44	0	0.05	P
T1 to T5_9	Fresh	3.664	98.8	3.665	98.80	0	0.03	P
T1 to T5_10	Fresh	3.661	98.75	3.662	98.75	0	0.03	P
T1 to T5_11	Full Dis.	3.622	97.89	3.623	97.89	0	0.03	P
T1 to T5_12	Full Dis.	3.621	98.18	3.62	98.18	0	0.03	P
T1 to T5_13	Full Dis.	3.595	98.11	3.595	98.11	0	0	P
T1 to T5_14	Full Dis.	3.62	98.13	3.619	98.13	0	0.03	P
T1 to T5_15	Full Dis.	3.632	98.11	3.633	98.11	0	0.03	P
T1 to T5_16	Full Dis.	3.624	98.04	3.626	98.04	0	0.06	P
T1 to T5_17	Full Dis.	3.638	96.96	3.64	96.96	0	0.05	P
T1 to T5_18	Full Dis.	3.641	98.44	3.644	98.44	0	0.08	P
T1 to T5_19	Full Dis.	3.603	99.45	3.603	99.45	0	0	P
T1 to T5_20	Full Dis.	3.64	97.52	3.642	97.52	0	0.05	P

**Supplementary information:**

**Precondition:**

Full Dis. : Fully discharged state.

Fresh : Undischarged state.

**Results:**

P : No leakage, no venting, no short-circuit (voltage not remain 90%), no rupture, no disassembly(explosion), and no fire.

F : Fail

**UN 38.3.4.2. : Thermal Test**

Clause	Requirement + Test	Result - Remarks	Verdict
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Sample No.	Pre-condition	OCV before test (V)	Mass before test (g)	OCV after test (V)	Mass after test (g)	Mass loss (%)	Voltage remain (%)	Results
T1 to T5_1	Fresh	3.66	99.21	3.656	99.21	0	0.11	P
T1 to T5_2	Fresh	3.664	98.94	3.662	98.94	0	0.05	P
T1 to T5_3	Fresh	3.659	99.23	3.654	99.23	0	0.14	P
T1 to T5_4	Fresh	3.658	99.44	3.682	99.44	0	0.66	P
T1 to T5_5	Fresh	3.662	99.72	3.655	99.72	0	0.19	P
T1 to T5_6	Fresh	3.664	99.26	3.658	99.26	0	0.16	P
T1 to T5_7	Fresh	3.658	99.43	3.658	99.43	0	0	P
T1 to T5_8	Fresh	3.662	99.44	3.659	99.44	0	0.08	P
T1 to T5_9	Fresh	3.665	98.8	3.666	98.80	0	0.03	P
T1 to T5_10	Fresh	3.662	98.75	3.662	98.75	0	0	P
T1 to T5_11	Full Dis.	3.623	97.89	3.617	97.89	0	0.17	P
T1 to T5_12	Full Dis.	3.62	98.18	3.63	98.18	0	0.28	P
T1 to T5_13	Full Dis.	3.595	98.11	3.546	98.11	0	1.36	P
T1 to T5_14	Full Dis.	3.619	98.13	3.624	98.13	0	0.14	P
T1 to T5_15	Full Dis.	3.633	98.11	3.639	98.11	0	0.17	P
T1 to T5_16	Full Dis.	3.626	98.04	3.646	98.04	0	0.55	P
T1 to T5_17	Full Dis.	3.64	96.96	3.63	96.96	0	0.27	P
T1 to T5_18	Full Dis.	3.644	98.44	3.678	98.44	0	0.93	P
T1 to T5_19	Full Dis.	3.603	99.45	3.552	99.45	0	1.42	P
T1 to T5_20	Full Dis.	3.642	97.52	3.653	97.52	0	0.3	P

**Supplementary information:**

**Precondition:**

Full Dis. : Fully discharged state.

Fresh : Undischarged state.

**Results:**

P : No leakage, no venting, no short-circuit (voltage not remain 90%), no rupture, no disassembly(explosion), and no fire.

F : Fail

**UN 38.3.4.3. : Vibration Test**

Clause	Requirement + Test	Result - Remarks	Verdict
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Sample No.	Pre-condition	OCV before test (V)	Mass before test (g)	OCV after test (V)	Mass after test (g)	Mass loss (%)	Voltage remain (%)	Results
T1 to T5_1	Fresh	3.656	99.21	3.655	99.21	0	0.03	P
T1 to T5_2	Fresh	3.662	98.94	3.658	98.94	0	0.11	P
T1 to T5_3	Fresh	3.654	99.23	3.655	99.23	0	0.03	P
T1 to T5_4	Fresh	3.682	99.44	3.68	99.44	0	0.05	P
T1 to T5_5	Fresh	3.655	99.72	3.655	99.72	0	0	P
T1 to T5_6	Fresh	3.658	99.26	3.658	99.26	0	0	P
T1 to T5_7	Fresh	3.658	99.43	3.653	99.43	0	0.14	P
T1 to T5_8	Fresh	3.659	99.44	3.657	99.44	0	0.05	P
T1 to T5_9	Fresh	3.666	98.80	3.66	98.80	0	0.16	P
T1 to T5_10	Fresh	3.662	98.75	3.655	98.75	0	0.19	P
T1 to T5_11	Full Dis.	3.617	97.89	3.59	97.89	0	0.75	P
T1 to T5_12	Full Dis.	3.63	98.18	3.628	98.18	0	0.06	P
T1 to T5_13	Full Dis.	3.546	98.11	3.516	98.11	0	0.85	P
T1 to T5_14	Full Dis.	3.624	98.13	3.621	98.13	0	0.08	P
T1 to T5_15	Full Dis.	3.639	98.11	3.64	98.11	0	0.03	P
T1 to T5_16	Full Dis.	3.646	98.04	3.645	98.04	0	0.03	P
T1 to T5_17	Full Dis.	3.63	96.96	3.631	96.96	0	0.03	P
T1 to T5_18	Full Dis.	3.678	98.44	3.674	98.44	0	0.11	P
T1 to T5_19	Full Dis.	3.552	99.45	3.524	99.45	0	0.79	P
T1 to T5_20	Full Dis.	3.653	97.52	3.645	97.52	0	0.22	P

**Supplementary information:**

**Precondition:**

Full Dis. : Fully discharged state.

Fresh : Undischarged state.

**Results:**

P : No leakage, no venting, no short-circuit (voltage not remain 90%), no rupture, no disassembly(explosion), and no fire.

F : Fail

**UN 38.3.4.4. : Shock Test**

Clause	Requirement + Test	Result - Remarks	Verdict
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Sample No.	Pre-condition	OCV before test (V)	Mass before test (g)	OCV after test (V)	Mass after test (g)	Mass loss (%)	Voltage remain (%)	Results
T1 to T5_1	Fresh	3.655	99.21	3.659	99.21	0	0.11	P
T1 to T5_2	Fresh	3.658	98.94	3.663	98.94	0	0.14	P
T1 to T5_3	Fresh	3.655	99.23	3.666	99.23	0	0.3	P
T1 to T5_4	Fresh	3.68	99.44	3.675	99.44	0	0.14	P
T1 to T5_5	Fresh	3.655	99.72	3.648	99.72	0	0.19	P
T1 to T5_6	Fresh	3.658	99.26	3.666	99.26	0	0.22	P
T1 to T5_7	Fresh	3.653	99.43	3.656	99.43	0	0.08	P
T1 to T5_8	Fresh	3.657	99.44	3.656	99.44	0	0.03	P
T1 to T5_9	Fresh	3.66	98.80	3.643	98.80	0	0.46	P
T1 to T5_10	Fresh	3.655	98.75	3.653	98.75	0	0.05	P
T1 to T5_11	Full Dis.	3.590	97.89	3.600	97.89	0	0.28	P
T1 to T5_12	Full Dis.	3.628	98.18	3.658	98.18	0	0.83	P
T1 to T5_13	Full Dis.	3.516	98.11	3.518	98.11	0	0.06	P
T1 to T5_14	Full Dis.	3.621	98.13	3.620	98.13	0	0.03	P
T1 to T5_15	Full Dis.	3.64	98.11	3.640	98.11	0	0	P
T1 to T5_16	Full Dis.	3.645	98.04	3.650	98.04	0	0.14	P
T1 to T5_17	Full Dis.	3.631	96.96	3.632	96.96	0	0.03	P
T1 to T5_18	Full Dis.	3.674	98.44	3.671	98.44	0	0.08	P
T1 to T5_19	Full Dis.	3.524	99.45	3.455	99.45	0	1.96	P
T1 to T5_20	Full Dis.	3.645	97.52	3.645	97.52	0	0	P

**Supplementary information:**

**Precondition:**

Full Dis. : Fully discharged state.

Fresh : Undischarged state.

**Results:**

P : No leakage, no venting, no short-circuit (voltage not remain 90%), no rupture, no disassembly(explosion), and no fire.

F : Fail

**UN 38.3.4.5. : External short-circuit Test**

Clause	Requirement + Test	Result - Remarks	Verdict
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Sample No.	Pre-condition	OCV before test (V)	Mass before test (g)	OCV after test (V)	Mass after test (g)	Mass loss (%)	Max. case Temp. (°C)	Results
T1 to T5_1	Fresh	3.659	99.33	0	99.33	0	58.2	P
T1 to T5_2	Fresh	3.663	99.53	0	99.53	0	57.3	P
T1 to T5_3	Fresh	3.666	99.29	0	99.29	0	57.5	P
T1 to T5_4	Fresh	3.675	99.14	0	99.14	0	56.7	P
T1 to T5_5	Fresh	3.648	98.73	0	98.73	0	57.5	P
T1 to T5_6	Fresh	3.666	99.49	0	99.49	0	58.1	P
T1 to T5_7	Fresh	3.656	99.34	0	99.34	0	57.9	P
T1 to T5_8	Fresh	3.656	99.45	0	99.45	0	57.2	P
T1 to T5_9	Fresh	3.643	99.26	0	99.26	0	57.5	P
T1 to T5_10	Fresh	3.653	99.39	0	99.39	0	58.1	P
T1 to T5_11	Full Dis.	3.600	96.74	3.545	96.74	0	60	P
T1 to T5_12	Full Dis.	3.658	96.65	3.646	96.65	0	60.2	P
T1 to T5_13	Full Dis.	3.518	97.59	3.442	97.59	0	59.2	P
T1 to T5_14	Full Dis.	3.620	95.51	3.618	95.51	0	59.7	P
T1 to T5_15	Full Dis.	3.640	96.76	3.640	96.76	0	61.8	P
T1 to T5_16	Full Dis.	3.650	96.2	3.628	96.20	0	62.7	P
T1 to T5_17	Full Dis.	3.632	97.2	3.609	97.20	0	62.3	P
T1 to T5_18	Full Dis.	3.671	97.16	3.647	97.16	0	72.6	P
T1 to T5_19	Full Dis.	3.455	96.95	3.441	96.95	0	62.2	P
T1 to T5_20	Full Dis.	3.645	97.11	3.636	97.11	0	70.3	P

**Supplementary information:**

**Precondition:**

Full Dis. : Fully discharged state.

Fresh : Undischarged state(with Fuse).

**Results:**

P : No leakage, no venting, no short-circuit (voltage not remain 90%), no rupture, no disassembly(explosion), and no fire.

F : Fail

**UN 38.3.4\*.6a. : Impact Test**

Clause	Requirement + Test	Result - Remarks	Verdict
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Sample No.	Pre-condition	OCV before test (V)	Mass before test (g)	Max. case Temp. (°C)	Results
T6a_1	Fresh	3.663	98.09	46.9	P
T6a_2	Fresh	3.659	97.99	29.5	P
T6a_3	Fresh	3.665	98.37	74.1	P
T6a_4	Fresh	3.653	98.1	35.3	P
T6a_5	Fresh	3.657	98.31	26.4	P
T6a_6	Full Dis.	3.628	98.06	26.6	P
T6a_7	Full Dis.	3.613	97.47	31.2	P
T6a_8	Full Dis.	3.637	98.54	30.8	P
T6a_9	Full Dis.	3.661	98.22	34.2	P
T6a_10	Full Dis.	3.661	98.48	33.6	P

**Supplementary information:**

**Precondition:**

Full Dis. : Fully discharged state(with Fuse).

Fresh : Undischarged state(with Fuse).

**Results:**

P : No leakage, no venting, no short-circuit (voltage not remain 90%), no rupture, no disassembly(explosion), and no fire.

F : Fail

**UN 38.3.4.8. : Forced discharge Test**

Clause	Requirement + Test	Result - Remarks	Verdict
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Sample No.	Pre-condition	OCV before test (V)	Mass before test (g)	OCV after test (V)	Reverse charging Current (A)	Max. case Temp. (°C)	Results
T8_1	Full Dis.	3.667	98.3	2.273	1.8	45.6	P
T8_2	Full Dis.	3.665	97.68	0		33.4	P
T8_3	Full Dis.	3.666	98.25	0		33	P
T8_4	Full Dis.	3.666	97.88	1.103		40.9	P
T8_5	Full Dis.	3.667	97.62	1.377		38.3	P
T8_6	Full Dis.	3.608	98.15	0.003		40.9	P
T8_7	Full Dis.	3.619	98.29	0.128		41.9	P
T8_8	Full Dis.	3.6	98.14	0.001		79.6	P
T8_9	Full Dis.	3.612	97.7	0.125		64.3	P
T8_10	Full Dis.	3.623	98.85	0.001		36.8	P

**Supplementary information:**

**Precondition:**

Full Dis. : Fully discharged state.

Fresh : Undischarged state(with Fuse).

**Results:**

P : No leakage, no venting, no short-circuit (voltage not remain 90%), no rupture, no disassembly(explosion), and no fire.

F : Fail

## 4. Documents

### 4.1. Specifications

Lithium Primary Battery (Li-SOCl<sub>2</sub>)

# CLH-20

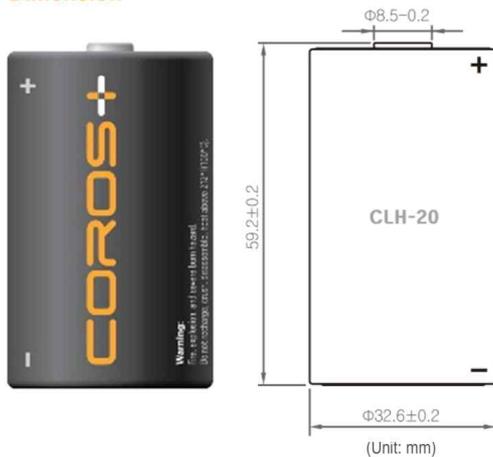
3.6V, D Spiral

COROS+

#### Specifications

Standard	ER33600
Nominal Voltage	3.6V
Nominal Capacity (@~20mA, to 2.0V)	14.0Ah
Max. Cont. Current	1800mA
Max. Pulse Current	3000mA
Operating Temp. range	-55~+85°C
Lithium Contents	~4.5g
Weight	102g
UL Filing No.	MH62104

#### Dimension



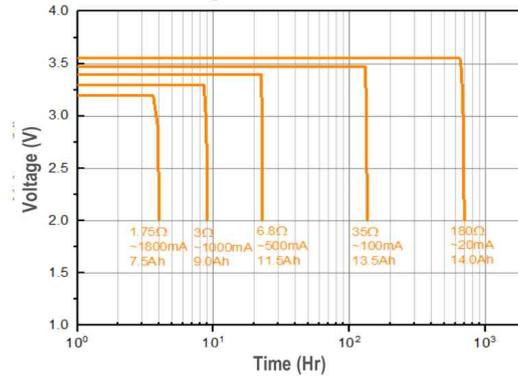
#### Available Terminals & Connectors

T1, AX, Wire, C&W (custom type)

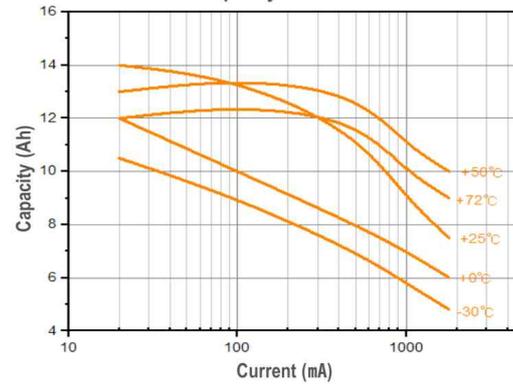
#### WARNING

Fire, explosion, and severe burn hazards.  
 Do not disassemble  
 Do not heat above 100°C  
 Do not recharge, short circuit, crush, incinerate, or expose contents to water

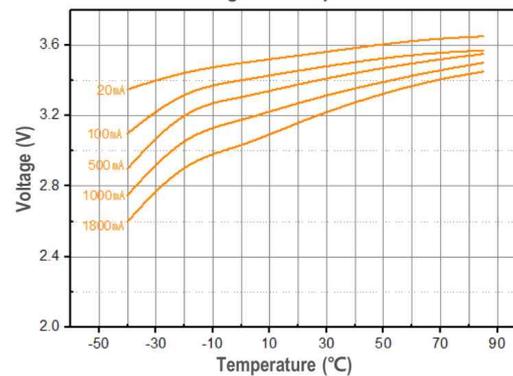
#### Discharge Characteristics at +25°C



#### Capacity vs. Current



#### Voltage vs. Temperature



(Typical values stored at 25°C for one year)

COROS BATTERY CO., LTD. [www.corosbattery.com](http://www.corosbattery.com) [info@corosbattery.com](mailto:info@corosbattery.com)

V-19A

Any values in this data sheet are only for information purpose and not the warranty of future performance and they are subjected to change without notice.