Test Report issued under the responsibility of:

TEST REPORT
UL 2056
Standard of Power Banks

Report Number. .....:	ATSL191113611
Date of issue .....:	2019-12-10
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Testing Laboratory .....:	**ATS Electronic Technology Co., Ltd.**
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Applicant's name.....:	ShenZhen TopSharp Precision Electronics Co., Ltd
Address .....:	north,8th Floor, Building 1st,B District,HuaFeng 1st Technology zone, XiXiang, SanWei, Xixiang street, Baoan, ShenZhen, Guangdong, China
Manufacturer's name .....:	ShenZhen TopSharp Precision Electronics Co., Ltd
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Factory's name.....:	ShenZhen TopSharp Precision Electronics Co., Ltd
Address .....:	north,8th Floor, Building 1st,B District,HuaFeng 1st Technology zone, XiXiang, SanWei, Xixiang street, Baoan, ShenZhen, Guangdong, China
Test specification:	
Standard.....:	UL2056: 2015
Test procedure .....:	N/A
Non-standard test method.....:	N/A
Test item description .....:	Hand warmers
Trade Mark.....:	N/A
Manufacturer .....:	Same as applicant
Model/Type reference .....:	HF-408
Ratings .....:	Battery Capacity: 5200mAh USB Input: 5V dc, 2.1A; USB Output: 5V dc, 2.1A; (3100mAh)

Summary of testing:	
Tests performed (name of test and test clause): cl.8.4 Abnormal Charging Test; cl.8.5 Abusive Overcharge Test; cl.8.7/8.8 Battery Pack Component Temperature Test and Battery Pack Surface Temperature Test; cl.9 Power Input Test; cl.10 Overload of Output Ports Test; cl.12 Capacity Verification Test	**Testing location:** **ATS Electronic Technology Co., Ltd.** 3/F, Building A, No. 1 Hedong Three Road, Jinxia Community, Changan Town, Dongguan City, Guangdong, China

Test item particulars .....:	
Classification of installation and use ..... :	Portable (not directly connected to the mains)
Supply connection ..... :	Connector
Recommend charging method declared by the manufacturer ..... :	Charging the power bank with 2100mA constant current and 5V constant voltage until the current reduces to 104mA at ambient 20°C±5°C
Discharge current (0.2 I_t A) ..... :	1040mA
Specified final voltage ..... :	4.5V
Chemistry ..... :	☐ nickel systems ☒ lithium systems
Recommend of charging limit for lithium system	
Upper limit charging voltage per cell..... :	4.2V
Maximum charging current..... :	2100mA
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)
Testing:	
Date of receipt of test item ..... :	2019-11-22
Date(s) of performance of tests..... ..... :	2019-11-22 to 2019-12-03

General remarks:

The test results presented in this report relate only to the object tested.
This report shall not be reproduced, except in full, without the written approval of the Issuing testing laboratory.
"(See Enclosure #)" refers to additional information appended to the report.
"(See appended table)" refers to a table appended to the report.
Throughout this report a ☐ comma / ☒ point is used as the decimal separator.

General product information:

The product covered in this report is a power bank which is intended to use for mobile powering of low voltage electronic devices. The Power bank consists of single Li-ion cell inside.

1). The component cell has been approved according to UL1642.

2). The power bank has been evaluated according to UL 2054, except the test items in Clause 8 (details see page 2).

3). The Input load and output loads can not be operated at the same time.

The main features of the power bank are shown as below:

Model	Nominal capacity	Nominal voltage	Nominal Charge Current	Nominal Discharge Current	Maximum Charge Current	Maximum Discharge Current	Maximum Charge Voltage	Cut-off Voltage
HF408	3100mAh	5.0V	2100mA	2100mA	2100mA	2100mA	5.0V	4.5V

The main features of the built-in cell are shown as below:

Model	Nominal capacity	Nominal voltage	Nominal Charge Current	Nominal Discharge Current	Maximum Charge Current	Maximum Discharge Current	Maximum Charge Voltage	Cut-off Voltage
18560	2600mAh	3.7V	520mA	520mA	2600mA	2600mA	4.2V	3.0V

CONSTRUCTION			
7	**General**		**P**
7.1	Power banks shall comply with the requirements in the Standard for Household and Commercial Batteries, UL 2054	Full compliance according to UL2054 not applied for. Only critical tests according to clauses 9, 10, 19, 20 and 21 were evaluated and complied.	P
7.2	The input port from external power supply is in general dc jack or USB port, and shall not be of the types described in 1.3	Micro USB used.	P
7.4	For power banks with direct plug-in construction, the following shall be met.	Not direct plug-in construction.	N/A
	a) The power bank and its built-in ac/dc power supply shall comply with the applicable requirements of either the Standard for Information Technology Equipment-Safety-Part 1: General Requirements, UL60950-1 or the Standard for Audio/Video, Information and Communication Technology Equipment-Part 1: Safety Requirements, UL 62368-1.		N/A
	b) A barrier shall be provided between the built-in ac/dc power supply and built-in battery pack. The barrier shall comply with the requirements of electrical insulation and fire enclosure of either the Standard for Information Technology Equipment-Safety-Part 1: General Requirements, UL60950-1 or the Standard for Audio/Video, Information and Communication Technology Equipment-Part 1: Safety Requirements, UL 62368-1.		N/A
7.4	For power banks with direct plug-in construction, the following shall be met.	Not direct plug-in construction.	N/A

PERFORMANCE			
8	**General**		**P**
8.1	Unless otherwise superseded by a requirement in this Outline, power banks shall comply with the requirements of battery packs in the Standard for Household and Commercial Batteries, UL 2054	Full compliance according to UL2054 not applied for. Only critical tests according to clauses 9, 10, 19, 20 and 21 were evaluated and complied.	P
8.2	For the Abnormal Charging Test and Abusive Overcharge Test in the Standard for Household and Commercial Batteries, UL 2054, 8.3 – 8.5 shall be followed		P
8.3	The tests shall be conducted at the input point of battery protecting circuit. Note – This means dc/dc converter circuitry will be bypassed to result in battery overcharging, which is required for the evaluation of protecting circuit	DC/DC converter circuitry is bypassed.	P

8.4	For the Abnormal Charging Test in the Standard for Household and Commercial Batteries, UL 2054, the following shall be taken as maximum current Ic: Rated maximum charging current of the built-in battery (rather than the power bank)	See appended table 8.4	P
8.5	For the Abusive Overcharge Test in the Standard for Household and Commercial Batteries, UL 2054, the C5 amp rate of the built-in battery (rather than the power bank) shall be taken for the purpose of this test	See appended table 8.5	P
8.6	For the Battery Pack Component Temperature Test and Battery Pack Surface Temperature Test in the Standard for Household and Commercial Batteries, UL 2054, 8.7 and 8.8 shall be followed		P
8.7	For output loading temperature test, a fully charged power bank shall be discharged. Any load of the output ports that can be operated at the same time shall be considered to result in maximum temperature rise	See appended table 8.7/8.8	P
8.8	For input loading temperature test, a fully discharged power bank shall be charged in accordance with manufacturer's specifications. Any load of the output ports that can be operated at the same time shall be considered to result in maximum temperature rise	See appended table 8.7/8.8	P
8.9	Each output port shall be a limited power source in accordance with Standard for Household and Commercial Batteries, UL 2054 or the Standard for Information Technology Equipment – Safety – Part 1: General Requirements, UL 60950-1, or a Class 2 power source in accordance with the Standard for Class 2 Power Units, UL 1310	See appended table 8.9	P
8.10	Each output port shall be a SELV circuit in accordance with the Standard for Information Technology Equipment – Safety – Part 1: General Requirements, UL 60950-1	SELV circuit, dc output rated less than 60Vdc.	N/A

9	**Power Input Test**		**P**
9.1	The current input to a power bank shall not exceed 110% of the marked input current rating of the power bank, when the power bank is operated under the conditions of maximum normal load	See appended table 9	P
9.2	Maximum normal load shall consist of the maximum current draw while the power bank is operating in all possible modes. This may include charging the built-in battery, and output ports unloaded or loaded at the rated maximum normal load. Any load that can be operated at the same time shall be considered in order to obtain the maximum normal load	The Input load and output loads can not be operated at the same time.	N/A

10	**Overload of Output Ports Test**	**P**

10.1	Each power output pin of output port shall be overloaded in accordance with 10.2 – 10.5		P
10.2	In accordance with manufacturer's specifications, fully charge the built-in battery of power bank	DC 5V/2.1A charge.	P
10.3	The power bank is covered with one layer of cheesecloth and placed on a softwood board covered with one layer of tissue paper		P
10.4	Each power output pin of output port shall then be loaded to draw the maximum current, for at least 1 h. The maximum current shall be just below the trip point of any protective device, which is considered to be 110% of its current rating.		P
10.5	After this test, the cheesecloth and tissue paper shall remain intact.	See appended table 10	P

11	**Flammability of Photovoltaic Cells Test**		**N/A**
11.1	This test shall be conducted if the power bank is provided with integral photovoltaic cells as a power source.	No photovoltaic cells used.	N/A
11.2	In accordance with manufacturer's specifications, fully charge the built-in battery of the power bank.		N/A
11.3	The power bank is covered with one layer of cheesecloth and placed on a softwood board covered with one layer of tissue paper.		N/A
11.4	The power bank is subjected to single component fault that is likely to occur and which would result in flammability issue of the photovoltaic cells, such as back-feed of battery power, and is kept in this state for 1 h		N/A
11.5	After this test, the cheesecloth and tissue paper shall remain intact.		N/A

12	**Capacity Verification Test**		**P**
12.1	The marked electrical capacity of power bank, measured at the power output pin of output port, shall comply with the Standard for Secondary Cells and Batteries Containing Alkaline or Other Non-Acid Electrolytes – Secondary Lithium Cells and Batteries for Portable Applications, IEC 61960, Clause 7.3.1, Discharge Performance at 20°C (Rated Capacity), and the modified test method in 12.2	See appended table 12	P
12.2	The power bank is discharged at a constant current equals to rated current of the output port, until its voltage is equal to the end-of-discharge voltage of the output port, specified by the manufacturer		P

MARKINGS

13	**General**		**P**
13.1	Unless otherwise superseded by a requirement in this Outline, power banks shall comply with the requirements in the Standard for Household and Commercial Batteries, UL 2054	See marking plate on page 2	P
13.2	For electrical ratings, the following information shall be provided:	See marking plate on page 2	P
	a) Input rating in Vdc and A. If there are more than one input ports, the rating of each port shall be provided;	Considered.	P
	b) Output rating in Vdc and A. If there are more than one output ports, it shall include rating of each port and the combined rating (if it is not equal to the summation of all ports); and	Considered.	P
	c) Electrical capacity in Ah or mAh. If there are more than one output ports/output ratings, either the capacity of each port/rating shall be provided, or the minimum capacity of these ports/ratings shall be provided.	Considered.	P

INSTRUCTIONS			
14	**General**		P
14.1	Power banks shall be provided with legible instructions pertaining to the proper selection and replacement of its power supply or charger.	User manual provided.	P
14.2	Power banks shall be provided with legible instructions pertaining to a risk of fire or injury to persons associated with the use of the product.	User manual provided.	P
14.3	An illustration is allowed with a required instruction to clarify the intent but shall not replace the written instruction.	No related illustration in the user manual	N/A

15	**Instructions Pertaining to Risk of Fire or Injury to Persons**		**P**
15.1	Instructions pertaining to a risk of fire or injury to persons shall warn the user of reasonably foreseeable risks and state the precautions to be taken to reduce such risks. Such instructions shall be preceded by the heading “INSTRUCTIONS PERTAINING TO RISK OF FIRE OR INJURY TO PERSONS” or the equivalent.	User manual provided.	P
15.2	Unless otherwise indicated, the text of the instructions in 15.4 shall be in the words specified or words that are equivalent, clear, and understandable. Substitution of the signal word “DANGER” for “WARNING” is allowed when the risk associated with the product is such that a situation exists which, if not avoided, will result in death or serious injury.	User manual provided.	P

15.3	Numbering of the items in the list in 15.4 and including other instructions pertaining to a risk of fire or injury to persons that the manufacturer determines to be necessary and that do not conflict with the intent of the instructions are acceptable.	User manual provided.	P
15.4	The instructions pertaining to a risk of fire or injury to persons shall include those items in the following list that are applicable to the product. The statement "IMPORTANT SAFETY INSTRUCTIONS" or the equivalent shall precede the list, and the statement "SAVE THESE INSTRUCTIONS" or the equivalent shall either precede or follow the list. The word "WARNING" shall be entirely in upper case letters or shall be emphasized to distinguish it from the rest of the text. IMPORTANT SAFETY INSTRUCTIONS WARNING – When using this product, basic precautions should always be followed, including the following: a) Read all the instructions before using the product. b) To reduce the risk of injury, close supervision is necessary when the product is used near children. c) Do not put fingers or hands into the product. d) Do not expose power bank to rain or snow. e) Use of a power supply or charger not recommended or sold by power pack manufacturer may result in a risk of fire or injury to persons. f) Do not use the power bank in excess of its output rating. Overload outputs above rating may result in a risk of fire or injury to persons. g) Do not use the power bank that is damaged or modified. Damaged or modified batteries may exhibit unpredictable behavior resulting in fire, explosion or risk of injury. h) Do not disassemble the power bank. Take it to a qualified service person when service or repair is required. Incorrect reassembly may result in a risk of fire or injury to persons. i) Do not expose a power pack to fire or excessive temperature. Exposure to fire or temperature above 100°C may cause explosion. The temperature of 100°C can be replaced by the temperature of 212°F. j) Have servicing performed by a qualified repair person using only identical replacement parts. This will ensure that the safety of the product is maintained. k) Switch off the power bank when not in use. SAVE THESE INSTRUCTIONS	User manual provided.	P

	APPENDIX A		**P**
	Standards for Components Standards under which components of the products covered by this outline of investigation are evaluated include the following: Title of Standard – UL Standard Designation Automatic Electrical Controls for Household and Similar Use, Part 1: General Requirements – UL 60730-1 Low-Voltage Fuses – Part 1: General Requirements – UL 248-1 Low-Voltage Fuses – Part 14: Supplemental Fuses – UL 248-14 Marking and Labeling Systems – UL 969 Polymeric Materials – Use in Electrical Equipment Evaluations – UL 746C Printed-Wiring Boards – UL 796 Tests for Flammability of Plastic Materials for Parts in Devices and Appliances – UL 94 Thermal-Links – Requirements and Application Guide – UL 60691 Thermistor-Type Devices – UL 1434		P

8.4	TABLE: Abnormal Charging Test for model (battery)					P
Ambient temperature: 22.4°C						
Id	1.04A					
Ue	3.0V					
Ic	5.2A					
Uc	4.2V					
Sample No.	1#	2#	3#	4#	5#	
Cell Case temp. (°C)	23.2	23.0	23.1	22.9	22.8	
Battery surface temp. (°C)	23.0	22.8	22.7	22.6	22.6	
Failure Mode	Yes	Yes	Yes	Yes	Yes	
Faulted Protective Device	MOSFET Q1 SC					

Supplementary information:
1) The DC/DC converter circuit is bypassed.
2) Charging current is 3x Ic=15.6A and test data obtained as above.
3) Charge until the power bank fully charged plus additional 7hrs.
-No explosion or fire, or chemical leak.

8.5	TABLE: Abusive Overcharge Test for model (battery)					P
Ambient temperature: 22.1 C						
Sample No.	1#	2#	3#	4#	5#	
Ic(mA)	10400	10400	10400	5200	5200	
Cell Case temp. (°C)	22.8	22.9	22.7	22.8	22.8	
Battery surface temp. (°C)	22.6	22.6	22.4	22.5	22.6	
Failure Mode	Yes	Yes	Yes	Yes	Yes	
Faulted Protective Device	MOSFET Q1 SC					

Supplementary information:
1) The DC/DC converter circuit is bypassed.
2) Test current is 10 times C5 for 2pcs and 5 times C5 for 3pcs.
3) Charge until the temperature of the internal cell casing reaches steady state conditions stop the test.
-No explosion or fire.

8.7/8.8	TABLE: Battery Pack Component Temperature Test and Battery Pack Surface Temperature Test for model (battery)	P

Battery Pack Component Temperature Test

Sample No.	1#		2#		Limited T	
Testing Process	Charging	Discharging	Charging	Discharging	Charging	Discharging
PCB near U1	90.3	99.2	89.6	98.5	130	130
PCB near Q1	82.6	85.5	83.1	85.6	130	130
Cell surface	50.5	55.8	50.9	54.9	-	-
Ambient	45.0	45.0	45.0	45.0	-	-

Battery Pack Surface Temperature Test

Sample No.	1#		2#		Limited T	
Testing Process	Charging	Discharging	Charging	Discharging	Charging	Discharging
Enclosure outside near U1	52.3	57.4	53.1	57.3	60	60
Ambient	45.0	45.0	45.0	45.0	-	-

Supplementary information:

1) Input temperature test: charging with DC 5V/2.1A.

2) Output temperature test: loaded with DC 5V/2.1A.

-Component & surface temperature not exceed the limits.

8.10	TABLE: evaluation of voltage limiting components in SELV circuits	N/A

Component (measured between)	max. voltage (V) (normal operation)		Voltage Limiting Components
	V peak	V d.c.	

Fault test performed on voltage limiting components	Voltage measured (V) in SELV circuits (V peak or V d.c.)

Supplementary information: directly measured on the fully charged power bank output.

9	TABLE: Power Input Test			P
U (V)	I (A)	Irated (A)	P (W)	Condition/status
5.0	2.05	2.1	10.25	Power bank charging with fully discharged battery inside.

Supplementary information:

1) USB port can not load when charged by DC source.

- The input to power bank not exceed 110% of the marked input current rating.

10	**TABLE: Overload of Output Ports Test**					P
	Ambient temperature (°C) .....:				22.8	—
	Power source for EUT: Manufacturer, model/type, output rating .....:				See below	—
Component No.	Fault	Supply voltage (V)	Test time	Current drawn (A)	Observation	
Output	Overload	5.10	1h	3.4	NC, NT	
Test results:						
- Chemical leaks					No	P
- Explosion of the battery					No	P
- Emission of flame or expulsion of molten metal					No	P
- Electric strength tests of equipment after completion of tests						P
- cheesecloth and tissue paper shall remain intact					NC, NT	P
Supplementary information: NC = Cheesecloth remain intact YC = Cheesecloth charred or flamed NT = Tissue paper remained intact YT = Tissue paper charred or flamed - The cheesecloth and tissue paper remain intact.						

11	**TABLE: Flammability of Photovoltaic Cells Test**					N/A
	Ambient temperature (°C) ..... :					—
	Power source for EUT: Manufacturer, model/type, output rating ..... :					—
Com-ponent No.	Fault	Supply voltage (V)	Test time	Current drawn (A)	Observation	
Test results:						Verdict
- Chemical leaks						
- Explosion of the battery						
- Emission of flame or expulsion of molten metal						
- Electric strength tests of equipment after completion of tests						
- cheesecloth and tissue paper shall remain intact						
Supplementary information: NC = Cheesecloth remain intact YC = Cheesecloth charred or flamed NT = Tissue paper remained intact YT = Tissue paper charred or flamed						

12	TABLE: Capacity Verification Test					P
Ambient temperature: 23.0°C						
USB Output						
Sample No.	016	017	018	019	020	
Discharge current (mA)	2100	2100	2100	2100	2100	
Capacity (mAh)	3156	3201	3143	3129	3187	
Rated capacity (mAh)	3100mAh					
Supplementary information: - Marked capacity verified and complied.						

--End of Report--

Attachment 1: photo document

Details of: Front view of battery

Details of: Back view of battery