



CHEMICAL POWER SOURCES TESTING LABORATORY

TEST REPORT

№ S 121/2020/1

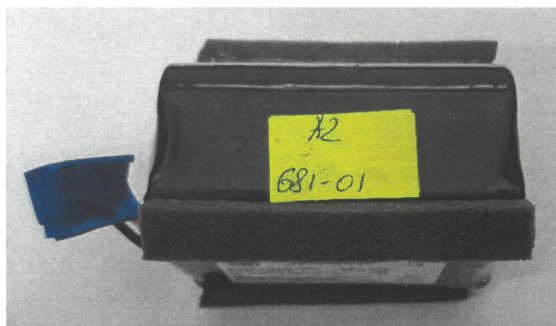
Test object/product: Lithium-Ion battery

	NAME/POSITION	SIGNATURE/STAMP
TEST RESULTS AUTHORIZED BY	Ryszard Bartnicki <i>Technician Supervising Tests</i>	Laboratorium Badań Chemicznych Źródeł Prądu TECHNIK NADZORUJĄCY BADANIA 
TEST REPORT VALIDATED BY	Kamil Frączek <i>Head of Laboratory</i>	KIEROWNIK Laboratorium Badań Chemicznych Źródeł Prądu  mgr Kamil Frączek
Date of test report: 01/02/2021		Distribution list: 1 copy for Client, 1 copy a/a



1. This test report presents results of accredited tests covered by the scope of Laboratory's accreditation and the not-accredited ones.
2. Acronyms:
A – accredited test covered by the scope of Laboratory's Accreditation No PCA AB 124, **NA** – non-accredited test.
3. Chemical Power Sources Testing Laboratory is accredited by Polish Centre for Accreditation, a signatory of EA MLA and ILAC MRA. Accreditation № AB 124.
4. Test results refer only to the tested sample.
5. This test report cannot be reproduced without Laboratory's written consent.
6. Client is entitled to submit his claims up to 14 days after reception of this test report.
7. Annexe: Test summary (refers only to UN TESTS).

Test report no: S 121/2020/1			
F-01/LPO-10	Form date F: 11.05.2020	Form issue no: 05	Page 2/9
GENERAL INFORMATION			
CLIENT/MANUFACTURER		DOCUMENT	
Name: Omnitron Griese GmbH Address: Mühlstrasse 20; D-65388 Schlangenbad, Website: www.omnitron.de Email: info@omnitron.de Telephone: +49 (0) 6129/5053 - 0		Order / agreement №: 121/2020 date: 22/12/2020	
TESTED OBJECT / PRODUCT			
Name:	LITHIUM-ION RECHARGEABLE BATTERY LG Lithium-Ion Akkupack Model: 3s2p INR18650MJ1		
Description / state:	Rated capacity 7,0 Ah Rated voltage 10,8 V Rated energy 75,6 Wh		
Sampling / sample delivery method:	Sample was delivered by the Client		
Sample size:	8 pieces		
Sample collection date: 18.12.2020		Sample production date: -	
Test initiation date: 18.12.2020		Test completion date: 30.01.2021	
SCOPE AND METHODOLOGY			
Tests carried out according to: Recommendations on the Transport Of Dangerous Goods Manual of Tests and Criteria ST/SG/AC.10/11/Rev.7, Section 38.3 Lithium metal and lithium ion batteries (hereinafter referred to as UN TEST)			
SAMPLE IDENTIFICATION NUMBERS			
Laboratory identification numbers (sample ID): AZ 681 – (01÷08)			
(at 1 st cycle) AZ 681-(01÷04)		(after 25 cycles performed at the Client) AZ 681-(05÷08)	



TEST PROGRAMME

Item	Test name		Methodology	Sample ID:	Page of report
1.	T1. Altitude simulation	A	UN TEST paragraph 38.3.4.1	AZ 681-01+08	4
2.	T2. Thermal test	A	UN TEST paragraph 38.3.4.2	AZ 681-01+08	5
3.	T3. Vibration	NA	UN TEST paragraph 38.3.4.3	AZ 681-01+08	6
4.	T4. Shock	NA	UN TEST paragraph 38.3.4.4	AZ 681-01+08	7
5.	T5. External short circuit	A	UN TEST paragraph 38.3.4.5	AZ 681-01+08	8
6.	T7. Overcharge	A	UN TEST paragraph 38.3.4.5	AZ 681-01+08	9

Test report no: S 121/2020/1			
F-01/LPO-10	Form date F: 11.05.2020	Form issue no: 05	Page 4/9

T.1 ALTITUDE SIMULATION

Test procedure (document): UN TEST paragraph 38.3.4.1 **Sample ID:** AZ 681-(01÷08)

Test conditions: pressure in the chamber 11kPa/ time t ≥ 6h/ ambient temperature 20±5°C

TEST RESULTS								
Sample ID	Fully charged state	VOLTAGE [V]			MASS [g]			Sample observation
		before testing	after testing	change OCV [%]	before testing	after testing	change mass [%]	
AZ 681-01	at 1 st cycle	12,46	12,44	99,84	297,05	297,16	0,04	O
AZ 681-02	at 1 st cycle	12,48	12,45	99,76	296,97	297,06	0,03	O
AZ 681-03	at 1 st cycle	12,46	12,44	99,84	297,39	297,50	0,04	O
AZ 681-04	at 1 st cycle	12,47	12,44	99,76	297,41	297,56	0,05	O
AZ 681-05	after 25 cycles	12,49	12,47	99,84	297,07	297,18	0,04	O
AZ 681-06	after 25 cycles	12,49	12,47	99,84	297,79	297,90	0,04	O
AZ 681-07	after 25 cycles	12,48	12,46	99,84	297,21	297,31	0,03	O
AZ 681-08	after 25 cycles	12,49	12,47	99,84	297,73	297,83	0,03	O
Measurement uncertainty:		± 0,01 V			± 0,01 g			
Result:		PASS						

Description phenomenon: **D** – disassembly; **F** – fire; **L** – leakage; **R** – rupture; **V** – venting; **SN** – the open circuit voltage after testing is less than 90% of its voltage immediately prior the test
Acceptance criteria: **O** – none of above phenomena were observed

Test equipment:	ATT TD150C vacuum chamber
	Digital thermometer
	METRAHIT X-TRA multimeter
	RADWAG WTC 2000 balance

Test report no: S 121/2020/1			
F-01/LPO-10	Form date F: 11.05.2020	Form issue no: 05	Page 5/9

T.2 THERMAL TEST

Test procedure (document): UN TEST paragraph 38.3.4.2 **Sample ID:** AZ 681-(01÷08)

Test conditions: storage at a test temp. $72\pm 2^{\circ}\text{C}$ for $t \geq 6\text{h}$ / storage at a test temp. $-40\pm 2^{\circ}\text{C}$ for $t \geq 6\text{h}$ / x 10 cycles

TEST RESULTS								
Sample ID	Fully charged state	VOLTAGE [V]			MASS [g]			Sample observation
		before testing	after testing	change OCV [%]	before testing	after testing	change mass [%]	
AZ 681-01	at 1 st cycle	12,44	12,30	98,87	297,16	297,10	0,02	O
AZ 681-02	at 1 st cycle	12,45	12,30	98,80	297,06	297,01	0,02	O
AZ 681-03	at 1 st cycle	12,44	12,30	98,87	297,50	297,45	0,02	O
AZ 681-04	at 1 st cycle	12,44	12,30	98,87	297,56	297,47	0,03	O
AZ 681-05	after 25 cycles	12,47	12,31	98,72	297,18	297,12	0,02	O
AZ 681-06	after 25 cycles	12,47	12,31	98,72	297,90	297,84	0,02	O
AZ 681-07	after 25 cycles	12,46	12,31	98,80	297,31	297,27	0,01	O
AZ 681-08	after 25 cycles	12,47	12,32	98,80	297,83	297,78	0,02	O
Measurement uncertainty:		$\pm 0,01\text{ V}$			$\pm 0,01\text{ g}$			
Result:		PASS						

Description phenomenon: **D** – disassembly; **F** – fire; **L** – leakage; **R** – rupture; **V** – venting; **SN** – the open circuit voltage after testing is less than 90% of its voltage immediately prior the test
Acceptance criteria: **O** – none of above phenomena were observed

Test equipment:	ATT TD150C climatic chamber
	METRAHIT X-TRA multimeter
	RADWAG WTC 2000 balance
	Digital thermometer

Test report no: S 121/2020/1			
F-01/LPO-10	Form date F: 11.05.2020	Form issue no: 05	Page 6/9

T.3 VIBRATION

Test procedure (document): UN TEST paragraph 38.3.4.3 **Sample ID:** AZ 681-(01÷08)

Test conditions:

Frequency range [Hz]		Amplitudes	Duration of logarithmic sweep cycle (7 Hz – 200 Hz – 7Hz)	Axis	Number of cycles
from	to				
7	18	1 g _n	15 min	X	12
18	50	0,8 mm		Y	12
50	200	8 g _n		Z	12
And back to 7 Hz				Total	36

TEST RESULTS								
Sample ID	Fully charged state	VOLTAGE [V]			MASS [g]			Sample observation
		before testing	after testing	change OCV [%]	before testing	after testing	change mass [%]	
AZ 681-01	at 1 st cycle	12,30	12,30	100,00	297,10	297,05	0,02	O
AZ 681-02	at 1 st cycle	12,30	12,29	99,92	297,01	296,96	0,02	O
AZ 681-03	at 1 st cycle	12,30	12,29	99,92	297,45	297,38	0,02	O
AZ 681-04	at 1 st cycle	12,30	12,30	100,00	297,47	297,41	0,02	O
AZ 681-05	after 25 cycles	12,31	12,31	100,00	297,12	297,06	0,02	O
AZ 681-06	after 25 cycles	12,31	12,31	100,00	297,84	297,78	0,02	O
AZ 681-07	after 25 cycles	12,31	12,30	99,92	297,27	297,20	0,02	O
AZ 681-08	after 25 cycles	12,32	12,31	99,92	297,78	297,71	0,02	O
Measurement uncertainty:		± 0,01 V			± 0,01 g			
Result:		PASS						

Description phenomenon: **D** – disassembly; **F** – fire; **L** – leakage; **R** – rupture; **V** – venting; **SN** – the open circuit voltage after testing is less than 90% of its voltage immediately prior the test
Acceptance criteria: **O** – none of above phenomena were observed

Test equipment:	TIRA vibration test system
	SVAN 956 vibration meter
	METRAHIT X-TRA multimeter
	RADWAG WTC 2000 balance

Test report no: S 121/2020/1			
F-01/LPO-10	Form date F: 11.05.2020	Form issue no: 05	Page 7/9

T.4 SHOCK

Test procedure (document): UN TEST paragraph 38.3.4.4 **Sample ID:** AZ 681-(01÷08)

Test conditions: peak acceleration 150g / pulse duration 6 ms / 3 shocks for each axis and each direction/ total 18 shocks

TEST RESULTS								
Sample ID	Fully charged state	VOLTAGE [V]			MASS [g]			Sample observation
		before testing	after testing	change OCV [%]	before testing	after testing	change mass [%]	
AZ 681-01	at 1 st cycle	12,30	12,29	99,92	297,05	297,05	0,00	O
AZ 681-02	at 1 st cycle	12,29	12,29	100,00	296,96	296,96	0,00	O
AZ 681-03	at 1 st cycle	12,29	12,29	100,00	297,38	297,38	0,00	O
AZ 681-04	at 1 st cycle	12,30	12,30	100,00	297,41	297,41	0,00	O
AZ 681-05	after 25 cycles	12,31	12,31	100,00	297,06	297,06	0,00	O
AZ 681-06	after 25 cycles	12,31	12,31	100,00	297,78	297,78	0,00	O
AZ 681-07	after 25 cycles	12,30	12,30	100,00	297,20	297,20	0,00	O
AZ 681-08	after 25 cycles	12,31	12,31	100,00	297,71	297,71	0,00	O
Measurement uncertainty:		± 0,01 V			± 0,01 g			
Result:		PASS						

Description phenomenon: **D** – disassembly; **F** – fire; **L** – leakage; **R** – rupture; **V** – venting; **SN** – the open circuit voltage after testing is less than 90% of its voltage immediately prior the test

Acceptance criteria: **O** – none of above phenomena were observed

Test equipment:	TIRA vibration test system
	SVAN 956 vibration meter
	METRAHIT X-TRA multimeter
	RADWAG WTC 2000 balance

Test report no: S 121/2020/1			
F-01/LPO-10	Form date F: 11.05.2020	Form issue no: 05	Page 8/9

T.5 EXTERNAL SHORT CIRCUIT

Test procedure (*document*): UN TEST paragraph 38.3.4.5 **Sample ID:** AZ 681-(01+08)

Test conditions: heating time $t \geq 6h$ / temperature $57 \pm 4^\circ C$ / external resistance $< 0,1\Omega$ / short circuit duration $t_z \geq 1h$

TEST RESULTS				
Sample ID	Fully charged state	Temp. of external case after heating [°C]	Max. temp. of external case during test [°C]	Observation of the sample after 6h
AZ 681-01	at 1 st cycle	56,5	56,6	O
AZ 681-02	at 1 st cycle	56,7	56,9	O
AZ 681-03	at 1 st cycle	55,9	56,0	O
AZ 681-04	at 1 st cycle	56,2	56,4	O
AZ 681-05	after 25 cycles	56,5	56,6	O
AZ 681-06	after 25 cycles	55,8	55,9	O
AZ 681-07	after 25 cycles	56,1	56,2	O
AZ 681-08	after 25 cycles	55,5	55,7	O
Measurement uncertainty:		$\pm 0,2^\circ C$		
Result:		PASS		

Description phenomenon: **D** – disassembly; **R** – rupture; **F** – fire; **T** - temperature $>170^\circ C$

Acceptance criteria: **O** – none of above phenomena were observed during the test and within 6 h after the test

Test equipment:	MSK-TE901-UL device to short-circuit tests
	Temperature chamber
	Hioki resistance tester
	Digital thermometer

Test report no: S 121/2020/1			
F-01/LPO-10	Form date F: 11.05.2020	Form issue no: 05	Page 9/9

T.7 OVERCHARGE

Test procedure (*document*): UN TEST paragraph 38.3.4.7 **Sample ID:** AZ 681-(01÷08)

Test conditions: test duration 24h/ ambient temperature 20±5°C/ if max. charge voltage ≤ 18 V, min. test voltage is 2 x max. charge voltage or 22 V/ charge current = 2x max. charge current recommended by the manufacturer

TEST RESULTS			
Charge current $I_t \leq 6,8 \text{ A}$			Voltage $U_{\text{const}} = 22,0 \text{ V}$
Sample ID	Fully charged state	Sample observation	
AZ 681-01	at 1 st cycle	O	
AZ 681-02	at 1 st cycle	O	
AZ 681-03	at 1 st cycle	O	
AZ 681-04	at 1 st cycle	O	
AZ 681-05	after 25 cycles	O	
AZ 681-06	after 25 cycles	O	
AZ 681-07	after 25 cycles	O	
AZ 681-08	after 25 cycles	O	
Result:		PASS	

Description phenomenon: **D** – disassembly; **F** – fire

Acceptance criteria: **O** – none of above phenomena were observed during the test and within 7 days after the test

Test equipment:	DIGATRON tester
	Digital thermometer

END OF TEST REPORT

TEST SUMMARY

Product: LITHIUM-ION RECHARGEABLE BATTERY		
Model №: 3s2p INR18650MJ1		
Product description: LG Lithium-Ion Akkupack 7,0 Ah; 10,8 V		
Mass: 298 g	Nominal energy: 75,6 Wh	
Manufacturer: <i>(name, address)</i>	Omnitron Griese GmbH Mühlstrasse 20, D-65388 Schlangenbad	
Website: www.omnitron.de		
Email: info@omnitron.de	Telephone: +49 (0) 6129/5053 - 0	
Based on the following test results:		
UN TEST PARAGRAPH	TEST NAME	¹⁾RESULT/CONFIRMATION OF CONFORMITY
38.3.4.1	T.1 Altitude simulation	passed
38.3.4.2	T.2 Thermal test	passed
38.3.4.3	T.3 Vibration	passed
38.3.4.4	T.4 Shock	passed
38.3.4.5	T.5 External short circuit	passed
38.3.4.6	T.6a Impact	not applicable
38.3.4.6	T.6b Crush	not applicable
38.3.4.7	T.7 Overcharge	passed
38.3.4.8	T.8 Forced discharge	not applicable
¹⁾ according to Test Report № S 121/2020/1 result: passed/failed/not applicable (not required or not included in the order). This Test Summary is an integral part of the Test Report, which contains detailed test results.		
<u>it is confirmed</u> that the product met requirements of: Recommendations on the Transport Of Dangerous Goods Manual of Tests and Criteria ST/SG/AC.10/11/Rev.7:2020, Lithium metal and lithium ion batteries (Section 38.3) except paragraph 38.3.4.6, 38.3.4.8		

Poznań, 01.02.2021

Technician supervising test



Ryszard Bartnicki



Head of Laboratory



Kamil Frączyk M.A.